

(1) Number of pages 20

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MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

G.O. No.	1723	Press
B.P. No.		Mis.
Dated	21-7-1876	196

Not to be folded or roughly handled

No. 482. Read the following Proceedings of the Madras Government in the Revenue Department, dated 23rd May 1876, No. 671:—

Read the following Proceedings of the Board of Revenue, dated 15th May 1876, No. 1,262.

Read the following letter from J. J. L. RATTON, Esq., M.D., on Special Salt Duty, to E. GIBSON, Esq., Acting Sub-Secretary to the Board of Revenue, dated Porto Novo, 13th April 1876, No. 105.

I HAVE the honor to inform you that I received lately a copy of Board's Proceedings dated 22nd February 1876.

2. The 4 Rupees a-garce estimate of the cost of salt manufacture therein alluded to is taken from paragraph 43 of my last report on the best method of working salt-pans. It includes the annual charge for repairing and working the salt-pans, excepting the charge for working steam-pumps omitted by mistake. It does not include the interest on capital, charge for establishment or guards, as Government has always borne these charges in addition to paying contractors from Rupees 9 to Rupees 17-8-0 a-garce to make the salt. This payment I have looked upon as the price of its manufacture as distinguished from its net cost. Inclusive of steam charges, I think it would cost Rupees 5 a-garce to make the salt.

3. As this estimate is based on the supposition that the salt-scraping season will last for four months only, and that the yield of salt will be at the rate of three garce only per acre of salt works per month it may be found, in practice, to err on the side of excess.

4. At the above rate, however, the Irigoshti pans, which are estimated to cost about a lakh of Rupees, would yield 3,000 garce annually; this at 5 per cent. interest on capital would give Rupees 1-10-0 a-garce as the capital charge on the salt in addition to the 5 Rupees a-garce cost of manufacture. This strikes me as being a heavy first charge. The estimate includes Rupees 25,000 for buying the land, Rupees 5,000 for building bridges from the Railway Station, and Rs. 25,000 for steam machinery. Of these, the first two charges are, I think, exceptional in the sense that they will not require to be incurred at most other sites, and the last charge is very high.

5. I understand that two engines with pumps, &c., each capable of doing the whole work required, are estimated for. I am not an expert in this matter, but I cannot recall to mind having seen anywhere the whole steam machinery required in

a manufactory provided in duplicate. I know that it is considered a very costly thing to have steam machinery lying idle, and, as machinery at Harigoshti replaces labor and directly affects the cost of salt manufacture for which I am held responsible, I would suggest having engines of less power. Considering that our estimate of the amount of brine required, 14,955 gallons per cawnie per diem, is a very outside one based on the half-inch a-day rate of evaporation, which exists perhaps for one month of the salt season in South Arcot, I think that two engines, each capable of delivering half that quantity per diem, would amply suffice for our wants. If one were disabled, the other would keep the pans going well enough whilst repairs were being effected.

6. M. deClosets, C.E., of the Napier Iron Foundry, and Mr. Cammiade have been lately making experiments with wind-mill pumps at Madras, and the former now informs me that he can supply wind-pumps capable of raising 700 gallons of brine a minute for Rupees 1,200 laid down at Porto Novo. I have written to the Collector of South Arcot, Mr. Garstin, asking him to sanction my ordering one of these pumps for the 16-cawny plot of salt-pans at Porto Novo, where we are now employing twenty-four coolies at Rupees 6 a-month each to do the work of one such wind-pump, and are suffering great inconvenience from these coolies sometimes absenting themselves. I look upon this as a very important experiment—if experiment it can be called—for, at the most, fifteen such pumps would do the irrigation work of the proposed Harigoshti salt-pans, for which 25,000 Rupees' worth of steam machinery is set apart in the estimate, besides saving fuel and the wear and tear of complex and expensive steam-gear. I would be very glad to have permission to order and test one of these wind-pumps at once, so as to be able to report upon it at the end of the season.

7. Since writing the above, I have received Proceedings of the Madras Government, Revenue Department, dated 5th April 1876, Nos. 46 and 47, in which I am called upon to furnish information as to the difference in density of the water at A (District Engineer's plan) from that of sea water. I tested the water at A about a dozen times at different tides in January and February and found it to vary in density between 2° and 3° Beaumé. I have tested it again two or three times lately at high tide and found it to be 3° Beaumé. But, whilst I was suffering from dysentery, Mr. Garstin had the water tested by the Salt Superintendent ten times a-day from the 15th February to the 14th March for the purpose of comparing it with that at B in the District Engineer's plan. The Collector sent the series of observations to me for information with reference to the question I raised as to the best pumping station for supplying the Harigoshti salt-pans. These observations exhibit the water at A as having been much below the density of sea water during the greater part of the period covered. Even at high tide on two days only was the water 3° Beaumé, or of the same density as sea water. As the matter is very important, I subjoin a statement showing the highest reading and the lowest reading each day and the mean of the ten observations taken daily, but I must add that, these observations having been entirely in the hands of natives, I am not disposed to place absolute confidence in their accuracy:—

	Highest or High Tide Reading.	Lowest or Low Tide Reading.	Mean of 10 Obser- vations from 8 A.M. to 5 P.M.		Highest or High Tide Reading.	Lowest or Low Tide Reading.	Mean of 10 Obser- vations from 8 A.M. to 5 P.M.
Feb. 15th	2°	Beaumé. 1°	Beaumé. 1.75	Mar. 1st	2°	Beaumé. 1°	Beaumé. 1.65
" 16th	2°	"	" 1.55	" 2nd	2°	"	" 1.45
" 17th	2°	"	" 1.55	" 3rd	2°	"	" 1.47
" 18th	2°	"	" 1.30	" 4th	2°	"	" 1.20
" 19th	2°	"	" 1.10	" 5th	2°	"	" 1.02
" 20th	2°	"	" 1.05	" 6th	2°	"	" 1.07
" 21st	1½°	"	" 1.25	" 7th	2°	"	" 1.22
" 22nd	1½°	"	" 1.00	" 8th	2°	"	" 1.35
" 23rd	2°	"	" 1.15	" 9th	2°	"	" 1.40
" 24th	2°	"	" 1.05	" 10th	3°	"	" 1.80
" 25th	2°	"	" 1.15	" 11th	3°	"	" 1.97
" 26th	2°	"	" 1.55	" 12th	2½°	"	" 2.10
" 27th	2°	"	" 1.60	" 13th	2°	"	" 1.85
" 28th	2°	"	" 1.55	" 14th	2°	"	" 1.85
" 29th	2°	"	" 1.75				

Brine for our purpose is only taken from the river at and about high tide, and a practical answer to the question as to the suitability of the brine at A for salt manufacture is to be found in the fact that we are making salt successfully with it at present at Porto Novo.

8. The same series of observations referred to in the last paragraph has furnished me with a few facts with regard to the relative densities of the brine at A and B (see survey plan). These observations were made on twenty-nine consecutive days in February and March. Taking the mean density of the ten observations as showing the average strength of the brine each day at each place, I find that on ten days the brine at A was twice as strong as at B, on two days it was three times as strong, on three days it was four times as strong, and on two days it was more than four times as strong as at B, so that on seventeen days out of the twenty-nine the difference was as regards salt manufacture enormous. The weak state of the river-brine at B is due to a purely local cause. B is the point of outfall of a drainage channel which drains a pretty extensive tract of country.

This letter will be submitted to Government in continuation of Board's Proceedings, dated 11th April 1876, No. 1,001.

2. It is clear from Dr. Ratton's experiments that the density of the brine at A is considerably greater than at B, and the cause of this difference is pointed out.

3. As regards the proposal to raise the salt water by means of a wind-mill, the Board have already requested the Presidency Engineer to inspect the model prepared by M. deClosets, and they await his report before offering an opinion upon this portion of Dr. Ratton's letter.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Sub-Secretary.

Separate Revenue, No. 25.

Salt.

ORDERED that these papers, together with copies of G.Os., dated 8th May 1876, No. 587, and 5th April 1876, No. 481, be transferred to the Public Works

*Proceedings of the Madras Government, Public Works Department,
23rd June 1876. No. 1,579.*

Department in view to the sanction of the Government of India being obtained to the project in that department with reference to paragraph 3 of the letter from the Government of India recorded in Public Works G.O., 24th April 1876, No. 1,022.

(True Extract.)

(Signed) D. F. CARMICHAEL,
Secretary to Government.

Read the following Proceedings of the Madras Government in the Revenue Department, dated 8th May 1876, No. 587:—

Read the following Proceedings of the Board of Revenue, dated 11th April 1876, No. 1,001:—

Read the following papers:—

Proceedings of the Madras Government, dated 5th April 1876, No. 481, Revenue Department.

ABSTRACT.—*Salt Manufacture at Harigochti in South Arcot.*—Sanctioning the lesser of the two schemes in connection with the extension of —; requesting Dr. Ratton to report what is the difference of density of the water at A from that of sea water; and awaiting the report called for by the Board as to the cost of the change of plan proposed by Dr. Ratton.

From J. H. GARSTIN, Esq., Collector of South Arcot, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Tindivanam, 28th March 1876, No. 131.

In reply to the requisition contained in the last portion of paragraph 5 of the Board's Proceedings of the 22nd February last, No. 520, I have the honor to forward, in original, the supplemental memorandum (requested to be returned) drawn up by the District Engineer on the probable additional expenditure entailed by shifting the head sluice from B to A as proposed by Dr. Ratton, as well as a copy of his letter* forwarding the said memorandum.

* Dated 22nd March 1876, No. 328.

2. From these papers the Board will see that Major Mead has no hesitation in recommending the transfer of the head sluice from B to A if careful inquiry shows that the brine at the latter place is stronger than that at the former. He, however, adheres to the original position chosen by him for the pumping station and proposes to pass the brine admitted at A under the canal by means of an under-tunnel thirty-five feet long with two vents having a sectional area of eleven and-a-half square feet each (that is, five feet long and about two and-a-quarter feet broad) carried under the canal at such a depth as will always admit of three feet of water over the tunnel in order to allow of boats passing over it.

3. The under-tunnel he estimates will cost about Rupees 12,000, and he considers that the banks and channel round the 16-cawny plot AH will require strengthening and widening respectively, which will probably cost Rupees 2,000 more. The cost of the remainder of the project will remain as before. This would raise the whole cost from Rupees 90,000 to Rs. 1,04,000.

4. I do not quite understand where the District Engineer proposes to cross the canal. His words are "in a line with the northern boundary of the bund proposed to be taken up." Probably "bund" is a slip of the pen for "land," and he intends to cross at or near H on the plan.

5. He sketches an alternative plan, which he has worked out but does not recommend, and in paragraph 10 of the memorandum, while alluding to this plan, he says that the channel round the 16-cawny plot "will have to be considerably enlarged to make it hold half a-day's supply (a bottom width of sixty feet will be required)." If this width of channel at bottom is to be required in any case, then, with slopes of 2 to 1 and a depth of 4 feet only, the water-surface will be 76 feet

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3. The under-tunnel he estimates will cost about Rupees 12,000, and he considers that the banks and channel round the 16-cawny plot AH will require strengthening and widening respectively, which will probably cost Rupees 2,000 more. The cost of the remainder of the project will remain as before. This would raise the whole cost from Rupees 90,000 to Rs. 1,04,000.

4. I do not quite understand where the District Engineer proposes to cross the canal. His words are "in a line with the northern boundary of the bund proposed to be taken up." Probably "bund" is a slip of the pen for "land," and he intends to cross at or near H on the plan.

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*Proceedings of the Madras Government, Public Works Department,
23rd June 1876. No. 1,579.*

or 25½ yards; and, as the whole length of the channel all round the 16-cawny plot is about a mile, the channel will take up about 8 of the 16 cawnies. The remaining 8 in the midst of such a brine-supply might then be worked on the most approved principles with permanent crystallizing beds really impervious to percolation, which I consider are essential to the production of a really pure salt.

6. I have communicated a copy of paragraph 3 of the District Engineer's letter to the Chief Engineer of the South Indian Railway and to the Divisional Engineer at Porto Novo with a request that a sufficient opening, as suggested by Major Mead, be left in the line.

7. I had experiments set on foot for the systematic testing of the brine at Manambadi for a distance of about a mile up the river above A on the plan. The water was tested hourly every day from 8 A.M. to 5 P.M. at seven spots including A, and I have sent the registers to Dr. Ratton for his scrutiny. So far as I could judge, the density of the water at A was nearly always 2° Beaumé between half flow and half ebb tide, while at B it was sometimes rather lower. Beaumé's hydrometers, however, are by no means delicate instruments, and it is rare to find three persons read them exactly alike, so that I consider the only general result to be deduced from these observations is that in an exceptionally dry season there is always between half flow and half ebb a fairly strong brine available at A, but not always so strong at B. On only occasion only I think, during the flood tides at full moon, the water was registered as 3° Beaumé opposite the Manambadi pans.

ENCLOSURE No. 1.

From Major H. R. MEAD, R.E., District Engineer, South Arcot, to J. H. GARSTIN, Esq., Collector of South Arcot, dated Lalpett, 22nd March 1876, No. 328.

With reference to G.O., No. 569, dated 3rd March 1876, and your letter, No. 55, dated 10th March, forwarding Proceedings of the Board of Revenue, I have the honor to forward a supplemental memorandum on the proposed salt-works at Harigoshti.

2. I regret to have to bring to notice that Dr. Ratton in his letter, No. 16, of 28th January, forgets that the plan proposed in the former memorandum was based on his own proposition, and I must say I consider, before reporting as favorable as he has done on the Harigoshti scheme, he should have satisfied himself that at the place where it was proposed to take the water good salt water was always available.

3. I would further remark that there is no reason to delay handing over the land north of the Vellaur to the Railway if they should be requested to arrange for an opening, say fifteen feet span, to cross a channel carrying water, the surface of which will be slightly above the ground level and the bed about four feet below it. The water in the channel will have but a slight fall and velocity.

(True Copy.)

(Signed) J. H. GARSTIN,
Collector.

ENCLOSURE No. 2.—Supplemental Memorandum drawn up by District Engineer.

THE Government Order read above will be communicated to the Collector of South Arcot, who will observe that Government are disposed to sanction the lesser of the two schemes (BK) referred to in his letter embodied in the Board's Proceedings of 22nd February 1876, No. 520.

2. Referring to paragraph 7 of the Collector's letter of the 28th March, the Board observe that the information regarding the relative density of the brine at the several points where it has

Proceedings of the Madras Government, Public Works Department,
23rd June 1876. No. 1,579.

been gauged is not sufficiently full to enable them to furnish the statement called for by Government. Before proceeding further, the Board will await Dr. Ratton's report.

(True Copies and Extract.)

(Signed) E. GIBSON,
Acting Sub-Secretary.

Separate Revenue, No. 8.

Salt.

RECORDED.

2. The Government await the report from Dr. Ratton.

(True Extract.)

(Signed) D. F. CARMICHAEL,
Secretary to Government.

Read the following Proceedings of Madras Government in the Revenue Department, dated 5th April 1876, No. 481:—

Read the following Proceedings of the Board of Revenue, dated 22nd February 1876, No. 520.

Read again Board's Proceedings, dated 22nd December 1875, No. 3,417.

Read also the following letters:—

From J. H. GARSTIN, Esq., Collector of South Arcot, to H. E. STOKES, Esq., Acting Secretary to the Board of Revenue, dated Cuddalore, 22nd January 1876, No. 30.

I HAVE at length the honor to submit the survey plan and estimates for laying out in salt-pans the land proposed to be taken up at Harigoshti, in the vicinity of Porto Novo, for that purpose. These papers would have been submitted some months ago had it not been that in consequence of the Board's recommendation to Government to send Dr. Ratton to Harigoshti to carry out, on a large scale, experiments as to the feasibility of introducing the French system of salt manufacture into the Presidency, and in consequence of the visit of that officer to Cuddalore in September last when he explained to me and to the District Engineer what he proposed to do at Harigoshti, it was determined to anticipate the decision of Government and to estimate for the carrying out of the experiments as proposed by Dr. Ratton.

2. The original scheme comprised three plots of land AH, BK, and DG; the two former situated within the limits of the village of Manambadi, and the latter within those of the village of Harigoshti. It was proposed to cut a channel from A to D, and to carry it all round DG and across the two blocks into which it is divided by the Porto Novo-Virdachellam road, and to make large central platforms for storing the salt which was to be made according to the system called after Dr. Ratton.

3. It is now proposed to take advantage of Dr. Ratton's presence at Porto Novo to lay out all these blocks on the French system.

4. The Board are aware that the plot AH, which is reported by Mr. Freer to be about 16 cawnies* in area, has been already nearly entirely enclosed by an embankment and a

channel, that on two cawnies of it salt was made during 1875, and that the conversion of the remainder into pans is now in progress. Dr. Ratton, when here a few days ago en route to Porto Novo, was kind enough to say he would show Mr. Freer how to lay out these pans on the French system, so that we have now only to consider the two remaining plots comprised in the scheme, viz., BK having an area according to the District Engineer's calculation of about eighty acres and DG one of 240 according to the estimate of the same officer, but of 271 acres according to the Revenue Survey accounts.

Proceedings of the Madras Government, Public Works Department,
23rd June 1876. No. 1,579.

5. Dr. Ratton's proposals for converting DG into a salt-pan on the French system entail the lifting the brine-supply to the highest point of the area to be converted, whence it is to be allowed to flow by gravitation over the said area, or embankments into three terraces, and from the lowest of these the highly-condensed brine will flow into the crystallizing beds. As there is, as I understand, to be no attempt at symmetrical arrangement of these terraces, they will probably be extremely irregular in shape, but, as the general slope of the ground at Harigoshti is from west to east, it follows, as a matter of course, that the crystallizing beds will be in a long row from north to south, and, as a necessity on this arrangement, that the platforms must adjoin the crystallizing beds on the east, because, as the railway station will be close to the salt pans on the east, the platforms must be between the railway and the crystallizing beds. This arrangement is, I have reason to believe, in accordance with Dr. Ratton's views. That officer will no doubt submit his propositions in full detail if called on, but it seems to me that the position of the ground and its proximity to the railway are such as to leave no alternative but throwing up a long platform, perhaps the whole length of the crystallizing beds, and of a width sufficient to admit of the storing of a single line of salt heaps, each containing, say, 100 garce, with a line of railway on each side of the heaps. The salt will thus have to be carried a very short distance to be stored, and every point of the platform will be readily accessible for loading railway trucks at a minimum of expenditure on the platform, which will serve as the embankment to the pans at the same time. The brine-supply, as explained by the District Engineer in his memorandum enclosed, is to be pumped by steam-power at C, the western extremity of the channel enclosing BK. A high-level channel will cross the line of railway and carry water to E, F, and G, whence it will be allowed to flow by gravitation. The Railway Company will have to bridge the channel at R.

6. The works at BK will be as follows:—A channel dug down to about 2½ feet below low-tide level will be carried completely round it as shown by the red dotted line on the plan. From B to C the bottom width will be 9 feet, on the other sides only 8 feet, and, as the slopes will be 2 to 1, there will be at full channel level a depth of water of 4·6 feet, and a surface breadth of 27 feet from B to C, and of 26 feet on all the other sides. This water is to be admitted through a head sluice capable of admitting in four hours all the water required to be pumped during a single day to the Harigoshti plot. With the earth thrown up all round it and enclosing it. The slope of this piece of ground being from south to north, the crystallizing beds will be in a row all along the north channel, and I propose to have ten or twelve boats built to work in the channels and to carry the salt from the crystallizing beds to the platform which I propose to place at S, where there is some waste land available close to the high road and to the canal; and, as large cargo boats can ascend the latter as far as the proposed site for the platform, it will be easy to export salt by sea from this platform if required.

7. The cost of carrying out all these works will be large. For BK the District Engineer estimates as follows:—

	rs.
Head sluice	4,000
Earthwork	5,500
Laying out in pans, including crystallizing beds and platform at 100 Rupees an acre	8,000
	17,500
To which must be added compensation for land	1,000
Cost of twelve boats	1,800
	20,300

8. The cost of the works at Harigoshti he estimates as follows:—	RS.
Earthwork	5,000
Laying out, including platform and crystallizing beds (but exclusive of embankment, railway,) at 100 Rupees an acre	24,000
Steam engines, &c.	25,000
Aqueduct over drainage channel at D	3,000
Two culverts in road	1,600
Five surplus sluices for draining salt-pans	1,500
Two bridges from railway station to embankment	5,000
	65,100
To which has to be added the cost of buying the land, which at, say, 100 Rupees an acre for 250 acres to be taken up	25,000
	90,100

9. The cost of Police lines and a Salt Office, amounting to Rupees 7,400, will probably have to be incurred at once in connection with the Manambadi pans now being worked, but a separate set of Police lines will probably be required for Harigoshti; and if the pans have, when completed, to be divided into two separate charges under two Superintendents, there will have to be another office built, so that the total cost of the works, &c., at Harigoshti will be about 97,500 Rupees, or, in round numbers, a lakh of Rupees.

10. Estimating the outturn at 20 garce per acre of salt-pans, there should be 5,000 garce which, at 4 Rupees* a-garce, will cost Rupees 20,000. Adding to this the interest on a lakh of Rupees at 5 per cent., or Rupees 5,000, the total cost will be 25,000 Rupees, leaving 235 Rupees a-garce on 5,000 garce, or 11½ lakhs, as the annual profit of the undertaking at those pans alone.

11. From BK the outturn will be probably 1,600 garce worth 3,84,000 Rupees, and the cost thereof, at 4 Rupees a-garce, 6,400 Rupees, plus the interest, at 5 per cent., on 20,000 Rupees = 1,000, or 7,400 Rupees in all, leaving over three lakhs as profit annually.

12. I request that the Board will obtain sanction for the estimate for the works at the plot proposed at Harigoshti, for whether Dr. Ratton's proposals for the latter place are accepted in their entirety or not does not affect the general plan of the works at the former plot, except that, if the Harigoshti proposals are rejected for the present, neither the channel round BK nor the head sluice need be made so large as at present proposed; but I trust that the proposals put forward will meet with the Board's hearty support in their entirety, as I consider they promise to result in a great success.

13. Dr. Ratton is now at Porto Novo unable to do anything, except advise Mr. Freer how to lay out the little plot at AH, till the estimates now submitted are sanctioned; and, as there will be probable savings in the current year's budget amounting to about 10,000 Rupees, there are ample funds for commencing work both at Harigoshti (GD) and at west Manambadi (BK).

ENCLOSURE No. 1.—Plan.

ENCLOSURE No. 2.—Estimate.

ENCLOSURE No. 3.—District Engineer's Memorandum on proposed works.

From J. H. GARSTIN, Esq., Collector of South Arcot, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated 1 Porto Novo, 3rd February 1876, No. 55.

In continuation of my letter of the 22nd ultimo, No. 30, forwarding a plan and estimate for the proposed salt works at Harigoshti, I have the honor to send a copy of a letter from Dr. Ratton, who thinks that it is advisable to transfer the head sluice and source of brine-supply

4. The estimated cost of manufacture is very low, and does not, it is presumed, include charges for establishments, guarding &c. It is a little more than two francs a-ton, the cost at which Dr. Ratton calculated that salt equal to the French might be produced in India. The items of charge were not specified in his report, but probably labor only is referred to. The Board have every confidence, however, that the financial results will be satisfactory if Dr. Ratton superintends the operations from first to last.

5. From the second letter above recorded, it appears that the Collector has been in communication with the District Engineer on the advisability of altering the site of the head sluice, lengthening the high-level channel and transferring the position of the pumping station to the south-west corner of AH with a view to securing a better brine-supply. Dr. Ratton strongly recommends the alterations proposed, as he has ascertained by testing that the brine at A is stronger than that procurable at B, the site at first proposed for the head sluice. The Collector supports the recommendation, but the District Engineer has raised objections on the score of the additional expense which he anticipates will result from the modification proposed.

The Collector will ascertain definitely what will be the cost of the change of plan; meanwhile the Board will not defer laying the proposals now submitted before Government, as it is of importance that early orders should be passed, if advantage is to be taken of Dr. Ratton's presence on the spot whilst the season serves, and also with a view to a settlement of the level of the line and the northern abutment of the Vellaur bridge.

6. Considering the extensive nature of the scheme the cost does not appear to be excessive; and as the Board have limited expenditure at Mercanum to what is absolutely necessary in the prospect of that station, which has been condemned, being superseded by the new salt works at Harigoshti, they strongly recommend the acceptance of Dr. Ratton's proposals in their entirety, or at any rate that sanction be accorded for laying out the smaller plot of 80 acres at BK and commencing operations there at once.

7. The Collector states that ample funds are available, as he anticipates a saving of Rupees 10,000 in the current year's budget, and the budget for the ensuing year contains a provision of Rupees 60,000 for the Harigoshti project.

(True Copies and Extract.)

(Signed) C. A. GALTON,
Acting Secretary.

SEPARATE REVENUE, No. 3.

Salt.

THE Government consider that the expenses of the scheme are under-estimated. They would sanction the lesser of the two schemes; but as it is essential to the manufacture, economically, of salt that the most dense water be

obtained, they desire to know what is the difference of density of the water at A from that of sea water. Dr. Ratton will be requested to furnish this information, and the report called for in paragraph 5 of the Board's Proceedings as to the cost of the change of plan proposed by Dr. Ratton will be awaited.

(True Extract.)

(Signed) D. F. CARMICHAEL,
Secretary to Government.

Memorandum on proposed Salt Works at Harigoshti.

It is proposed to make salt on a large scale on Dr. Ratton's system; this may be briefly described as follows.

2. The salt water is to be lifted to the level of the highest part of the pans and allowed to flow into large pans; these pans may be of any size or shape according to the ground. As the brine gets stronger, it is to be passed into other pans on a lower level and finally run into where the salt is to be made; these last Dr. Ratton, I believe, prefers should be of masonry.

3. The ground at Harigoshti is in one respect most favorable, as the large pan on each side of high road is a parallelogram of about 5,600 feet from south to north and 1,900 from east to west; the ground on the west side is about 5 feet, that on the east $1\frac{1}{2}$ feet above high water; the cost of laying it out should be therefore but small and the drainage of it in the hot weather easy; the area 240 acres, or three-eighths of a square mile, is also believed to be sufficient.

4. With regard to bringing the water on the ground, the situation is not favorable, as the water has to be carried a considerable distance and also lifted about $6\frac{1}{2}$ feet.

5. The land is on the north side of the Vellaur river, which is tidal, but, of course, for salt work it is important that the water should be taken from as near the sea as possible, and therefore it is proposed that the sluice to supply the pans should be placed at B, a distance of nearly 3,000 yards below the south-west corner of the ground, and the water has to be carried this distance before it is begun to be used in the large pans.

6. It is, however, proposed to utilize for salt a portion of ground situated just west of the proposed site of the head sluice; this is a piece of land 4,200 feet in length with a breadth of 800 feet, the area being about 80 acres, the height of it alongside of the river averages $2\frac{1}{2}$ feet above high water, on the north side it is slightly above high water.

7. I propose, as there is a large quantity of water to be lifted, that it should be raised by steam-power.

8. The following is a sketch of the works proposed. The total area of land to be used for salt manufactory is 320 acres; to supply this surface with water half an inch in depth 6.5 cubic feet per second is required; as, however, this supply should be passed into the channels only at and above half tide; the head sluice and channels should be large enough to pass this water through in four hours or be capable of supplying water at the rate of, to allow for contingencies, say 50 feet per second, as it is important to have the water on as high a level as possible. I propose that the channel round the east pans should be kept full of water, the level never being allowed below 14.5 above the datum line of the levels or never below half tide level, the bed of the channel being cut down to 11 above datum or about $2\frac{1}{2}$ feet below low-water.

9. For the supply of the west pans, 240 acres, 4.7 cubic feet per one inch is required every 24 hours; this water is to be lifted by steam-power, and we ought to be able to supply it by working four hours per day, or at the rate of 28.2 cubic feet per 1" taking contingencies into consideration, say 30 cubic feet per 1".

10. This water to command the land should be kept up at a level of 21 above datum or about $5\frac{1}{2}$ feet above high water; the bed of this channel to be cut down to 17 above datum level, so as to yield sufficient earth for banks.

11. With regard to banks, I propose the river bank throughout should be 2 yards wide at the top, which is to be 24 above datum level or about $8\frac{1}{2}$ feet above high water; this height will be safe from floods; the cross banks to be 22 feet above datum.

12. The banks of the high level channel to be 24 feet above datum; the bank of the river side to be 2 yards wide; the others one yard wide at top. All banks to have slopes of $1\frac{1}{2}$ to 1, channels 2 to 1.

13. The proposed direction and arrangements of the banks and channels are shown in the plan by a thick red dotted line. There is to be a circular channel round the east pans with banks; this channel will act as a reservoir; it also has to carry 50 cubic feet per 1". I propose, therefore, the bottom width of 9 feet for the south channel and 8 feet for the north; this will give enough earth to form banks and also give a total section of $108\frac{1}{2}$ square feet of waterway. With water at 14.5 above datum level, this should be ample.

14. The head sluice at B must be large enough to pass the water required without much loss of land. I propose 4 vents of 5 feet, the depth of water on sill being $3\frac{1}{2}$ at half tide, the area of waterway 70 square feet.

15. The proposed site for the pumping stations is at C. At first I would propose that only water for the western pans should be raised by steam, the eastern ones being supplied by piccottahs or other means; hereafter, should it be thought advisable, water might be pumped up for these pans and passed over the supply-channel by means of a small aqueduct; the fall of the ground for this is favorable.

16. For the supply of the western pans we must have means to raise water at the rate of 30 cubic feet per 1" for 4 hours from minimum height of 14.5 feet above datum level to a height of 21 feet above D. L. or $6\frac{1}{2}$ feet in height, or say 12,200 feet pounds per 1" or nearly 22-horse power. As a rule the engine would work for 8 hours a-day, but I consider we ought to have sufficient power and also capacity of channel to do the day's work, if required, in four hours.

17. The cost of raising this water will be heavy both as regards the capital charge of the cost of engines and pumps and also their wear and tear, cost of fuel, &c.; it will, however be cheaper to do the work by steam-power at one pumping station than by doing the same work by manual labor.

18. I would propose that 2 steam engines, each of 15 horse power with separate pumps (Groyne's or Appold's) should be used; it is necessary, in order to ensure the supply of brine to the pans, to have duplicate engines. I believe that it is generally considered that the friction of the pumps is nearly compensated by the excess of indicated over nominal power, and therefore a 15-horse power engine should do the work required in less than 8 hours, and if at any time it be wished to do the work quicker—for example, at the commencement of the season,—the two engines and pumps might be worked together.

19. West of the pumping station the water is to be carried by the high-level channel to D, where it is to cross the stream by an aqueduct and from there to E, the south-west corner of the ground; from E it is to go north to G, crossing the road by a culvert. This channel is to carry water in the surface 21 feet above D. L. the banks to be 3 feet above water-surface, 1 yard wide at top with slopes $1\frac{1}{2}$ to 1, bed of channel 17 above D. L., the channel to have a section of at least 88 square feet, bottom width not less than 14 feet, so that we may be able to store water in it. Also, that practically no head may be lost from the pumping station to the north-west corner of the ground; as to form the banks of a necessary section a large quantity of earth is required, no extra cost is incurred in making it of a large section.

20. From this channel, E to G, the salt water is to be taken to the pans. The pans are to be embanked all round.

21. In the estimate I have allowed a lump sum for laying out this ground according to Dr. Ratton's plan of large irregular pans, and also for making up platforms for the storage of the salt; this last will be a very heavy item.

22. For the drainage of the ground 5 small surplus sluices are allowed, for a channel will be formed along the east side of the ground in excavating for the bank; this will be the main drain.

23. The railway station is on the east side of the drainage. East of the ground and eventually rails should be laid from it to the platforms, so that the salt may be loaded at once from the storage heaps on the trucks. I have allowed nothing for this, but have entered approximate amount for two bridges across the drainage.

24. I enclose a detailed estimate for the earthwork of the main channels and banks, and the following is the approximate estimate for the whole project exclusive of cost of the land:—

	RS.
Earthwork of main channel and banks for east portion	5,500
Do. do. for west do.	5,000
Head sluice, 4 vents of 5 feet each, founded on wells, complete ...	4,000
Two 15-horse steam engines, each with separate boilers, pumps, &c., including store, engine-house, and quarters for engine driver, &c.	25,000
Aqueduct waterway for channel above 8' x 4' that of drainage below 20 feet span	3,000
Two culverts in road, 10 feet span, each Rupees 800	1,600
Five surplus sluices, each 3 feet square, at Rupees 300	1,560
Two bridges across drainage, 20 feet span each, for the salt to be carried to Railway Station, each Rupees 2,500	5,000
Laying out the eastern plot of ground including condensers, salt- pans, and platforms, 80 acres, at Rupees 100 an acre	8,000
Laying out the western portion, 240 acres, at Rupees 100 an acre...	24,000
Police Lines	5,000
Salt Office	2,400
Grand total exclusive cost of land	90,000

CAMP TRIVANELLORE,
19th January 1876.

(Signed) H. R. MEAD, Major, R.E.,
District Engineer, South Arcot.

SUPPLEMENTAL MEMORANDUM on a revised scheme for the proposed Salt Works at Harigoshti.

In the former scheme it was proposed to take the salt water from the Vellaur by a head sluice placed at B close to the mouth of the east coast canal. This place was considered eligible by Dr. Ratton, who I certainly thought had thoroughly gone into the question; it however appears that he had not done so, and now he considers the point A as more eligible.

2. Moving the head sluice from B to A entails a heavy extra cost, but in an undertaking of this magnitude the extra cost may be considered but small, and considering how much money would be saved yearly should the water at A be even slightly stronger in brine, I have no hesitation in recommending its adoption should it be found, after careful inquiry, to be the case.

3. I must bring to notice, however, that as yet we have only a few isolated observations to go on, and these taken at only one time of the year; the Collector, however, at my request, is having a series of observations carried out, and these I hope will settle the matter definitely; from what I saw when with him on the 14th February I have but little doubt but that it will be found advisable to move the sluice to A.

4. The reason of the difference of the strength of the brine-water at B and A is that the eastern coast canal acts as a spring channel. The water in it was in February certainly but very slightly brackish, and at that time no land water except springs found its way into it.

5. In determining the best line for the channel and the site for the pumping station, the first point to be considered is the crossing of the east coast canal, and as Government have directed that the Railway Company shall cross it by a bridge, giving ample roadway so that the canal may be at any future time improved and made use of, it is necessary for the contingency of the canal being required for use being borne in mind. This necessitates the use of a very heavy and expensive work, namely, a large under-tunnel sunk to a depth, so that there may be always at least 3 feet of water over it for the passage of boats; the area of the passages for the salt water must be large, so that but little head may be lost.

6. We require about 6½ cubic feet per second per day, but we should be able, as before explained, to pass the quantity required in a day in four hours, or, say, be able to pass 50 cubic feet

per 1" through the under-tunnel; it would be the economy, as all the water has to be lifted by steam-power, to do this with a high velocity with a loss of head, and therefore I would propose two vents of 5 feet in width and 11½ square feet in area each, or a total area of 23 square feet a head of less 6" would pass the water through this area.

7. The next point for consideration is the position of the pumping station, or where the level of the water should change from a maximum of high tide or 15.5 above datum to 21 feet above.

8. I consider the best place will be at C, as in the plan before proposed for the under-tunnel to be placed across the canal in a line with the northern boundary of the bund proposed to be taken up, the head sluice to be placed slightly north of the point A, so that it may be safe from any encroachment from the river.

9. The cost of the project would remain as before, but I have sketched out with an addition of, say, Rupees 12,000 for the under-tunnel and Rupees 1,04,000 for strengthening the banks and widening the channel round the 16-acre plot, or a total cost of Rupees 1,04,000 exclusive of cost of land.

10. Another alternative scheme which I have sketched out, but do not think as good as the one above, is to place the pumping station just west of the proposed site for the under-tunnel (south of the small tank east of the canal) to raise the water from the channel round the 16-acre plot which will have to be considerably enlarged to make it hold half a-day's supply (a bottom width of 60 feet will be required).

11. This water to be passed by an aqueduct over the canal for the present. Should, however, the canal ever be opened, this aqueduct to be replaced by an under-tunnel.

12. The salt water to be carried by a high-level channel along the north boundary of the salt ground for about 600 yards, then across to the high ground on the south side alongside of the river to the former proposed pumping station at D.

13. I find the earthwork would cost Rupees 900 against the Rupees 5,500 + 2,000 for enlarging, &c., the channel round the 16-acre plot Rupees 7,500 in all; the aqueduct would be a cheaper work than the under-tunnel, but it must be remembered we might have at any time to replace it by an under-tunnel which, as it would have to pass water across the canal at a level of 21 feet above D. L. instead of 15.5 above D. L., would be a more expensive work.

14. Again, this high-level channel has to cross a long length of low ground only 16 feet above D. L. or 5 feet below water-level; the maintenance of these high banks would be expensive, and the earth for them would destroy a large area of land.

15. Under these circumstances I recommend the former project to stand as it is, but to have the channel round the 16-acre plot considerably enlarged, the head sluice to be placed at A, and an under-tunnel of two vents of 11½ square feet area, each 35 feet long, to be built across the canal, the total cost of this probably being Rupees 1,04,000 against Rupees 90,000 of the former project; to this has to be added the cost of lifting the salt water an additional height of about half a-foot or about 940 feet lbs. per second for the supply of the western pans or an addition of about 1½-horse power; this may be put down as an increase of nearly 8 per cent. in the power to be expended in lifting the water.

CAMP AT LALPETT,
22nd March 1876.

(Signed) H. R. MEAD, Major, R.E.,
District Engineer, South Arcot.

Nos. 483 & 484.

ORDER THEREON, 23rd June 1876, No. 1,579.

CIVIL WORKS, No. 60.

ORDERED that the papers be forwarded to the Government of India for general approval of the project in the Department of Revenue, Agriculture, and Commerce.

2. And that the District Engineer, South Arcot, be instructed to submit for sanction at an early date detailed plans and estimates of the works connected with the site BK, on which it is desired to commence operations irrespective of those connected with the larger project.

(Here enter No. 1, dated 23rd June 1876.)

(This Extract.)

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

To the District Engineer, South Arcot.
„ Revenue Department.

Order thereon 21 July 1876 No. 1723.

Communicated to the

Board of Revenue.

Sy D. J. Carmichael.

Secy to Govt.

Exd. J. W. Fischer.

Spare Copies

per 1" through the under-tunnel; it would be also economy, as all the water has to be lifted by steam-power, to do this with a high velocity with a loss of head, and therefore I would propose two vents of 5 feet in width and $11\frac{1}{2}$ square feet in area each, or a total area of 23 square feet a head of less 6" would pass the water through this area.

7. The next point for consideration is the position of the pumping station, or where the level of the water should change from a maximum of high tide or 15.5 above datum to 21 feet above.

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9. The cost of the project would remain as before sketched out with an addition of, say, Rupees 12,000 for the under-tunnel and Rupees 2,000 for strengthening the banks and widening the channel round the 16-acre plot, or a total cost of Rupees 1,04,000 exclusive of cost of land.

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12. The salt water to be carried by a high-level channel along the north boundary of the salt ground for about 600 yards, then across to the high ground on the south side alongside of the river to the former proposed pumping station at C.

13. I find the earthwork would cost Rupees 14,400 against the Rupees 5,500 + 2,000 for enlarging, &c., the channel round the 16-acre plot, or Rupees 7,500 in all; the aqueduct would be a cheaper work than the under-tunnel, but it must be remembered we might have at any time to replace it by an under-tunnel which, as it would have to pass water across the canal at a level of 21 feet above D. L. instead of 15.5 above D. L., would be a more expensive work.

14. Again, this high-level channel has to cross a long length of low ground only 16 feet above D. L. or 5 feet below water-level; the maintenance of these high banks would be expensive, and the earth for them would destroy a large area of land.

15. Under these circumstances I recommend the former project to stand as it is, but to have the channel round the 16-acre plot considerably enlarged, the head sluice to be placed at A, and an under-tunnel of two vents of $11\frac{1}{2}$ square feet area, each 35 feet long, to be built across the canal, the total cost of this probably being Rupees 1,04,000 against Rupees 90,000 of the former project; to this has to be added the daily cost of lifting the salt water an additional height of about half a-foot or about 940 feet lbs. per second for the supply of the western pans or an addition of about $1\frac{1}{2}$ -horse power; this may be put down as an increase of nearly 8 per cent. in the power to be expended in lifting the water.

CAMP AT LALPETT,
22nd March 1876.

(Signed) H. R. MEAD, Major, R.E.,
District Engineer, South Arcot.

Nos. 483 & 484.

ORDER THEREON, 23rd June 1876, No. 1,579.

CIVIL WORKS, No. 60.

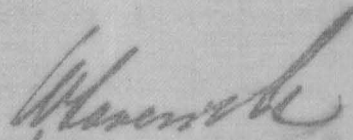
ORDERED that the papers be forwarded to the Government of India for general approval of the project in the Department of Revenue, Agriculture, and Commerce.

*Proceedings of the Madras Government, Public Works Department,
23rd June 1876. No. 1,579.*

2. And that the District Engineer, South Arcot, be instructed to submit for sanction at an early date detailed plans and estimates of the works connected with the site BK, on which it is desired to commence operations irrespective of those connected with the larger project.

(Here enter No. 1,80, dated 23rd June 1876.)

(The Extract.)



Colonel,

Offg. Under Secy. to Govt., P.W.D.

To the District Engineer, South Arcot
" Revenue Department.

Exd. J. W. Fischer.

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Sent to

ad as office

Gobt. of {1876} Madras.

PUBLIC WORKS.

To

THE DISTRICT ENGINEER,
SOUTH ARCOT,
&c., &c., &c.

Dated June 23rd.

Issued

Recd.

Encl.

G. O., 23rd June 1876, No. 1,579.

JUNE.

Nos. 432-434.

Harigoshli Salt Project, South Arcot District.—Papers relating to the — ordered to be forwarded for the approval of the Government of India.

Mis 1723

With order in the Revdly
21/7/86

NA 7600/82

F