



EAST AFR. PROT.
No. 8398

C. O.
8398
Recd
R. 9 MAR 08

then the intelligence
of his death, and
that, in doing so, you
will convey an expression
of his Lordship's sympathy
with them in their
bereavement

I am to request
also that you will be
good enough to furnish
Lord Selkirk with the
name of and address
of some relative to
whom further details
can be sent when received
from the Protectorate.

HCW

45
No. 59
1908
25 Jan.
Next previous Paper.
1091
Copy includes H. Fauveau case 394
of copy draft to Gov. inf. 168. 6 Apr.

(Subject.)

Mr Fauveau - Concession on Tana River
Transmits Report and Minutes by
Comrs of Works (neither of whom has visited the
river) It is considered that no concession should
be granted before examⁿ of river by a competent Engineer.

(Minutes.)

Mr Reed
These reports are to some extent
antedated as evidence by the fact
that Mr Watts has not visited the
river: but it is pretty clear
that the £30,000 or £40,000
which Mr Fauveau & his
friends propose to spend would
not go any way towards
the cost of a satisfactory scheme
& that their plans so far
as they are have debauched
any would probably be
unsuccessful.

Mr Hardy of the East
Africa Cotton Syndicate of

Next subsequent Paper.

T 142

is chairman & all the other
persons have done any real
work in this district has now
overed their connection with
Mr. Fauces, & are renouncing
their original efforts for
10,000 acres in the usual way.

In the circumstances I am
not particularly anxious to
open £1,600 on sending
at an expert, who, it is ab-
-solutely certain will advise a
scheme which neither Mr.
Fauces nor the Govt. will
be able to fund of the money for

I am inclined to say
and their reports to Mr. F. &
ask him whether in view of them
he wishes to proceed with the
matter; ~~but~~ if he does say
that the Govt. will be asked to
when Mr. Netto can be persuaded
to go to the Town & report on
Mr. Fauces's scheme

11/13/3

W. Antrobus, passed as proposed?

14/3
11/13/3

30.3.

t.A.D.

998

334

Governor's Office,

Nairobi,

January 25th 1908.

~~EAST AFRICA PROTECTORATE.~~



No. 52
(Incl. 2)

8398
Recd
9 MAR 08

My Lord,

25231
7

Mr. Watts
15th 08
Mr. Jones
27th 08

With reference to paragraph 4 of my despatch No. 240 of the 13th of June last, I now have the honour to forward a report by the Commissioner of Public Works on the proposed concession on the Tana River to Mr. W.P. J. Fawcus, and a Minute by the Director of Public Works on the same subject.

2. Neither Mr. Williams or Mr. Watts have personally visited the Tana River and their reports in consequence admittedly suffer from insufficient data, but though they differ very widely in their estimation of the volume of water which will have to be dealt with per diem, they agree in thinking, Mr. Watts more emphatically than Mr. Williams, that the sluices proposed by Mr. Fawcus will be quite inadequate for the purpose for which they are intended: it would also seem to be very doubtful if the floods of a river flowing through many miles of flat country can be efficiently controlled by sluices situated near the mouth, below the flooded area.

3.

H.M. PRINCIPAL SECRETARY OF STATE

FOR THE COLONIES,

DOWNING STREET,

LONDON, S. W.

99-15

25231

3. Only one conclusion can, I think, be arrived at from a perusal of these reports, and that is that no concession should ^{be} granted before a careful examination has been made of the varying conditions of the Tana River, over a considerable period of time, by a competent Engineer.

4. The grave objections to the institution of a scheme formulated on insufficient data are sufficiently emphasized in the reports under notice.

I have the honour to be,
With the highest respect,

My Lord,

Your Lordship's most obedient,
humble servant,

J. J. Sullivan

(In the absence of H.E. the Governor)

Dec 20 of 1908.

336
COMMISSIONER OF WORKS' OFFICE,

File 10/11
ENCLOSURE *Vol* NAIROBI,

In Despatch No. *52 of Jan 25 1908* 15th. JAN. 1908.

8398

RECEIVED
9 MAR 08

Sir,

I have the honour to forward a Minute inquaduplicate on Mr. Fawc's proposed Concession on the Tana River, and to invite your attention to the Minute by the Director of Works.

2. In Irrigation matters, in future, I assume that the Honourable the Commissioner of Lands and myself will always work hand in hand— the former being responsible for water rates, and all questions regarding the land irrigated, the latter being solely responsible for the Engineering Projects.

3. There are several methods of *levying* ~~levying~~ water rates with which I am conversant. In a new country, however, the best way to do so, where water is plentiful, is to enhance the land Revenue of the irrigated tracts, Crediting the P.W.D. with this Enhancement. By this means the Land Department alone deal with the distribution of the water— the P.W.D. alone being in charge of the Head Works & large Sluices. Where every cubic foot of water has to be cared for, this system would not do and P.W.D. Engineers would have to distribute the water.

To,
The Secretary to the Administration.

NAIROBI.

On the Tana River however I do not think there will be any scarcity of water for many years to come, so the Enhancement of Land Revenue system is the one which I recommend.

~~to,~~
I have the honour to be,

Sir,

Your obedient servant,

J. Kwatts

COMMISSIONER OF PUBLIC WORKS.

— E. A. P. —

MINUTE BY THE COMMISSIONER OF PUBLIC WORKS.

-----oo0000-----

I am placed at great disadvantage in criticising the proposals made by Mr. Pavous by not having yet visited the Tana River; and by having no longitudinal and cross sections of this River and the flooded area before me.

8. In Tropical Countries with large Drainage Areas (Watersheds) the flood discharge of a river, as calculated from the longitudinal and cross sections, is never entirely relied on; because the cross section is as a rule too small to carry all the water, the surplus of which spills over the banks on one or both sides, thus submerging large areas of land. Such rivers usually have their banks and beds situated above the level of the surrounding country-- (vide the following typical Cross Section--)



A, B = the Banks of the river.

C.D.G. - the Cross Section of the water in Normal times

E.H } - the land liable to be submerged from water spill-

I.F) ling over from the channel.

3. To calculate the Flood Discharge therefore in flooded areas the size of the Drainage Area and the rainfall, are the main factors which determine it, not the Cross Section of the river, and I know of four Formulas which are used for this calculations-

I. Dickens'

$$D = 835 M^2$$

II. Barge

$$D = \frac{1800 M}{\sqrt{2}}$$

III. Ryves

$$D = C \times \sqrt[3]{M^2}$$

Where

D - the discharge in cubic feet per minute.

M - the Drainage Area in square miles.

C - a constant - 480 within 15 miles of the sea

- 568.5 between 15 & 100 - do - do

- 675 for limited areas near hills

IV.

Origma. This is the best one, because it takes the Shape of the Drainage Area into consideration. I have

These formulas are a step towards the solution of the problem

not however got it with me. It gives less results than Dickens'. It was the Formula used by Sir. W. Gaistin in calculating the flood discharge of the Nile at the Ripon Falls.

Applying the first three Formulae to the flood discharge of the whole Drainage Area of the Tana River viz: 41500 sq. miles we obtain the following results:-

By Dickens' Formula	=	306,496,000,000	cubic ft. per	
		<i>65,491,200,000</i>	diem.	
, Burges'	,	62,227,400,000	"	"
		<i>62,038,880,000</i>	"	"
, Ryves	,	61,252,200,000	"	"

By Dickens' Formula	=	2,390,000	cubic ft. per	^{approx} 1 st (second)
, Burges'	,	758,000	"	" 1 st (d ^o)
, Ryves'	,	710,200	"	" 1 st (d ^o)

As however the Drainage Area below Hargase is said to be rainless, the above discharges must be far too great if this statement is correct.

4. Assuming that the discharge of the river at its mouth is due to the Drainage Area of 2450 Square miles, then the flood discharge at Hargase is :-

By Dickens' Formula	Q -	791,000	cubic ft. per second
, Burges'	-do-	Q - 385,000	" " " "
, Ryves	-do-	Q - 301,000	" " " "

This D.A. is however incorrect because Fort-Hall is shown several miles out of place on the present Maps. It is all however that I have to go on.

Assuming the least result as the correct one,

we have:-

D = 301,000 cubic feet per second.

D = 18,060,000 , , , minute

D = 1,083,600,000 , , , hour

D = 26,002,400,000 , , , diem.

To find the " run off " of the rain fall which gives this discharge:-

<u>Cubic feet.</u>	<u>Coefft.</u>	<u>Sq.miles</u>
26,002,400,000	= 2,328,300	x 9450 x X (inches of rain fall)

therefore X = 1.24 inches of rainfall per diem as the

" run off ". Therefore the maximum flooded discharge is due to a " run off " of 1.24 inches of rainfall.

Even supposing the ground to be thoroughly saturated the " run off " would probably not be more than 40 per cent of the actual rainfall, and therefore I assume the possibilities of :-

- (a) a rainfall of 3.12 inches in a day giving
- (b) a " run off " of 1.24 -do- , , (approx.)

This is not too heavy a rainfall to assume, because one can conceive a much heavier snow or rainfall than this on Mount Kenia and its vicinity.

5. In India, in parts where only 30 to 40 inches of rain fall annually, a " run off " of one inch per hour is often assumed, when calculating the s-

forming artificial lakes

Bridges, and also of Waste Weirs for large dams for water supplies or Irrigation Projects and even with this large allowance there are "washways". Mr. Williams calculates the flood discharge from sections of the river at Hargase to be 2,200,000,000 cubic feet per diem on the assumption that the "run off" is only 0.10 inches per diem. In my opinion this is far too low an assumption in a tropical country. In my opinion he has not made his calculation on a sound basis. They give the amount of water which would reach the river and be available for storage in a bad year - this being the method used for calculating the minimum quantity of water to be stored in an artificial reservoir. In figuring out the flood discharge of a River the Formulae we have used are I believe the correct ones.

We therefore have :-

By my calculation by Byves Formula

Cubic feet per diem

$Q = 26,002,400,000$

• Mr. Williams' calculation

$Q = 2,200,000,000$

difference C F $23,802,400,000$

Mr. Williams calculates the discharge at Merifano as practically the same as that at Hargase therefore if his

about 1,500,000 cubic feet per minute.

page 7 of his report 31 para on that page.

assumption is correct, then 85,808,400,000 cubic feet of water per diem are lost between Hargase and Morifane. That a great deal of the water is lost - (due to evaporation ^{absorption} by the river in travelling the long distance of a practically rainless country, is evident, but that such an amount as this can disappear is past my belief. I therefore think that the flood discharge at Morifane is much greater than Mr. Williams supposes, and I should not be surprised if it were double. If my view is correct then the Sluices as proposed by Mr. Fawcett & (of their style and dimensions I have no knowledge) - will be even more insufficient than Mr. Williams supposes, and they will be useless for the purpose for which they are intended, and will not fully protect the flooded area.

The Company's money will therefore be thrown away, and the present Channel will be damaged, because nothing is said of the nature of the soil on which the Sluices are to be founded, and it is probably very friable, or else the Tana River would not have so easily changed its course, as it did when the Belasemi Canal was deepened and improved.

6. I think Mr. Williams' views (on pages 7 to 9 of his report - marked A) are very sound, and I support them, and to give further evidence of the drainage which may be done by all considered Projects for Sluices and Embankments, I append an extract from Pioneer Mail of 29/11/07 giving the views of H. H. Sir. Lancelot Gage K.C.S.I., I.C.S. the present Lieut. Governor of eastern

assumption is correct, then 83,802,400,000 cubic feet of water per diem are lost between Hargabe and Merifano. That a great deal of the water is lost - (due to evaporation ^{absorption}) - by the river in travelling the long distance of a practically rainless country, is evident, but that such an amount as this can disappear is past my belief. I therefore think that the flood discharge at Merifano is much greater than Mr. Williams supposes, and I should not be surprised if it were double. If my view is correct then the Sluices as proposed by Mr. Faucus - (of their style and dimensions I have no knowledge) - will be even more insufficient than Mr. Williams supposes, and they will be useless for the purpose for which they are intended, and will not fully protect the flooded area. The Company's money will therefore be thrown away, and the present Channel will be damaged, because nothing is said of the nature of the soil on which the Sluices are to be founded, and it is probably very friable, or else the Jaha River would not have so easily changed its course, as it did when the Helaseni Canal was deepened and improved.

6. I think Mr. Williams' views (on pages 7 to 9 of his report - marked A) are very sound, and I support them, and to give further evidence of the drainage which may be done by all considered Projects for Sluices and Embankments, I append an extract from Pioneer Mail of 29/11/07 giving the views of H.H. Sir. Lancelot ~~Ware~~ K.C.S.I., I.C.S. the present Lieut. Governor of eastern

Bengal and Assam, who has lived for over 3 years in a Country where such Embankments have been erected on a larger scale than probably anywhere else in the World, and whose authority must carry great weight.

7. Sir Lancelot however omits one method of treating rivers which has been ^{used} successfully on the Indus in Seindo, and which has been the means of saving the country between ^{the} ~~them~~ and Beluchistan from floods. By this method the great "Kuzmore Bund" (Earthen Dam) has been constructed parallel to the River for 100 miles or more on one side of it. In the Dam there are Sluices to let out any water (which may be due to any rainfall on the land side) into the river when floods subside. On the other side of the river there are no ~~sluices~~ and the land is flooded yearly, and is highly cultivated by means of ^{Inundation} "Foundations" canals, which can only be used in flood times.

8. Applying this method to the Tana I would advocate :-

(I) Erecting an Earthen Dam parallel to the river and $\frac{1}{2}$ a mile away from it on the South side from Merifano to Ngao - say 80 miles long.

(II) Building Sluices in the Dam on the South side of the River at Ngao.

(III) Cutting a new Channel connecting up the Swamps from Ngao to the sea - (points A and B on Mr. Williams

Map)

sufficient to discharge all the water which the River between Ngao and the sea cannot carry, if the levels admit.

(IV) Improving the Channel between Ngao and Charra.

(V) Improving the Channel between Charra and Mt. Tana.

(VI) Using Dredgers at all the mouths of the river so as to keep the openings in the sandbanks free.

(VII) Planting up the sandbanks with Casuarina Trees to prevent sand blows and as a fuel reserve.

(VIII) Protecting the banks of the channels through the sandbanks by roughly made hurdles or grass mats.

(IX) The whole question to be gone into by an Advisory permanent Tana River Conservancy Board with the Provincial Commissioner as Chairman, the District Commissioner, Executive Engineer, and an Officer of the Land Board to be the Official members, and Non-official ones who have interests near the River to be added.

(X) The Board to send its report to the Commissioner of Lands, Public Works who after consulting the suitable the Commissioner of Lands, would place the Scheme before Government.

Any measures short of these will I believe prove very unsatisfactory and imperfect.

9. Embankments on both side sides of the river I am not in favour of, because they are usually a failure vide the disastrous results of constructing them on the Tiber.

10. With reference to Mr. Williams conclusions on page 10 of his report, I do not think that the sluices as suggested by Mr. Pawson will be of practical use, and as they are far too small I think they may do harm. I do not believe in tinkering with a big river like the Tana, and I should like to see all waterways in this Protectorate nationalised. If however Government cannot at present do this, then should this Company be prepared to take up the drainage of the whole flooded area on the lines which I have indicated, I have no objection to it doing so subject to the following safeguards:-

(a) That the work should not be commenced until the plans and Estimates have been passed by Government on the advice of the Board, the Honourable the Commissioner of Lands and the Commissioner of P.W.D.

(b) That the work should be subjected to inspection during construction by the Executive Engineer who should bring any shortcomings before the Board, who would either take action, or report the case to the Commissioner of P.W.D. for orders.

(c) That the carrying out of these works should only give the Company water rights sufficient to irrigate their property if necessary.

(d) That Government should contribute towards the Capital expenditure.

(e) That the works on completion should be inspected and passed by the Commissioner P.W.D. before the Government grant can be drawn.

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(f) That the Maintenance of the Works should be placed in the hands of the Board the cost being defrayed by Government unless a Cess which should be levied on all parties benefitting by the Works as a "River Conservancy Cess" proves sufficient for the purpose.

11. If my views are not accepted then I advise the adoption of the suggestions by Mr. Williams with the addition of a clause (5) viz. "That the works proposed by Mr. Pawcus may not be commenced until the plans &c. for the Sluices, and other Projects suggested by that Gentleman are passed by the Commissioner of P.W.D."

12. As it will take some years before the flooded Area is free from being submerged and ready for cotton cultivation I throw out the following suggestion for its cultivation. In Sybhet and Cachar (two Districts of Assam a certain variety of rice is sown before the floods rise, the crops grow, they ripen before the floods subside and are reaped by men in boats. Would this method be practicable on the Tana? and is it worth trying? A second crop of a different kind of rice is grown in these Districts on the same land in the cold weather when there are no floods, and the land is assessed as "doubled cropped".

In conclusion I am indebted to Mr. B. D. B. ... and Mr. Reynolds. The new ... given Nairobi ... checking ...

Nairobi
13th January 1908
Commissioner of Public Works

Another interesting point in the Lieutenant Governor's speech was his answer to the request for protection against floods by a system of embankments. His Honour replied as follows:- " You next ask for a system of embankments to protect you from floods and weirs. I think you must mean sluice-gates, for weirs would perhaps be inconsistent with holding back the flood sufficiently to let in the silt, but the amount of all the silt which you could get through sluices in your embankment would be as nothing to what you now get. I have seen much of these river embankment, and am by no means convinced of their being sound projects. That they often - even generally - confer, a very great ~~future~~ immediate benefit I am free to confess, but this is generally at the cost of very great future loss. They stop the process of raising the land which is otherwise continually going on, and head off the fertilising silt to a large extent, if not entirely. The result is that in time the river bed becomes higher than the protected lands, which then become water logged and unhealthy and useless. I believe the better opinion is at present against embankments, but the question is largely one of detail and a balance of corresponding advantages and disadvantages as regards each Scheme. The expense of construction and maintenance of these works has also to be considered. I am willing to have an enquiry made, and I shall keep an open mind until I see the results of that enquiry".

Re Mr. Fawcus's application for land on the
Tana River.

Commissioner of Public Works.

It is difficult at the present stage to criticize the proposals for works of development on the Tana River, as the file to hand is an incomplete one, and contains no particulars as to the engineering details of Mr. Fawcus's suggested scheme beyond an allusion to the report by Mr. Williams to a proposal to make one or two dams in the abandoned river bed near the mouth, and to erect sluices for opening or closing the waterway so formed. Presumably Mr. Fawcus has at some time or other described these proposals in some detail, as otherwise Mr. Williams would not be in a position to remark upon them.

However the proposal, even in such brief outline as is here presented to us, appears to me to be sound. The regulation of floods along the East African coast, of a river flowing through very flat country can not be efficiently managed by works below the mouth, and that only by control of approaching floods at the source is the question. As a scheme for the regulation of floods, nothing approaches, either from the point of view of efficiency or from the permanence of results and absence of recurring maintenance charges, the policy of extensive afforestation of the higher parts of the river basin, the effect being to convert a short period of heavy flood into a prolonged period of (comparatively) slightly increased flow. Not only does the afforestation of a river basin exercise this balancing action on the discharge of a river during periods

Handwritten note:
This is a
matter of
5000 acres
of forest

of widely differing rainfall, but it directly reduces the volume of water reaching the river. Further protection from inundation of the lower reaches is to be obtained by improving the discharge of the river, not only at the mouth, though that of course is of great importance, but along the whole course. This improvement is to be obtained not only by regulating the width and direction of the river by treatment of its banks, but also by securing uniformity of depth and slope by treatment of the river bed. Works may further be instituted along the banks for including flood waters from the lying lands adjacent, or for only supplying to them, through sluices, the quantities of water required for agricultural operations. Under these circumstances it is practically certain that there will, in a climate like ours, be periods when it is not only unnecessary to admit any water to the adjacent lands, but when it will be necessary to drain them by putting up sluices. It is the configuration of the land that is to be marked control of the flood water is to be obtained by erecting masonry or other works across the valleys, and the water to be held back until the low water on the main river has been reached, and then be released. However, it is to be noted that this will be prohibitive unless the water is to be used for the irrigation of the lands, or for power purposes. In any case they are likely, in the event of a rapid access to the sea, to be useless as a river-control measure, unless the water is to be used for the purposes contemplated in any locality, and the best careful attention of the amount of water to be allowed to pass should be made,

as otherwise it may be found to accumulate behind the dam at such a rate as to soon render the latter useless for the purpose for which it was erected.

It is more than probable that for the most economical and efficient control of such a river as the Tana, considered both as a waterway for commerce and as an irrigation stream, all the above measures, together with canalization on certain stretches, would be employed in a great or less degree and in some portion or other of the river's course. The best method for final action, in a case of this sort, is one of the most complex of engineering problems, and it is probable that at least three years' minute study of conditions prevailing throughout the basin would be required to enable anyone to deliver a sound decision on the scheme. The institution of a new station at Korokoro and its connection with the coast by telegraph will be of the greatest service in studying floods on the river. I have spoken with Mr. Reilly who some years ago struck the river at Kinakombe and travelled up towards its source, and from what he remembers of the upper reaches, he does not hold out much hope of its being possible to regulate floods from the hills by means of a dam system. Unfortunately it seems that a report and regular survey that was made of the river were subsequently lost. There is, I consider, the very strongest objection from an engineering point of view to permitting the institution of ill-considered attempts at regulation at one or two points on the course of a stream such as the Tana. Work of this nature should be a State measure solely, and should only be undertaken after prolonged and careful study

study by qualified men, under the instruction of engineers, of the conditions prevailing along the whole course of the stream and throughout the entire basin.

The suggested expenditure of £.45,000 spread over seven years would in my opinion be quite useless in effecting any useful improvement in the conditions along the lower reaches of the river and in any case there are serious objections to the institution of sluices near the mouths of tidal rivers. There are numerous instances on record where such action has produced permanent damage to rivers which has not even been undone by the entire demolition of the works in question.

~~Sd/-~~ W. McGregor Ross.

Director of Public Works.

Nairobi,

December 27th 1907.

[Copy to file: 197.]



3rd April
March 1908
In reply to

With reference to your

DRAFT

Mr James Fawcett Esq

of the same

MINUTE.

- Mr. Ashworthy 3/13
- Mr. Read 11/27/13
- Mr. Just. 1/4
- Mr. Antrobus.
- Mr. Cox.
- Sir C. Lucas.
- Sir F. Hopwood.
- Mr. Churchill.
- The Earl of Elgin.

+

letter of the 26th of February, I am directed by the Earl of Elgin to transmit to you the accompanying copies of reports which have been received from the Gov^t of the E.A.P. on the subject of the proposed concession on the Tana River

2. Lord Elgin will be glad to be inf^d whether in view of these reports you wish to proceed further with the matter. If so, the Gov^t will be asked when the Comm^{tee} of Works can

reference to 8398 + enclosure no 8398

which point to the necessity of expending a very large sum of money if anything is to be accomplished

#110 6004