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NOTES

ON THE

APPLICATION OF THE TEST

OF

ORGANIC DISEASE OF THE SPLEEN,

AS AN

EASY AND CERTAIN METHOD OF DETECTING MALARIOUS LOCALITIES

IN

HOT CLIMATES.

BY

SURGEON T. E. DEMPSTER,

Member of late Canal Medical Committee.

AGRA:

WM H. HAYCOCK, SECUNDRA ORPHAN PRESS.

1848.

FROM T. E. DEMPSTER, ESQ.,
1st Brigade, Horse Artillery,

TO J. THORNTON, ESQ.,
Secretary to Government, N. W. P.

Dated, the 31st January, 1848.

SIR,

I have the honor to forward two colored Maps or Plans of the country gone over by the late Canal Committee, together with an explanatory memoir relating to subjects, either directly connected with that enquiry, or deduced from the observations made on that occasion. I have to solicit the favor of your submitting these documents to the Honorable the Lieutenant Governor, North Western Provinces, in the hope that his Honor will be pleased to cause them to be placed on the Public Record, or to make such other use of them as he may deem conducive to the Public Service.

The Maps are compiled entirely from the Tables appended to the Committee's Report, and therefore contain no new facts; but they appear to me to place the former facts in a new, simple and striking point of view, and to exhibit at a glance the whole grounds of the Medical opinions expressed in the Report.

As the sole Medical Member of a Committee of Enquiry into sanatory questions of such vast public importance, I feel myself to be in a position of no ordinary responsibility; and however confident as to the general soundness of my opinions, I am naturally anxious to show precisely what these opinions are, and to place on record proof clear and undeniable, that I have advanced nothing but what is based on certain and well ascertained facts.

I have a strong conviction that the concluding portion of the accompanying paper will be found to contain matter calculated to be extensively useful in this country.

I have the honor to be, &c.,
(Signed) T. E. DEMPSTER, SURGEON,
1st Brigade, Horse Artillery, and late Member Canal Committee.

Loodianah, 31*st January,* 1848.

No. 972 of 1848.

FROM J. THORNTON, ESQ.,
Secretary to Government, N. W. P.

TO T. E. DEMPSTER, ESQ.,
Surgeon, 1st Brigade, Horse Artillery,
Late Member Canal Committee.

Dated Agra, the 11th March, 1848.

SIR,

Revenue Department.

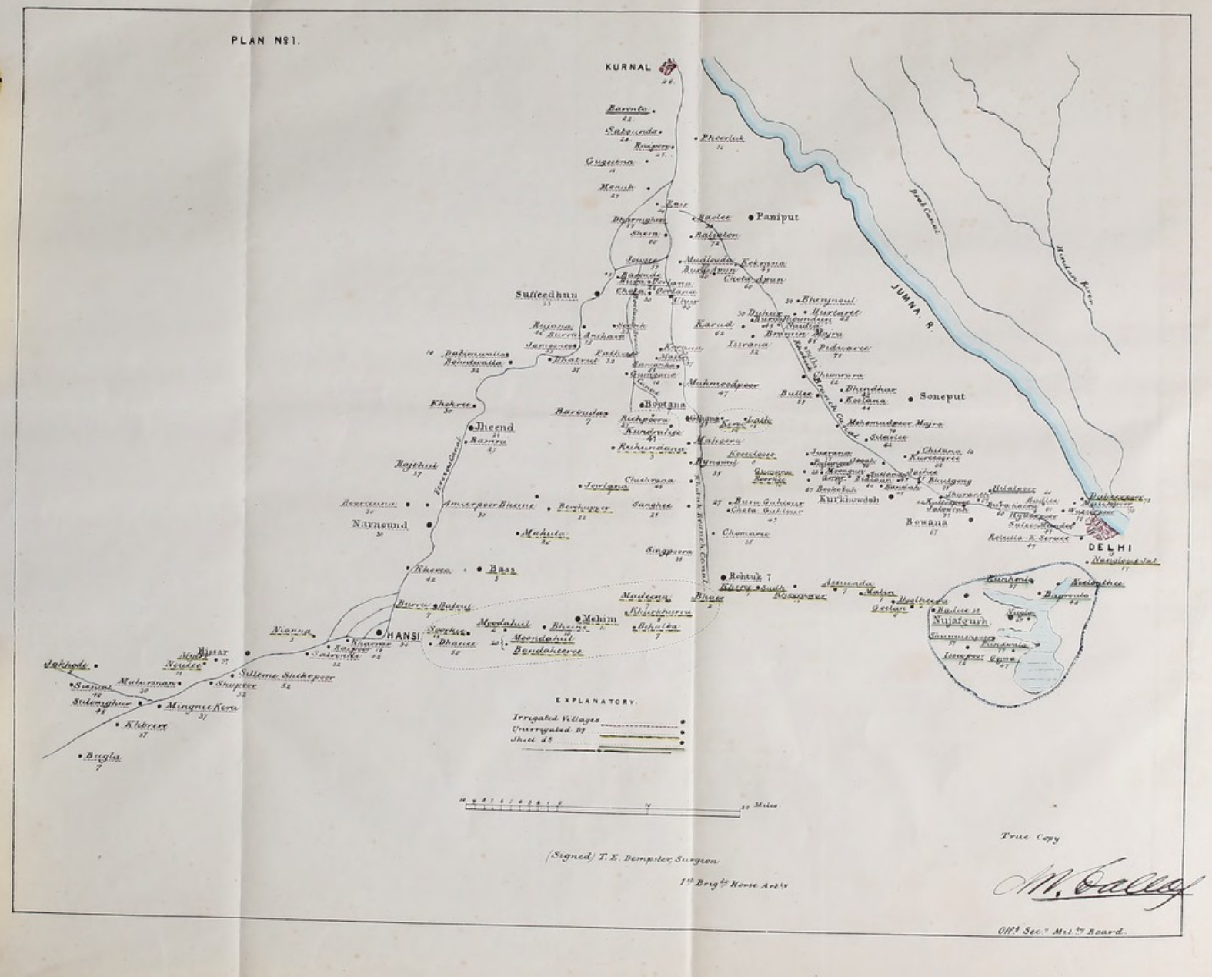
I am directed by the Hon'ble the Lieutenant Governor to acknowledge the receipt of your letter, dated the 31st January last, with its enclosure, being additional remarks by you as an Appendix to the Canal Committee's Report, and in reply to inform you, that your communication was not received in time to admit of its being bound up and circulated with the Committee's Report. The Lieutenant Governor is however so anxious to give publicity to all that will throw light upon the subject, that he has given directions for printing it uniformly with the Report.

I have the honor to be, &c.,

(Signed) J. THORNTON,
Secretary to Government, N. W. P.

Agra, the 11th March, 1848.

PLAN No. 1.


KURNAL
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EXPLANATORY.
Irrigated Villages
Unirrigated Do
Shed do
Miles.
(Signed) T. E. Dempster, Surgeon.
1st Brigade Horse Artly
True Copy
M. Bailey
Offg Secy Mil. Board.

APPENDIX.

ALTHOUGH the Tables and figured Abstracts appended to the Report of the Canal Committee comprise all the results of the Medical examinations, as well as information on various other points connected with the enquiry, they fail to shew the relative position of the places visited. This appears to me to be a defect which I have attempted to remedy by the construction of the two accompanying Plans. When the eye sees at a glance, not only the percentage of organic disease found in each town and village, but also their relative positions, both to the Canal and to each other, the effect on the judgment is far more striking and convincing than could be produced by any other method of dealing with a question of this nature.

2nd. The percentages of spleen disease and classification of the villages are faithfully copied from the Tables appended to the Committee's Report; in fact these Plans are only the Tables in another form. The several villages, &c. are laid down from my private notes and not from any authentic Maps or Survey. In doing this I make no pretension to minute accuracy, and mistakes in distances will often be found; but I believe the whole is sufficiently correct for the particular purpose I have in view.

3rd. I have considered the present a good and fitting opportunity for entering more minutely than could have been done in the Report, into the chain of reasoning by which I arrived at the Medical opinions expressed in that document.

Plan No. I.

4th. The line of villages lying between Rohtuck and Hansie, and two villages to the east and two to the west of the Town of Gohana, (all of which are included within *dotted lines*) were examined during our first expedition in December 1845, and were not again visited in 1846-47: all these places were excluded from the Tables for reasons fully explained in the Report. I have however, thought it desirable to introduce them here into one general view, accompanied by such explanation as will insure their fair and proper use.

5th. Of 21 localities visited in two succeeding years, viz. 1845-46 and 1846-47, the average of spleen disease for the former season was 42·50 per cent.; and for the latter 37·19 per cent. These results are sufficiently near to secure some confidence in the general fidelity and usefulness of both sets of observations; and the trifling difference of 5·31 per cent. in favor of 1846-47, is amply accounted

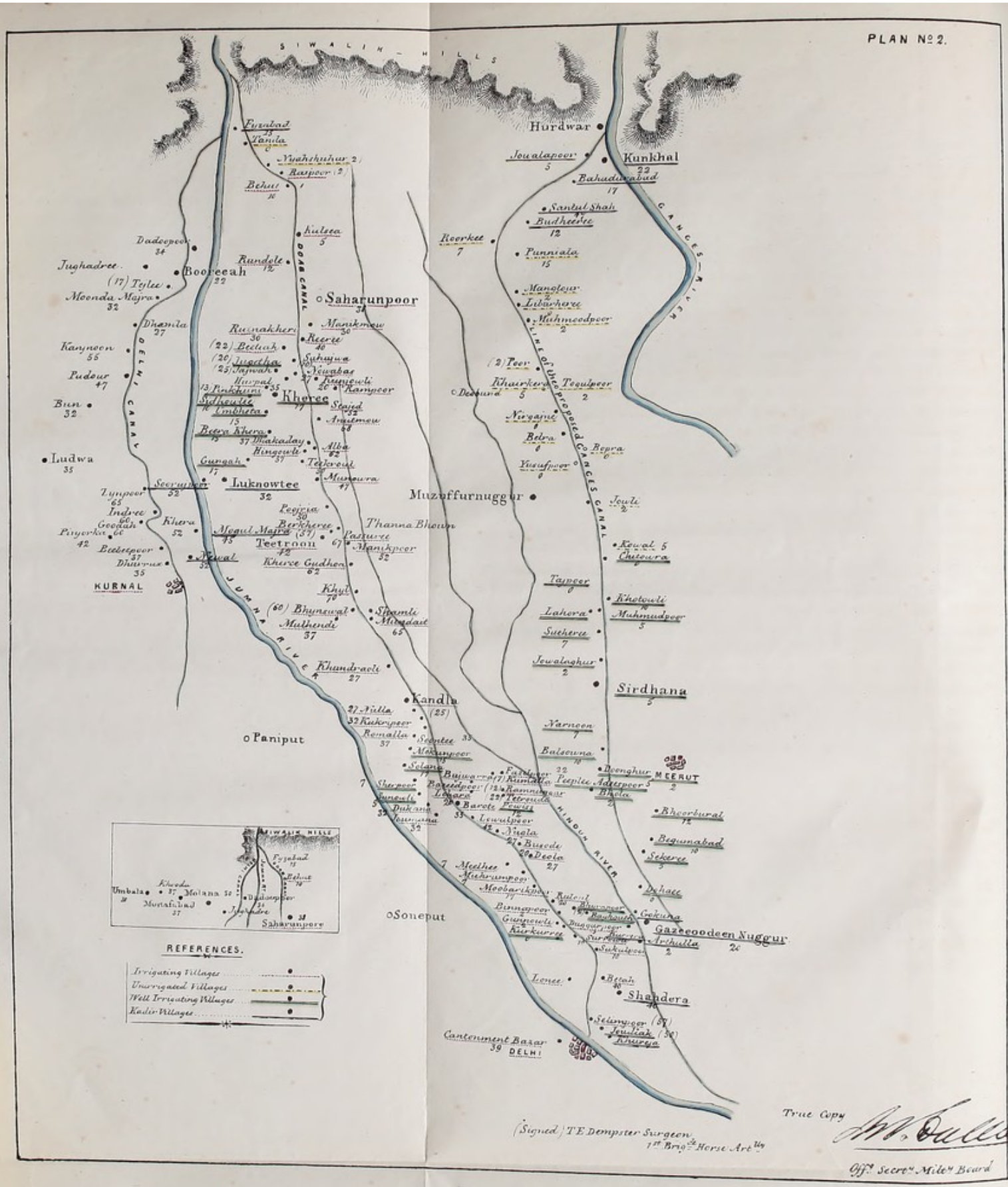
for by the acknowledged superior salubrity of that season over the two or three immediately preceding ; there is therefore nothing unfair (as far at least as Canal irrigation is concerned) in now comparing these villages with those examined a year later ; for if a corresponding decrease in spleen disease had taken place in them, the comparison would have given a trifle more in favor of the unirrigated parts. The numbers within the dotted lines, I believe, may be safely taken as they stand, and hey will be found to complete a very important chain of observations. It is much to be regretted that our enquiries in this part of the country were so much confined to places in the immediate vicinity of the Canal. The reason of this has already been fully explained ; but it may not be unimportant here further to state, that I was entirely ignorant of the nature of the country to be gone over, and that whenever we did diverge to the right or left (although of course consulted on the occasion) I necessarily put myself under the guidance of Major Baker. This will remove all suspicion that I selected favorable specimens of unirrigated localities: indeed, during the whole course of the enquiry I made it a rule to interfere as little as possible, either with the particular places, or particular persons to be subjected to examination. It is however also due to Major Baker, to record my entire conviction of his scrupulous impartiality throughout the investigation; and to state, that along the whole course of the west of Jumna Canals he advisedly selected the *worst* localities, and conducted me to every Canal, Town or Village, known or reported to be the most unhealthy.

6th. If any reliance is to be placed on the general fidelity of the Medical examinations, no one can cast his eye over the Plan without being struck with the astonishing difference between the numbers belonging to the irrigated and unirrigated parts; or at once acknowledging, that some cause or causes, intimately connected with *this* Canal, contribute in a remarkable degree to the production of spleen disease.

7th. Run the eye up the Rohtuck branch as far as Gohana, and compare the two unirrigated villages on the east bank of the Canal, with any two irrigated ones in the vicinity. The difference is great, but perhaps, it is accidental and depending on causes unconnected with Canals or Canal irrigation. Begin then again at Rair, the head of the Delhie branch, proceed downwards noting the numbers as you pass the eye along; stop at Jooah, look towards the west and contrast the group of unirrigating villages with any equal number from Rair to Delhie which use Canal irrigation. The difference here is indeed most remarkble. Surely this is more than accidental!

8th. Pursue now the long lines of unirrigated villages from the west of the Nujufghur Jheels to within a few miles of Hansie, and from the termination of

PLAN No. 2.



True Copy

(Signed) T E Dempster Surgeon
1st Brigde Horse Artly

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the Bootana branches to the same point. Compare the numbers with those belonging to any irrigated tract to be found in this Plan; but especially observe the sudden and remarkable change which occurs the moment we come within the irrigated country near Hansie. Continue along the Hansie branch and mark well the five last villages beyond Hissar, three of which irrigate from the Canal and two do not.

9th. Observe, that a high number in an unirrigated group would be considered a low or at least moderate number, if belonging to an irrigated one, and lastly, remember, that the average percentage, (as given in the General Summary) for the irrigated villages within the Delhie Territory is 53; while that for the unirrigated parts within the *same Territory* is only 11!

10th. The conclusion is irresistable, that some cause or causes connected with *this* Canal, or with its irrigation have, during late years contributed in an extraordinary degree to the production of enlarged spleen. So far I trust, there can be no dispute.

Before quitting Plan No. 1, let attention be directed to the space included within the *blue* line, and which by an error in the sketch map, is placed somewhat too near Dehlie. An examination of the numbers belonging to this circle of villages will demonstrate, that whatever the cause or causes of spleen disease may be, they *also* abound in this notoriously low marshy tract.

11th. Having thus noticed the principal features of Plan No. 1, I proceed to Plan No. 2, which exhibits a series of facts not less important, but of a very different character. I beg it may be borne in mind, that I was still ignorant of the nature of the country to be gone over, and continued to place myself entirely under the direction of the Canal Officers, as to the places selected for examination.

12th. Let us commence near Dehlie, and follow the route of the Committee upwards to the head of this Canal. First, I would direct attention to the high numbers belonging to the villages situated in the low "khadir" land on this side of Dehlie, whether irrigated from the Canal or not. As we ascend the stream, we perceive, for the first time, that *full Canal irrigation*, even when conjoined with close proximity to the Canal is compatible with *a very moderate amount of spleen disease*. This most important step in the investigation will be found to be further confirmed by the condition of some of the villages above Seharunpore.

13th. We have also a good opportunity in the southern division of this Canal, of comparing Canal with Well irrigation in parts very similarly situated in all other particulars; and we observe that while spleen disease is moderate in all, there is an average in favor of Well irrigation.

14th. Proceeding upwards, remark particularly the sudden change which takes place in the immediate neighbourhood of the Town of Shamlee,* how the numbers at once attain the maximum rates, and continue very high, specially in the villages near the Canal, until we come to the high land above Seharunpore, where the numbers almost as suddenly return to low rates and so continue up to the Canals' head.

15th. It will be further perceived, that the villages situated in the low "khadir" of the Ganges, Jumna and Hindoon Rivers often, but not uniformly, exhibit high numbers. Finally turn the eye to the long line of villages from Roorkhi to Meerut and from Meerut to the banks of the Hindoon; the whole of this tract of country is in a high state of cultivation; the lands are either altogether unirrigated or irrigated from Wells: the whole enjoys the most remarkable exemption from spleen disease.

16th. Having finished a rapid survey of the plans, it is now the proper time to enquire, if any remarkable local circumstances are common to all those tracts where spleen disease generally prevails, and especially what conditions we find common to the central division of the Dooab, and the Delhie branch of the Kurnaul Canal.

17th. The peculiar geographical features of the high land on the right bank of the Jumna have been fully explained in the body of the Report, and it is there shown how the banks of a Canal, originally constructed without any view to preserving the drainage of the country, have every where impeded or absolutely obstructed it. To obstruct the natural drainage of a country subject to copious periodical rains, and having a hot climate, is obviously to flood it in the most mischievous manner; all this literally happens in most parts of the country traversed by the branches of the Kurnaul Canal, but more especially between Kurnaul and Delhie, where also the low or "khadir" land bordering the Jumna, is every where saturated with excess of moisture.

18th. With a few isolated exceptions, the soil of the irrigated lands, lying on the right bank of the Jumna is generally stiff and retentive of water, and

* It was agreed to exclude Shamlee from the Medical examinations, being a notoriously unhealthy town with *little* Canal irrigation.

it is easy to conceive how Canal irrigation practised under such circumstances must aggravate all the evils of an obstructed drainage.

19th. The country on the left bank of the Jumna through which the Dooab Canal passes is of a very unequal character.

20th. The main features of the southern division excluding the "khadir" lands are perfect surface drainage and a light permeable fertile soil. The Canal irrigation is here carried on by "Rajbahas" or main water-courses which control the useless and pernicious waste of water. The country generally is in the highest state of cultivation; the irrigated fields coming close up to and surrounding the villages. We had the advantage of examining this tract immediately after heavy rain, and witnessed the completeness of the drainage and the absorbent nature of the soil.

21st. In the Northern Division, the Canal is conducted from the Hills over an inclined plane, being let down to the lower levels by successive masonry falls. The stream is here rapid and the water clear and limpid, except in the rainy season. The soil of the adjoining country is almost uniformly light and fertile, but the lands are neither fully irrigated nor highly cultivated. The inclination of the country, and rapid fall of the Canal secure complete general drainage. Where springs occur, the water is found very near the surface, but it seems to be every where in a state of quick transition. We observed a considerable excavation in the bed of the Canal where they were repairing the foundations of a Bridge, and yet it was quite free from a drop of water, although, in other parts, it is within a few feet of the surface.

22nd. The Southern and Northern Divisions of the Dooab Canal thus agree in having a perfect surface drainage and a light absorbent fertile soil.

23rd. The Central Division of this Canal has a very different character from the Northern and Southern portions just described. From circumstances connected with the levels of the country, and with a natural adjustment taking place in the Canal itself, the drainage of the country has here become as completely obstructed as in the worst portions of the Delhie Canal. After passing Mundait, a village near the notoriously unhealthy Town of Shamlee, the whole aspect of the Canal and adjoining country becomes suddenly and completely changed; the swampy belt of reeds and high grass which so commonly accompanies the Delhie Canal is here met with for the first time. "Jheels" and marshes, swarming with aquatic fowls, are seen on either side, and the villages close to the Canal are often surrounded

with shallow stagnant pools. The soil too undergoes a decided change, being no longer light and friable but generally stiff and clayey. From Abba, there is less apparent swamp; but no decided improvement in the general aspect of the country takes place, until four or five miles to the North of Seharunpore.

24th. We have thus been able distinctly to trace two remarkable local conditions common to all tracts irrigated from the existing Canals where spleen disease prevails to a great extent, viz., obstructed surface drainage and a stiff retentive soil; the first of these conditions being more uniform and constant than the second. And on the other hand, we find these conditions generally absent wherever spleen disease is rare. This is another most important step in our enquiry.

25th. But the question of greatest importance still remains to be discussed, viz., how far do the facts of the case before us support the position, "that the amount of spleen disease found in any tract of country is a fair average measure of the amount and intensity of the malarious influences to which its inhabitants have been exposed!"

26th. Had this been susceptible of *direct* proof, this test would never have been required; but I trust I shall be able to adduce such evidence of another kind as will amount to the strongest possible confirmation of the soundnes of my position. It is no new doctrine of mine, that intermittent and remittent fevers are the usual antecedents to enlargement of the spleen, or that the remote cause of such fevers is malaria or marsh miasma. Both these opinions are alike based on general experience and observation. All of originality I can claim, is the practical application I have made of the well known, and universally admitted connection between malarious fevers and organic disease of a certain viscus.

27th. It has been shown above that wherever Canal irrigation is practised in parts where the drainage has been seriously obstructed, there spleen disease is generally found to an extraordinary extent; that the same occurs in extensive marshy tracts; in parts subject to annual inundations; and usually, in the low moist "khadir" lands found near the margins of large Rivers. Now all will admit that these are precisely the situations in which we might expect to meet with intermittent and remittent fevers; especially, if the soil is at the same time

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NOTE.—It was my original intention to collect and to procure analysis of the various soils of the parts visited, but unless such specimens had been selected with the greatest care, and the analysis conducted with the most scientific accuracy, it could only have served further to complicate an obscure and difficult subject. The great length of time which this would have occupied caused me to abandon the idea. This is less to be regretted, as all attempts to connect the production of malaria with certain chemical ingredients of the soil have hitherto entirely failed in the hands of the most scientific chemists of Europe.

stiff and retentive. The general prevalence of spleen disease in *these very localities*, and its comparative rareness in all others, having *an opposite character*, is, in the absence of more direct proof, the most striking verification of the doctrine, which it is possible to conceive.

28th. But we are not entirely without evidence of a more direct nature. The Tables appended to the Report exhibit the percentage of adults attacked with fever in three successive years, at each place visited. These numbers, if rightly understood, afford a very valuable description of testimony; but as they are liable, without particular caution, to be misconceived or improperly applied, the following explanation of their value becomes necessary.

29th. In describing the manner in which these numbers were obtained, it was stated, that each adult examined was asked "if he had had fever this year, last year, or the year before last?" We had too much trouble in obtaining satisfactory replies on these simple points, further to perplex the people with more minute questionings. Some gave their answers carelessly, and others with an obvious design to mislead; yet, on the whole, my conviction is that they generally replied to the best of their recollection at the moment, and that the *general averages* present a fair approximation to the truth. It should, however, be particularly borne in mind, that if an individual had suffered from fever for three months in succession, or only for one day in each year, *one and the same record was entered in the note book*, and therefore, that the Tables only show the percentage of persons having had *yearly* seizures of fever, *but convey no idea of the frequency, duration, or severity of the particular attacks, suffered in each year.* It should also be remembered, that fevers may be very prevalent; but at the same time, mild and manageable in some seasons and situations; while at other places, or in other years, they may be obstinate and severe, but the numbers attacked not materially greater. Although, therefore, the tables claim only to give the numbers attacked in each year, and although it is certain that the prevalence of fever bears no *fixed* ratio to its severity, yet, when *large averages* are taken, it is unquestionably to be expected that where the greatest numbers are attacked, there also will the disease prove most severe and protracted.

30th. To apply all this to the case before us let us take from the general abstract of medical examinations, the three highest and three lowest average

percentages of spleen disease, and observe what relation they bear to the percentage of persons having fever in three successive years, thus :—

	Percentage of enlarged Spleens.	*Percentage of Adults, having Fever in the years, viz.* 1844.	1845.	1846.
Highest.	59	63	54	31=148
	58	51	45	41=137
	49	51	49	40=140
Lowest.	11	32	28	11= 71
	8	37	31	20= 88
	3	32	30	13= 75

N. B.—I have rejected six per cent. of spleen disease, as being an average of too small a number; viz., of three small unirrigating villages near the head of the Dooab Canal.

31st. *Slight attacks* of malarious fevers are seldom followed by bad consequences; but beyond a certain point of severity, they may be expected often to leave their mark behind, and in native subjects, this will usually be in the form of enlargement of the spleen. We have only then to suppose (which we are fully authorized to do), that where the greatest numbers were seized, the attacks were most severe and most recurring; that in the three first instances above given, the severity and obstinacy of the disease was often *above*, and in the three last instances often *below* the point at which organic disease arises, and we obtain another and most striking confirmation of the soundness of the theory of the spleen test.

32nd. Need I here repeat, what I have so distinctly stated in another place viz., that I do not pretend that this test will indicate the presence of the remote causes of *all fevers*, or even of all *endemic diseases* of this class?

33rd. If I had detected but a few cases of spleen here and there, and could only show a *trifling* excess of that disease in certain localities, I admit little dependence could have been placed on a test of this nature. But the facts before us are very different. The amount of spleen disease found in certain situations is prodigious, and the difference in this respect, in others, often in close proximity, and only differing in those conditions which all admit to be favorable to the production of malaria, is most wonderful.

34th. If the explanation I have given be rejected, I am utterly at a loss to conceive what other can be offered, to account for the singular phenomena exhibited in the accompanying plans.

35th. As for the facts, which rest alone on my professional testimony, I am under no concern, knowing well they can be verified at any time, by any competent person. From first to last, I kept steadily in view, that I could have no personal interest in any result, not strictly and substantially true; and I took so many precautions only to register such cases as admitted of no doubt, and moreover had the advantage of comparing two sets of observations made in two separate seasons, that I can afford securely to abide the result of any future enquiry; due allowance being made for any decided change in the character of the seasons.

36th. Again, if I had always found what I looked for, others might have suspected the accuracy of my observations. Nay, I might have had reason to suspect myself; but Major Baker knows that I was early obliged to confess how impossible it is, in any single instance, to pronounce a confident opinion, from a mere hasty inspection of the external features of a place, and that in some instances the result was the very opposite of what I expected.

37th. These exceptions, when they occurred, were a source of disappointment, but now that the whole results are before me, I see in this very uncertainty a confirmation of my general fidelity; not that such exceptions confirm the rule, but they show, that I make no pretension to that suspicious degree of accuracy which is incompatible with investigations of this kind.

38th. I confidently appeal to the great mass of facts, especially as they appear in *general averages*, in support of the principles on which I proceeded, although there is admitted uncertainty in particular instances. Does not the same kind of uncertainty pervade the whole field of medical enquiry? What higher verification of sound principles could I expect, than that which I have obtained?

39th. I freely confess, then, that I often met with results which, on a hasty inspection of a place, I did not expect. Some of these apparent exceptions admit of a reasonable explanation; but others I am unable to account for. It would be interesting, but would extend these notes to a very inconvenient length, were I to enter into a detail of all the cases alluded to. I am, however, persuaded that much which at present seems obscure could be cleared up by a minute examination at different periods of the year; for it must be borne in mind that the plan of our enquiry rendered it necessary that we should travel 1200 miles, inspect above

300 separate localities, and personally examine above 12,000 individuals in a period little exceeding three months; and that it was impossible to do more at each place than note those obvious conditions which are admitted on all hands to be most concerned in the production of malaria. We could see where the surface drainage was much obstructed; and the general levels of the country were known to the Canal Officers. We could mark the physical character of the upper soils; observe the nature of the crops; measure the wells; and estimate the amount of percolation from the Canal, &c., &c. But the nature of the *sub*-soils was usually a matter of conjecture; and those minute and partial differences of level, which *the eye cannot discern*, but which cause some places to remain dry, and others to be long kept in a state between dryness and moisture, necessarily passed unobserved. Rivers, or "nullas" confined within narrow channels, or altogether dry in the cold weather, but which overflow their banks during the rainy season, and flood the neighbouring country, must also have escaped our observation, unless our attention happened to be especially called to them by some one well acquainted with the locality. All this considered, it is not to be wondered at if some places which appeared to us unobjectionable might assume a very different character if seen during the rainy season, or if minutely investigated.

40th. I beg I may not be misunderstood as to the nature of these exceptions. I never met with much spleen disease in parts acknowledged to be generally healthy nor found that disease absent in others where fevers are known to be commonly, endemic. But judging of unknown localities by their external features alone, I occasionally found organic disease prevailing where I expected none, or looked for it where it did not exist.

41st. Some of these cases are so strikingly illustrative both of the uncertainty of common indications and of the practical value of the spleen test, that I shall relate a few of them, at the risk of being tedious.

42nd. We had been passing through a comparatively healthy portion of the Dooab or Saharunpore Canal, when the point came to be discussed whether or not Shamli should be included in our medical examinations. That town had been notorious for years past for its extreme unhealthiness; but its lands were only *partially* irrigated from the Canal. By including it, therefore, we ran the risk of throwing blame on Canal irrigation for disease, which, in this instance, obviously depended in a great measure, on other causes. For these reasons it was determined to exclude Shamli from our returns. I had not seen any map, and had no knowledge of the position of Shamli beyond a vague idea that we should pass it in a day or two. Next morning, I was conducted by Lieutenant Smith, of Engi-

neers, to the village of Mundait (see plan No. 2,) the site of which appeared favorable, the whole of the surrounding lands perfectly dry, and the soil light and fertile. I remarked, "We ought to have a favorable result here." I then commenced the usual examinations, and to my extreme surprise found the test indicating the maximum of malaria. To add to my perplexity, the persons interrogated did not acknowledge any unusual amount of fever. I could not help concluding that the test had at last completely failed me. When the examination was finished, I confess I was not a little gratified to learn from Lieutenant Smith, that the notorious Shamli, although concealed from view by the neighbouring hedges, was only *half a mile* distant, and that the ground we were then on was annually submerged by the overflowing of the adjoining Shamli Nulla. In point of fact (as I afterwards learnt) we had just then entered upon an extensive unhealthy tract. A few miles further on, and the whole aspect of the Canal and country was suddenly and entirely altered; but at Mundait, this was not perceived. The true character of the locality was at once detected by the test *before a single visible sign appeared to indicate the change.*

43rd. The spleen test stood higher in my estimation than ever, the more so perhaps that I had doubted its veracity at the very time when its practical utility was most clearly exhibited.

44th. When residing with Major Baker at Roorkhi (the Head Quarters of the Ganges Canal establishment), I was asked by that officer to examine the non-irrigating village of Punniala (a few miles to the south of Roorkhi) and which he suspected would turn out badly. It had a large shallow tank on one side, viz., from S. E. to S. W. On the west were rice fields and small shallow tanks. On the east a grove of fine mangoe trees, and about half a mile beyond in this direction, a considerable extent of low land, then dry, but wet and swampy in the rainy season. Few would hesitate to pronounce such a locality decidedly malarious. The test, however, only indicated a moderate degree of malaria, and the inhabitants persisted in declaring that they were not much afflicted with fever. Inquiries afterwards made at Roorkhi fully corroborated this statement of the people. My conjecture is that the very *excess* of moisture in the rainy season and the belt of fine trees between the village and low swampy ground save this locality from mischief; but in whatever way it is accounted for, there is little doubt that the village of Punniala is not decidedly unhealthy.

45th. On our way to Hurdwar we stopped at Sunthul Shah (see plan No. 2,) a non-irrigating village, on a good and perfectly dry site. The upper soil was sandy, and not a *jheel* or pool of water visible in any direction. The village last examined,

was tolerably healthy, and I expected this would turn out even better; but here again I was deceived, and surprised to find an unusually large amount of spleen disease, the inhabitants without a dissenting voice declaring that they were greatly afflicted with fever in the rainy season. After hearing Lieut. Yule's explanation, the mystery was completely solved. It appears that this village is built close to the right bank of the Putthee, a river or nulla with a narrow channel, which becomes so suddenly filled in the rains by several hill torrents that it overflows, and inundates the whole ground to the north of the village up to the walls of the houses. The soil too, although it has a stratum of sand deposited on its surface, is below very stiff clay, and where there are cart tracks, is cut up into the deepest and most rugged ruts.

46th. Judging from external features alone, who would hesitate to encamp an army near Mundait or Sunthul Shah? The mistake would hereafter be discovered to the cost of that army. By the spleen test, the real character of these localities was detected in a few minutes.

47th. The following circumstance first suggested to my mind the probable value of the test of organic disease.

48th. In the cold weather of 1843-44, I was directed by my Commanding Officer to report on the physical efficiency of the Europeans of the 1st Brigade Horse Artillery, who had suffered so severely from the Kurnaul fever during the three or four previous months. On this occasion, I made a minute and careful exploration of the abdominal region of every man in the corps, and was surprised to find so great a number of them laboring under some degree of chronic enlargement of the liver and spleen, which would not othervise have attracted attention. The women and children were even in a worse state; but in them the organ affected was almost uniformly the spleen. Suppose I had made this examination without any knowledge of the previous history of the detachment, could I have hesitated in pronouncing that they were then in, or had recently been removed from, an unhealthy locality? or that the diseases from which they had chiefly suffered, were intermittent and remittent fevers? On this hint I afterwards acted, and when I found a whole native community afflicted with organic disease of the spleen, could I hesitate in coming to the same conclusions? The converse of the proposition is not so obvious, viz., that where the inhabitants are free from organic disease, the locality is healthy, for it is possible they may have suffered from causes unconnected with malaria, and from diseases which leave no such marks behind.

49th. Our reasons for adopting such a test as the one above described, instead of the more direct and obvious methods of calling for the sick at each place,

comparing their number with that of the healthy population, &c., &c., have already been explained in the body of the report and in appendix B. But for the benefit of European readers it will be necessary to advert more particularly to the causes which rendered the ordinary modes of procedure impossible in the present case.

First. We were sent to investigate the nature and causes of a disease, the force of which had *passed by* before the Committee commenced its labors, and of which not a single authentic record remained among the agricultural population, except in the effects it might have left on the persons of those who had been subjected to its influence.

Second. At the time the Canal enquiry was ordered, there existed two parties violently opposed to each other, and holding entirely different opinions as to the nature and causes of the sickness which had prevailed along the banks of the Canal and other portions of the North Western Provinces; one contending that the Canal was the sole cause of the disease—the other as resolutely maintaining that it was a pure epidemic, with which the Canal had nothing to do, even as an accessary or aggravating cause. It was highly necessary that the members of the Committee should avoid all suspicion of being the partisans of either of these parties; and we consequently refrained from soliciting or recording the opinions and impressions of the natives as to the connection of the sickness with Canal irrigation, for if our object had been to defend preconceived opinions we could have so shaped our questions, and so intimated our wishes, as to have obtained any amount of native opinions on *either side.* All such evidence, we knew, would have been rejected as uncertain and suspicious by both parties.

Third. If we had been dealing with a present instead of a past disease, the following obstacles would have opposed themselves to any of the usual modes of proceeding which would have followed in Europe. The natives of these provinces, especially if they have had little intercourse with Europeans, entertain the most absurd notions of our medical science: they either expect from it cures literally miraculous, or they reject it altogether as hurtful. They are moreover capable of believing the grossest absurdities as to our motives for interfering with matters concerning the public health. The history of vaccination in India will well illustrate these points of the native character.

50th. Had we attempted to compare the relative salubrity of different places by calling for the sick at each, the caprice of the moment, an extravagant hope of benefit, or equally extravagant dread of evil, would have determined the conduct of the people towards us, and it would have been impossible to foretell, in any

particular instance, whether they would have produced their sick with eagerness, or concealed them with obstinacy. If we had applied to the civil power to aid us in the production of the sick, we should have found ourselves in even a worse position. Our visit would have been immediately converted by the native officials into an instrument of extortion; the wildest falsehoods would have been propagated as to our designs; the sick would have *paid* to be exempted from examinations; and we should have been more completely deceived than ever. To collect *all* the sick at each place, was then, I maintain, impossible by any means at our disposal. But supposing this effected, viz., that we not only got together all the sick at each town or village, but did so in a very short time (a most important point) what should we have gained, unless we had at the same time the means of comparing their number with that of the healthy? and how was this possible in a country where the population of the towns and villages is either altogether unknown or matter of vague conjecture?

51st. Any other method than that which we pursued, might indeed have served to prolong a party controversy, but never could have elicited the truth.

52nd. Scanty as the means at our disposal were, they have notwithstanding served us admirably, and have led to a degree of certainty in the results which could hardly have been anticipated when we set out.

53rd. I have one more observation to make regarding the true value to be attached to the facts we have collected, and the propriety of drawing from them *general conclusions* as to the effects of Canal irrigation. Our observations were extensive enough as regards *space*, but limited as to *time*. They were made after a series of notoriously unhealthy years, and confined to a period hardly exceeding three months. They appear satisfactorily to establish the fact that certain localities suffered more severely in those *sickly seasons;* but what would be the relative salubrity of the irrigated and unirrigated parts under *ordinary and more favorable circumstances*, is only matter of conjecture.

54th. It would contribute greatly to the settlement of this important question, as well as to medical science generally, if the same ground were gone over again in the same manner after a series of *healthy years*, and when the purely local causes of disease are uncomplicated with any powerful and extensive epidemic influence.

55th. If the facts exhibited in the accompanying plans be received as correct, and the arguments deduced from them be admitted as sound, the whole will be found to involve a principle capable of the most important and extensive practical

application, and which I now proceed to explain as a corollary to the other results of the Canal Committee.

56th. It is now generally admitted, and has been most fully confirmed by our recent observations, that, although certain general principles are unquestionably true and deserving of the most careful consideration, there are no *infallible marks*, by which we can at once distinguish between a healthy and unhealthy locality. It is much to be regretted that the hasty and confident predictions of medical men, too often falsified by the result, have tended to bring their judgment on such matters into disrepute, and have led both Government and Military Commanders often to disregard some of the best established general truths, to the incalculable loss of life and property.

57th. It is the acknowledged difficulty, as well as the great importance, of being able to decide at once in particular instances, that constitutes the value of some other corroborative test, which can be easily applied wherever there are inhabitants. The following rules, carefully applied, will, I feel confident, never fail to give important information, in so far as disease depends on local malarious influences.

First. However healthy a locality may appear in other respects, if its native inhabitants are generally afflicted with organic disease of the spleen, *there*, beyond all doubt, does much malaria exist, and there also, will European and native troops suffer, especially in all unhealthy years or seasons.

Second. If a district has the ordinary marks of a malarious locality, and its native inhabitants are notwithstanding found free from disease of the spleen, the presumption is, that malaria is not present in any intensity; but strangers may suffer, where permanent residents escape.

Third. Again, if it has the usual characters of a healthy locality, and its native inhabitants are entirely or almost free from spleen disease, it may be confidently selected as a good position for European and native troops.

58th. I do not for a moment forget, that there are other efficient causes of human disease, besides malaria, and that to some of these the European soldier is especially obnoxious—such as excessive heat; great and sudden alternations of temperature; epidemic influences of various kinds, &c. &c. Of the existence of such causes, the spleen test cannot be expected to give intimation. But all will admit that these causes of disease are enhanced by the presence of malaria,

and that it is in malarious situations where epidemic fevers often rage in India with the greatest virulence. The facts recorded in the Committee's Report strikingly illustrate this last position.

59th. It has been suggested that no new position for troops should be taken up in this country, before interrogating the natives as to the prevalence of disease. But my experience teaches me that no reliance can be placed, *in any single instance*, on what the people say on such a subject. If the object of enquiry is suspected, and they dread the presence of troops, they will not hesitate in giving a false report. If they fear (as they sometimes do) that they are to be physicked by order of Government, they will protest "they never were sick in their lives." If in doubt as to our motives, they too often think their safest course is in falsehood. The testimony of the native inhabitants, if given in a *truthful* manner, and taken in conjunction with the test of organic disease, may no doubt prove most valuable in many cases.

60th. It seldom happens in India, that troops are encamped in situations altogether destitute of inhabitants; but should such a case occur, the following directions may be found useful to Officers in the selection of ground, especially if it is intended to be occupied during the rainy season. The rules are drawn entirely from observations made during the recent inquiry. I believe they include all the principal conditions, but I do not particularly notice those of which we have seen no examples.

61st. Good *general drainage*, not of a camp or cantonment only, but of the whole immediate neighbourhood, is the alpha and omega of the code. Without this, few localities can really be healthy in these provinces. The stiffer and more retentive the soil, the more important does good drainage become.

62nd. The following are the more obvious marks of a healthy situation. Ground dry and generally free from heavy grass or bush jungle. Drainage of the surrounding country good. Soil light, or not very stiff and clayey, it may also be fertile and bearing fine crops. No extensive shallow *jheels* with shelving *poachy** margins. Water of wells good and potable. Absence of rivers or *nullahs* liable to overflow their banks during the rainy season. The state of the roads furnishes an excellent index to the nature of the soil and drainage. In good localities they are dry, dusty or sandy, but never extensively cut up into *deep rugged ruts*. Tanks, if they have steep sides, and are kept full of water all the year through, appear

* *Poachy*—An expressive word used by McCullock to signify that state of the surface when it easily *receives* and *retains* the foot marks of animals, &c. &c.

harmless. Fine trees, not so closely planted as to impede ventilation, are desirable. Such a locality will generally have a gentle inclination in one, or several directions, often invisible to the unassisted eye, but sufficient for good drainage.

63rd. I need say nothing here of palpable swamps and marshes, or extensive dense Indian jungles: all know such situations are to be avoided if possible. But the following are not so obvious or generally known.

64th. The belt of moist low and often fertile land, found alternately on one or other side of large rivers in these provinces, is generally to be avoided as unhealthy. There are, however, some notable exceptions to this rule. Villages built on the verge of the high land overhanging a low unhealthy *khadir* tract are sometimes in as bad a position as if situated in the low land. To this rule also there are exceptions. Isolated elevations in low moist tracts are often the worst positions which can be chosen.

65th. All cup-like depressions, even if so gentle as to appear to the eye a perfect flat, are to be avoided. Such localities may be free from *jheels*, or stagnant water, may be cultivated throughout, and bearing fine crops; yet if the soil be stiff and retentive, and the lands irrigated, they may turn out more unhealthy than the worst apparent marshes.

66th. In some parts, and especially in the neighbourhood of the Nujufghur *jheels*, we found disease to bear an almost exact ratio to the nearness of the water to the surface; but in other situations the people were perfectly healthy, although the water in the wells was only a few feet from it.

67th. The subject of the local and remediable causes of disease is attracting great attention at home, where so much has already been done in this department; but in this country, where such measures are far more urgently required, very little has yet been attempted. The evils of impeded drainage have long been fully appreciated in Europe. What some of its effects are in India, the accompanying plans will sufficiently demonstrate. The recent Canal Committee is perhaps the first methodical attempt ever made in this country, to ascertain the local causes of disease, in order that they may be remedied; and although, I hope, good will result, as far as the improved construction of irrigating canals is concerned, I need not say how much remains every where to be done.

68th. It is an error to say that all the mischief we witness in India, is inseparably connected with the climate; for healthy and unhealthy localities are every

where found in close proximity. It is equally unreasonable to assert that all these local sources of disease are beyond remedy. Some are so perhaps, and when known, (and the sooner they are known the better,) can only be avoided; but that the majority are capable of being removed, or greatly diminished, all experience tends to establish.

69th. I believe that profitable irrigation and improved drainage, instead of being incompatible, may very often be made to assist and promote each other. Major Dixon's measures seems to be a valuable example of this, and some similar system might be followed with advantage in various parts of India. In the protected Sikh States, for instance, the people are in the habit of damming up the streams which traverse the country, flooding their own lands with a mischievous excess of water, and thus depriving their neighbours below, of their proper share. How much good would a proper and fair distribution of water do, both for the agriculture and salubrity of such a country?

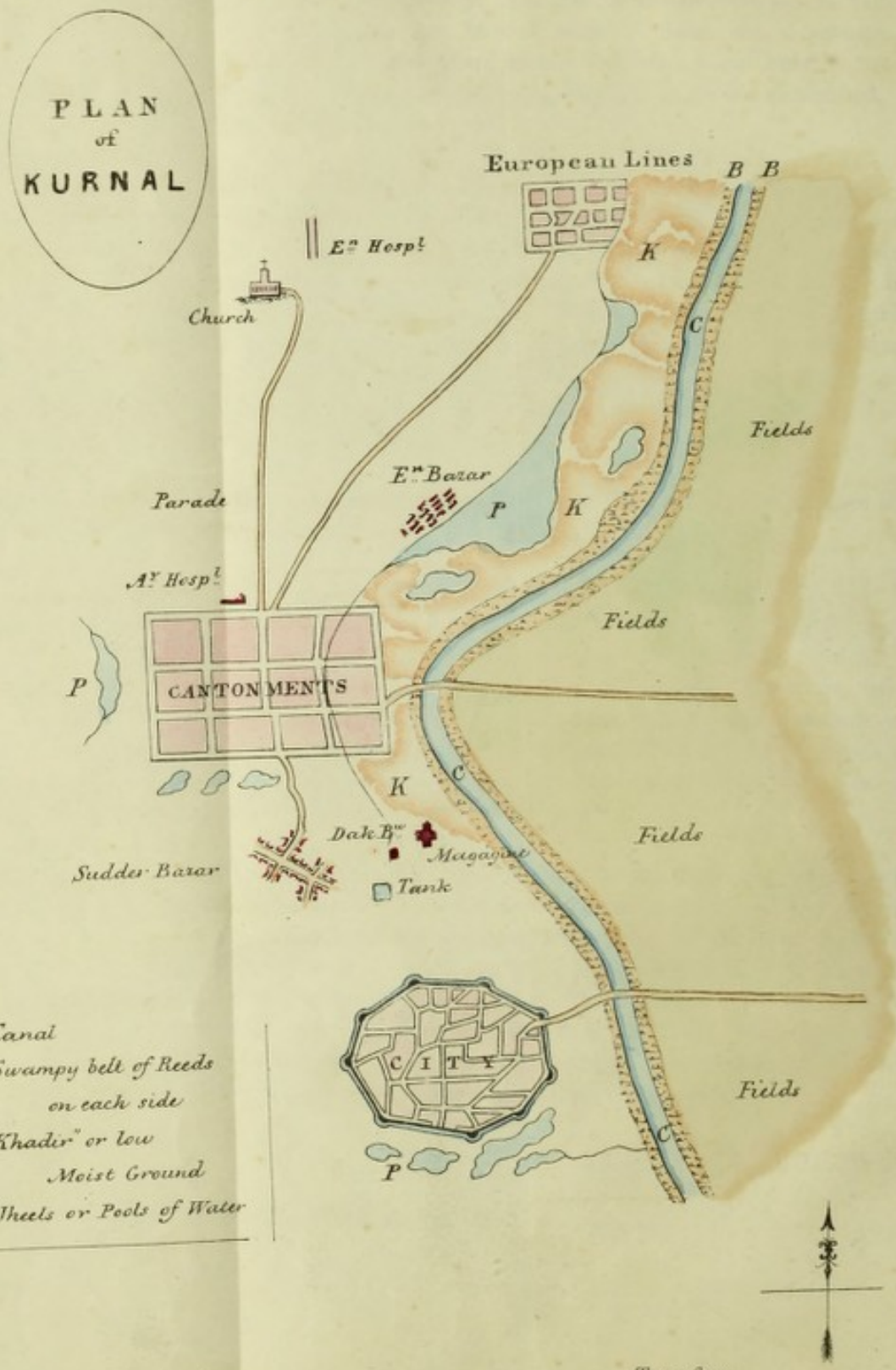
70th. The whole of this subject is of the most vital importance both to the Government and people of British India.

71st. All men admit that "prevention of human disease is better than cure," but it is neither so obvious nor so generally known, though equally true, that it is not only better in itself, but more certainly attained and more efficaciously applied. The progress of medicine, as a curative art, has been slow and uncertain, and can claim no comparison with the improvements which have taken place within the last 150 years, in the *far better art* of preserving health. For one life now saved by physic, 100 might be preserved from fatal disease, by improved drainage, ventilation, cleanliness, &c. &c.

72d. The present attempt to confer on the natives of India the benefits of European medical science is worthy of a humane and liberal Government. Yet if its success were to exceed the expectations even of the most sanguine, if every native town had its Hospital and Dispensary conducted on European principles, every village its educated practitioner, and all classes eager to resort to them for medical aid, the advantage to the health and well being of the mass of the people, would not be a tithe of what would result from general and well directed measures for removing or alleviating the local causes of disease.

(Signed) T. E. DEMPSTER.

Loodianah, 1st August, 1847.



True Copy

M. Dalley

Off.r Sec.y Mil.y Board

P. S.—Several medical men having found difficulty in clearly comprehending how an irrigating canal comes to obstruct the drainage of the country through which it passes, I give the following explanation, as being more easily understood by persons who have not turned their attention to such subjects, than the one alluded to in the report.

The west of Jumna canal was a work originally constructed by the Moosulman Government of Delhie, and only re-opened by us. The native Engineer, instead of taking the levels of the country, simply observed what was the natural course of the drainage water; and finding a considerable water channel running nearly in the direction required, he put his canal into it, following its most minute and tortuous windings. He was thus able at a small expense of engineering science to construct a canal, which he was sure would flow in the proper direction. Now, if we thus occupy the principal drainage channel of a country with an artificial canal, then introduce so much water, as will bring its level up to that of the lands through which it passes; a lower level will not do for irrigation; and lastly, add banks higher still; it is obvious, that no more drainage water can flow off in this direction; and, if no other efficient drainage channel exist, it is equally obvious that during and after the periodical rains, such lands must be flooded in the manner most prejudicial to health, that is, be long kept in the mid condition between moisture and dryness.

The annexed sketch of Kurnaul will serve to elucidate this point. In former days the drainage water of this part of the country was carried off by a natural water course, *now occupied by the canal.* For years after the canal was re-opened, the level of the water at this point was lower than that of the low *khadir* land lying between the canal and cantonments, and so long as this was the case, the canal still served the purpose of a drainage channel. But when a large additional supply of water was brought down, and the level permanently raised to that of the fields on the east, (now irrigated,) the water from the high land of the cantonment found its way as usual into the low *khadir* ground, *but could get no further.* The canal, instead of serving as a drain, acted in the opposite manner; for its water freely percolated the banks and kept the whole of the low land saturated with moisture even in the driest seasons of the year.

The chain of *jheels* at the back of the city, formerly drained itself into the canal channel; now, a constant stream of water flows *from* the canal *into* those *jheels.* This fact aptly illustrates the whole matter.