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CHAPTER V.

OUR ASSET IN ARTESIAN WATER.

Erroneous Judgment of Western Queensland.—Scarcity of Surface Water.—Water Supply Department.—Discovery of Artesian Water in New South Wales.—Prospecting in Queensland.—Difficulties Experienced by Early Borers.—First Artesian Flowing Bore.—Dr. Jack's First Estimate of Artesian Area.—Revised Figures.—Number of Bores and Estimated Flow.—Area Capable of being Irrigated with Artesian Water.—Cost of Boring.—Value of Artesian Water.—Extent of Intake Beds.—Waste of Water.—Necessity for Government Control of Wells.—Value of Water for Irrigation, Consumption, and Motive Power.—Artesian Water a Great National Asset.

FIFTY years ago the white population of Australia, including Tasmania, scarcely exceeded a million persons. At that time the theory was generally accepted that only a fringe of the coast south of the tropic of Capricorn would be found habitable by a British or European population. The reports of explorers led to the conclusion that the vast inland area of our continent was an irreclaimable arid desert, save when, at long and uncertain intervals, it was ravaged by destructive floods, the water from which, licked up by a fiery sun or absorbed by a porous subsoil, disappeared from the surface with marvellous rapidity. A little more than forty years ago squatting occupation had been pushed towards the interior of the continent with not only rapid strides, but it was held by many explorers with a presumptuous boldness that could only be followed by disaster. So deeply had this conviction been driven into the minds of experienced men that a distinguished Australian explorer, the late Sir A. C. Gregory, declared in his late maturity, little more than ten years ago, that on what is now some of the richest and most productive country in Western Queensland a bandicoot could not live; and on the statement being challenged he said he spoke from personal experience as an explorer after two visits separated by an interval of nine years. The country more particularly so condemned was the well-known pastoral run, Wellshot, a little to the south of Longreach, and one of the largest and finest wool-growing properties in Australia.

It must be frankly conceded that the occupation by flocks and herds nearly forty years ago of what was then known as the Barcoo and Thomson country was venturesome to the point of recklessness. Except in the sandy beds of these rivers there was practically no surface water of a permanent nature; and the average rainfall was so inadequate, not to mention its capriciousness, and the ground in many places so porous, that any attempt to provide artificial water by the construction of dams or tanks seemed almost tempting Providence. Yet there arose a persistent belief, afterwards more than justified, that underneath the arid surface was flowing water in great abundance. The rainfall, however copious in exceptional seasons, certainly did not reach the sea, and the hypothesis that great subterranean rivers would disclose themselves to a systematic search attracted much notice. In the dry year of 1883 the necessity of an improved water supply if the country was not to be denuded of stock forced itself upon the attention of our leading public men. The Premier, the late Sir Thomas McIlwraith, decided to constitute a Government Hydraulic Department with a competent engineer at its head. There had previously been so-called hydraulic engineers, but their work was chiefly confined to the water supply of a few towns and of the more settled districts on the coast. But Sir Thomas McIlwraith, as a runholder in the Far West, realised that nothing but heroic efforts, assisted by the Government, would save the country from desertion, with appalling loss to its adventurous occupiers and their flocks and herds. Mr. J. Baillie Henderson was at the time in the Queensland public service, and the Premier knew that he had served with distinction as an engineer in the Water Supply Department of Victoria. That gentleman was therefore selected to organise a Water Supply Department in Queensland, and on 1st February, 1883, he was gazetted Hydraulic Engineer, an appointment which he has ever since held with credit to himself and advantage to the country.[a]

At that time the existence of artesian water in Queensland was no more than suspected. It had been tapped four years previously in New South Wales, but the boring appliances were so inadequate as to make the process tedious and of questionable practicability on an extensive scale. In Queensland some prospecting work had been done, and in some places fair supplies of water obtained by sinking ordinary wells. But in the Far West there was little scope for enterprise in that direction. Hence some extensive dams were constructed across watercourses ordinarily dry, but without conspicuous success. For often the rush of flood waters either carried away the embankments, or the reservoirs they created quickly silted up, or the porousness of the subsoil could not be entirely combated

(a) For digest of Hydraulic Engineer's reports, 1883 to 1908 inclusive, see Appendix H, post.

by "puddling." Then streams at times complaisantly abandoned their old channels and formed new ones, leaving the intended reservoirs high and dry after the most deluging rains. After a time it was found that better sites than the beds of main watercourses could be found for dams, and that the construction of tanks would suffice in many places to provide sufficient water for a scattered population and the increasing numbers of live stock, although the expense of this mode of conservation was great for the limited supply obtained. Evidently, if the Far West was ever to be completely utilised, its almost illimitable areas of splendid pastures must be watered by some more effective means.

Attention was at this time attracted to the success of the few artesian bores in New South Wales, and to the vast scale on which water had been tapped by that means in the United States of America. The chief obstacles, however, were the great depth at which artesian water might be expected to be found, and the utter inadequacy of the boring machinery then in use in Australia; moreover, the search was most needed in the areas practically inaccessible by reason of the absence of surface water. For a considerable time, as is disclosed in the digest of the Hydraulic Engineer's annual reports reproduced in Appendix H, little progress could be made.

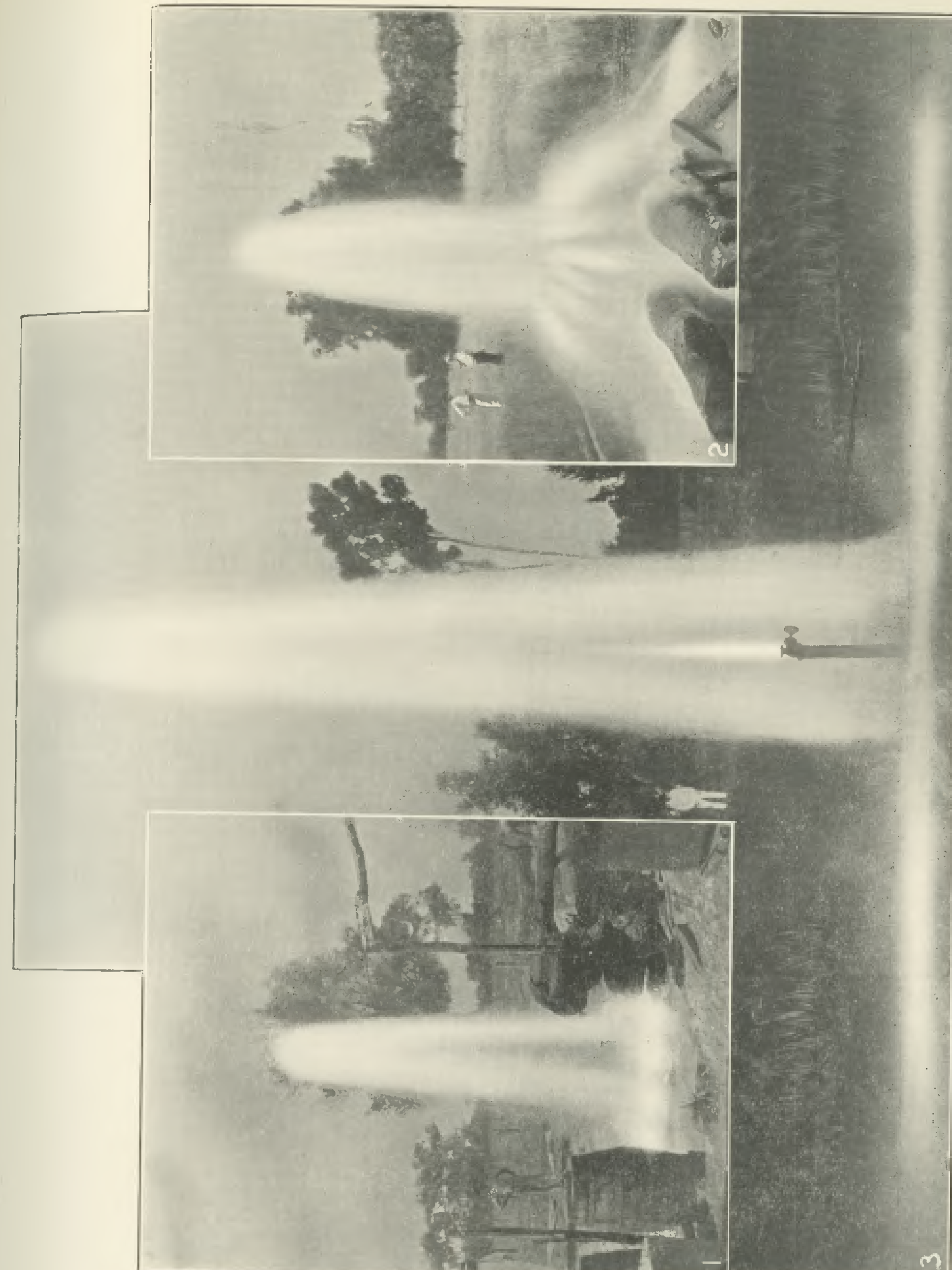
It was not until October, 1884, in fact—just twenty-five years ago—that information was obtained of the striking of sub-artesian[a] water by the Messrs. Bignell at Widgeegoara Station, close to the New South Wales border. The place was visited by Mr. Henderson, and by him reported upon encouragingly. In the same month the Treasurer received a letter from the late Hon. George King, of Gowrie Station, Darling Downs, directing attention to the "Walking Beam Rig" machine, an American well-boring apparatus, by the use of which it had been ascertained that his firm might have saved £4,500 out of the £6,000 spent by it in well-sinking in the Warrego district. The letter being referred to the Hydraulic Engineer, that officer recommended the introduction of American bore-sinking machinery, and the engagement of American skilled drillers who would undertake to give instruction in the use of the machinery as well as engage in drilling work for the Government of Queensland. Delays occurred, however, apparently through the unwillingness of the Government to adopt the advice tendered. It was not until December, 1885, that

(a) "Sub-artesian" is a term applied when the water in a bore rises to or near the surface, but does not automatically flow along it.

Mr. Arnold, an American well-borer, was despatched to Blackall to sink a bore there. The first attempt failed, but afterwards water was struck in abundance, though not by him, or until after the first Queensland flowing well had been sunk by the Government at Barcaldine in December, 1887.

In April, 1887, the Hydraulic Engineer had visited Thurulgoona Station, and there found that Mr. Loughead, with the "Canadian Pole Tool" boring apparatus, had obtained a supply of excellent fresh artesian water from a depth of 1,009 feet, the flow rising 20 inches above ground. From that date boring went on apace, and the exploratory success of the Government encouraged private persons to follow their lead. There were failures to strike artesian water, of course, both on the part of the Government and private persons, but on the whole the results have been such as to add to Queensland occupiable country equivalent to a great new province in the Far West.

The map presented herewith shows the area of artesian water-bearing country in Australia as estimated by Dr. R. L. Jack, formerly Government Geologist. Since 1893 Queensland has been credited with the area of



FLOWING ARTESIAN WELLS, WESTERN QUEENSLAND

376,832 square miles, this being equal to 56 per cent. of the estimated total. But that total has since been reduced to 569,000 square miles, and late information shows that the approximate area of the Queensland artesian basin, as ascertained by scaling off the most recent map issued by the Hydraulic Engineer, is 372,105 square miles—4,727 square miles less than the area given in his report for 1893. Yet the revised figures bring the Queensland artesian area up to 65 per cent. of the Australian total. The difference is accounted for by later information acquired in the field. Of the 372,105 square miles mentioned the area of 146,430 square miles has been tested and found to be less or more artesian or sub-artesian. Mr. Henderson says: "The flows from many of the artesian bores which at one time or another yielded artesian water have failed, but owing to the suspension of the hydraulic survey the available data are quite insufficient to admit of a trustworthy estimate being made of the area so affected."

The total supply of bore water has not been ascertained by actual measurement except from Government bores. But all possible reports of reputed flows have been obtained from the owners of private bores, and the figures cut down to 47 per cent. of the furnished estimates. This reduction is not an arbitrary one, however, but is the equivalent of the difference found to exist between the average estimate and the measured flow of such bores as the Hydraulic Department has been enabled to test.

Information from the Hydraulic Engineer's office shows that up to the end of May last there were 716 flowing bores in Queensland, pouring forth an enormous supply of sparkling water estimated at slightly over 479¼ million gallons a day, equal to a discharge of 175,000 million gallons per annum.[a] This flow, if conserved in tanks and pipes, would furnish a population of nearly 12 millions with 40 gallons of water per capita a day. It would irrigate 644,366 acres of cultivated land with 12 inches of water per annum.[b] An area so irrigated, utilised solely for wheat-growing, would produce, at 20 bushels per acre, nearly 13 million bushels of grain, which is equal to 28·87 per cent. of the entire Commonwealth wheat crop for the year 1907-8. The average Commonwealth yield for the last five years, however, was 61½ million bushels. The average area under

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(a) It will be seen on reference to Appendix H that since the Hydraulic Engineer supplied his figures a number of additional flowing bores have been sunk, and have substantially increased the aggregate flow, although, the figures not having been officially verified, the aggregate flow remains in the text as from the 716 bores recognised by the Hydraulic Engineer.

(b) The quantity of water deposited on an acre of land by an inch of rain is 22,614 gallons.

wheat for the same period was 5,864,114 acres, the average yield for the Commonwealth therefore being slightly over 10½ bushels to the acre. As much wheat is cut for fodder, and as irrigated land should produce a largely increased crop, 20 bushels per acre for such land seems a moderate estimate. Moreover, in 1902-3, the Commonwealth crop was under 12½ million bushels, or less than one-fifth of the mean average for the succeeding five years. At the same time the area of land under crop was in 1902-3 but little below the succeeding five-year average on an acre of land.[a]

The presumably perpetual daily flow of 479¼ million gallons of artesian water—the quantity named being equal to only 47 per cent. of the reputed flow in the case of unmeasured wells—has cost, so far as an estimate can be made, £1,873,515. This works out at the average of £2,616 per flowing bore, supplying 669,369 gallons a day. Calculating on the basis of 5 per cent., including interest and redemption payments, the annual charge for this money is equal to £131 per well, spread over a forty-one years' term, the average cost to each well-owner being thus £1 for 1,865,000 gallons of water a year. Thus, although much money has been lost in sinking unsuccessful bores, the investment has on the whole been amazingly profitable, even allowing that a further annual charge for maintenance must be added.

It need hardly be said, however, that in practice this enormous flow of artesian water could not be utilised solely either for human consumption or for irrigation. Under existing conditions the first claim upon it may be said to be for the sustenance of live stock, as the domestic consumption in the region of the flow is comparatively trifling. And here arises a problem of vast importance. Will this flow be perpetual, or will it gradually decline until exhaustion of the sources of supply ultimately takes place? The latter contingency there seems to be little reason to fear, for the area of the intake beds, estimated by Dr. R. L. Jack at 5,000 square miles, affords the assurance that our artesian springs will be constantly replenished by the rainfall over that large extent of country. Yet, when the existing number of artesian wells has been doubled or trebled, it seems not improbable that many of them will become sub-artesian, and only yield their fertilising streams in response to pumping-power. On this question, however, expert opinions widely differ. But, taking the experience of America and other countries in which artesian springs have been tapped, it may be said that the flow steadily decreases as the number of bores multiplies.

(a) See "Commonwealth Year Book," 1909, page 382.

The Hydraulic Engineer estimates that about two-thirds of the artesian water at present tapped flows to waste. As to the definition of "waste," however, there is sharp conflict of opinion. A pastoralist who distributes a supply of a million gallons of bore water a day by replenishing dry creeks or constructing artificial channels may contend that in his case the loss by evaporation or soakage is not waste, but an expenditure of water necessary to make his artesian well serve its desired purposes. To control and distribute by means of reticulating pipes the product of all Queensland's flowing bores would involve a heavy investment of capital, and one not warranted by the existing population in the artesian area—a population mainly dependent upon sheep-raising and wool-growing for subsistence. But the time may come when it will be deemed indispensable that flowing wells should be brought under Government control, or their product be subject, as in the case of surface water, to riparian rights. The pastoralist who has spent several thousand pounds in sinking a successful bore not unnaturally claims the water issuing from it as his own property; but public policy may require that after diverting so much as may be requisite for his reasonable individual uses the remainder shall be made available for the occupiers of neighbouring lands.

The information that little more than one-half the area of the artesian basin in Queensland has yet been explored is in some respects disappointing, but it is reassuring in others. For if the unexplored country yields as much water per square mile of surface as is now pouring forth from the wells on the tested area—which is not yet fully developed—the total daily yield will ultimately approach 1,000 millions of gallons. Never, according to official information, was bore-sinking more active than it is during the current year, and the thoughtful reader will sympathise with Mr. Henderson's repeated expression of regret that want of money some years ago compelled the department to discontinue both exploration on scientific lines and the periodical measurement of all artesian flows. For with careful surveys of the entire water-bearing area much capital might be saved by teaching where copious springs might or might not be expected to be met with; while with measurement and registration of all flows the question as to the perpetuity or the contrary of the supply would be placed beyond controversy. In that case legislation could be initiated with confidence, and the public interest safeguarded with the least possible disturbance of private interests.

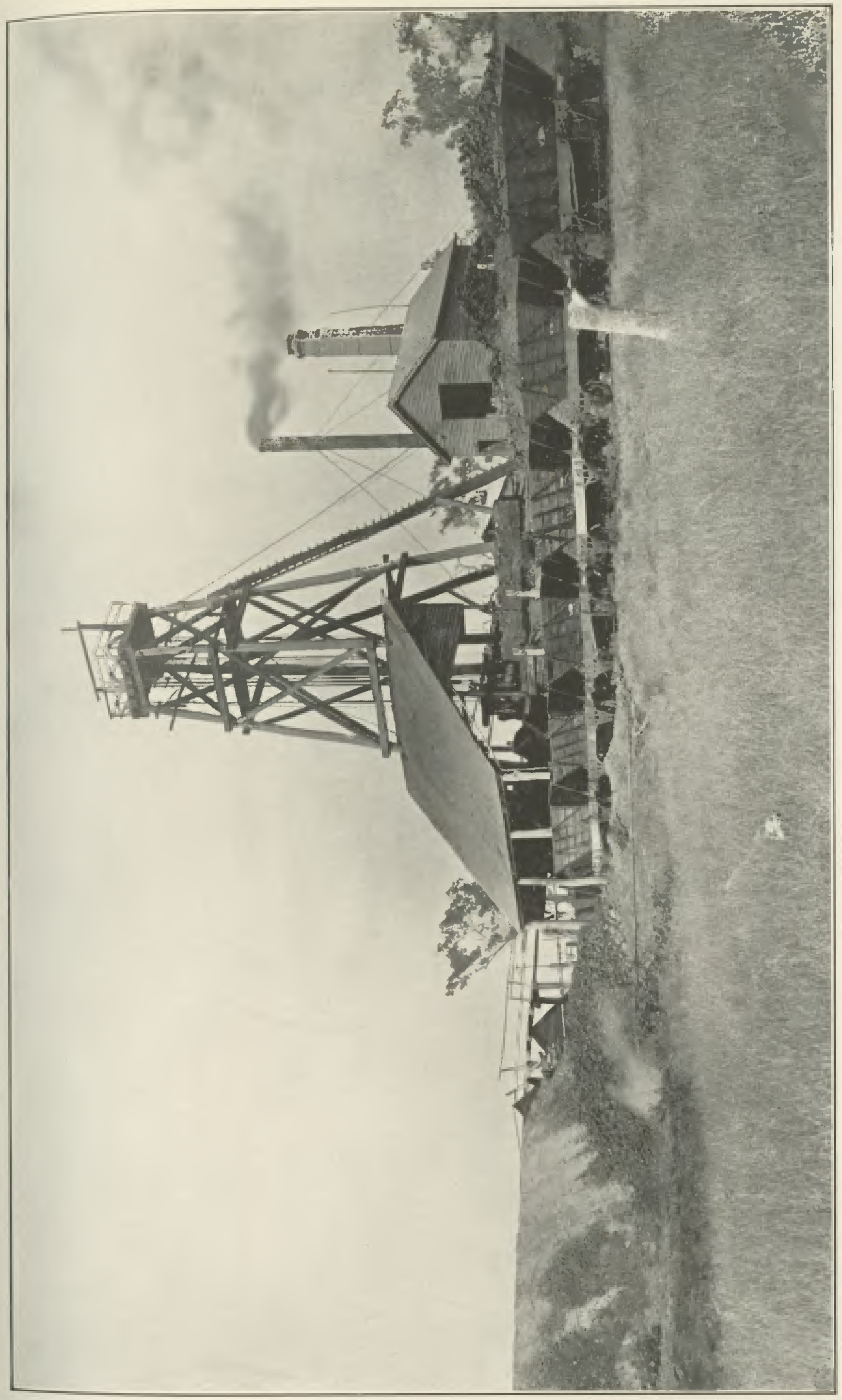
An important consideration in connection with the artesian area is that the land watered by bores is as a rule more than commonly fertile.

Its pastures produce some of the most nutritious natural grasses and herbage found on the face of the earth; and, what is of immense significance, they are grasses and herbage that either would not live or would deteriorate under a tropical sun, with a rainfall equal to the coastal average. Thus it may be argued that artesian bore water—at any rate, when so free from mineral impregnation as to be unquestionably potable—is more valuable, gallon for gallon, than the supply direct from the clouds.

In several of his numerous reports the Hydraulic Engineer makes reference to the subject of irrigation by means of artesian water. It is certain that the water from some bores, while useful for live stock, is not fit for either domestic use or for irrigation. The Hydraulic Department many years ago began what was intended to be a systematic analysis of bore water with the view to providing an official record that would be highly useful for public purposes. But in one case at least water pronounced by the Government Analyst as useless even for stock was highly esteemed on the run whence it was obtained; and evidently much has yet to be learned as to the value of subterranean waters not regarded as potable by scientific standards.

Some of the most copiously flowing bores, however, discharge water of unexceptional quality, whether for domestic use, manufacturing purposes, or irrigation. The Hydraulic Engineer doubts, having regard to the immense quantity of water required for irrigation, whether it will ever be found useful for that purpose in so far as the greater agricultural industries are concerned; but for intense cultivation around the homestead he thinks bore water might well be utilised. In some cases it would be in sufficiently large supply for the raising of green fodder for stud stock—perhaps even for protection against minor local droughts. An irrigated crop needs three or four waterings of 3 inches each, and as each inch means 22,614 gallons, the quantity required for a crop, with four waterings, would be 271,368 gallons per acre; so that a cultivation plot of 20 or 30 acres would absorb from 5 to 8 million gallons a year, according to the seasons, the nature of the soil, or the soakage.

While doubtful as to the suitability of bore water for irrigation on a large scale, Mr. Henderson strongly advocates its being applied to machinery of small power. Many years ago he directed attention in one of his annual reports to the extensive use of water power in competition with steam in certain parts of America; and it is satisfactory to note that in some inland towns of Queensland the American example has been followed. In quite a number of towns the public water service is



ABERDARE COLLIERY, IPSWICH DISTRICT

artesian, and in a few it is the motive power of electric lighting systems. The information that the flowing wells of Queensland are discharging daily 320 million gallons of water "to waste" indicates that when population in the artesian area becomes more dense bore power will become an invaluable aid in economic manufacture. The water so harnessed would not be wasted, as every gallon would still be available for human or animal consumption.

The money value of the water annually discharged from the flowing bores of Queensland runs into stupendous figures, even at the rate of 6d. per 1,000 gallons. At that rate its annual value would exceed 4¼ millions sterling. Capitalise this sum at 4 per cent., and the artesian water flow of Queensland becomes worth upwards of 109¼ millions sterling, less, of course, the cost of maintenance and supervision similarly capitalised. And this colossal endowment is the result during the last quarter of a century of a total expenditure of less than 2 millions sterling. Granting that to utilise all this water already under pressure would mean a very large additional expenditure in tanks, aqueducts, and pipes, that expenditure may be calculated in advance to a minute fraction in every case, and it would of course be disbursed gradually as the demand for the delivery of water under pressure developed with the increase of population and the multiplication of industries. It must be apparent, therefore, that any needful public expenditure to ascertain whether the flow diminishes or increases as the years go on, and to prevent waste if waste there be, is more than justified. Indeed, should any great public loss be suffered for want of State control of this life-giving national asset, it might be difficult for Parliament entirely to clear itself from blame if charged with neglecting the reiterated advice of its own responsible officer in this respect.