(No. 54.)

1900.

PARLIAMENT OF TASMANIA.

MOUNT CAMERON WATER-RACE:

PRELIMINARY REPORT BY MR. K. L. RAHBEK, M. DAN. ASS. C.E.

Presented to both Houses of Parliament by His Excellency's Command.

Cost of printing—£2 19*s.* 6*d.*

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Office of Mines, Hobart, 25th August, 1900.

SIR,

IN accordance with your instructions to me, I left Hobart for the Mount Cameron Water-race on the 23rd July, accompanied by the Secretary for Mines, for the purpose of examining the syphons, and to see whether it would be possible to increase the supply to the aforementioned water-race.

On these subjects I now have the honour to present my preliminary Report.

In accordance with your wishes I examined, first of all, the syphons, six in number, of which numbers 1, 2, and 3 belong to the upper or southern half of the water-race, and Nos. 4, 5, and 6 to the lower or northern half.

Syphon No. 6 has at present a length of about 47 chains, and a water-head of about 6·05 feet. The pipes, which are said to be made of steel plates $\frac{1}{8}$ in. thick, are 20 feet long, consisting of 5 sections, which are rivetted together; they are 3 feet in diameter, and of the spigot and faucet type, joined by yarn and lead-wire packing. The appearance of the pipes in this, and No. 5 and No. 4 syphons, makes it clear that they cannot possibly last for any length of time. Corrosion has apparently been going on for some considerable time, and has only been partly checked by occasional coatings of tar or asphalt. Many of the pipes have a very weak and decomposed appearance at the rivet-joints; others, again, have their spigot-ends corroded to such an extent that the yarn and lead-packing cannot be driven properly home, the result being that many of the packing-joints are leaking freely.

The syphon is not buried in the ground, but placed on sleepers, 4 to 5 feet apart, and carried on trestle-work over the deepest parts of the gullies; and, to allow for the "creeping" of the pipes, on account of the difference in temperature during the different seasons, and during day and night, an expansion-joint, 18 inches wide, has been placed at 26·5 chains, reckoned from the intake. At 24·5 chains there is a scour-valve, and at 6·80 chains, an air-valve. On the syphon I counted twenty places where breaks of the pipe-shell have taken place, in sizes from $\frac{1}{2}$ an inch to 8 or 9 inches, and which have been stopped temporarily, as far as the smaller leakages are concerned, by driving wooden pegs into the openings; and in case of the larger breaks, when on the underside of the pipe, by placing a sleeper below, and, by means of wooden wedges, pressing sackcloth, saturated in tar, against the breakage; and, again, in other places a more rational method has been adopted by using iron bands, made of iron plate $\frac{1}{16}$ inch thick, which, by means of lugs and bolts, were strapped round the pipe, using sackcloth as packing material.

In many places the pipes scale off to an alarming extent; I have picked up scalings in extent, say, 5″ x 9″, and $\frac{1}{8}$ inch in thickness, made up of corroded iron, or steel and tar combined. A great many blisters can be found all along the pipes, and when broken by the pressure of a finger, water freely oozes out. Corrosion has progressed so far, that it would be unwise, now, to scrape the pipes before applying any fresh coating. I should not estimate the lifetime of these pipes to be more than twelve to eighteen months, and then it will only be possible to keep them in working order by using iron bands already partly in use, and to use felt and tar as a means of packing. It is most fortunate that these pipes are under a maximum hydrostatic pressure of 13 lbs. only per square inch.

The general description of the pipes which has been given here also holds good for those in syphons No. 5 and No. 4.

Syphon No. 5 has a length of 4,200 feet, and a waterhead of 13·95 feet. The pipes are of similar size, construction, and in the same state as described for syphon No. 6. At a distance of 20 chains from the intake there is a scour-valve, at 27·80 chains an air-valve, at 36·5 chains an expansion-joint, and at 41·8 chains a scour-valve, at 50·90 chains a man-hole, with cover, and at 52·33 chains an air-valve. From 56·40 to 59·7 chains this syphon is carried on trestle-work. The maximum hydrostatic pressure is 36 lbs per square inch. I counted, on this syphon, 78 breaks or leakages of the same nature, and repaired mostly in the same way as described for syphon No. 6.

Syphon No. 4, as originally constructed, a length of about 3730 feet, and a water-head of 12·64 feet. However, some years ago an opening was made in the side of the syphon, 1·71 chains from the intake, for the purpose of admitting the water from reservoir No. 2 (the capacity of which, I understand, is about 4,000,000 gallons), and which has been constructed to act as a kind of regulator. When the consumption of the water from the race for a certain time is not so heavy as usual, the water from the race, instead of running to waste, is sent into reservoir No. 2, from which it is again drawn on as required. However, by constructing this reservoir, more than 8 feet in water-head for the syphon was lost, and the reservoir could not have been made to operate at all if it had not been for the fact that the syphon pipes are so large that they are comfortably sending the 40 to 45 sluice-heads through, although the water-head has been decreased from 13·74 to 5·18 feet.

The pipes in syphon No. 4 are made to the same size and constructed in the same way as described for syphon No. 6.

At 1·67 chains, reckoned from the original intake of syphon, there is the present intake from reservoir No. 2, at 15·92 chains expansion-joint, at 18·67 chains air-valve, at 22·27 chains man-hole, with cover, at 26·72 chains scour-valve, at 35·32 chains air-valve, at 37·87 chains man-hole, with cover, and at 41·87 chains scour-valve. From 25·17 to 28·16 chains, and from 39·57 to 44·47 chains, the syphon is carried on trestle-work, but especially is the lastnamed trestle-work exceedingly weak, and seems ready to collapse at any time. The maximum hydrostatic pressure is 36 lbs. per square inch.

On this syphon I counted 28 places where the pipes had been leaking, and which had been attended to in the same way as described for syphon No. 6.

Syphon No. 3 has a length of about 354 feet, and a water-head of 4·02 feet. The pipes here, as well as those of syphons No. 2 and No. 1, are 2½ feet in diameter, and are said to have been made of steel plates one-eighth of an inch thick; they are spigot and faucet pipes, and otherwise constructed in a similar way as described for syphon No. 6.

At 2·55 chains there is a scour-valve, and the syphon is resting on trestle-work from 1·41 to 3·19 chains. No break or leakage has, as yet, taken place in this syphon. The pipes here have not the same corroded and blistered appearance as was the case for Nos. 4, 5, and 6 syphons. The lifetime of this syphon I should judge to be three or four years.

Syphon No. 2 has a length of about 362 feet, and a waterhead of 5 feet, the pipes being of the same size, kind, and made of a similar kind of material as described for syphon No. 3.

At a distance of 2·70 chains there is a scour-valve, and the pipes are carried on high trestles from 1·79 to 3·25 chains.

There has been one leakage on this syphon, near the intake, which has been packed by means of an iron band; otherwise, these pipes have the same good appearance as described for syphon No. 3, and I should also judge their lifetime to be three to four years.

Syphon No. 1 has a length of about 463 feet, and a waterhead of 5·80 feet, the pipes being in every way as described for syphon No. 3.

At 3·80 chains there is a scour-valve, and the syphon is carried on trestle-work from 2·60 to 5·26 chains.

On this syphon I found three leakages, and I was informed that it was about three months since the first leakage took place; otherwise, the pipes of this syphon have nearly the same appearance as syphon No. 3. With care, they may, perhaps, last for three years.

As it is asserted that syphons Nos. 1, 2, and 3 were made at the same time, and of the sam kind of materials as syphons Nos. 4, 5, and 6, and, since it is obvious that the three lastnamed syphons have suffered considerably more than the firstnamed, I thought it possible (though it is, perhaps, not likely) that the water drawn into the race, between syphons Nos. 3 and 4, perhaps contained some mineral or organic acids, the presence of which might account for the rapid decay of syphons Nos. 6, 5, and 4, and I therefore took one sample of water from the Great Mussel Roe River, at the intake, and another sample from the race in front of syphon No. 6. The two samples of water were kept in sealed bottles, and I have handed them to the Secretary for Mines for the purpose of having the samples of water analysed.

I am under the impression that it is only about ten years since the syphons were constructed, and, unless the analysis should prove a marked difference in the nature of the water taken in front

of syphon No. 1, and the water drawn in between syphons Nos. 3 and 4, I think there can be only one of two reasons, or, perhaps, both combined, which is the cause of the short lifetime of the pipes in syphons Nos. 6, 5, and 4; viz.:—

(1.) The steel plates used may have been of inferior quality;

(2.) The coating of the pipes (which ought to have been asphalt, mixed with only a small percentage of coal tar, but which, I understand, was coal tar only) was, perhaps, carried out under difficult circumstances, as I believe the pipe-bathing was executed at the different sites of the syphons, and for these reasons it is possible that the coating has not been of a character suitable to protect the pipes against chemical action.

In accordance with what has been stated above, I beg to recommend that syphons Nos. 6, 5, and 4 should be removed. As the maximum hydrostatic pressure at the syphons in question is only 36 lbs. per square inch, I therefore cannot see any reason for using steel, and I beg to recommend that the new syphons should be ordered of best rolled wrought-iron plates, of tough and ductile quality, of ultimate strength not less than 55,000 per square inch, and that will elongate at 15 per cent., and reduce in sectional area 25 per cent before fracture.

In the Appendix attached to this Report I have stated, for convenient reference, what diameter of pipes in the syphons it will be necessary to employ under different conditions.

Leaving syphons Nos. 3, 2, and 1 out of consideration, I shall apply myself only to the three lower syphons. But, before proceeding further, I shall use this opportunity, and state here that I understand that a Tasmanian statute sluice-head is equal to 24·168 (twenty-four one hundred sixty-eight thousandth part) cubic feet per minute, and, if I am under a misconception, I beg to be corrected.

I understand that the Mount Cameron Water-race was originally intended to carry 50 sluice-heads, but I do not think the water-race at present is able to carry more than, say, 40 to 45 sluice-heads. I gauged the water in the race in front of syphon No. 6 on the 30th July, and found 19⅔ sluice-heads running; I gauged in the outlet box of syphon No. 5 the next day, and found 27¹ sluice-heads, and on the 1st instant I gauged in front of syphon No. 4, and measured 41½ sluice-heads; and I believe that 3 or 4 sluice-heads more here would have sent the water over the embankment in several places; but it is also quite easy to understand that the race, during, say, 10 years' operations, may have silted up a few inches.

To be able to determine the best way of renewing the three lower syphons, surveys of these should be made, drawings for new syphons put in hand, and the following points should be settled:—

With regard to syphon No. 6—

1. How far this syphon could be shortened in length by carrying the race forward on an embankment.
2. Whether this syphon should be computed to carry 30 sluice-heads; or,
3. Whether it would be less expensive to construct the syphon for a carrying capacity of 21 sluice-heads only, and taking advantage of the water-head lost by the "drops" to be found at about 15 miles 71 chains, constructing a race which would be, more or less, 2 miles 10 chains long, and which would carry the balance of the water from the inlet of syphon No. 6 to reservoir No 1, at the northern or lower end of the Mount Cameron Water-race; or
4. Whether it would be practicable to construct a small reservoir at the outlet of the syphon, the capacity of which needs to be only 125,000, in which case the syphon could be reduced to carry only 7 sluice-heads.

With regard to syphon No. 5—

1. To choose a more direct line than used for the existing syphon; and
2. Whether this syphon should be computed to carry 40 or 45 sluice-heads.

With regard to syphon No. 4—

1. To choose a more direct line for syphon.
2. Whether this syphon should be computed to carry 40 or 45 sluice-heads.
3. To examine whether it would be less expensive to abandon the present small reservoir No. 2, and regaining over 8 feet additional water-head for the working of the syphon, by which means the diameter of pipe necessary will be considerably reduced, or to keep reservoir No. 2, and employ larger pipes for syphon on account of reduced water-head. (See Appendix.)

With a view of ascertaining whether it is practicable to increase the present supply to the Mount Cameron Water-race during the dry season, I examined:—

1. The Great Mussel Roe River, above the intake to the race, but found there is no site for dam or weir available.
2. The Little Mussel Roe River is at present drawn upon as a feeder for the Mount Cameron Water-race; maximum supply drawn is stated to be 12 sluice-heads, and minimum at

3 sluice-heads. There are 2 or 3 places where a small concrete weir could be constructed for a comparatively small expenditure, but the body of water a weir would keep back would also be small; so this water-course is hardly available for storing purposes, but, as it is a perennial stream, it is important as a feeder, and its use in this capacity may be increased.

At a distance of ½ to ¾ miles up-stream from the present intake, 2 waterfalls, within about 50 feet of each other, will be seen; the drops are 10 to 12 feet each.

3. The Old Chum Creek is also said to be perennial, and is not at present drawn upon as a supply. Two apparently good sites were found here.

The one is within a distance of about ½ mile up-stream from where fluming of the race crosses the creek; and this site would essentially be for an earthern dam, with a by-wash at one end. The length of the dam would possibly be about 150 feet, and greatest height about 20 to 25 feet. It seems as if a large body of water could be stored by such an embankment, as the fall of the creek immediately above this site seems small.

The other site found is about ¾ mile further up-stream, and is decidedly a site for a concrete weir, as both the bottom and the side of the creek here are composed of solid rock (granite), and both banks coming together leave an opening in width of only about 60 feet.

The length of the weir would probably be about 70 feet, and greatest height about 20 feet, and while the ordinary flow of the stream, after the reservoir had been filled, would be allowed to escape over a small by-wash, the configuration of the river banks is such, that the weir must be designed to allow any flood coming down the creek to pass over the weir in its entire length. Although the bed of the creek in this case seems to rise quicker than at the site for the earthern dam, yet it is evident a good storage will be found up-stream from the proposed site for weir, as the river banks here abruptly widen out, especially so to the western side. However, it is impossible for me to say for certain, until surveys have been made, and drawings prepared, which (if any) of the 2 sites would be the more practicable to adopt, and whether the benefit derived from such impounding reservoir would warrant the expenses being incurred.

I am under obligation to Mr. Griffin, the Manager of the Mount Cameron Water-race, for although he, at the time of my visit, was not in the best of health, yet he accompanied me daily over the race, assisted me in every way, and gave me all possible information.

In conclusion, I beg to say that this temporary report has grown to a greater length than I intended it to be; but this has happened only by a desire to give you all possible information in my power on the subjects under review.

I have the honour to be,
Sir,
Your obedient Servant,

K. L. RAHBEK, *M.Dan.Assoc.C.E.*

NOTE.—I have just received attached report from Mr. Ward. Although the report states that the water drawn between syphons Nos. 3 and 4 contains some dissolved carbonic acid, and a perceptible amount of sulphuric acid, yet they seem to be in such small quantities that they probably could not wholly account for the rapid decay of syphons Nos. 6, 5, and 4.

K.L.R.

Appendix.

RETURN showing the Size of Pipes necessary to be used in the Syphons, under different conditions, as stated.

Syphon No. 6.—Length assumed to be 3105 feet, and the working water-head = 6·58 − 8% = 6·05 feet.
Supplying 50 sluice-heads, diameter of pipe = 30 inches.
„ 40 „ „ = 28 „
„ 30 „ „ = 25 „
„ 20 „ „ = 22 „
Waterhead, in this case, only 4·21 ft. } „ 7 „ „ = 16 „

Syphon No. 5.—Length assumed to be 4200 feet, and the working water-head = 15 feet − 7% = 13·95 feet.
Supplying 50 sluice-heads, diameter of pipe = 27 inches.
„ 40 „ „ = 25 „

Syphon No. 4.—Length assumed to be 3730 feet, and the working water-head = 13·74 − 8% = 12·64 feet.
Supplying 50 sluice-heads, diameter of pipe = 27 inches.
„ 40 „ „ = 25 „

Syphon No. 4.—Length assumed to be 3618 feet, and the working water-head = (13·74 − 8·11) − 8% = 5·18 feet.
Supplying 50 sluice-heads, diameter of pipe = 32 inches.
„ 40 „ „ = 29 „

Syphon No. 3.—Length assumed to be 354 feet, and the working water-head = 4·02 feet.
Supplying 50 sluice-heads, diameter of pipe = 23 inches.
„ 40 „ „ = 21 „

Syphon No. 2.—Length assumed to be 362 feet, and the working water-head = 5·00 feet.
Supplying 50 sluice-heads, diameter of pipe = 23 inches.
„ 40 „ „ = 21 „

Syphon No. 1.—Length assumed to be 463 feet, and the working water-head = 5·80 feet.
Supplying 50 sluice-heads, diameter of pipe = 23 inches.
„ 40 „ „ = 21 „

Approximate Proportionate Cost of Pipes of different Sizes, taking a Pipe with a diameter of 36″ as a unit.

Diameter in Inches.	Proportion.	Diameter in Inches.	Proportion.
36	1	25	67·1%
32	86·2%	24	64·4%
30	81·0%	23	61·7%
29	78·0%	22	59·3%
28	74·5%	21	56·3%
27	72·5%	16	43·0%

Government Laboratories, Hobart,
23rd August, 1900.

Dear Sir,

The samples of water received from you on the 18th instant, and stated to be from Mount Cameron Water-race, have been examined, with results following :—

1. From channel at inlet of Syphon No. 6.
2. From intake of race from Great Mussel Roe River.

	Grains per gallon.	
	No. 1.	No. 2.
Total Solid Matter	8·8	7·0
Organic Matter, &c., lost on ignition of residue	3·0	2·4
Total Mineral Matter	5·8	4·6
Chlorine and Chlorides	2·3	2·2

The residues from both waters were alkaline after ignition; the waters were neutral, even when concentrated. No. 1 contains more organic matter and dissolved carbonic acid, also a perceptible amount of sulphuric acid, probably as sulphate of iron, derived from the oxidation of pyrites.

Yours faithfully,

W. F. WARD, *Government Analyst.*

To the Secretary for Mines, Hobart.

JOHN VAIL,
GOVERNMENT PRINTER, TASMANIA.