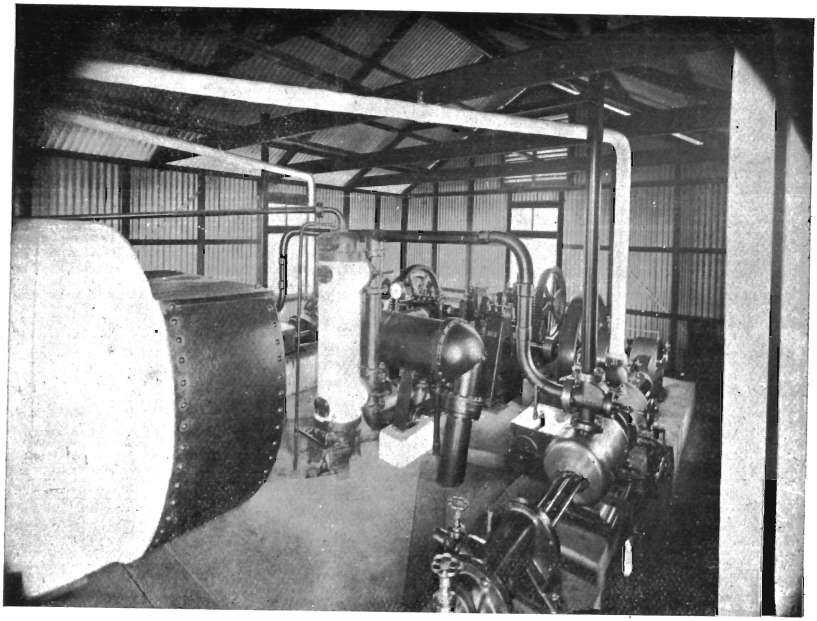


FIG. 1.—ENGINE HOUSE.

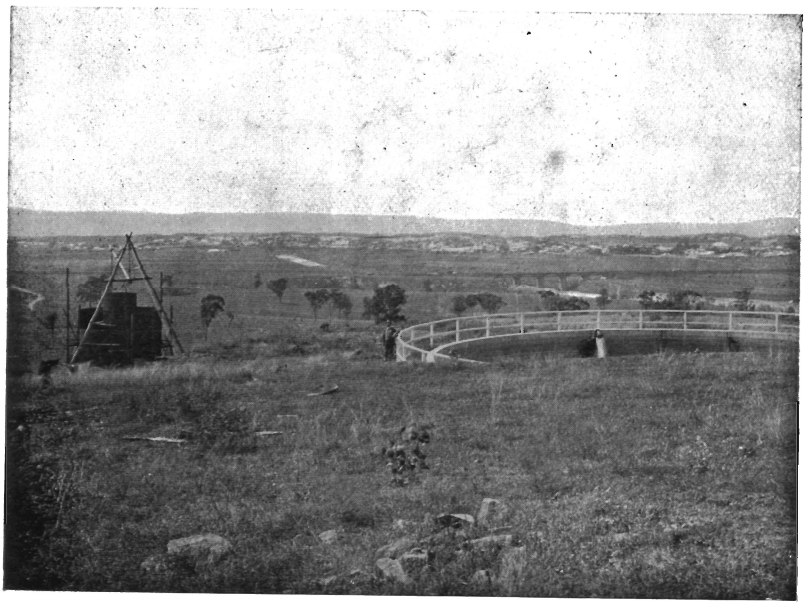


FIG. 2.—SERVICE RESERVOIR,
With Water Softener in Course of Erection.

the sides of the excavation was filled in with sand run in with a water jet, which ensured close packing, and filling of interstitial spaces. Holes were then cut in the brickwork for the placing of the girders for the machinery platforms and, after fixing, these were closed up with bricks and rich concrete well rammed in.

Between the platform girders at the top of the well were placed curved sheets of corrugated galvanised iron, in a double thickness, to act as centreing for the concrete roof with which the well is covered. This gave a very rigid structure, as was shown by the fact that when both engines were running at 150 revolutions per minute, a penny was stood on edge on each, and remained in that position, although the engines were seated on the roof of the pump well.

ENGINE HOUSE.

The engine house is 39ft. 4in. x 20ft., constructed of galvanised iron, with concrete floor, supported on piles planted in the solid ground. Portion of the top of the Pump Well is included within the engine-house, from which access is obtained to the pumps through a trap door in the floor. The inside equipment includes a ¾in. water service, taken off the rising main, for hosing down and boiler feed, while outside the house a fuel bin has been provided for storage of coal, which will be carted from the railway, about half a mile away.

PUMPING MACHINERY.

Tenders were invited for the supply and fixing of the Pumping Machinery in a separate Contract, as this is a class of work distinct from that embraced by the remainder of the Scheme. The specified requirements were that the machinery should be in duplicate, each set capable of lifting 15,000 gallons per hour against a total static head, including suction lift, of 242 feet, through a rising main 8in. diameter, 5493 feet long. It was specified that each set should be capable of lifting this quantity working separately, or that the two sets should lift 30,000 gallons per hour when working together.

It will be observed that no mention was made in the specification of the friction head to be provided for. This is an indeterminate quantity, and it was thought better that manufacturers should make their own allowance for friction, the important consideration being that the specified quantity should be delivered into the reservoir. Based upon Kutter's formula, which is that adopted by the Public Works Department for pipe discharges, the friction head with both pumps working together

was estimated at 80 feet, or a total head of 322 feet. This would give the Water Horse Power of each pump (omitting losses in the machinery itself), as under:—

$$\text{W.H.P.} = \frac{15{,}000 \times 10 \times 322}{60 \times 33{,}000} = 24.4$$

The specification called for the pumping machinery in two units, but with only one boiler, capable of steaming both pumps, "preferably of the Marine type," designed for burning coal. The accepted tender for the Pumping Machinery was that of Messrs. Gibson, Battle and Co., at £2257 10s., or at the rate of £46.3 per W.H.P.

This plant included a boiler of the "Dryback" type, internally fired with the combustion chamber at the back, 6ft. 6in. diameter, 7ft. 11¼in. long outside tube plates; heating surface 340 square feet; grate area, 18 sq. feet; tested to 180lb. per sq. inch; working pressure, 120lb. per sq. inch. This boiler was made by Messrs. G. and C. Hoskins, at Ultimo. The engines are of the compound condensing type, made by Messrs. Ruston, Proctor and Co., Ltd., of Lincoln, with high pressure cylinders 7in. and low pressure cylinders 11in. diameter, 12in. stroke, fitted with fly wheels 5 feet diameter. Automatic cut-off gear has been provided which so regulates the admission of steam that in case of any sudden reduction of pressure occurring in the mains, due to an accident, the governor at once takes charge, and cuts off the steam and prevents racing.

The condenser is 21in. diameter, 5ft. long, fitted with 200 brass tubes, ⅝in. inside diameter, giving a total cooling surface of 200 sq. feet. The water from the rising main is passed through the Condenser and forms the cooling agent.

The plant includes a Babcock and Wilcox Vertical Feed Heater 13in. outside diameter, 7ft. 3¼in. high, with a heating surface of 35 square feet. A Mumford Feed Pump 3in. diameter, 3in. stroke was also included.

The arrangement of the boiler, machinery and piping is shown on Plate 2 and in photograph.

Steam from the boiler is taken by the main steam pipes (1) to the engines. The exhaust steam from the engines passes either to the atmosphere through (3), or to the top of the feed heater, through (2), and passes through the heater to the condenser, whence, after condensation, it is drawn by the air pumps through (8) and (9) to the feed tank. The boiler is fed (a) through (7), by the feed pump, with cold water from the service pipe, which is connected to the rising main; or (b) with cold water from the service pipe, forced by the feed pump through (5) to the top of the feed heater, and from the bottom of the feed heater through (6) to the boiler; or

(c) with hot water from the feed tank, forced by the feed pump through (5) and (6). The feed heater can be cut out if desired, and the steam from the engines exhausted direct into the condenser.

The Pumps are of the Gould Single Acting Triplex Plunger type, each set consisting of three bronze plungers 8in. diameter, 10in. stroke, making about 50 revolutions per minute, and driven from the engine through spur gearing. The pinions are of raw-hide, and the spur wheels of charcoal iron with teeth machine cut from the solid. By means of the gearing the speed of the engine is reduced in the ratio of about 4 to 1. The pumps are fitted for 6in. suction and 5in. delivery, and reflux valves are fitted on the rising main next to the pumps.

The guaranteed steam consumption with only one set working, and 100lb. steam pressure at throttle was 39½lb., or with both sets working together, and steam pressure at 110lb. at throttle, 47½lb. per 1000 gallons raised into the Service Reservoir.

The total head was estimated by the Contractors at or somewhat below the Departmental figure, viz., including friction, as 256 feet with one unit working, or 300 feet with both units working. This included a static head, as originally proposed, of 242 feet, but after the Pumping Machinery Contract was advertised the position of the Service Reservoir was altered, and a water softener added, increasing the static head to 253 feet.

In Appendix A are given the results of the tests of the Pumping Machinery, made by Mr. Howarth, Assistant Engineer, in February last, before the plant was taken over. Even with the increased static head, the plant delivered more than the specified quantity, and since placing in operation has proved very satisfactory.

SUCTION AND RISING MAINS.

The suction mains are of spiral riveted pipe, 6in. diameter, with a foot valve and strainer fixed at about 2 feet above the bottom of the well.

The rising main is of cast iron 8in. diameter, 88 2/3 chains long, extending from the engine-house to the inlet at the top of the Water Softener, with a byepass to admit of pumping direct into the Service Reservoir should the Water Softener be out of action. Under ordinary working conditions the suction lift is about 10 feet. With one pump only working at its specified delivery of 15,000 gallons per hour, the estimated velocity in the rising main is 1.9 feet per second, and with both pumps working together, 3.8 feet per second. The rising main is laid below

the surface of the ground except where it is carried on the bridge over the Hunter River and at the crossing of a small gully where a timber trestle has been provided. In order to allow of the escape of air, which accummulate at the summits, a number of air cocks have been provided, one at the top of each elevation. These cocks were fixed on the side of spring hydrants secured to the top of tee pipes.

When the rising main was being charged, the hydrants were depressed and the air cocks opened, so as to give as rapid an escape for the air as possible, and the water allowed to flow until there was no sign of air, when the hydrants were closed. The air cocks, however, were left partially open until the main was fully charged.

For cleaning purposes there are 3in. stop valves, secured to cast iron tees, inserted in the pipe lines and placed at the bottom of depressions, so that any sediment in the pipes may be carried out by opening the valves and flushing the pipes.

In order to shut off any section of the main in case of breakage, stop valves have been also provided along the rising and service mains at convenient intervals.

The water is delivered from the rising main to the top of the Water Softener, through which it passes before delivery into the Service Reservoir. In case, however, that the Water Softener may be temporarily out of action for cleaning or repairs, provision has been made for a byepass (See Plate 3), whereby the rising main will deliver direct into the Service Reservoir instead of through the Water Softener.

A byepass has also been provided on the Singleton side of the river to permit of pumping direct into the reticulation mains, in case it is required to cut out the Service Reservoir.

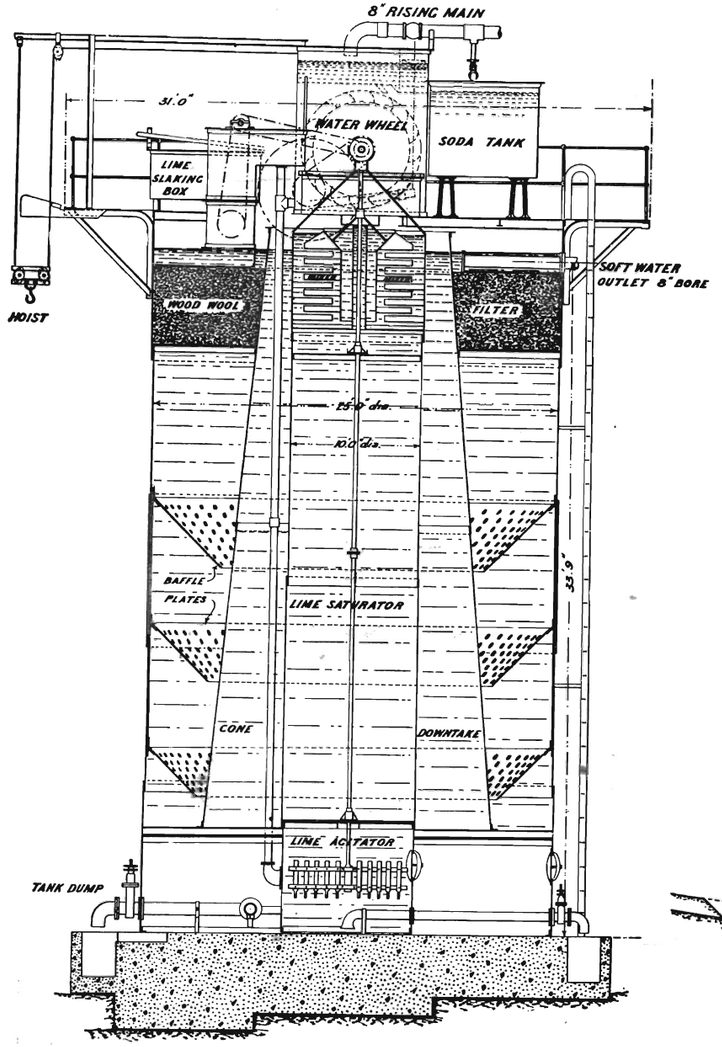
WATER SOFTENER.

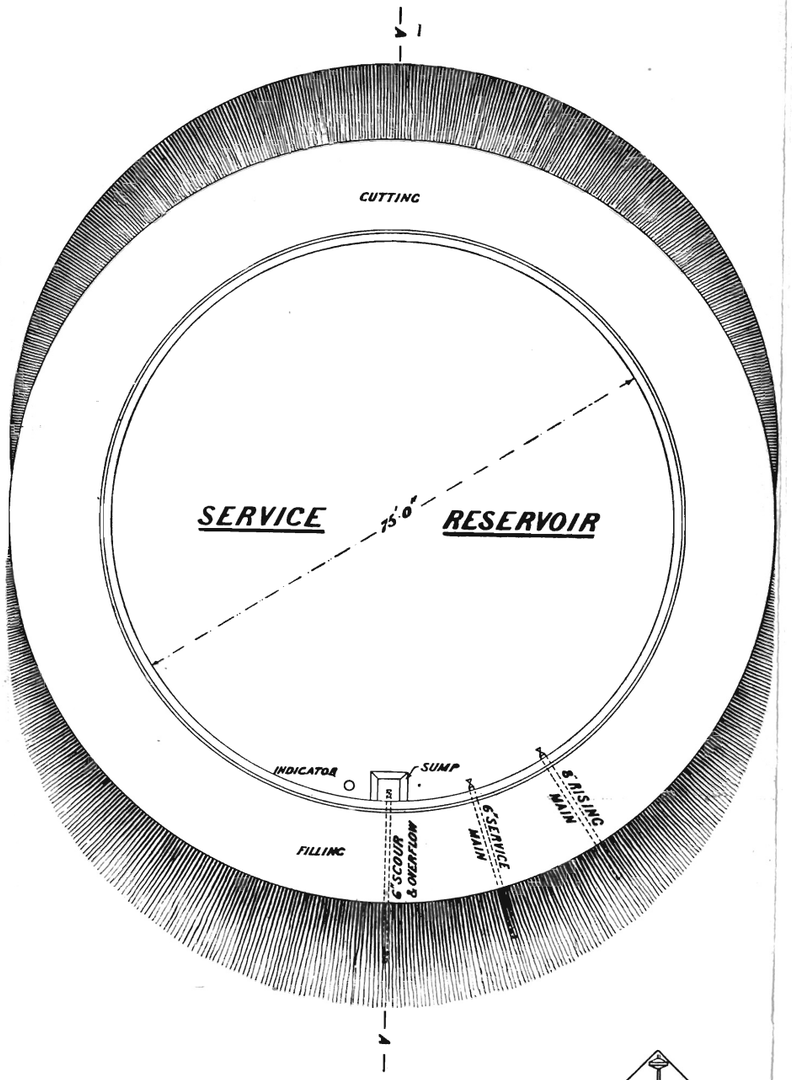
In view of the fact that a large quantity of water is to be used for locomotive purposes, and that the price paid for this by the Railway Department will bring in considerable revenue to the Singleton Council, it was decided to include in the scheme a Water Softener, through which the water will pass before delivery into the Service Reservoir. Before describing this apparatus brief reference will be made to the general question of water softening and the reasons rendering this advisable in the case of Singleton.

Hard water, such as that obtained from the Hunter River, would be unsuitable for boiler purposes, since it holds in solution certain mineral impurities which tend to form boiler scale. It has been estimated that the increased consumption of fuel due to scale, varies

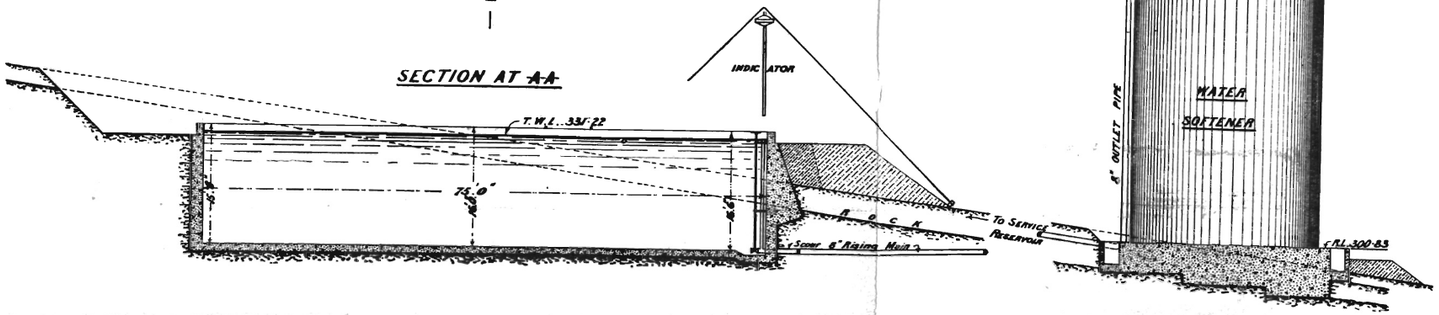
THE KENNICOTT WATER SOFTENER

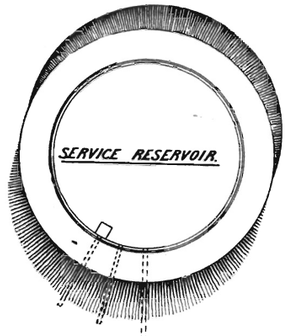
DIAGRAM ONLY





SECTION AT AA





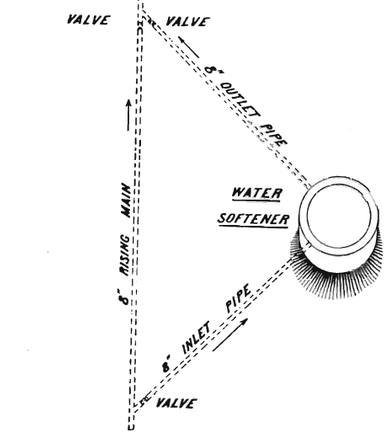


PLATE Nº 3

SECTION OF WALL

SERVICE RESERVOIR