No. 127. Read the following letter from W. FRASER, Esq., C. E., Executive Engineer, to the Secretary to Government, Public Works Department, dated Madras, 24th March 1868, No. 274 :—

1. I have the honor to forward a set of plans and estimates, with a report, on the proposed Sea Level Junction Canal at Madras.

2. I much regret the unusual delay in the preparation of these documents. It has arisen from the length of time occupied in the preparation of so many separate estimates. I was unable to get them from my Assistant until a day or two ago. I trust, however, that the information supplied will be found complete.

MADRAS JUNCTION CANAL.

REPORT ON A PROPOSED SEA LEVEL CANAL.

By William Fraser, Esq., c. e.

1. With this report the following plans are furnished :—

Plan No. 1.—General map of the country between the Adiyar and Kuam rivers, showing some of the trial lines which were surveyed and levelled for the purpose of this report.

This map has been compiled from the key maps of the Revenue Survey, an actual survey of the Kuam and its vicinity made by me, a skeleton survey of Chintadrepet made by Mr. Sinclair, and from several other sources.

Upon this map are drawn the lines shown upon Plan No. 1 of my report on the *High Level Fresh Water project.*

The lines of which sections are now furnished are—

No. I.—Coast line, single red line, lettered A, L, M, N, K.

No. II.—Red, and dotted red line, A, L, O, N, K.

No. III.—Brown, dotted brown, and red line, A, O, P, N, K.

No. IV.—Brown line, A, O, P, G, Q, D.

No. V.—Blue line, A, R, G, H.

This is the line originally proposed by Colonel Sir Arthur Cotton, and surveyed by Mr. Kennedy.

No. VI.—Blue dotted line, A, R, Q, D.

No. VII.—Double red line, A, D.

This is the line proposed for a *high level fresh water canal* in my report already furnished.

No. VIII.—Red, red dotted, and green line.

This is a variation of Nos. 1 and 2, and its section is attached to that of the latter.

Several other lines and portions of lines were surveyed; but it would only needlessly complicate the subject to exhibit the results, as the eight lines drawn upon the map are, practically, the only ones the country between the two rivers affords. On all the lines, the tinted red circular discs show where public road bridges must be built; the small untinted circles where accommodation bridges are proposed; and the blue discs where under-tunnels are necessary, the number of discs showing the number of openings.

Plan No. 2.—Longitudinal sections of the eight lines, and proposed cross sections of the canal, where the depth of cutting would or would not exceed 7 feet.

All these longitudinal sections are drawn to the same scale; and, except in the case of No. 8, the Adiyar ends of all are placed in the same vertical line, so that a tolerable idea of the difference of length, and general depth of cutting on the several lines, may be obtained by mere inspection.

The blue lines upon the sections show the mean sea level according to Colonel DeHavilland's observations; the red line, 4 feet below it, the proposed bottom of the canal; and the red line, 3 feet above it (7 feet above the bottom), the level of the towing path. The whole depth of excavation is tinted red, and is figured, at certain intervals, upon the sections.

Besides these plans a separate section, sheet No. 3, is given of a line which is composed of portions of Nos. 1, 2, 3, and 4. This, for the sake of reference, we shall call No. 9. It will be explained further on. To make it plain to the eye, this line is edged with purple on the map.

2. It is extremely difficult to lay out a line of canal between the Adiyar and the Kuam, not because there is any engineering difficulty in the way, but partly because the land is so thickly covered with cocoanut and other topes, and almost impenetrable plantain and beetle-nut gardens; and partly, because the country presents so many different ways of accomplishing the same thing, most of them varying but slightly in point of difficulty and probable expense.

3. The point of departure from the Adiyar is fixed by the position of the Sadras Canal, and the first question to be considered is at what point the canal should enter the Kuam; an inspection of the map will show that there are but two places where a junction can be effected without the destruction of a large quantity of house and other valuable private property. Those places are at D and K: the former lying on the boundary between the Mount Road Hotel compound and the Ameer Baugh, and the latter in the Government Park, some 300 yards west of the Marine Villa. The point marked H, opposite to Waller's stables, where Colonel Sir Arthur Cotton proposed to form the junction, is objectionable on account of the large amount of house and other valuable property the line must pass through between the crossing of Peter's road and the river. In many other respects it is a good line, and would certainly accomplish what its projector desired, namely, to carry the canal through the heart of the city. Another great objection to it is, that it would involve the construction of ten public road bridges, just twice as many as would be required on the double red line No. 7. The extra cost of the bridges is not the greatest objection to them, but it is that, doubling the number, doubles the inconvenience of embanked approaches; and at five of them, those at the northern end, raising the roads would greatly interfere with the houses on both sides for a considerable distance along the streets. For these reasons, and also on account of the large sum that should be paid as compensation for damages, I am of opinion that this line need not be further considered. If this opinion be aquiesced in the choice of a line will be confined to those which enter the Kuam at either of the points marked D and K.

4. There are two ways of looking at this project, so far as *length of navigation* is concerned, either to consider it as a means of connecting the two rivers only, or of connecting the Sadras and Cochrane's Canals. In the latter case, the points

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to be connected are A on the Adiyar, and S on the Kuam near the General Hospital.

If we assume that the latter points are those to be connected, there will be less difference between any two lines in the length to be traversed by boats, than would appear to be the case by a comparison of their longitudinal sections; but the double red line, A, D, which is the shortest between the two rivers, is also a mile and three-eighths shorter than the coast line (single red line) between the points A and S; and the longest of the three lines entering the Kuam at D, that is the brown line, nearly a mile shorter than the coast line between the same extreme points. Boats entering the Kuam at the point D could go on direct, and by the shortest line to any part of the city on the margin of the river, or on Cochrane's Canal; whereas those entering at the point marked K, would have to double back up the river for 3 miles if their cargoes were wanted near the Commander-in-Chief's bridge.

It appears from these facts that, as regards length of navigation and convenience to the traffic, D is a better point of junction than K. Indeed, in these respects, it is so superior as a point of junction, that we might almost confine the investigation to lines entering the Kuam there.

5. Having submitted these general views of the question, I will now proceed to describe, briefly, the several lines represented on the map; beginning at the Adiyar end.

No. 1.—THE COAST LINE is a modification of the one surveyed in 1861 by Mr. Dopping, C. E., and marked on the map by a blue dotted line thus — | — | — — | — |. The material points of difference are, that the red line avoids the Adiyar river at the southern end, and takes a different course through Chepauk and Government Parks at the northern end.

It would be injudicious to carry the navigation through any part of the Adiyar below the point marked *L*, as the sand banks frequently shift their position; and at all times it would be difficult and, during floods, extremely dangerous to cross the river below Elphinstone's bridge. These objections can be easily met by carrying the line as drawn in red.

From A to *L*, the canal may be along the north side of the river, or an independent canal can be excavated through the swampy land colored green, which is the property of the Government, having been reserved for purposes of river conservancy. Thence to Elphinstone's bridge, the line runs through the swamp, and through similar land in Brodie Castle compound, into the back-water at Robertson's Petta.

It skirts the margin of the back-water, passing in front of the Honorable Mr. Norton's house, to a small cocoanut tope south of the Roman Catholic Chapel near the point marked J. It then follows the line of lowest land between Mylapoor and St. Thomé, crossing the main or Cutcherry street at the most favorable point; whence it passes through some paddy-fields and gardens, and crossing another street descends to what is known as the Koshupet back-water. The first houses touched are at the crossing of Cutcherry street, where those on both sides of the road should be removed, but they are of small value; at the crossing of the next street the line passes through an opening in the houses on the south side, but those on the north side should be removed.

The line runs through a burning ground on the north side of Koshupet back-water, along the west side of Capper house compound, across Kistnampet drain, where town rubbish is now being deposited, through the west side of a Mahomedans' burying ground, west of the Ice-house, through the low ground on the west of a high burying ground north of the Ice-house, and crossing Triplicane main drain, and the waste ground near it, crosses Pycroft's road into Chepauk Park.

Mr. Dopping's line ran straight through Chepauk and Government Parks on the west side of, and close to the public buildings. I consider this line objectionable, and have drawn the red one along the west side of the Park. This would avoid any serious severance of the land, and would bring the canal into connection with the public road on the west. The line bends to the right through the Government Park for the convenience of boats going by Wallajah bridge to Cochrane's Canal.

At the crossing of Pycroft's road some houses on the south side should be removed.

6. PUBLIC ROAD BRIDGES ON THE COAST LINE.—Of these there must be ten on the following roads :—

I.—At Elphinstone's bridge.
II.—South Beach road, opposite Brodie Castle.
III. } Two public roads between Mylapoor and St. Thomé.
IV. }
V.—Cutcherry street, Mylapoor.
VI.—Pagoda street, do.
VII.—Barber's bridge road.
VIII.—Lodge new road.
IX.—Ice-house road.
X.—Pycroft's road.

At Elphinstone's bridge I propose to cut the channel through the embanked approach, instead of carrying it through one of the present arches.

The level of the road-way need not be altered, as it is 12 feet above mean sea level.

The bridge at the South Beach road will require the approaches to be raised about 5 feet: a private road in the small cocoanut tope, and the public road at the Roman Catholic Chapel near J, are proposed to be diverted along the sides of the canal as shown on the plan.

The next two public bridges will require the roads to be raised 5 and 3 feet respectively. At the crossing of Cutcherry street in Mylapoor the excavation will be 26 feet. Here, the level of the road need not be altered, and the bridge may be altogether of masonry. At this place, and for about 800 yards in length, the excavation will range from 15 to 26 feet in depth, which will be particularly objectionable in this locality; but anything that could be substituted for a wide open cutting, such as reveting the slopes with stone or tunnelling, would be very expensive. Under any circumstances, it would be difficult and expensive to dispose of the excavated earth.

At the crossing of the Koshupet back-water, the cutting will be between 4 and 5 feet. It is proposed to give the present channel an easy slope into the canal, and let the water spread as it may. A considerable part of this back-water could

be converted into valuable land by raising it with the earth run down from the deep cutting through Mylapoor. The earth should be disposed of in this way as the quantity would be too great to put into the usual form of spoil banks along the sides of the canal. The Lodge road and the Ice-house road will each require to be raised only about one foot, and Pycroft's road about 4 feet.

At the accommodation bridge in Chepauk Park, the level of the road-way will not be disturbed, but the road along the margin of the Kuam, in the Government Park, must be raised 7 feet. The private road from Government House to Chepauk Palace may be diverted to the new bridge as shown in red.

The deepest cutting in Chepauk Park will be 16 feet, the earth from which might be used advantageously to raise certain low portions of the Government Park. In a similar way the earth from the deep cutting at the place marked N might be used to fill up a part of the dirty back-water, into which the Kistnampet drain falls. Indeed, by the judicious disposal of the excavated earth all along the line, great improvements might be made at and about the Triplicane and Kistnampet drains, and many other places which, in their present condition, are very offensive. Only two under-tunnels are absolutely necessary on this line, a treble one at Kistnampet drain, and a double one at Triplicane drain. For a considerable portion of the line the drainage is towards the canal from both sides, and the water may be allowed to come in after passing through silt traps.

The line just described is, I believe, the best coast line that the ground affords. No other line, generally so good, can be got on the east side of Mylapoor.

7. LINE No. 2.—*Red and red dotted line.*—This is the same as No. 1 to the point marked L, where it turns across Mr. Mackenzie's compound, across Greenaway's road at Washermanpetta, and along the east side of the Bishop's compound; whence it runs, almost straight, across paddy-fields and plantain and beetle-nut gardens to the Luz Church road, near the north-west angle of the compound of Seth Sam's house. It then crosses the Ice manufactory compound and Brodie's road, and thence, through gardens and cocoanut topes, to Koshupett back-water, which it follows to Barber's bridge. Here it turns northwards, and crossing the Lodge road and Kistnampet drain, joins No. 1 at the point marked N.

8. On this line there would be nine public road bridges, and five accommodation bridges; three single, one double, and one treble under-tunnels. The land traversed by this line is generally more valuable than that occupied by No. 1; but except at the crossing of Pycroft's road, it would not interfere with house property.

Its great advantage over No. 1 is in avoiding the deep cutting in Mylapoor. A reference to the sections will show that where No. 1 crosses Cutcherry street, the cutting is 26 feet in depth, whilst on No. 2, the maximum cutting through the same summit line is but 16½ feet. It is about half a mile shorter than No. 1.

9. Instead of running along Koshupett back-water down to Barber's bridge, this line might be carried straight across the back-water to No. 3 by the double red line, and thus connected with No. 1. This would, to some extent, be a better line so far as future maintenance is concerned.

It might also be modified by following the brown line from O to A, instead of going round by the Adiyar; and this would shorten the distance by about 670 yards.

These two modifications would make this line very direct, the entire length from A to K being $4\frac{3}{4}$ miles.

It is the shortest line that can be had between those two points. It is called No. 9, and the section of it is given on sheet No. 3.

10. Line No. 8—Red, dotted red and green.—As this line is but a modification of Nos. 1 and 2, I may describe it here. It departs from No. 1 in Brodie Castle compound, and following the green line through the gardens on the west of Mylapoor, joins No. 2 at Koshupet. It should have eleven public road bridges, one more than No. 1; but, like No. 2, it avoids the deep cutting in Mylapoor and the destruction of houses. There is but little choice between this line and No. 2. The depth of excavation is a little less, but it has two additional public road bridges, and is about a quarter of a mile longer.

11. Line No. 3—Brown, brown dotted and red line. This line runs straight from the Adiyar through Pugh's gardens, and across Greenaway's road into an Illipay tope, on the north side of Mr. Walker's compound. Thence it runs through paddy-fields, and highly cultivated garden lands to the Auratha tank, near the Luz Church; whence it runs into the Koshupet back-water at P; and thence, by the brown dotted line, across Brodie's road, the Lodge road, through a Mahomedan burying ground west of Kistnampet main road, and joins No. 2 at the crossing of Kistnampet drain. This line is shorter by three-eighths of a mile than No. 2; but would require one public road bridge more, unless the road was diverted, as shown, near Koshupet.

The damage to property would be about the same. I consider that it has no advantage over No. 2.

12. These four lines all enter the Kuam at the point marked K, and we now proceed to describe those which enter at D.

Line No. 4.—Brown line, A, O, G, D.—This line has been described as far as the point P, whence it continues nearly straight to the Lodge road, where it bends to the west, and crossing Mowbray's road, near the house lately occupied by Colonel Silver, runs through the gardens and paddy-fields on the west side of Royapetta to Peter's road, which it crosses near Hall's gardens. It passes down by the west side of Hall's gardens, takes the north-east angle off Jamna Doss' compound, and crosses White's road; whence, to the crossing of the Mount Road, it runs between the Elphinstone's hotel and Mr. Dighton's house. From the Mount Road it runs by the west side of the Ameer Bagh to the Kuam at D.

13. Nine public road bridges and five accommodation bridges would be required on this line, and also seven single under-tunnels. For nearly its entire length it passes through highly cultivated land; but it is almost entirely free from interference with house property, as the only houses it touches are a few huts on the west of Royapetta, and two godowns where it passes between Mr. Dighton's and the Elphinstone's hotel. This line is nearly a mile and a quarter shorter than No. 3, and a mile and a quarter shorter than No. 2, if modified as suggested in paragraph 9. The great advantage it has over the other lines which enter the river at D, is that by lying more to the east it occupies lower ground, and the depth of excavation would not be so great. In point of accommodation it has the advantage of running close to Royapetta, and not far from Mylapoor. Where it crosses the Koshupet back-water or drainage channel at P, it would be necessary to make provision for the drainage, either by constructing a large under-tunnel or a dam, over which the water might be allowed to pass into the canal.

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14. Line No. 5.—Blue line.—This is Colonel Cotton's line, and is an excellent one in most respects; but I do not consider that the advantages it would afford compensate for the amount of damage and inconvenience it would inflict on the property and population between Peter's road and the Kuam.

15. Line No. 6.—Blue dotted line.—This line occupies the same ground as Colonel Cotton's up to the crossing of the Luz Church road, where it turns to the left across Mowbray's road into the old Sudder Court compound; thence it runs nearly straight through paddy-fields, garden lands, and by the east side of the Honorable Mir Homayan Jah's compound to Peter's road, whence it follows the same line as No. 4 to the Kuam. This line crosses eight public roads, but the number of bridges might be reduced to seven, by diverting the Luz Church road, as shown in red. Three accommodation bridges would be required, and eight under-tunnels.

This is a very direct and otherwise a good line, and I would have selected it for a high level fresh water canal instead of No. 7, only that it crossed eight public roads instead of five; and I was unwilling to increase the amount of inconvenience arising from elevated bridges. It has an advantage over No. 7, as regards depth of excavation, and a considerable advantage in its non-interference with house property. Should the result of this enquiry be a decision in favor of a high level canal, I shall submit a detailed comparison (already partly prepared) between these two lines, that the Government may be in a position to decide, with certainty, between them.

16. Line No. 7 is the one already reported on, and need not be further described here.

17. To enable a ready comparison to be made of these several lines, I have prepared the following table, which shows, in a condensed form, most of the facts on the consideration of which the selection of a line will depend. The headings of the several columns will explain themselves.

Comparative Statement of the nine lines.

No. of line.	Description.	Length from Adiyar to Kuam.			Length from A to S.			Area of land required.	Depth of excavation, feet.			Farthworks, cubic yards.
1	2	3			4			5	6			7
		Miles.	Furlongs.	Yards.	Miles.	Furlongs.	Yards.	Acres.	Maximum.	Minimum.	Average.	
1	Coast line—Red, A, L, M, N, K.	5	4	0	6	6	50	67	26·8	2·2	9·8	606,898
2	Red, and red dotted line, A, L, O, N, K.	5	0	76	6	2	126	91	21·9	3	11	655,656
3	Brown, brown dotted and red line, A, O, P, N, K.	4	5	46	5	7	96	76	21·9	4	11·6	631,436
4	Brown line, A, O, P, G, Q, D.	3	3	88	5	6	118	81	20·5	4	13	564,236
5	Blue line, A, R, G, H.	3	4	200	5	0	200	92	18·5	5·4	14·3	658,302
6	Blue dotted line, A, R, Q, D.	3	0	166	5	3	196	88	20·5	5·4	15·5	640,512
7	Double red line, A, D ...	3	0	63	5	3	93	96	22	6·6	19	759,878
8	Red, red dotted and green line.	5	2	0	6	4	50	811	21·9	2·2	9·7	643,834
9	Line edged with purple ...	4	4	180	5	7	10	87	21·9	3	9·6	668,624

Public road bridges.		Number of accommodation bridges.	Number of under-tunnels.	Estimate Rupees.							Total of estimate.
				Earthwork.	Public road bridges	Accommodation bridges	Under-tunnels.	Diversion of roads.	Boat basins and water shoots.	Compensation.	
8	9	10	11	12	13	14	15	16	17	18	19
No.	Roads to be raised. Feet.										
10	6-6-2 2-7-2 1-4-0	4	2 1 treble. 1 double.	81,439	76,540	25,403	10,536	1,808	24,394	81,088	3,01,208
9	1-4-1 1-3-5 5-1-4	5	5 3 single. 1 treble. 1 double.	80,453	67,373	30,321	18,761	354	25,547	66,401	2,89,210
9	1-4-1 5-5-4 3-1-4	6	5 3 single. 1 treble. 1 double.	79,685	68,226	37,434	19,787	354	26,699	61,794	2,93,979
9	1-4-1 5-4-0	5	7 Single.	76,782	71,233	30,055	20,391	...	28,679	63,888	2,91,028
10	1-1-2 1-3-0	6	9 7 single. 2 double.	89,334	76,031	33,517	31,505	...	29,178	1,46,954	4,06,521
7	1-1-0	3	8 6 single. 2 double.	93,440	54,480	16,707	29,369	942	30,719	70,191	2,95,878
5	.....	3	8 6 single. 2 double.	1,22,377	40,651	17,037	28,692	2,850	34,600	72,235	3,18,442
11	4-6-3 2-1-5 5-1-4	6	5 3 single. 1 treble. 1 double.	77,177	82,587	38,257	18,587	354	28,449	65,048	3,10,459
9	1-4-1 1-3-4 3-1-4	6	5 3 single. 1 treble. 1 double.	84,682	66,522	36,941	18,646	354	28,359	68,128	3,03,632

18. The figures in column 9 show the heights to which the roads must be raised at the new bridges. It will be seen that, as we go westwards, the number of roads that must be raised and the height, diminishes ; for example, on No. 1 eight roads must be raised to heights varying from 1 to 6 feet; whilst on No. 6 only two roads are to be raised 1 foot each, and on No. 7, no roads would require to be altered in level. The estimates are abstracts of those which have been prepared in detail for the nine lines described. I consider it unnecessary to furnish these detailed estimates until the Government have decided which line they will sanction.

To each item 10 per cent. has been added for contingencies.

19. The estimates do not include the cost of forming a road along each side of the canal, as proposed in my report on the high level project, because such roads are no essential part of the scheme; and, on some of the lines, they would be quite unnecessary.

20. Three boat basins, or landing wharves, have been estimated for on each line : 50 yards in length and 10 yards in width at the bottom, with paved slopes of 4 to 1 all round, as also a gravelled wharf 15 yards wide.

21. The cost of under-tunnels is a heavy item of expenditure on some of the lines; most of them are for the conveyance of water for irrigation, and in many of these cases it can be carried across at the level of the ground in iron pipes at the public road or accommodation bridges, at a smaller cost than that of the tunnels estimated for.

22. The amount entered for compensation for damages has been settled, in each case, in consultation with the Tahsildar of Madras ; but the valuation is only a rough one, a detailed valuation will be made when a line has been selected.

23. I would gladly close this report here without expressing any opinion on the relative merits of these several lines, or on the question of whether the junction of the two rivers should be effected by a high level fresh water canal, or by one at the level of the sea. But it is necessary that I should draw attention to what I consider the principal arguments in favor of each.

I have already pointed out, in paragraphs 3 and 4, some of the disadvantages of the point marked K, near the Marine Villa, as the place of junction with the Kuam, as compared with that marked D. To these observations I have only to add that it is undesirable that cargo and passenger boats should occupy any portion of the Kuam east of the Mount Road ; and I presume it would be considered still more objectionable to raise the road along the margin of the river, where it should cross the canal, so much as 7 feet.

24. Should, however, this place be adopted as the point of junction, we have Nos. 1, 2, 3, 8, and 9 to decide between. In making a comparison, we must take into account not only the probable cost of construction, but the future of the canal as regards convenience to the public, stability of the work, future maintenance, and so forth.

Taking these points into consideration, I am disposed to recommend line No. 9, the one edged with purple on the plan.

It is the shortest of all the lines between A and K, it interferes very little with houses ; and, as a navigation, it would afford a fair amount of accommodation

to the villages between the two rivers. All the roads crossed by it should be raised, but generally to a less extent than should those on the other lines.

25. Of the three lines which enter the Kuam at D, I consider two of them, Nos. 6 and 7, unsuited for a sea level canal, on account of the depth of the requisite excavation. A deep wide channel across the country in those lines, with high spoil banks, would, I consider, be most objectionable.

I am, therefore, of opinion that the best of these three lines is No. 4 ; indeed, as a line for a sea level canal, I consider it the best of them all. It is not quite $3\frac{1}{2}$ miles in length, and its average depth, 13 feet, is but $3\frac{1}{2}$ feet above the lowest average, and is 6 feet lower than the highest.

It interferes to a very small extent with house property, and the line it takes across the country is very favorable for affording accommodation to the villages Besides these advantages, its estimate is the lowest except one.

26. On the question of a Sea Level *versus* a High Level Fresh Water Canal, I have only a few remarks to make. The advantages of a sea level canal, in this case, are—

I.—An unobstructed through navigation from a sea level canal on one side of Madras to a similar one on the other side.
II.—The boats not delayed by locks.
III.—The navigation open at all hours of the day and night.
IV.—No lock establishment to maintain.
V.—Public roads either not raised at all at the bridges, or to a height much less than would be necessary for a high level canal.
VI.—Supply of water always certain.

The principal disadvantages are—

I.—The canal being far below the ground level, and thus difficult of access.
II.—For the same reason boat basins, wharves, &c., more expensive and inconvenient.
III.—Maintenance more expensive than that of a fresh water canal, partly from silting up, and partly from long slopes washing in.
IV.—Branch canals, if required, expensive on account of depth of excavation.
V.—Salt water injuring the wells in its vicinity.
VI.—Water of no use for anything but navigation.
VII.—High spoil banks along the canal.

27. The points in favor of a High Level Fresh Water Canal are—

I.—The canal water at or near the level of the ground, and easy of access.
II.—Boat-basins, for the same reason, convenient and cheap.
III.—Cost of maintenance comparatively light.
IV.—Branch canals simple and cheap in construction.
V.—Water, replenishing the wells and springs in its vicinity.
VI.—Water could be used for irrigation and other purposes both in the main canal and branches.
VII.—No high banks along the canal.

The disadvantages of a high level canal are—

I.—Navigation obstructed by the locks.
II.—Boats delayed by the same, and,
III.—Especially at night, when it is often difficult to get the lock-keepers up.
IV.—First cost of locks, and a perpetual lock establishment.

The latter would cost about 90 Rupees a month for two locks.

V.—Public roads raised to an inconvenient height at the bridges.
VI.—Supply of water not quite certain.

28. If this project be considered merely as a means of connecting the two existing navigations, the sea level canal is, certainly, the best; but it is said, "if the Junction Canal be a necessity for navigation, why not make it as useful as "possible for other purposes." This question should be considered, for no one can deny that very many advantages would accrue from having a fresh water canal across this part of Madras.

The principal objections to a high level canal as a navigation, are the cost of the locks and the establishments necessary to work them, and the inconvenience they would cause to the traffic; but in this country a little loss of time is never much objected to, and the cost of the locks would be met by the diminished cost of earth-works.

I look on the raising of the bridges as the most serious objection to a high level canal, and it was principally for this reason that I selected No. 7, which crosses only five public roads.

Any one, however, of the three lines, Nos. 4, 6, and 7, would answer very well for a high level canal; and No. 4 would be the cheapest so far as the construction and working of locks was concerned, but it would be the most expensive and inconvenient in bridges.

29. I have already expressed my opinion (paragraph 53, Report on the High Level Fresh Water Canal) regarding the probability of a sufficient supply of fresh water. If any well-founded doubt exist on this subject, it would of course go far to settle the question in favor of a sea level canal which, so far as water is concerned, is certain.

In conclusion, I trust that this report, and the former one on the high level project, taken together, will afford the Government all the information they require on the subject of the proposed canal.

(Signed) W. FRASER, C. E.,
Executive Engineer.

No. 128. ORDER THEREON, 7th April 1868, No. 1,095.

CIVIL WORKS, No. 14.

1. Before taking these reports into final consideration, the Government would wish to have before them further professional opinions regarding the relative advantages and disadvantages of constructing the proposed Junction Canal through Madras as a high level fresh water line of communication, or as a low level tide-water canal, and His Excellency in Council accordingly resolves to request the Officers named in the margin to form themselves into a Committee to investigate the subject.

Colonel J. Carpendale, R. E.
Captain J. Mullins, R. E.
,, W. H. Edgcome, R. E.

Proceedings of the Madras Government, Public Works Department, 7th April 1868.

2. Mr. Fraser's plans and reports, as well as all previous papers, will be at the disposal of the Committee, and, in making its views known to Government, the Committee will state which of the various lines that have been proposed for the canal is, in its opinion, most suitable.

(True Extract.)

Colonel, R. E.,
Secretary to Government.

To the Superintending Engineer, 4th Division.
To Colonel J. Carpendale, R. E., with file of correspondence, and five Plans and a book of Plans.
To Captain J. Mullins, R. E.
,, ,, W. H. Edgcome, R. E.
To the Revenue Department.
To W. Fraser, Esq., C. E., Executive Engineer.

Exd. S. T. Augustin.

Rev. 1868 Dept.
Pro. of Govt. Jal April
No. 1145.

Progs. of Govt. in the
P. W. D.

Rec'd April 1868.
No. 1095

No. 999. of Apl.

Appointing a
Committee to investigate the subject regarding the relative advantages and disadvantages of constructing the proposed Junction Canal thro Madras as a high level fresh water line of communication, or as a low level tide water canal.

With Boer

A. 333 & 334
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No. 999.

Comm^d to the
Revenue Board.

17th. Apl. /68

14 Apls Letter Bd of Revr with Pro. Govt No 1095 Dept. 17