(No. 55.)

1901.

PARLIAMENT OF TASMANIA.

CONSERVATION OF WATER, BLUE TIER DISTRICT:

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

Cost of Printing—£15 16*s.* 6*d.*

(No. 55.)

PRELIMINARY REPORT ON THE FEASIBILITY OF CONSERVING WATER FOR POWER PURPOSES IN THE BLUE TIER DISTRICT.

Hobart, 23rd September, 1901.

SIR,

IN accordance with instructions contained in your letter dated the 1st May last, viz.—to examine the Blue Tier District, and by means of preliminary Surveys to ascertain whether it appears practicable to conserve water for power purposes, for the working of several Mines, principally situated on the southern slope of the Blue Tier District, and also to ascertain the practicability of conserving water for the profitable working of some alluvial flats, principally the Ruby Flat, in the vicinity of George's Bay, I left Hobart on the 2nd May for the Blue Tier, and finished my examinations on the 19th June. I then received instructions from you to inspect the Ringarooma River from Branxholm to Boobyalla, which I did, and I have, therefore, not yet had time to carry out the second part of your instructions, namely,—to look into the question of water-conservation for the Golden Fleece and the Ruby Flat at St. Helens.

With respect to the Blue Tier District, I have the honour to report as follows:—

I made the tin-mining township, Lottah, my headquarters, and from here I examined first the District on the southern slope of the Blue Tier.

The Ransom, the Laffer, and the Swan Rivers. I gauged the Ransom River on the 6th of May just below its junction with the Swan River, and found 14 sluice-heads passing; (a Tasmanian sluice-head being 24·168 cubic feet per minute). This quantity represents the combined flow of the Ransom, the Laffer, and the Swan Rivers. I may add, that very little rain had fallen in this District since the middle of April. Just below the junction of the Ransom and the Swan, there is a suitable site for a Weir, but an impounding Reservoir could not be constructed with profit, as the River above has a fall of about 2 feet to the chain. The site for a Weir is about 400 feet above sea-level. I must say here, that all heights appearing in this Report, and on the accompanying sketch-plan, are taken with Aneroid, and should be trusted only within a margin of, say 50 feet.

On the 7th May I put in a temporary gauge across the Ransom just out from Kunnara sawmill, and found 6·76 sluice-heads passing. The next day I put in another temporary gauge across the same stream a quarter of a mile down-stream from the junction of the Ransom and the Laffer Rivers, and found that 4·5 sluice-heads passed. The place where I had this gauge erected would make a suitable site for a Weir; its altitude above sea-level is 650 feet. However, by running levels up-stream, I found that a 40 feet high Weir would scarcely back the water for half a mile, and probably not for more than 8 to 10 chains in width; so I also abandoned this as a possible site for a Reservoir.

I examined some distance of the Laffer River, crossed the country, and when down the Swan Rivulet, but found no suitable place for impounding water on these two streams.

The Ransom Reservoir.—About a mile down-stream from the junction of the Swan and the Ransom, the river banks retreat, and a plain is thus formed which may be utilised as a reservoir site. The site for the Weir across the Ransom River is situated three quarters of a mile east from *Gould's Country Hotel.* The eventual outlet from the Reservoir would be only about 300 feet above sea-level, and, being so low-lying, would consequently be useless for any of the Mines at the Blue Tier. It would however, possibly be useful for the working of the alluvial flats at St. Helens. The proposed Reservoir is shown on the accompanying sketch-plan. With a water depth of 40 feet at the Weir, the water surface of the Reservoir will amount to about 40 acres, and the capacity about 27 million cubic feet. One sluice-head is 24·168 cubic feet per minute, and this running for 24 hours will represent 34,800 cubic feet. The reservoir would thus contain 775 sluice-heads for 24 hours, or say 20 sluice-heads running continuously for 38 days; or, as the water on the alluvial flats would be required for 8 hours only per diem, it would supply 20 sluice-heads daily during 114 days. I need hardly add, that as all information as to the size, &c., of reservoirs, is based on flying surveys only, all measurements given throughout in this Report can only be deemed to be approximations.

The length of a proposed race from this reservoir to the northern boundary of the Ruby Flat will probably be 9 to 10 miles; and a Syphon will be required for crossing the George River at a place about a quarter of a mile down-stream from the junction of the Powers Rivulet. Levels taken with an instrument of precision will reveal whether this reservoir has a sufficiently high altitude to forward water to the flats with necessary pressure, but judging from Aneroid readings, I think that it would command about three quarters of the areas of the alluvial flats at St. Helens. As shown on the map, some private land would be inundated by this reservoir, namely, a part of lot 16, W. J. Fitzgerald, and a smaller part of J. Lee's ground, besides submerging the road leading to these properties for a length of about half a mile. None of the houses would be touched in consequence of the raised water-level. I do not think it would be expensive to acquire the private land necessary, but it will of course be incumbent to make a new road, as well as a kind of crossing over the Ransom River above the reservoir, for the convenience of J. Lee. One special feature in connection with this proposed reservoir is the fact that the water proposed to be impounded is not, and has not been used hitherto for any mining purposes. I do not think there would be any question about compensation water, as it is only a mile distant from the site of the proposed Weir to the junction of the Ransom and the Groom Rivers, and only one private lot of a little over 9 acres in area is to be found along this distance.

I should not advise incurring the expense of a permanent survey for this reservoir until other likely places for impounding reservoirs (for instance on the George River) had been examined.

Having finished my inspection of the water-courses to the east from Lottah, I began my examination of the Groom River.

The Groom River.—In examining this river, I started from its junction with the Ransom. It would be possible to conserve water on the Groom River as shown on the map, on lots 7 and 8, that is, as far as the natural configuration of the country here is concerned. The capacity of this reservoir would probably not be more than one-third or one-half of that mentioned for the Ransom Reservoir. About a quarter of a mile of the public road running alongside the Groom River would be submerged, and would, therefore, have to be deviated. But as the water in the Groom River is heavily laden with tailings from the Mines up-stream, I should not propose any reservoir to be constructed on the river, as better sites on other streams are available, and, therefore, I examined this site only cursorily. The water from a reservoir here could be used for the flats at St. Helens.

The Groom River Falls.—These falls are located about 2 miles down stream from the Anchor Mine. There is one perpendicular drop of 26 feet, and for a distance of about 8 chains, the total fall amounts to say 75 feet. By constructing a race about a quarter of a mile in length, and taking advantage of the numerous small rapids, about a total drop of say 100 feet may be obtained. Assuming that at present (with the exception of a few weeks in the driest season) the minimum flow in this stream is 20 sluice-heads; these, with a 100 feet drop would develop 90 h.p. theoretically, or, say 60 h.p. from the turbine shaft. If water should be conserved on top of the Blue Tier for power purposes, it will all come down the Groom River, and assuming that at that time the minimum flow in the Groom River would be 40 sluice-heads, 120 h.p. actual can be had from these falls. It should, however, be mentioned that, as a great deal of tailings are coming down the river, special arrangements would have to be made to clear the power-water before it reaches the turbine.

I did not notice any other place along the Groom River where water could be conserved with advantage. Above the Anchor Battery, the river-bed is strewn with large boulders.

The Crystal Creek.—This creek has in places quite a precipitous fall, but a short distance above where it crosses the Lottah-Weldborough road, a small reservoir could be constructed to serve one of the Mines as storage for dressing-water.

The whole of the Blue Tier District is a pronounced granite country, and the solid bedrock presents itself in many places along the streams. By viewing the accompanying map, and noticing the different altitudes as marked, it is patent, what a very precipitous fall all the streams have along their upper parts. For instance, the fall of the Groom River between the Liberator and the Anchor Mines, being a distance of less than two miles in a straight line, has a fall of, say 450 feet. The Crystal Creek has even a heavier fall in places; the Ransom River, in its upper 3 miles, has a fall of about 400 feet a mile, and the Laffer and the Swan Rivulets have also very rapid falls. So it is quite evident that it is impossible to impound a sufficient quantity of water on the southern slope of the Tier for power purposes for the existing Mines. I therefore turned my attention to the top and the northern slopes of the Blue Tier, having already learned that it was likely that some good dam sites would be found there.

However, before examining that part of the country, I paid visits to the different Mines, the Anchor, the Liberator, the New Crystal Hill, and the Puzzle, to see in what altitudes the different batteries were situated, and to get an idea of what power each of them might require.

The Anchor Mine.—This Mine has a battery consisting of 100 stampers, besides all auxiliary machinery for dressing purposes. It is a great pleasure to walk through the battery-sheds and note how all the different machinery has been arranged to the best purpose. The whole of the establishment is arranged so that the stones obtained from the different "faces" are transported on down-grade tramways to the stone-crushers, and again, from here, on a down-grade to the stampers. The stones treated are low-grade and give, on an average, from $\frac{1}{3}$ to $\frac{1}{2}$ per cent. black tin of about 74 per cent. metallic assay. All stones are sent through the battery, and none rejected. The power employed is water by means of pelton-wheels.

The Anchor Mine is a living testimony to the fact, that tin-winning of low-grade stones as low as $\frac{1}{3}$ to $\frac{1}{2}$ per cent. can be made to pay, and pay handsomely, when treated on a large scale with modern machinery and with inexpensive power.

The Manager informed me that on account of want of sufficient water-power, the battery (which is kept working night and day except Sunday) had worked the last year with an average only of 37 stampers instead of 95 or 100, and that the Mine, with only these few stampers at work, was able to pay working expenses. He argued, furthermore, that the expenses for keeping the full number of stampers going entailed only a small increase in expenditure, while of course, the quantity of stuff crushed would be in due proportion to the number of stampers kept at work. Therefore, if he had sufficient motive power to keep the whole battery going during the different seasons, the capital invested would reap a handsome profit.

At present water for power is obtained from the Upper Groom and the Laffer Rivers, and a new race is being constructed to obtain additional water-power from the North-George River, and, eventually, also from the South-George River. Comparatively large expenditures are thus incurred in constructing races of great lengths with accompanying numbers of perishable timber flumings, which after 8 to 12 years, require complete renewals. Had a part of the capital thus expended been employed in water-conservation works, the Mine, as a business concern, would undoubtedly have been better off. On the other hand, it must be admitted, that water-conservation on any large scale, as a rule, is so expensive that a single Mine could not very well undertake it, and I imagine that it is difficult for several Mines to agree to carry out such works, even if these would be for their mutual benefit. This at least, is the only reason I can find to explain the fact that so far no step has been taken to attempt water-conservation.

I was informed that 95 heads of stampers with 95 blows per minute would crush 400 tons per diem, or 120,000 tons a year, at 300 working days, and at a cost of 2*s.* 6*d.* to 3*s.* per ton, so this points to the conclusion that here is a profitable investment of capital, and what is at least just as important, here is a prospect of steady work for a large number of men, if reliable and inexpensive motive-power can be obtained.

I estimate that 275 actual h.p. is required to run the Anchor Mine's battery of 100 stampers, including all dressing machinery, 2 stone-crushers, and the electric lighting plant. I believe that 13 sluice-heads are required as dressing-water. The pelton-wheels driving the stampers are situated in reduced level, 700 feet above sea-level.

The Liberator Mine's battery consists of 20 heads of stampers, 8 jigs, 9 frue-vanners, 2 buddles, and one stone-crusher (Gate No. 2). Each stamper weighs 1000 lbs., and with 7½ inches drop, and 95 blows per minute, will require, theoretically, 36 h.p., or, allowing for loss incurred by friction, &c., say 48 h.p.; and all the auxiliary machinery, including an electric lighting plant of 30 incandescent lamps (some of 8, some of 16 c.p.) will probably require an additional 12 h.p., so that in all, 60 h.p. actual, will run all machinery. This battery I deem to be quite a model; it is very compact, and all machinery seems to be of the best design. A pelton-wheel drives all the machinery with the exception of the two buddles, which are worked by a small breast-wheel, utilising the escape-water from the pelton-wheel as motive-power, and with the exception of a small pelton-wheel which takes the power of the water used for dressing purposes and runs the electric light plant and the stone-crusher.

The water driving the large pelton-wheel is under a pressure of 430 feet, and as only 60 h.p. actual are required, consequently, less than 5 sluice-heads are necessary as power-water. But even this comparatively small quantity of water cannot be had during the whole year, the Manager stating that he had only water for about 6 months during the year. At the time of my visit (22.5.1901) the battery was not working for the want of water. I gauged the amount of water flowing in the flume above the pipe-intake, and found only 1·15 sluice-heads passing, which, of course, were useless for power-purposes. When the battery is in full work, 3 sluice-heads are required for dressing purposes. The Manager informed me he was constructing a new race for the purpose of tapping George Creek, and two or three other smaller creeks, and hoped to get about 4 sluice-heads during the dry season.

The New Crystal Hill Tin Mine.—At the time of my visit this company had started making a road to the site for the battery, but the buildings had at that time not been started. The Manager, however, pointed out to me the proposed site as shown on the map, and informed me that the intention was to put up only a small battery to begin with, consisting of 10 heads of stampers, 2 jigs, 4 frue-vanners, 1 buddle, and 1 stone-crusher. As to power, he said it was not quite decided whether to use steam or to try to tap the Groom Falls (already mentioned in this report) for mechanical energy, and send it by wire, transferred into electric energy, to their battery. I noticed a small water-course containing, perhaps, ½ sluice-head of water running past the proposed battery site, and asked if that was all he had for dressing-water, and was informed he intended to make arrangements for storing dressing-water. About 1¼ to 1½ sluice-heads are required as dressing-water for a battery of 10 stampers.

The Australian Tin Mine.—Or, as it is called locally, the *Puzzle*, has a battery consisting of 30 heads of stampers, 2 rotary tables, 12 jigs, and 3 buddles. Each stamper weighs 616 lbs., and with 8 inches drop, and 90 blows per minute, will require 33 and a third theoretically h.p., or, allowing for friction, &c., say 45 h.p.; allowing a further 10 h.p. for the dressing machinery, 55 actual h.p. would be required for running this battery. The machinery employed in this battery is not up-to-date. I believe it is put together of the remains of 2 or 3 old batteries, and both boiler and steam-engine looked ancient. I believe the stones from the "Don Face" average about 1 per cent. black tin, and only the best stones are sent through the battery: quantities of stones rejected here are better than those which are treated at the Anchor Battery with profit. If it were not for the fact that the stones here are comparatively rich, and that the Manager is trying to do his best with the kind of machinery at hand, this business would never pay.

The battery site is at a higher elevation than the "face" from where the stones come; it costs money to lift this mass of stones daily; the machinery itself is old fashioned and inefficient; and then the motive-power is steam, which I assume may cost anything between £20 to £30 per h.p. per year. If a new site for the battery were chosen at a lower altitude, efficient machinery put in, and inexpensive motive-power established, this Mine would be sure to pay large dividends.

These are the four Mines at present at work, or about to be started, but there are other Mines equally good, if not better, which have not been worked lately, for different reasons. There is for instance—

The Moon.—This mine has been previously worked from the top of the Blue Tier, or rather, from the northern slope. I have heard the opinion expressed, that the stones here would probably average ¾ to 1 per cent. black oxide, and that the reason why the work at this Mine was discontinued was the fact that the stones from the "face" worked had to be lifted up to the battery site, that the motive-power was steam, and as the country there seems to be water-logged there was difficulty in getting the ground water away by gravitation. It is now argued that if this Mine were worked from the southern slope of the tier by means of a tunnel, with the battery also on the southern side, some distance below the tunnel, which should have a rising grade towards the north, this would be the means of draining the ground water by gravitation, and a tramway through the tunnel would bring the stones on a down-grade to the battery. It is further argued, that if water-power were available, this Mine would also prove to be a remunerative one.

When I speak about the probable value of stones in the different Mines, I do not do so from my own personal knowledge; I simply state what I have heard from different people; and when I compare the statements with what appears in a very interesting report dated the 19.1.1893, and signed by a late Government Geologist, Mr. A. Montgomery, M.A., and I find that the various views put forward agree, I have no doubt that the statements are correct.

Seeing what can be achieved by treating ⅓ to ½ per cent. low-grade stones in a battery like the Anchor Mine's, I have no doubt that similar or better results can be obtained from the "Moon," if the mine is worked as suggested, and power-water is supplied.

On the 40-acre block, 2143 (*see* map) there are, as shown, 3 tunnels driven into the Blue Tier from the Lottah side. The lowest one is at an altitude of about 1750 feet above sea-level, and might, perhaps be used in connection with the development of the Moon Mine. The tunnel is said to have a length of 1000 to 1100 feet.

Haley's Lease Mine is situated close to Poimena and in a direction N.W. from the township. It is not worked at present. I am not sure if this mine would be most profitably worked from the northern or the southern slope. Drainage can be effected, I believe, if worked from the northern slope, and if water-power is sent along the southern slope of the tier, electric-power could be generated at a suitable place there, and sent per wire to the battery; the distance would only be about a mile. If worked direct from the southern slope, a tunnel would be required, as described for the Moon Mine.

The proposed Wheal Tasman Flat Power Reservoir.—On the top of the Blue Tier, and at a distance a little over a mile, and in a direction N.E. from the small township of Poimena, there is a plain called the Wheal Tasman Flat, which on nearly all sides is closed in by low ranges.

This plain is quite an ideal site for an impounding power-reservoir, situated as it is at the highest possible altitude, namely, 2300 feet above sea-level, and with the highest part of the Blue Tier, I should judge, probably, not more than 2500 or 2600 feet above sea-level.

This flat, considered as a site for a reservoir, is otherwise quite unique, as the water from here could be turned down into four different catchment areas, viz.:—

1. The Wyniford River, to which it belongs, as arranged by nature, and whither it is going at present;
2. The Great Mussel Roe River;
3. The Swan, the Laffer, and the Ransom rivers; and
4. The Groom River, were it will be sent in case this site should be utilised for a power-reservoir.

As already stated, the Blue Tier is a granite country, and the Wheal Tasman Flat is covered with a layer of sand and clay, I should judge, of a thickness from 3 to 6 feet. Some alluvial tin-washing has been done here in years gone by, and, consequently, a part of the flat presents itself as a succession of holes and moles. In the event of a reservoir being constructed here, the excavated holes would be filled up and the moles levelled down, vegetation, shrubs and trees felled and burned, and, I think, there is very good prospect that no percolation would take place. But, as it is of importance to reduce the doubts of no percolation taking place, even to the smallest degree, I would suggest, when permanent surveys are started, that the Government Geologist be instructed to examine the Wheal Tasman Flat and adjacent country. It is probable that his trained eye may discover "faults," or other geological features of moment, which an engineer would overlook, or not be able to see at all

The only doubt as to this otherwise splendid site for a reservoir is whether the catchment area is large enough to keep the reservoir supplied with a sufficient quantity of water. I have not made any survey in order to determine the size of the catchment area, but I should judge the direct catchment area (*i.e.*, that area which sends its waters direct into the flat) to be at least one square mile. And in spite of the heavy rainfall, which amounts to over 60 inches a year, and in spite of the steep inclination of the area which catches the rainfall (but which, on the other hand, is covered with dense vegetation), notwithstanding the fact that the area of the reservoir itself will amount to, say one-third of the whole catchment area, and also, in spite of the fact that the yearly evaporation here cannot be large; in spite of all these favourable circumstances, I am far from sure that a sufficient quantity of flow-off water will be available for the reservoir. I am very much impressed with the fact that if such a power-scheme as this is started, the very first condition is that it is made an absolute certainty the contracts entered into with the different mines are kept, and that the amount of power specified and agreed to is forthcoming, no matter whether it is a "dry" or a "wet" year. As it is thus of paramount importance to have settled what amount of available rainfall there may be to reckon with, I constructed a permanent gauge (situation shown on map) a few chains down-stream from the junction of the Sun and Moon creeks, and, in accordance with your approval, the gauge-records have been taken daily since the 13th June last; in case of floods, the records are taken twice a day. When these records have been

taken for a year it will be known what quantity of water could have been stored during that period, and, comparing the rainfall for that year with that for other years, it would be possible to find approximately the least quantity we are likely to get. I should say that the Wheal Tasman Flat is supplied by the Sun Creek and a nameless creek, (which might appropriately be called the Tasman Creek), and in addition to that I propose to take in the water from the Moon Creek and the Seven-mile Creek, whereby, I think, the catchment area will be increased to over two square miles. I also think it would be well to go farther afield to increae the water-supplying area; but I shall return to this subject later on. The great usefulness of the proposed Wheal Tasman Flat Reservoir is not only on account of its large size, and because the plain has a rise only of about 1 in 250, but it lies still more in the fact that water-power will be delivered at the highest possible altitude (2300 feet above sea-level); and as the usefulness of power-water consists of the two factors "quantity" and head," it is obvious that the larger the "head" we can utilise, the smaller is the "quantity" required for supplying the same amount of power. The power-reservoir, as proposed, is shown on the accompanying sketch-plan. I propose to raise the water-level to a depth of 30 feet at the weir, when the reservoir is filled. The length of the weir or dam will be about 17 chains, or, say 1120 feet. Weirs across watercourses may be constructed of different materials, as—(1) Timber, (2) Stone—filling in cribwork, (3) Rock-filling, (4) Earth-embankment, (5) Cement-concrete, or (6) Stone-masonry.

1. To use timber or any other perishable material is out of the question in the present instance, as these works should essentially be of a permanent character, and should last for centuries.
2. Timber cribwork with stone filling has been largely used in different countries, and has also been used in this State. I understand, for instance, that the Esk Dam, spanning the Ringarooma River at Gladstone, was constructed in this way. Such dams can, of course, not be water-tight unless a "skin" of single or double planking is placed on the up-stream side, but as a part of this skin now and then is exposed to atmospheric influences, the dam will, in time, become leaky.
3. Rock-filling is used where a gorge with steep rocky sides has to be closed by a dam, and where imperviousness to water is of no consequence as long as it does not impair the stability of the structure. It is out of the question to use this kind of material in the present case.
4. Earthen-embankments are by far the most commonly used structures, chiefly on account of inexpensiveness in construction, and because they in many cases fulfil very well the conditions for which they are built.

   The weak point of this class of structures is that it is open to the attack of different kinds of vermin, which may burrow holes through them, make the dams leaky, and even threaten their stability or safety. If by any chance the water impounded above the dams in any large quantity could find its way above, below, round, or through such embankments, the earth will melt away as snow before the rays of the sun.
5. Cement-concrete weirs, with or without stone-ashlar protection, when well designed and faithfully constructed, are absolutely permanent structures, and the older they get the stronger they become. One point in favour of these structures which is not shared by masonry-weirs, is this—that concerte can be produced without the aid of skilled labour, with the exception of a few carpenters.
6. Stone-masonry, especially if employed as cyclop-work (*i.e.*, built of irregular stones not laid in courses, but as irregular as possible, and with all interstices well filled with hydraulic mortar), with or without ashlar-work, is considered the safest, strongest, and as durable as cement-concrete work, but it is also, as a rule, the most expensive.

In the present case I think our choice will be between an earth-embankment or a cement-concrete weir. At the time the permanent surveys are carried out, the foundation itself, for the weir, will have to be thoroughly examined, as well as the class and the cost of the materials at hand for the construction of the dam or weir.

Sketches showing the approximate cross-section of an earth-embankment and a cement-concrete weir, as well as a sketch of the site itself, are attached.

The power-water is required on the southern slope of the Blue Tier, and if the outlet of the reservoir were made at the weir, this would necessitate either the cutting of a long tunnel through the top of the mountain, or several miles of contouring race-cutting for the purpose of rounding the mountain ranges somewhere at their S.W. termination. But since there are three different places on the opposite side of the reservoir where it is possible to get through the range with much less work, this course should be adopted, and, as a consequence, there will then be no sluice-opening through the weir. But since it is necessary, in that case, to draw the water out of the reservoir against the natural fall of the flat, the cutting of a centre-canal, as shown on the drawing, will be necessitated.

At the time I was running different lines to learn, approximately, how large the impounding reservoir would be, I found "saddles" at three different places where water would escape when raised to a high water-level (30 feet at the weir). Of these three places one is marked on the plan where I propose to construct the by-wash, and the other two places are marked with the letters C. and A.

The three places marked A., B., and C., will have to be carefully examined when the permanent survey is in progress, to find the best place for the outlet from the reservoir. At A. there will be an open cut, say 10 to 12 chains long, and a maximum depth of 30 feet.

At B. there will be a tunnel 12 to 15 chains long and a few chains open-cut, and at C. there will be an open-cut a few chains long. I believe, from the information to hand at present, the best outlet will be at A. If so, the centre-canal will be excavated from the weir, where the lowest part of the reservoir is to be found, and led in easy curves, following somewhat the deepest part of the reservoir, until the outlet at A. is reached. The fall of the canal need not be more than, say 1 in 2000. At the outlet there will be established a regulator and gauge, and from here the top-power race will start.

The reservoir as proposed, with a water-depth at the weir of 30 feet, will have a water-spread of, say 200 acres, and its capacity will be about 134 million cubic feet.

I now propose to go into the important question of finding the probable available quantity of water for the reservoir.

By the courtesy of the Meteorological Observer I have obtained the rainfall recorded at Poimena. The records obtainable are very few, but, naturally, I could not get more records than existed. The rainfall records for Poimena have been taken only during 8 months from November to June, 1892, and for 12 months from September, 1900, to date. Fortunately, rainfall records for Gould's Country exist as far back as the year 1883. I have used the abovementioned 20 months' rainfall from Poimena to find the difference in the yearly rainfall at this place and at Gould's Country. The rainfall at Poimena, from November, 1891, to June, 1892, was 62·91 inches, and at Gould's Country for the same period it was 37·72 inches; therefore, the rainfall at Poimena for that time was 1·67 times heavier than at Gould's Country.

Likewise, the rainfall at Poimena from September, 1900, to August, 1901, was 51·24 inches, and at Gould's Country it was, for the same time, 26·83 inches. This demonstrates that the rainfall at Poimena for this period was 1·91 times heavier than at Gould's Country. The mean of 1·67 and 1·91 is 1·79, and this I reckoned to be the proportionate difference in rainfall at the two places. As already stated, the rainfall at Gould's Country has been recorded since the year 1883, and the three driest consecutive years during that time were the years 1897-9. I have taken the monthly means for these three years, multiplied the figures with 1.79, and the result appears in the table below as the average monthly rainfall at Poimena. The method thus followed is, perhaps, not the most reassuring. It would obviously have been better if the direct rainfall recorded for Poimena from 1883 till now had been obtainable; but, anyhow, it appears to me that the means I have used in trying to solve this question are the best which can be adopted under the circumstances.

I judge the direct catchment-area for the power-reservoir (*i.e.*, that area which drains directly into the reservoir) to be one square mile, and the indirect catchment-area (*i.e.*, that which drains into the proposed feeder-reservoir—see map) to be one square mile.

It is probable, however, that there will be a further loss in the quantity of the available part of the rainfall belonging to the indirect catchment-area, and I deduct, therefore, 25 per cent. from this: the the total catchment-area I thus reckon to be, in all, $1\frac{3}{4}$ square mile.

The records from the permanent gauge constructed below the junction of the Sun and Moon creeks have been taken daily (and in case of floods occurring, twice a day) since the 13th June last. Comparing the daily quantities of water which have passed through the gauge with the rainfall for the same period, and knowing, approximately, how large an area the rainfall passing through the gauge drains (and which I have reckoned at 1·4 square mile), I find that 0·67 is the available proportion of the rainfall which could have been stored, and in the table below this is the proportion for the yearly available rainfall with which I have reckoned.

The Wheal Tasman Flat Power Reservoir.—The catchment-area is assumed to be $1\frac{3}{4}$ square mile, the yearly rainfall 66·43 inches, the yearly evaporation 20 inches, and the supply required 13 sluice-heads, equals 452,425 cubic feet per 24 hours.

Month.	Monthly available Proportion of Rainfall as Storage, in million cub. feet.			Monthly Evaporation in million cub. feet.		Monthly Consumption in mil. cub. feet.	Surplus million cub. feet.	Deficiency million cub. feet.
	Gain.			Loss.				
	Rainfall in Inches.	Co-efficient.	Storage.	Inches.	Quantity.	Used.		
January	4·90	0·5	9·953	$2\frac{1}{2}$	1·815	14·025	...	5·887
February	2·45	0·4	3·981	$2\frac{1}{2}$	1·815	12·668	...	10·502
March	6·35	0·5	12·929	$2\frac{1}{2}$	1·815	14·025	...	2·911
April	3·24	0·6	7·904	2	1·452	13·573	...	7·121
May	8·84	0·7	25·169	$1\frac{1}{2}$	1·089	14·025	10·055	...
June	7·46	0·8	24·247	$\frac{1}{2}$	0·363	13·573	10·311	...
July	4·10	0·8	13·348	$\frac{1}{2}$	0·363	14·025	...	1·040
August	10·29	0·8	33·466	1	0·726	14·025	18·715	...
September	3·56	0·8	11·592	$1\frac{1}{2}$	1·089	13·573	...	3·070
October	7·39	0·8	24·042	$1\frac{1}{2}$	1·089	14·025	8·928	...
November	4·97	0·7	14·108	2	1·452	13·573	...	0·917
December	2·88	0·6	7·025	2	1·452	14·025	...	8·452
TOTALS			187·764	...	14·520	165·135	48·009	39·900

I may add that I deducted 2 sluice-heads per diem from the quantities I computed had daily passed through the gauge, because I could see from the gauge records that this quantity of water was forthcoming even if no rain had fallen for weeks, and I therefore reckoned these 2 sluice-heads per diem to represent general soakage from the part of the country under consideration.

The yearly evaporation I have reckoned at 20 inches, though I doubt if it will amount to this; but then, on the other hand, I have reckoned nothing for percolation: there ought to be none, judging from the proportionately large quantity of water the Wheal Tasman Flat disgorges after a rainfall.

From the table above, it appears, then, that it may be reckoned there will be 13 sluice-heads always at disposal. It has already been stated that the approximate capacity of the reservoir would be 134 million cubic feet; 13 sluice-heads running continuously for 24 hours represent 452,425 cubic feet per diem, and the reservoir would thus forward 13 sluice-heads continuously for 296 days, assuming no rain fell during that period, and neglecting the quantity of water evaporated during the same time. In connection herewith, I should say it will take about 10 months to have the reservoir filled for the first time.

Having thus ascertained the quantity of water at disposal, I now propose to proceed to distribute this as power-water.

The mines that should be supplied at present are:—1. The Moon, the battery of which I consider should be situated somewhat below the lower tunnel shown on lot No. 2143, E. R. C. Littleton, with its pelton-wheels in, say reduced level [r.l.] 1600; 2. the Puzzle, whose battery ought to be moved to a lower level (its pelton-wheel, I reckon to be in r.l. 1200); 3. the New Crystal Hill's pelton-wheel I reckon to be in r.l. 1300; and 4. the Liberator's pelton-wheel in r.l. 1200.

In the second series, comes (5) the Anchor Mine, whose pelton-wheels are in r.l. 700. I propose to have two sets of power-races: a top one in r.l. 2300, and a bottom one in r.l. 1200. The top power-race starts from the outlet at the power-reservoir, and contouring the side of the Blue Tier, sends down, in succession, water to the Moon, Puzzle, the New Crystal Hill, and the Liberator; that is, we deliver measured water into proper outlets from the race, out for each mine, and it will then be each mine's business to construct the necessary pipe-line for receiving the power-water and conduct it to their pelton-wheels.

The bottom power-race is situated in r.l. 1200, and into this the above-mentioned Mines have to send their used power-water as it escapes from the pelton-wheels; and the power-water is not to be mixed with any dressing-water, which has to be sent away in a natural or artificial watercourse, as the case may be. Neither are the mines abovenamed allowed to use the power-water for dressing purposes, but have to forward the same quantity they receive.

The 13 sluice-heads, which have already given power to the four mines, as described above, we collect in the bottom power-race and send it at a suitable point into an outlet for the use of the Anchor Mine, which, likewise, must construct its own pipe-line for conveying the power-water to its pelton-wheels.

The water from the reservoir will thus serve twice as power-water, and will also be paid for twice, as such.

In the following table A. is shown the approximate "head" the pelton-wheels in each mine will get.

TABLE A.

The Moon, 2300—1600 equals 700 feet, say 650 feet.
The Puzzle, 2300—1200 equals 1100 feet, say 1050 feet.
The New Crystal Hill, 2300—1300 equals 1000 feet, say 950 feet.
The Liberator, 2300—1200 equals 1100 feet, say 1050 feet.
The Anchor, 1200—700 equals 500 feet, say 450 feet.

And in the following table B., is shown what power *One sluice-head* will represent under the different "heads."

TABLE B.

450	feet head	equals	20·5	h.p. theor.	equals 14:4	h.p. actual.
650	„		29·7	„	„ 20·8	„
950	„		43·4	„	„ 30·4	„
1050	„		47·9	„	„ 33·5	„

Assuming, now, that we distribute the power-water to the different mines, as stated in table C., each mine will obtain the number of h.p. from their pelton-wheels, axles as stated, namely:—

TABLE C.

Power-water in first series.

The Moon...	4	sluice-heads	equals	83·2 h.p. actual.
The Puzzle...	3	„	„	100·5 „
The New Crystal Hill	3	„	„	91·2 „
The Liberator	3	„	„	100·5 „

Power-water in second series.

The Anchor	13	„	„	187·2 „
				562:6 h.p. actual.

And 562 h.p. at, say £8 per year, equals £4496.

I should imagine that any charge of, say £10 to £15 per year per actual h.p., would be accepted with alacrity by the different mines. On the other hand, it must be borne in mind, that the mines have to reckon with the interest of the capital invested in constructing their power-pipes and pelton-wheels, and to add the proper quota-part of the same to the cost per h.p. per year. Of course, the expenses will vary with the length of these pipe-lines, with the quantity of water they have to carry, and with the working pressure they are under. I would conjecture that the amount may vary from, say 10*s.* to, say, 30*s.* per h.p. per year.

Where the potentiality of the usefulness of power-water is so high, as in the present case, the water can only be used as power-water. Therefore, each mine will have to find its own dressing-water, and all the mines mentioned can easily do so, perhaps, with the exception of the New Crystal Mine, which will probably have to bring it in by gravitation from some distance.

Assuming that the Anchor and the Liberator mines, by constructing their new races, should be able to run their present number of stampers the whole year round, even then, I think these mines would be very glad to extend their batteries if additional inexpensive motive-power were offered them; for it is a fact, that the larger scale on which these low-grade stones are treated, the more remunerative is it as a business concern. As to the other mines, this project, if carried out, will simply be the making of them.

Reckoning that each stamper will require 2½ h.p., including power for its quota-part of all dressing machinery and electric light, and referring to table C., the different mines could, on account of the present scheme, put up the following additional heads of stampers, including all auxiliary machinery.

TABLE D.

The Moon	83·2	h.p. equals	30	heads of stampers.
The Puzzle	100·5	„	40	„
The New Crystal Hill...	91·2	„	35	„
The Liberator	100·5	„	40	„
The Anchor...	187·2	„	75	„
			220	heads of stampers.

And reckoning 1¼ sluice-head is required as dressing-water per 10 heads of stampers, the mines would need additional quantities of dressing-water, as follows:—

TABLE E.

The Moon...	3 x 1¼	equals	3·75	sluice-heads.
The Puzzle	4 x 1¼	„	5	„
New Crystal Hill	3·5 x 1¼	„	4·38	„
Liberator	4 x 1¼	„	5	„
Anchor...	7·5 x 1¼	„	9·38	„

The Compensation Reservoir.—It has already been stated that, as nature has arranged matters, the water which it is thus proposed to send to the southern slope really belongs to the Wyniford River, and that it, therefore, will presumably be necessary to obtain Parliamentary sanction.

By far the greatest quantity of the water which it is proposed to impound, will be storm-water, which at present goes down the Wyniford River as flood-water, and probably does more harm than good. On the other hand, it may be said that the water which is coming down from the Sun, the Moon, and the Seven-mile Creeks in the dry season is of some importance to the district watered by the Wyniford. If, therefore, it should be proved in any future time that this summer flow could not be spared from the district to which it belongs, then a compensation reservoir may be constructed with a site for weir (as shown on the map), about four chains down-stream from the junction of the Camp Creek and the Wyniford River (or the Blue River, as the upper part of the Wyniford is locally called), and storm-water, stored here, could be distributed during the dry season. With a water-depth at the weir, of 40 feet, the area of the water-spread above would be, say 70 acres, and the capacity, say 58 million cubic feet. This reservoir would thus be able to forward, say 10 sluice-heads daily during 160 days. A sketch showing the site for weir and a cross-section of the weir is attached hereto.

Such a reservoir, however, would be expensive, and I assume it will not be necessary to construct this for many years to come. Again, a smaller compensation reservoir than the one here contemplated may suffice, but in that case it must be remembered that the expenses involved in construction do not decrease in the same ratio as the capacity of the reservoir is decreased. It might also be possible to find a better site for the purpose than the one fixed on. I did not go farther down the Wyniford, but I must say the present site is suitable, and it may be difficult to find one more suitable.

When the power-reservoir has been constructed it will be well to erect a permanent gauge at the site for weir for proposed Compensation Reservoir, for the purpose of learning if such a reservoir could be completely filled during one season.

Estimated Cost.—It is generally understood that the estimated cost made for works on foundation of preliminary surveys can only be considered approximations.

However, I have gone into this matter as well as I could with the information at hand, and find that the probable cost of the Wheal Tasman Flat Power Reservoir, with 3 feeder-reservoirs, and connecting races, and 2 series of power-races for supplying the mines mentioned, and also including the cost for constructing attendant's house, telephones, and other necessary auxiliary works, *but excluding* the cost of putting the main road Lottah-Blue Tier in proper condition, the cost of acquiring necessary land for the proper carrying out of the scheme as described, and also exclusive of expenses for acquiring private rights to water and dam-sites, will amount to £94,000.

In this amount, is included 25 per cent. for contingencies.

The cost for the compensation reservoir as described, I estimate at £22,500.

In this amount, is included 25 per cent. for contingencies.

When proper surveys have been executed, drawings made, and estimates formulated thereon prepared, the probabilities are that the amounts as stated above will be decreased.

Conclusion.

From the investigations made and the conclusions drawn thereform, as detailed in this report, it seems quite practicable to supply the mines on the southern slope, and one or two on the northern slope of the Blue Tier with a fair quantity of water-power. Some of the mines are not worked at all at present, and those at work are languishing for the want of reliable and inexpensive motive-power.

If it is really a proved fact that the stanniferous dykes at the Blue Tier are to be found in such immense quantities as represented, then it is quite clear that it would be profitable to carry out a water-conservation scheme, whereby the mines could be assured of reliable power, and the carrying out of such a scheme would give an impulse to this industry which would be carried on for centuries, thereby offering profitable investment for capital, and giving steady employment to a large number of men.

The water conservation power scheme itself is sound, considered as a pure business concern, and if it is carried out, there will probably be in a few years an outcry for power-water and more power-water, because it is not unlikely other mines in the same district may be opened, and which will undoubtedly be also anixous to obtain their share of power-water.

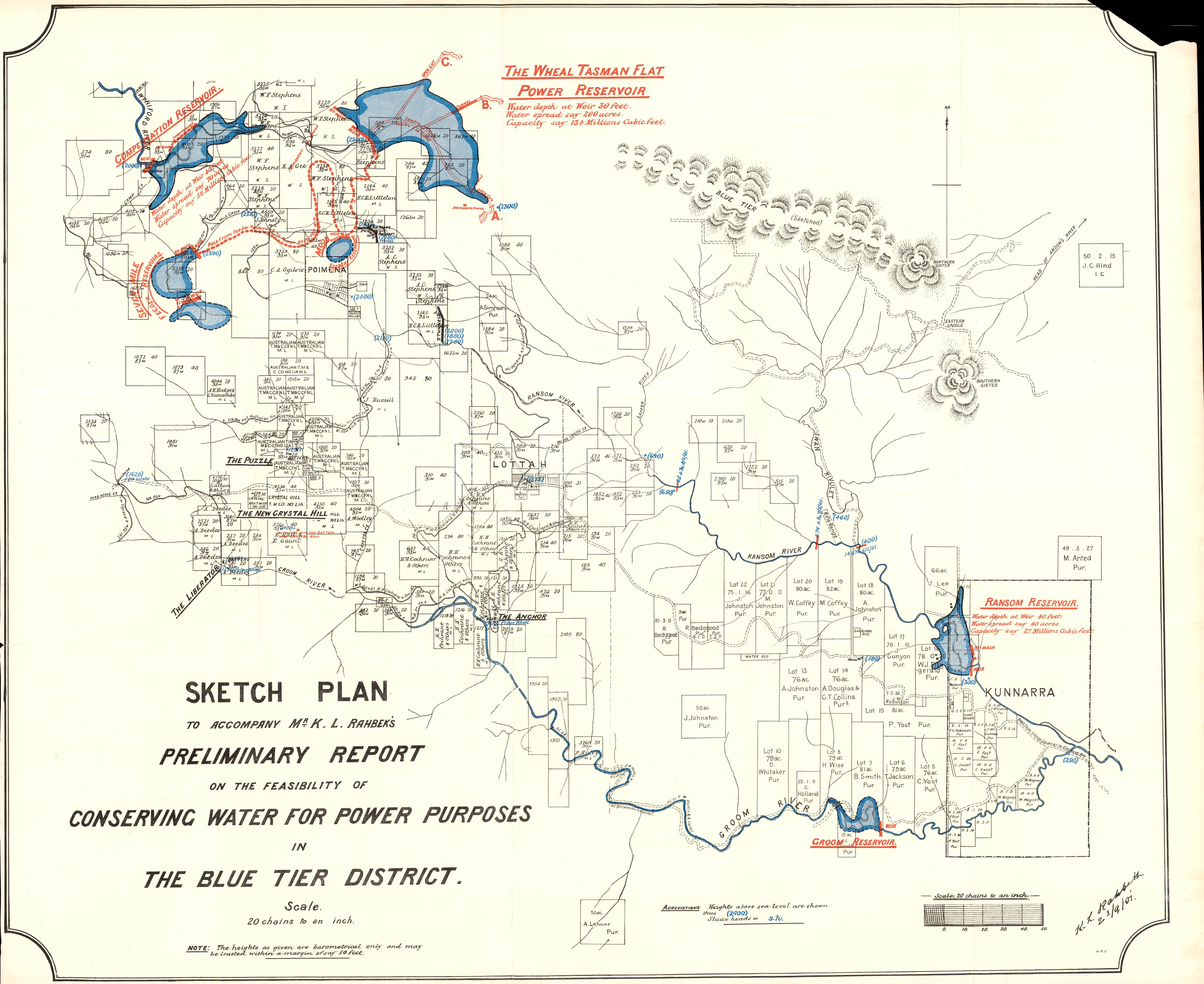
I would therefore suggest that if permanent surveys are to be started, then the whole of the top area of the Blue Tier should be examined with a view of securing all water which by gravitation could be made travel into the proposed power-reservoir for this reason, that water here has such an abnormally high commercial value, that every gallon secured is of consequence.

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

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

To the Honourable the Minister of Mines, Hobart.

JOHN VAIL,
GOVERNMENT PRINTER, TASMANIA.


SKETCH PLAN
TO ACCOMPANY Mr. K. L. RAHBEK'S
PRELIMINARY REPORT
ON THE FEASIBILITY OF
CONSERVING WATER FOR POWER PURPOSES
IN
THE BLUE TIER DISTRICT.
Scale.
20 chains to an inch.
NOTE: The heights as given are barometrical only and may be trusted within a margin of say 50 feet.
THE WHEAL TASMAN FLAT
POWER RESERVOIR
Water depth at Weir 30 feet.
Water spread say 200 acres.
Capacity say 134 Millions Cubic feet.
COMPENSATION RESERVOIR.
Water depth at Weir 40 feet
Water spread say 70 acres
Capacity say 58 Millions Cubic feet
SEVEN MILE RESERVOIRS.
FEEDER RESERVOIRS
Race from Feeder Reservoirs
RANSOM RESERVOIR.
Water depth at Weir 40 feet.
Water spread say 40 acres.
Capacity say 27 Millions Cubic feet.
GROOM RESERVOIR.
WEIR
BLUE TIER
(Sketched)
NORTHERN SISTER
SOUTHERN SISTER
EASTERN SADDLE
HEAD OF ANSON'S RIVER
POIMENA
LOTTAH
KUNNARRA
RANSOM RIVER
GROOM RIVER
SWAN RIVULET
LAFFER RIVER
WINNIFORD RIVER
SEVEN MILE CREEK
CAMP CK.
THE PUZZLE
THE NEW CRYSTAL HILL
THE LIBERATOR
THE ANCHOR
ABREVIATIONS: Heights above sea level are shown thus (2400)
Sluice heads = S.H.
Scale 20 chains to an inch.
0. 10. 20. 30. 40. 50.
K. L. Rahbek
2/3/4/01.

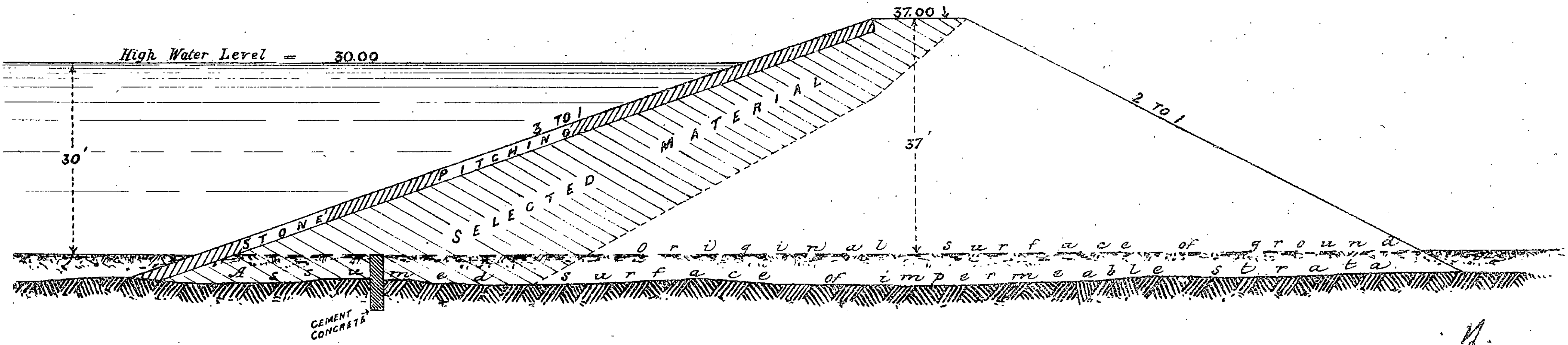
WHEAL TASMAN FLAT

POWER RESERVOIR.

EARTHEN EMBANKMENT.

Scale.
Horizontal and Vertical
20 feet to an inch.

CROSS SECTION.



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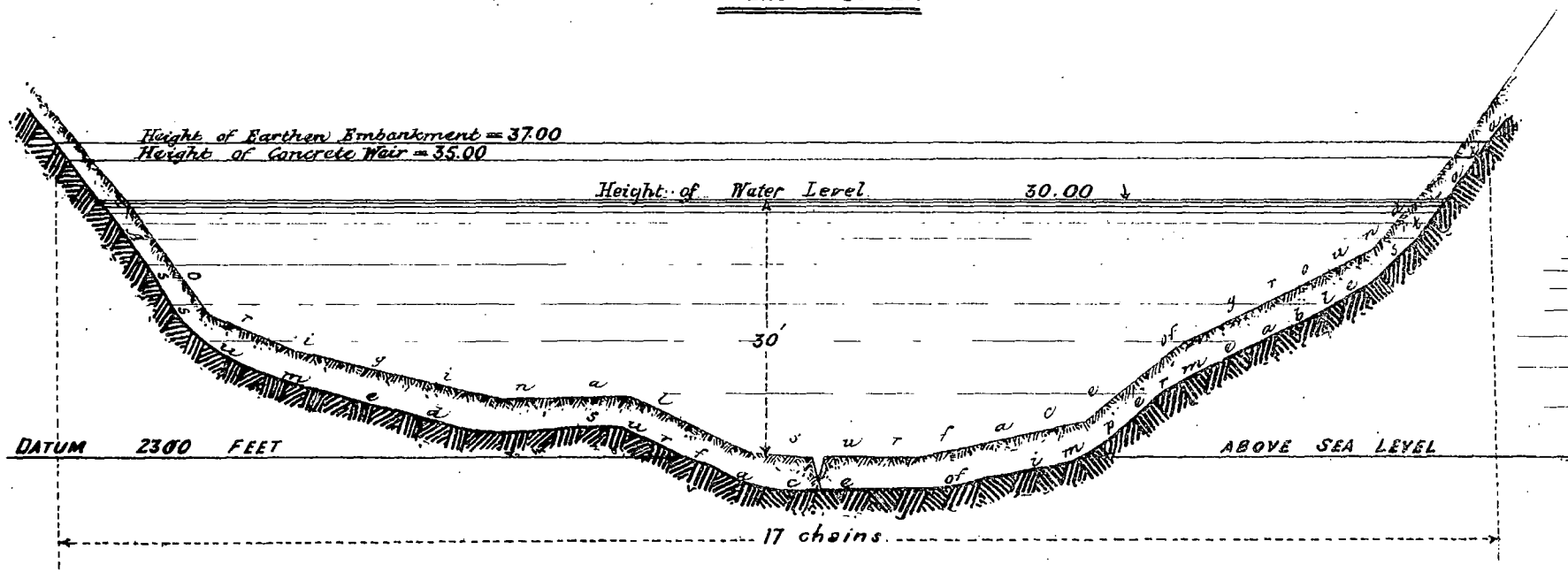
WHEAL TASMAN FLAT

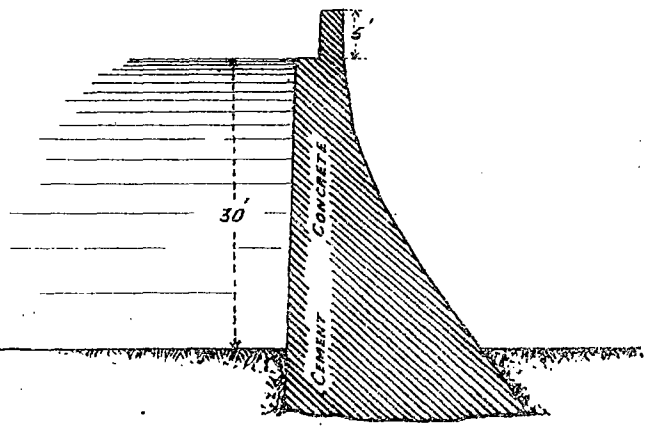
POWER RESERVOIR.

WEIR SITE.



WEIR.

CROSS SECTION.



Scales.

Horizontal: 2 chains to an inch.
Vertical: 20 feet to an inch.

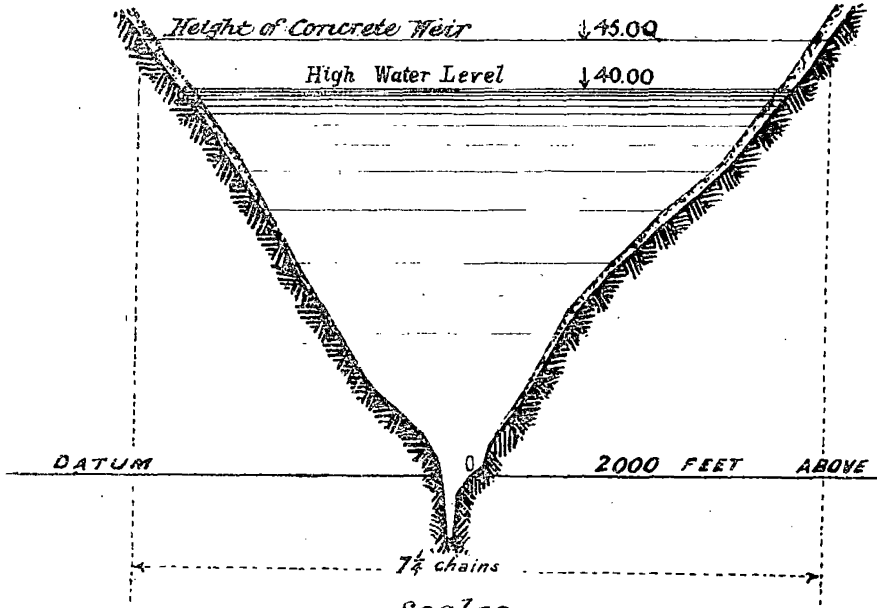
Scale.

Horizontal and Vertical
20 feet to an inch.

12.
16 Kr 23/9/01.

COMPENSATION RESERVOIR.

WEIR SITE.

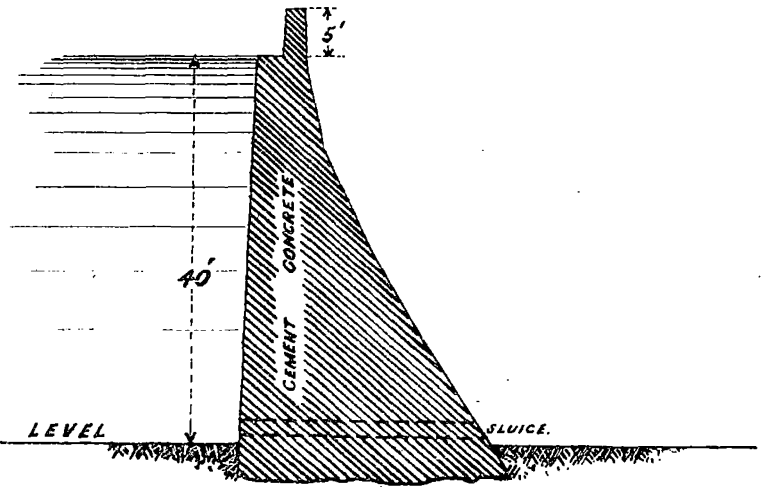


Scales

Horizontal: 2 chains to an inch
Vertical: 20 feet to an inch

WEIR.

CROSS SECTION.



Scale

Horizontal and Vertical
20 feet to an inch.

H.
1 L 2 3/4/01.