

MUNICIPAL DEPARTMENT

THE SANITARY WORKS OF BUENOS AYRES.*

The City of Buenos Ayres, situated on the western shore of the Rio de la Plata, where it was thirty miles in width, was described as being built upon a bank rising abruptly to a height of 60 feet above the river. Above and below the city were extensive marshes, the soil of which was composed of running silt, whilst the bank upon which the city was constructed was of hard clay. The annual rainfall averaged $33\frac{1}{2}$ in., but the district was subjected to violent storms during which 4 inches of rain frequently fell in one hour, the wind attaining a velocity of 100 miles. The water supply for the city, amounting to 20,000,000 gallons per day, and drawn from the river $3\frac{1}{2}$ miles above the city, although very turbid, was found, when filtered, to be in every way suited for domestic purposes. For the intake in the river a shaft was sunk, about 1,000 yards from the shore, communicating with a tunnel $3\frac{1}{2}$ miles in length, of which the first mile was under the river bed and which terminated at a point on the outskirts of the city, where the water was pumped into settling ponds. These ponds, each intended for the treatment of 4,000,000 gallons per day, consisted of continuous channels, 3,100 ft. in length, through which the water flowed slowly, depositing during its transit a considerable quantity of the suspended alluvial matter. It then flowed on to sand filters, 2 feet in thickness, and passed downwards into covered storage reservoirs constructed beneath them. Subsequently the filtered water was pumped to a height of 162 ft. into a large service reservoir in a central position in the city. This reservoir consisted of a series of wrought iron tanks, supported on cast iron columns above the surface of the ground, the whole being enclosed in a building of elaborate architectural design, faced entirely with terra cotta manufactured in England. The tanks were arranged in three tiers, each tier supplying the corresponding zone of the city, according to their respective levels. The capacity of the entire reservoir was 15,888,000 gallons. In addition to the pressure resulting from the levels of these various tanks, arrangements were made by which the water could be pumped at a higher pressure direct into the mains whenever desirable. The water was distributed through the city by means of five main pipes, varying between 36 in. and 24 in. in diameter, from which branch pipes passed to each separate block of houses. A uniform arrangement of piping was repeated throughout the

city, and a definite position assigned to each valve and hydrant. The internal services of both water supply and drainage were carried out in such a manner as to fulfil modern sanitary requirements. The sewerage of the town was on the combined principle, the collecting sewers being capable of discharging a rainfall of $1\frac{1}{2}$ in. per hour, which had been found amply sufficient to carry away the rain which fell during the heaviest storms. The sewers were ventilated by a pipe carried up the front of each house to a height of 6 ft. above the roof. This pipe was connected with the branch sewer immediately outside the syphon trap which cut off the sewer gas from the house. Air was admitted into the sewers by the gratings of the street manholes. The area of the city was divided into separate drainage districts, in each of which the collecting sewers formed an independent system converging to the lowest point and there connecting with the intercepting sewers. The capacity of these latter was sufficient to carry off a rainfall of $\frac{1}{4}$ in. in 24 hours, the difference between this quantity and that conveyed by the collecting sewers during storms being removed by large conduits discharging directly into the river in front of the city. The sewage passed from the collecting sewers of each district to the intercepting sewer over a trough, the capacity of which was limited to the quantity to be conveyed by the latter, so that any larger quantity was forced to overflow into the storm water conduits. The capacity of these troughs was regulated by means of a valve, and corresponded in each case with the discharge from the district, so that the quantity of storm water conveyed to the pumping station was reduced to a minimum. The conduits were for the most part 14 ft. wide by 12 ft. high, and the total quantity of water conveyed by them was about 9,000 cubic ft. per second. Over the greater area of the town the sewage found its way by gravitation into the intercepting sewers, pumping being resorted to only for the low district near the river. In two of the smaller districts the sewage was lifted by steam pumps, but in the large one lying to the south of the city an entirely different method was adopted, consisting of short pipe sewers, 6 in. and 9 in. in diameter, laid in shallow trenches, the rain water being entirely excluded from them. Over this area the sewage was raised at seventeen points by means of small pumps actuated by hydraulic motors worked automatically from one central power station. The pressure employed was 750 lbs. per square inch in the accumulator, and the pressure water was distributed to the motors through about 8 miles of hydraulic pressure piping varying between 3 in. and 6 in. in diameter. The pumps, which were in duplicate, were placed in wells sunk beneath the roadway, and were started and stopped automatically by floats actuated by the rise and fall of the sewage. The pressure water was admitted into a ram placed in the centre of the plunger, the return stroke being performed by two small

push-back rams, constantly open to the hydraulic pressure. The pumps were 30 in. in diameter, some being of 3-ft. and others of 4-ft. stroke. The area provided for in this portion of the scheme was about 1,600 acres, and the ultimate population 200,000. In this district automatic self-closing manhole covers were adopted to exclude the floods, which frequently inundated it. Self-acting valves were provided for flushing the sewers by water supplied from the mains. The sewage was discharged into the river 12 miles below the city at a point where no trouble was caused by its being washed back. The outfall conduit, on leaving the city, passed beneath a tributary of the Rio de la Plata, 200 ft. in width, by an inverted siphon, consisting of three tubes of cast iron, 5 ft. high by 2 ft. 3 in. wide, imbedded in concrete and supported on cylinder foundations sunk into the bed of the river. To avoid obstructing the river during construction, these tubes were put together inside large horizontal cylinders of wrought iron, which, after being built on shore, were floated out and sunk into position. The space between the casing and the tubes was then filled with concrete, in which were embedded strong wrought iron girders with the object of giving sufficient strength to span the intervals of 50 ft. separating the cylinder foundations, and thus rendering the tubes independent of any support from the soft mud upon which they rested. The abutments of the siphon were also upon cylinder foundations, the body of the abutment being constructed within an annular coffer dam of 14-in. piling. As no solid foundation could be obtained for this work, reliance had to be placed upon the depth to which the cylinder foundations were sunk into the soft material of the river bed. To secure the fall necessary for discharging the sewage at the outfall, a pumping station was erected on the line of the conduit where the whole sewage was lifted a height of 43 ft. The paper was accompanied by tables of the daily consumption of water for the last 21 years, and also of the comparative death rates for the years proceeding and of those following the inauguration of the sewerage works, which afforded conclusive evidence that the annual death rate of the city had been reduced from 32 to 24 per thousand. Details of the cost of the works were given, and showed that about two and a-half millions sterling had been expended on the water supply, and three millions sterling on the sewerage and drainage, equivalent to 5£ 10s. and 6d. respectively per head of population served. There was also appended a brief account of the political and financial vicissitudes to which the works had been subject since inception in 1871, which prevented them from being completed until twenty years after their commencement.

The Windsor Gas Company was recently summoned before the Police Magistrate for digging up the streets without the consent of the Board of Works. The action was taken to prevent the laying of wrought iron pipe instead of cast iron, as called for by the by-law. Meanwhile the gas company have been granted an injunction on the city to restrain it from interfering with the extension of their system.

* An abstract of a paper recently read before the London Institution of Civil Engineers by the Hon. R. C. Parsons, M. A., M. Inst. C. E.