

REPORT
ON THE
SPECIAL GANGES DIARA SURVEY,
1908-1915.

BY
BABU RAJANI KANTA SEN,
Personal Assistant to the Director of Land Records and Surveys, Bihar and Orissa.



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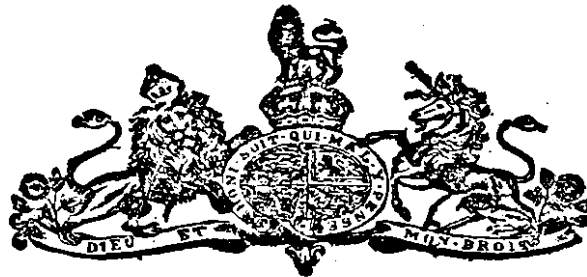
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REPORT

ON THE

SPECIAL GANGES DIARA SURVEY.

OBJECT OF THE SCHEME.

The scheme had for its object the provision of a special set of maps showing permanent marks and other prominent points in the *diara* tracts, which should show the difference between modern Survey, Revenue Survey and Diara Survey village boundaries and facilitate the relaying of any of them as required.

DIARA SURVEYS OF 1862—83.

2. The Diara Surveys were made of the beds of the Ganges and other large rivers, between 1862 and 1883, at a considerable expenditure of time and money; but, unfortunately the operations have not been described in detail, and as far as is known, the maps have not been kept up to date or revised. The whole of the river Ganges and certain rivers in North-West Bihar were surveyed professionally, between 1862 and 1865, under Act IX of 1847, for the purpose of assessment of land which had formed since the Decennial Settlement. No professional Diara Surveys were made in any river in the districts of Eastern Bengal excepting the Ganges north of Sirajganj in the district of Pabna.

CONNECTION BETWEEN THE DIARA SURVEYS AND THE REVENUE SURVEYS.

3. The professional Diara Survey maps followed generally on the footsteps of the Revenue Surveys, and as they almost invariably included the survey of a narrow tract of high land on each side of the river, coincidences between Diara Survey and Revenue Survey village trijunctions are very common. The professional Diara Survey maps often enable the surveyor to find out lost Revenue Survey boundaries, as there was sometimes no definite connection between the basis of Revenue Surveys conducted in different years in two different districts divided by a river. In such cases it is often difficult to relay accurately a Revenue Survey boundary by either Revenue Survey, without the help of the Diara Survey maps.

CHANGE DUE TO ALLUVIONS AND DILUVIONS.

4. Numerous alluvions and diluvions have occurred in consequence of the considerable changes that have taken place in the position of the river Ganges and other large rivers since the last Diara Survey. The fluvial actions of the rivers have made it very difficult to ascertain the true trijunctional points, and the boundaries of the *diara* villages cannot be ascertained with accuracy. Disputes have, therefore, arisen between zamindars and zamindars and between Government and zamindars regarding possession of newly-formed lands, which often result in riots and bloodshed.

PROPOSAL FOR A RESURVEY, BY THE COMMISSIONER OF DACCA.

5. In 1881 the Commissioner of the Dacca Division brought to the notice of the Board of Revenue, Lower Provinces, the unsatisfactory state of affairs resulting from the many changes that have taken place in the bed of the river Jamuna; he submitted a proposal for its resurvey, which was not accepted.

SURVEY AND SETTLEMENT OPERATIONS IN NORTH BIHAR: THEIR VALIDITY IN DIARA AREAS.

6. In the course of the Survey and Settlement operations in North Bihar, the Survey Officers reported that Survey work was proceeding in the Ganges and Gandak *diara* lands, and that a notification under the Tenancy

Act was required to legalise the Cadastral Survey and the record-of-rights being made in respect of such lands situated on the Patna and Saran banks. The matter was fully discussed in a conference in the Survey Camp office at Hajipur in 1892, where it was decided that Cadastral Survey and records should be completed at the same time as the traverse of the *diara* lands.

7. Mr. P. C. Lyon, I.C.S., Settlement Officer of Muzaffarpur, raised the question whether it was advisable to prepare an elaborate record-of-rights under the Tenancy Act for lands of the shifting character of *diara* lands, the chief object in view in dealing with such lands being to have accurate maps of them made from time to time. He considered that it was sufficient to prepare a rough *khasra* and summarily decide boundary disputes without notifying the area under the Tenancy Act.

The Collector of Muzaffarpur suggested that there should be merely a Diara Survey, under Act IX of 1847, within the area and that the Settlement Department should notify to the Collector all cases of alluvion and diluvion.

The Commissioner of the Patna Division recommended that advantage be taken of the presence of the Survey parties then in the field in Bihar to carry out a survey under Act IX of 1847, of the *diara* lands in both rivers in the districts of that division (Patna, Shahabad, Darbhanga, Muzaffarpur, Saran and Champaran), the first step being the publication of an order under section 3 of the above Act. As regards the question whether such survey should also be carried out as Cadastral survey under the Bengal Tenancy Act, he was of opinion on the whole that it should, as otherwise it would be necessary in some places when lands had alluviated, for the District Officers to prepare rent-rolls, etc., in order to enable them to effect settlements of accretions.

RESULT OF A CONFERENCE BETWEEN THE DIRECTOR OF LAND RECORDS AND SURVEY OFFICERS.

8. There was a further discussion on the subject of the *diara* lands lying in Hajipur Subdivision and on the Saran and Patna banks. Mr. W. C. Macpherson, I.C.S., Director of Land Records, after consultation with the Survey Officers at Hajipur in April 1893, decided that the survey should proceed according to the Revenue Survey maps of 1865 until the Settlement Officer had altered boundaries according to possession: that the Settlement Officer should proceed to the Diara survey as early as possible and decide how the records should be written, *i.e.*, what should be the exterior boundary of each unit of map and record. It was also thought desirable that an order should be at once passed under section 3 of Act IX of 1847, the Diara Survey Act, as recommended by the Commissioner of Patna in 1893, ordering a survey of lands both on the Muzaffarpur and Patna banks of the Ganges. The *chars* and the high bank on the west side of the Gandak were also to be surveyed. The question of taking up the survey of the remaining *diara* lands on the banks of the Ganges between the north and south Bihar districts was discussed, but reserved for further consideration.

DIFFICULTIES OF ATTESTATION OF DIARA VILLAGES.

9. In 1895, when the Settlement Officer of Muzaffarpur took up the villages for attestation, he was confronted with many difficulties. He found that in all the more important villages there had been considerable changes due to fluvial action, since the preparation of the record-of-rights. In some important villages the whole of the village site, together with a tract of about 150 acres of the best and oldest lands in the village had been swept away by the river, while a large area in the north, which was deep in sand and wholly uncultivable at the time of the survey, had already a light coating of silt on it, and was bearing then crops of melons and *rabi* of various kinds. It was also discovered that in many villages where the lands had been less disturbed by fluvial action, there were still many alterations necessary in the record owing to the disappearance of old raiyats and the advent of new ones, and the readjustment of fields and alterations in their area.

RECOMMENDATION FOR THE EXCLUSION OF DIARA LANDS FROM THE SCOPE OF SETTLEMENT OPERATION.

'As a result of these changes the Settlement Officer could not complete the proceedings satisfactorily in most of the estates, and he, accordingly, reported to the Collector of what little value the record-of-rights and rents would be when prepared, and that a settlement of rents for 15 years would be inequitable both to Government and the raiyats. The Settlement Officer recommended the exclusion of the *diara* lands,—the fluctuating riverain tracts—from the scope of the operations under Chapter X of the Bengal Tenancy Act, leaving the Settlement Department to make a survey only of the lands under Act V of 1875.

10. Mr. A. Forbes, C.S.I., I.C.S., Commissioner of Patna, in forwarding Mr. Lyons' proposals to the Board of Revenue, pointed out that it was very desirable in the interests of the Government revenue, that a decision on the first point, *viz.*, the procedure to be followed in future in the settlement of Government *diara*, *khas* or temporarily-settled estates, should be come to without delay, and that this should not be deferred pending the consideration of the other and wider question. Mr. Forbes was further of the opinion that the resettlement of the *diara*, *khas* and temporarily-settled estates should be left in the hands of the Collector and be carried out by him under the Regulations.

GOVERNMENT ORDER ON THE SUBJECT.

11. In Bengal Government order No. 5002, dated 22nd November, 1895, it was declared that in the case of the *diara* lands which were of a shifting character, the procedure of the Bengal Tenancy Act was too elaborate, that some of its provisions were inapplicable, and that it was better to proceed under the Regulations, the record being made by the Collector's establishment.

HIS HONOUR THE LIEUTENANT-GOVERNOR'S VISIT AND ORDERS ON THE SUBJECT.

12. The matter was further brought to the notice of Sir Charles Elliot during His Honour's tour in Bihar in July 1896, when it was ordered that the previous orders might be fully given effect to and draft notification submitted withdrawing from the operation of Chapter X of the Tenancy Act all villages that were entirely or mainly of a shifting character. Where the lands in such villages were temporarily-settled and had then to be resettled, they must be settled under the Regulations.

As regards *diara* lands in permanently-settled estates, it was declared there was no necessity to make any survey or record-of-rights; but if any action was necessary, that a survey would suffice. If the landlords and tenants of permanently-settled *diara* lands wanted such a survey, they should be required to deposit the estimated cost in advance. If they did not want a survey, such lands might be excluded from the operations altogether.

PROPOSAL FOR A SEPARATE STAFF BY THE COMMISSIONER OF BHAGALPUR AND SANTAL PARGANAS.

13. In November 1898, Mr. C. J. O'Donnell, I.C.S., officiating Commissioner of the Bhagalpur Division and Santal Parganas, in submitting certain proposals for levying enhanced rate of rent in the Government estate of Binda Diara in the district of Monghyr, brought to the notice of the Board of Revenue, Lower Provinces, that the want of a special establishment to deal with riparian settlements and the consequent mismanagement of such settlements resulted in very great loss to Government under the following heads:—

- (i) The loss of increased revenue whilst the new settlement is pending;
- (ii) The loss due to bad supervision, high class lands being lowly assessed;
- (iii) The waste of time involved in deputing a score of Deputy Collectors all over the province to settle by fits and starts distant *diaras*.

VIEWS OF THE BOARD OF REVENUE, LOWER PROVINCES.

14. The Board of Revenue were of opinion that a special staff for the re-settlement of *chars*, *diaras* and other temporarily-settled estates should be appointed. The annual loss of revenue on account of delays in resettlement of such lands was estimated to be about Rs. 67,100 in the districts of Nadia, Bhagalpur, Monghyr and Patna, while the Commissioner of Dacca reported that the existing defective system cost Government many lakhs of rupees a year.

In addition to the protection of the Government revenue afforded by the prompt discovery and settlement of newly formed *chars* and *diara* lands and the speedy disposal of pending petty settlements, it was urged that the entertainment of a special Diara Survey and Settlement agency was also likely to secure Government from loss in connection with proceeding in the Civil Courts and to promote peace and efficient administration by obviating the many disputes concerning *char* lands which especially in Eastern Bengal arise in the Criminal and Civil Courts.

APPROVAL OF GOVERNMENT.

15. The Government of Bengal agreed with the Board of Revenue and asked for a detailed scheme. In July 1900, the Board of Revenue submitted a separate proposal for the survey of the *diara* in the Eastern Bengal districts, and expressed the opinion that a Diara Survey would probably indirectly repay itself by the gain resulting to Government in civil suits regarding *diaras* and that on general administrative grounds it was very desirable that conflicting claims should be settled. In July 1901, the Board of Revenue were requested to furnish a report showing :—

- (i) What approximately would be the area dealt with, omitting the areas which the survey parties would take up in the course of the Survey and Settlement operations in Monghyr, Backerganj and Bhagalpur, etc.
- (ii) How long the operation would last.
- (iii) What would be the cost incurred each year.
- (iv) The reasons which led the Board of Revenue to think that the proposed survey should be undertaken for administrative reasons.

ABANDONMENT OF THE PROPOSAL FOR A SPECIAL AGENCY.

16. In December 1901, at the instance of the Board of Revenue, Government abandoned the original proposal to employ a special agency for the settlement of *chars* and *diara* lands in view of the larger question of undertaking a *diara* survey along the Ganges, the Brahmaputra, and the Meghna raised in the Board's letter of 1900.

FURTHER REPORT BY DIRECTOR OF LAND RECORDS.

17. In April 1902, the Director of Land Records, after consulting the Commissioners of Divisions and the District Officers, submitted a further report on the subject furnishing information in answer to the specific enquiries made by Government in their order of July 1901. He estimated that the total area to be dealt with by a Diara Survey would be about 9,540 square miles including the Jamuna river, and stated that the work would occupy about nine years and cost about Rs. 3,47,514 including costs of Settlement. He suggested that the work should be placed under the Superintendent of Provincial Surveys. The local officers were of opinion that the survey would not result in a large increase of revenue except in the Dacca Division ; but they considered that the survey would be advantageous in preventing disputes, and consequent riots and disturbances, regarding newly-formed lands and boundaries between Government and private lands, and in facilitating the resettlement of Government estates. The Superintendent of Provincial Surveys, however, estimated the cost at Rs. 32 for Traverse, Rs. 18 for Topographical work, Rs. 80 for Cadastral Survey per square mile, the total expenditure on Survey and Settlement thus being Rs. 11,90,320.

BOARD'S RECOMMENDATIONS.

18. The Board of Revenue were not prepared to recommend a wholesale Diara Survey, but proposed that the survey should be gradually undertaken and completed, through the agency employed in the Survey and Settlement of the districts concerned or of riparian estates in those districts. They expressed the following opinions :—

- (a) it was doubtful whether an adequate increase of revenue would be obtained to compensate for the expenditure on a general *diara* Survey;
- (b) great expense and trouble would be caused to the zamindar and tenants;
- (c) litigation would increase ;
- (d) the results of the survey, so far as they were beneficial in fixing true boundaries, would be transitory, owing to the shifting character and constant erosive action of the rivers;
- (e) there would be no real or appreciable reduction of affrays and riots arising from boundary disputes; and
- (f) a general survey might be dispensed with, since the *diaras* are being, and will be gradually surveyed in the course of the Survey and Settlement of the districts to which they appertain under the Bengal Tenancy Act.

FURTHER REPORT CALLED FOR BY GOVERNMENT.

19. The Bengal Government in their order No. 754-T., dated the 28th May, 1903, while agreeing with the Board that the proposal for a new Diara Survey should be abandoned, invited their attention to Mr. O'Donnell's original proposal to secure continuity by placing a special Deputy Collector in charge of this class of work and by retaining him for some years at a time, so that he might introduce system, method and punctuality into work which was done badly and often in haste by all sorts of officers.

VIEWS OF THE LIEUTENANT-GOVERNOR.

The Lieutenant-Governor was of opinion that there ought to be Diara Settlement Deputy Collectors just as there were Special Deputy Collectors for Land Acquisition and asked the Board's opinion and advice on the proposal to give effect to the scheme for a special Diara Settlement establishment on the lines originally proposed by Mr. O'Donnell.

VIEWS OF THE BOARD OF REVENUE.

The Board were of opinion that Government could hardly spare two special officers as suggested by Mr. O'Donnell for Settlement unless it was shown that there was sufficient work to justify their employment. As regards the scheme of work, the Board observed that what was wanted was a regular organized system of outline survey of the greater river banks, to be made every year showing all important changes. This should be done or at least supervised by a professional Surveyor of the Survey Department. The Diara Survey should be referred to and the map should show the nearest trijunction points of the Revenue Survey all along the banks. These latter should be recovered, or replaced where they had been removed, before the survey was made and special measures should be taken in every district for their careful preservation. By superimposing these maps upon the Revenue Survey maps or upon similar maps of former years, changes in the rivers and land formation and diluvion since the time of the Revenue Survey and from year to year would be easily detected. Thus, it would be possible to determine with accuracy what mauzas and what estates had reformed, what lands had formed in the bed of the river, and to which estates the newly-formed lands had accreted, or whether they had formed as islands in the bed of a river which was river at the time of the Revenue Survey. It would not be necessary to survey the whole of the great rivers every year along their whole banks. The procedure to be

adopted would be first to have all the trijunctions along the river faces distinguished and demarcated and put under special chaukidars' protection. A sufficient number of these trijunctions would be demarcated to make it easy to connect them with the trijunction points of the Revenue Survey. Where diluvion was anticipated more trijunctions would be recovered and from a further distance back from the river. Then every year at the beginning of the cold weather the Collector would send a Kanungo, or Sub-Deputy Collector, or even a qualified Amin along the rivers to note and report on the changes which had taken place, submitting a very rough survey outline map of changes to explain his report, referring to the trijunctions. These would go to the Surveyor in charge of this work, and he would examine and verify them and resurvey where necessary and prepare new maps showing alluviated or diluviated areas and the new position of the river. Small and unimportant changes would be neglected, and only material changes noticed, unless for very special reasons, such as serious disputes, etc. The Board, however, promised a further report after consulting the Director of Land Records and the Superintendent of Provincial Surveys, Bengal.

VIEWS OF THE LIEUTENANT-GOVERNOR.

20. The Hon'ble Mr. J. A. Bourdillon, the officiating Lieutenant-Governor of Bengal, thought that some scheme should be worked out to prevent the loss of revenue which occurred every year along the Ganges and other great rivers of Bengal. The *chars* and *diaras* were liable to constant changes and had to be constantly examined and settled. These Settlements were made for short periods because the rivers changed so much. Operations could not begin till the cold weather when every one was particularly busy and these settlements were made over to inexperienced or over-worked officers with the result that they were generally badly done or done in a hurry at the end of the year, and to save trouble the old settlement was often repeated. His Honour asked the opinion of the Director of Land Records and the Superintendent of Provincial Surveys whether it would be advisable to attempt a separate Diara Survey as a separate undertaking and asked for a list of petty *diara* settlements in the Patna and Bhagalpur Divisions with the area of each and the *jama*.

OPINION OF THE SUPERINTENDENT OF PROVINCIAL SURVEYS, BENGAL.

21. Major Crichton (now Colonel), Superintendent of Provincial Surveys, Bengal, pointed out that, though the system was quite feasible, the cost of initial traversing and subsequent maintenance would be exceedingly heavy and suggested that, if the work were taken up, it should be done along with the ordinary Settlement operations which were about to take place, and continue for a period of about nine years, the majority of these Settlements embracing practically all or the greater portion of the Ganges *diara* lands. He further deprecated the idea of making general arrangements for the entire province and suggested that experiments be carried out in Patna Division, *diara* with a view to formulating a general scheme later on.

OPINION OF THE DIRECTOR OF LAND RECORDS, BENGAL.

22. Mr. S. L. Maddox, I.C.S., Director of Land Records, in drawing up his 25 years' programme of Survey and Settlement work in 1903, included the *diara* areas in the Survey of the districts bordering on the great rivers. The Survey and Settlement of the districts of Saran, Champaran and Muzaffarpur had just been completed and the *diaras* of the district of Patna, so far as they were Government estates, and two *diara* estates of Darbhanga were being surveyed and settled by the Settlement Department: the Settlement Department was also engaged in the districts of the Bhagalpur Division. In the case of districts not recently surveyed it had been proposed in the 25 years' programme to make a survey, referring all lands in *diara* areas by means of traverses connected on to known trijunctions on firm ground to the Revenue Survey maps. It was proposed to survey the *diara* lands in detail on the 4-inch scale and to make a congregated trace of the mauzas which fell in the area and by means of the trijunction common to the new and old maps, tracing off the old Revenue Survey boundaries on the new maps. The new maps thus showing

existing lands and old boundaries would be handed over to the Settlement Officer or, if Settlement was not going on in the district, to the Collector, who should mark on them such portions as were to be surveyed on the 16-inch scale.

Mr. Maddox, agreeing with the views expressed by Colonel Crichton, did not advise the creation of a Diara Settlement Department in any areas except those in which a recent Survey or Settlement had been or was being made, as he thought that the work was so difficult and required so much accuracy that it could only be carried through by the professional Survey Department who were already fully occupied. In the case of the Patna Division he thought, however, that materials existed for preparing maps of the above kind for all districts except portions of Shāhabad and of Patna, and the Commissioner of the Patna Division suggested that *diara* work in Shahabad should be placed under a special Deputy Collector and the Director of Land Records with a view to continuation of the work hereafter in the other Gangetic *diaras*.

BOARD'S VIEWS : CALL FOR AN ESTIMATE OF PROBABLE COSTS.

23. The Board of Revenue agreeing with the views expressed by Major Crichton and Mr. Maddox that no general arrangement could be made for the province as a whole, pending the completion of the survey proceedings that were gradually spreading over Bengal, thought that it would be well to initiate an experiment in the *diara* area of the Patna Division and called for an estimate of the probable cost of completing the survey and preparing an accurate map of the actual circumstances of that area, and invited suggestions as to the organization of the staff that would be required to keep the maps up to date year by year.

COLONEL CRICHTON'S ESTIMATES AND SUGGESTIONS.

24. Colonel Crichton estimated the *diara* area of the Patna Division lying along the Ganges, Gandak and Gogra rivers which were surveyed in the period between 1892 and 1899 at 1,250 square miles, taking the average width of the rivers to be 4 miles over a length of 313 miles as shown below :—

1. The Gandak river from its entrance into the district of Champaran to its junction with the Ganges—184 miles.
2. The Gogra river from its entrance into the Saran district to its junction with the Ganges—62 miles.
3. The Ganges—67 miles.

Colonel Crichton considered the existing 16-inch maps to be unnecessarily large for a Diara Survey and he proposed that they be reduced to the 4-inch scale and combined into sheets of convenient size showing all topographical items such as rivers, *chars*, village sites, roads, etc., in *blue* and village boundaries in *black*. The next step he proposed was to complete the 4-inch sheets in the Bengal Drawing Office during recess and to send to the Collector of the district concerned copies of the latest 1-inch=1-mile standard sheets on which the approximate limits of these *diara* tracts would be marked, and ask him to ascertain and mark on these maps, any trijunction stones which might be proved to be in existence within or near the *diara* tract. The next step would be to send Theodolite Surveyors to run traverse lines along both banks of the rivers with instruction to take long lines, averaging about 30 chains, near the water's edge and to connect across at about every 12 miles and also with certain selected trijunctions which would be notified to them after examination of the standard sheets received back from the Collectors. The new traverse lines which would be marked temporarily with pegs, would be plotted in *red* on the sheets prepared in the Bengal Drawing Office, and the supplementary marking would be of the greatest assistance in the yearly revision surveys. As all these traverses would have been connected with selected trijunctions, the new stations could be plotted with absolute accuracy. The Topo Surveyor could then survey accurately and map in *red* the lines of the water's edge by means of off-setting from the *red* traverse lines, and survey and show in *red* any alterations and additions in village sites.

CONFERENCE IN 1904.

25. The matter was further discussed in detail at a conference consisting of the Hon'ble Member of the Board of Revenue, the Secretary, the

Director of Land Records and the Superintendent of Provincial Surveys, at which it was decided that as 4-inch survey could not show changes of less than one chain in width it would be advisable to increase the size of the scale and show all differences in the proposed new survey on the 16-inch scale. An estimate of Rs. 23,094 was then prepared for the experiment, Rs. 20,047 being required in 1904-05 and Rs. 3,047 in 1905-06. The annual expenditure necessary for subsequent years was estimated at Rs. 5,820.

GOVERNMENT APPROVAL OF THE PROPOSALS AND ESTIMATES AND INITIATION OF EXPERIMENTAL PROCEEDINGS.

26. The proposals and estimates were provisionally accepted by the Government of Bengal in their order No. 3002, dated the 30th July, 1904, but as there were no funds available sufficient for the work just then a length of only 55 miles covering an area of 354 square miles was surveyed in the season 1904-05 and marks were placed along the edge of the *diaras* concerned.

CONTINUATION OF THE EXPERIMENTS IN 1905-06.

27. The scheme was continued in 1905-06, when an attempt was made to mark a portion of the bed of the Ganges in the Patna Division permanently in such a way that non-professional Surveyors could survey the course of the stream, etc., year by year. The experiment, however, proved a failure as in December, 1906 it was found that, with few exceptions, the posts and bamboo pegs were all missing, the few remaining being discovered only after considerable search by a Surveyor skilled in the use of the plane table. The Board of Revenue, therefore, decided to abandon the scheme on the existing lines and asked the Superintendent of Provincial Surveys to make a further attempt to solve the difficulty.

CAPTAIN HIRST'S VIEWS AND SUGGESTIONS FOR REVISED SCHEME.

28. Captain Hirst, who was then officiating Superintendent of Provincial Surveys, suggested that iron buoys might be used in lieu of 10-foot posts and that the marks on the banks be withdrawn to such a distance inland as would ensure their not being subjected to heavy silt or any erosive action of river. His proposals for a new scheme were.—

- (a) That combined maps on the 4-inch scale be prepared showing—
 - (i) all Revenue Survey boundaries,
 - (ii) all Diara Survey boundaries,
 - (iii) all village boundaries dealt with cadastrally by the Survey Department and
 - (iv) any other properly surveyed boundaries considered necessary.
- (b) That the boundaries according to different surveys be shown by different symbols or in different colours, the maps to show all areas which would normally be expected to be covered by the changes in the bed of the Ganges, the decision on this point being left to a competent Surveyor who would fix the limits by personal observation and local enquiry.
- (c) All points which were found to be common to these surveys were to be shown by special symbols on the combined maps.
- (d) Along the limits of the bed of the river at every half mile, an absolutely permanent mark was to be embedded which should be of such a nature that a very high flag or a 40-foot bamboo could be erected over it when necessary. The positions of these marks would have to be fixed accurately by traverse work, each mark being plotted in position on the 4-inch combined maps.
- (e) These marks should give a competent Surveyor sufficient data for the following operations :—
 - (i) to survey the deep stream channel accurately with a plane table;
 - (ii) to relay with a theodolite any boundary or portion of boundary needed or to map the position and limits of a *char*;

- (iii) to fix on any piece of land, the true position of which is needed on the 4-inch combined maps, sufficient points to admit of a 16-inch Cadastral Survey of the area being undertaken by the Collector or any other competent agency.

It was suggested that (i) should be done once a year at comparatively low water, the cost being borne by Government. The operations described in (ii) and (iii) should be undertaken wherever required, the cost being borne in equal share by the parties concerned. It was further pointed out that these combined maps showing the modern Cadastral boundaries could only be prepared for that area which had been surveyed prior to 1904. This would cover the Ganges *diara* from Arrah to the eastern boundary of Monghyr and also probably most of the Gogra and Gandak *diaras*.

BOARD'S ACCEPTANCE OF THE PROPOSALS.

29. The Board of Revenue in accepting the proposals observed that for the areas surveyed up to 1904, materials were available for the compilation of a 4-inch combined map of the *diara* area showing the village boundaries according to (1) the Revenue Survey, (2) the Diara Survey, and (3) the recent survey of 1892—1904. Such maps were actually prepared for the Darbhanga *diara* and also for Muzaffarpur. In order to make such maps useful it was necessary that they should also show permanent marks on the high banks on either side of the river so placed as to be beyond the reach of fluvial action. These permanent marks, the Board suggested, should be erected at intervals of every half mile at each side, along the river bank and should be connected on the map with permanent traverse stations: they should have a pucca foundation of brick 18 inches deep, and in the middle, a strong socket, in which a long bamboo should be placed. The Board also suggested that in future, wherever any *diara* boundary dispute should arise, the Collector or Magistrate should decide what line he intended to adopt and call upon the Survey Department to relay it starting from the nearest permanent mark. This would, in most cases, enable a satisfactory order to be passed pending a final decision of a Civil Court.

The Board accordingly directed that the scheme, as now revised, be confined to the area for which it was possible to prepare the 4-inch combined maps *i.e.*, the area surveyed before 1904, covering the Ganges *diara* from Arrah to the eastern boundary of Monghyr, and most of the Gogra and Gandak *diaras*. The Superintendent of Provincial Surveys was then asked to prepare and submit an estimate of the cost for the preparation of the maps and the erection and maintenance of the permanent marks. Captain Hirst submitted an estimate for Rs. 20,000 for an area of about 1,200 square miles embraced by the *diara* of the Ganges, Gogra and Gandak rivers, so far as they affected the districts of Shahabad, Patna, Monghyr, Darbhanga, Muzaffarpur, Champaran and Saran. The area as calculated in linear miles was as follows:—

I.—GANGES DIARA—			
(a) Darbhanga	...	...	20 linear miles.
(b) Muzaffarpur	...	...	23 "
(c) Saran	...	...	40 "
(d) Monghyr	...	...	65 "
			148
		Add—25 per cent. for bends	37 "
		Total	185 "
II.—GOGRA DIARA—			
Saran and United Provinces	...	...	50 "
Add—for bends	...	...	20 "
		Total	70 "
III.—GANDAK DIARA—			
(a) Saran-Champaran	...	...	65 "
(b) Saran-Muzaffarpur	...	...	65 "
		Total	130 "
		GRAND TOTAL	355 "

GOVERNMENT SANCTION TO THE REVISED SCHEME.

30. The scheme with the estimate was submitted to Government in October 1907 and sanctioned in Government order No. 3789, dated the 30th November, 1907.

COLONEL CRICHTON'S PROPOSALS FOR AN EXPERIMENTAL SURVEY.

Colonel Crichton accepted Captain Hirst's scheme with certain modifications and proposed to deal, as an experimental measure, with only 40 linear miles of the river Ganges, on the Saran left bank and Shahabad and Patna right bank, *i.e.*, from the junction of the Gogra-Ganges to the junction of the Gandak-Ganges.

GOVERNMENT APPROVAL OF THE SCHEME.

31. This proposal was approved in Government order No. 1793T.R., dated the 8th September, 1909, and it was also agreed that the reference marks should be plotted on the 16-inch Cadastral sheets.

PROGRESS MADE IN 1909-10 AND THE METHOD ADOPTED.

A start was made in the field season 1909-10 in accordance with the finally accepted scheme, and test experiments were carried out in relaying old boundaries. An attempt was made to relay a village boundary in the *diara* tract with the aid of a plane table and sight vane from reference pillars fixed on the high banks. Four reference marks were chosen, approximately 40 chains apart, on the high bank of the river north of Dinapore, and marked temporarily by pegs, and these were connected by a theodolite traverse to certain trijunction marks of villages which a comparison of the old Revenue Survey maps and the modern survey maps showed to be common to these two surveys. Poles were erected on these reference points and a plane table traverse run round the boundary of a selected village, Kasim Chak, in the middle of the *diara* tract. All the plane table stations were marked temporarily on the ground by wooden pegs and these stations were then all traversed with the theodolite and the traverse plotted on the map already prepared. The work was first done by Captain Foster, Assistant Director of Surveys, Bengal, and then by Colonel Crichton himself, the results being identical.

The discrepancy between the boundary as laid down by the plane table and the true boundary according to the map, amounted in some places to as much as two chains and Colonel Crichton came to the conclusion that plane table method of relaying boundary should not be adopted when accurate work is required, unless there are a fair number of fixed reference points close to the boundary to be relaid. The fixing of selected points in the *diara* tract would, he considered, be useful for relaying boundaries with the theodolite, but in addition to the stones to be embedded prominent marks, such as temples, large single trees and the gables of houses should be observed and plotted on the sheets. If a good number of such subsidiary points could be fixed, it would be, he thought, possible to relay boundaries with a considerable degree of accuracy hereafter.

32. The results of the experiment and the conclusion arrived at were submitted to the Board with a proposal to resume the work in the following field season in a larger area to the east of the junction of the Gandak-Ganges. The Board accepted the proposal and sanctioned a continuation of the work during the season 1910-11 in their order No. 115 A/T., dated the 29th April, 1910.

PROGRESS MADE IN 1910-11.

33. During the field season 1910-11 the programme was extended from Manjhi on the Gogra river to Fatua on the Ganges, a distance of about 50 miles, covering an area of approximately 720 square miles included in 24 sheets: 153 special reference pillars were embedded along both banks of the Ganges. The work presented many difficulties as the Traversers employed failed for a long time to grasp the idea or to understand the nature of the work required of them: The necessary menial servants were only obtained after a

lot of trouble, and the chaining was found to be bad and had to be revised : the transport of stones to the river bank from the railway stations gave the greatest trouble and the Traversers got no help from the inhabitants.

34. So far the work was in an experimental stage and it was carried on in a haphazard fashion, there being no definite system to follow. The results of the experiments were carefully weighed and the procedure followed in the scheme as finally adopted and continued to the end was as follows:—

(a) Preparation in the Bengal Drawing Office, of preliminary maps on the scale 4-inch=1 mile showing village boundaries according to the latest Cadastral Surveys, the trijunction points which were found to be common to the three surveys (the Revenue Survey, the Diara Survey and the modern Survey) being denoted by special symbols, and other village trijunctions as well as village sites and the limits of the high bank of the river.

These maps were made over to the Traversers when they took the field and were used as guides to help them in fixing the best possible sites for the reference marks which were to be laid down.

(b) Embedding reference pillars about half a mile apart on either side of the river on high ground and in such positions as to be unaffected by all possibility of fluvial action.

Besides giving permanent fixed points from which to commence and close traverses, the object of fixing these reference marks was to furnish topographers or plane tablers with a sufficient number of points to enable them to relay any lost or disputed boundary without very great difficulty: the half mile limit was therefore not to be adhered to rigidly but altered according to circumstances and the nature of the country. As long as the pillars were easily visible, one from the other, the distances between them were not considered too great.

(c) Running of traverses along both banks using these reference pillars as traverse stations, and connecting them with the common trijunction points after every twenty stations or so.

An azimuth was to be observed at every fortieth station in those cases where two consecutive stations were not found when connections were made, and, at every ten or twelve miles, a connection was to be made to reference pillars on the opposite side of the river by triangulation.

(d) Intersecting and fixing by triangulation up to within one mile on the inner or landward side of the line of reference pillars of all Great Trigonometrical Survey stations and other prominent objects such as temples, mosques, church spires and conspicuous buildings as well as large isolated trees and landmarks.

The fixing of the reference pillars was to be determined by the traversers, who would do so after careful observation of the country and after obtaining the opinion of the inhabitants of the locality. Precautions were to be taken to safeguard all possibility of the stones being washed away, by fluvial action.

The stones used were about four feet long by one foot square, dressed at one end for a length of about one foot, marked by a circle and dot cut into the stone at its top and embedded into the ground to a depth of about 2½ feet: they were very heavy, weighing about 7½ maunds each.

REVIEW OF THE WORK BY THE BOARD.

35. In submitting to Government a review of the scheme on the result of the experiment in 1910-11 the Board of Revenue, in their letter No. 81-A, dated the 16th January, 1912, recommended the gradual extension of the operations as far as the trijunction of the districts of Purnea, the Santal

Parganas and Malda, at an estimated cost of Rs. 32,947 distributed over four years, viz. :—

					Rs.
1911-12	...	...	...	...	10,647
1912-13	...	...	...	...	7,300
1913-14	...	...	...	...	9,000
1914-15	...	...	...	...	6,000

The proposal was approved in Bengal Government order No. 951, dated the 27th February, 1912, for the year 1911-12, and it was suggested that after the close of that year inasmuch as the whole area in question fell in Bihar the Director of Surveys should apply for the orders of the Government of the new Province when formed as to the continuance of the work.

COLONEL CRICHTON'S PROPOSAL FOR THE PRESERVATION OF THE SPECIAL MARKS AND NOTIFICATION OF THE SPECIAL SURVEY.

36. Colonel Crichton submitted to the Board of Revenue, L. P., the proposal that if the field work was to continue, steps should be taken for the preservation of the special marks and the special survey should be notified. The Board of Revenue, L.P., in their letter No. 391-A., dated the 7th March, 1912, observed, however, that the map prepared in connection with the operation was meant to bring together the boundaries of the Revenue Survey, the Diara Survey and the modern Survey, and it was never intended to give it any particular binding authority. Boundaries would not be relaid according to the map, but according to either of three maps referred to above, and it was only for administrative convenience that these three maps were being brought together. It was doubtful whether a notification under the Bengal Survey Act, V of 1875, would confer any protection on the permanent marks now erected which were not "boundary" marks, as in many cases they are not on boundaries. Nor was it desirable to issue notifications under Act IX of 1847, as this was likely to give rise to a considerable amount of apprehension and might hamper the progress of the work in fr'

BOARD'S PROPOSALS.

The Board of Revenue, therefore, merely proposed that the Collectors of the districts concerned should have these permanent marks inspected at least once a year and submit a report to the Board through the Commissioner. If it was found that the utility of the map was being destroyed owing to the disappearance of the marks, the question of legislation for their protection would have to be faced; but till it was ascertained that the marks were being actually destroyed, this was unnecessary.

PROGRESS OF WORK IN 1911-12.

37. During the season 1911-12, the work was extended eastwards along the Ganges as far as Mokameh Ghat, a distance of about 51 miles along the mid-channel of the Ganges, covering an area of 690 square miles contained in 21 full-size special *diara* sheets and four half-size sheets; 149 special reference pillars were laid down and connection made with fixed common points.

This gave a total length of 93 linear miles along the Ganges contained in 45 full and four half sheets covering an area of 1,410 square miles. Colonel Crichton further proposed to continue the work to a point a little eastwards of Monghyr, a length of about 45 miles covering 24 sheets with an area of 720 square miles. A sum of Rs. 10,386 was sanctioned and provided in the budget of the year 1912-13; but the field work had to be postponed owing to insufficiency of staff and to the necessity of completing work of a more urgent character.

TRANSFER OF CHARGE OF THE SURVEY DEPARTMENT TO THE DIRECTOR OF LAND RECORDS, BIHAR AND ORISSA.

Progress in 1912-13.

38. The administration of the Traverse Section of the Provincial Surveys and of the Bengal Drawing Office (now the Bihar and Orissa Drawing Office) was in the meantime transferred to the Director of Land Records, Bihar and Orissa, who assumed charge of these two sections on the 21st March 1913. The work in the tract extending from Mokameh Ghat to Sultanganj a few miles east of Monghyr, was commenced in February 1914 and 229 special reference pillars were embedded in a distance of about 76 miles along the bed of the Ganges, included in 37 sheets. This completed the scheme as sanctioned by the Government of Bengal in 1909.

PROPOSALS FOR EXTENSION OF THE WORK UP TO BARHARWA ON THE BENGAL BORDER.

*39. There remained now (1) the portion of the Ganges between Sultanganj in Monghyr district and Sahebganj in the Santal Parganas, as also (2) the stretch of the river from Sahebganj to Barharwa at the junction of the districts of Malda, Murshidabad and the Santal Parganas, *i.e.*, the point at which the river emerges from the Province of Bihar and Orissa. With a view to have a complete system of marks along both banks of the river where it falls within the province of Bihar and Orissa, Mr. J. Reid, I.C.S., the Director of Land Records and Surveys, Bihar and Orissa, in his letter No. 4461, dated the 18th July, 1914, recommended that the scheme be carried out for the whole of the Ganges and that it be completed in the field season 1914-15. As regards the second stretch it was not possible to adhere to Colonel Crichton's scheme as the Cadastral maps of the Bengal district of Malda were not available, without which it would be impossible to prepare the combined maps for the tract on the Bengal side of the river or to lay down reference pillars on that side. It was also thought doubtful whether the Government of Bengal would be willing to defray a portion of the cost of the marks to be erected on the Bengal side. It was, therefore, proposed to lay down reference pillars for this stretch of the river on the Santal Parganas bank only from Sahebganj to Barharwa.

GOVERNMENT SANCTION TO THE PROPOSAL AND COMPLETION OF THE WORK.

40. The above proposals were sanctioned in the Bihar and Orissa Government letter No. 6802—11S-32R, dated the 27th August, 1914, a sum of Rs. 9,733 was provided in the Survey budget and the work was completed in March, 1915. In the tract extending from Sultanganj to Sahebganj the traverse was started from pillars laid down in the previous season and closed on trijunction stones of the latest Cadastral Survey: Numerous connections were made to trijunctions and points were intersected all along the banks. In the tract extending from Sahebganj to Barharwa, the traverse was started from and closed on trijunctions of the last Cadastral Survey and numerous intermediate connections to modern trijunctions and one pillar of the Diara Survey of 1865-66 were made.

DIFFICULTIES IN THE LAST SEASON'S PROGRAMME.

The programme in the last portion presented certain difficulties owing to the absence of Cadastral maps, the only maps available being those of the Revenue Surveys and the Diara Surveys. As in the majority of cases, it is either the Revenue or the Diara Survey boundary which is required to be relaid, a combined map of this area, showing only the Revenue Survey and the Diara Survey boundaries with the new marks laid down plotted on to them, was prepared. The special marks also serve a useful purpose as starting and closing points of any new traverse, if eventually a Cadastral Survey of the area is made, and, in that event, the new Survey boundaries can with facility be plotted on to the old combined map at any subsequent date.

A SUMMARY OF THE WORK DONE TO DATE.

41. There is now a regular chain of reference pillars extending along both banks of the river Gogra from Manjhi on the Saran-Ballia (U.P.) boundary to Chapra, and of the Ganges from Chapra to Sahebganj, and thence to Barharwa on the Santal Parganas—Malda (Bengal) border where the chain extends along the right bank only. The subjoined table gives a summary of the entire programme carried through year by year from its inception: 834 pillars were laid down in a length of 272 miles covering an area of 3,195 square miles, included in 138 sheets, in the districts of Saran, Shahabad, Patna, Monghyr, Bhagalpur and the Santal Parganas:—

Year of survey.	District.	Name of Diara.	Length in miles.	Area in square miles.	Number of sheets.	Number of marks.	Cost of survey.	Cost of preparation and publication of maps.	Total cost.	Remarks.
1	2	3	4	5	6	7	8	9	10	11
1904-06	Patna division	Ganges Diara	...	...	...	...	Rs. a. p. 2,588 0 0	Rs. a. p. ...	Rs. a. p. 2,588 0 0	Experimental work. Traversing of the actual course of the Ganges and preparation of combined map on 18" scale.
1906-06	Ditto	Ditto	...	...	...	2,665 0 0	...	2,665 0 0		
1906-07	Patna	Ditto	...	...	...	288 152 0 0	...	123 0 0		
							5,375 0 0	...	5,375 0 0	Experimental work. Embedding of special marks in the diara area and mapping of the work on one sheet on 2" scale.
1907-08	...	...	...	...	...	...	...	...
1908-09	...	...	...	...	...	...	415 0 0	415 0 0		
1909-10	...	...	...	...	...	...	3,177 0 0	3,177 0 0		
1910-11	Saran, Shahabad, Patna.	Gogra and Ganges Diara (Manjhi to Patna).	60	720	24	153	11,514 0 0	3,639 0 0	14,513 0 0	Experimental stage. Preparation of combined map on 4" scale in the Drawing Office.
1911-12	Patna	Ganges Diara (Patna to Mokameh Ghat).	66	775	23	149	2,313 0 0	3,747 0 0	4,959 0 0	
1912-13	Do.	Do.	...	...	...	...	...	3,164 0 0	3,164 0 0	
1913-14	Monghyr, Bhagalpur.	Ganges Diara (Mokameh Ghat to Sultanganj).	76	800	27	229	6,654 0 0	4,716 0 0	11,368 0 0	
1914-15	Bhagalpur, Purnea, Santal Parganas.	Ganges Diara (Sultanganj to Sahebganj and thence to Barharwa).	90	900	54	293	9,348 0 0	8,100 0 0	10,448 0 0	
		Balance of work still to be done.	...	...	...	...	...	23,000 0 0	23,000 0 0	Approximate.
		Total	272	3,195	138	834	23,029 0 0	44,015 0 0	74,045 0 0	

42. The reference pillars are extremely heavy and have been so placed as to be beyond the reach of fluvial action. They are plotted accurately in position on the combined maps on the 4-inch to 1 mile scale, the Revenue Survey boundaries being shown in *red*, the Diara Survey boundaries in *green*, the modern Survey boundaries in *black*, and the limits of the high banks in the season of the latest Cadastral Survey in *blue*.

43. Out of the total number of 138 sheets, 45 have been completed and published, 53 are under completion and will shortly be published leaving 40 to be still completed. The published sheets have been distributed among the District Officers and other officials as prescribed in the table below appended to the Board's letter No. 3755—1S-11R(A), dated the 16th September, 1912, to the address of the Director of Surveys, Bengal :

Distribution of Special Ganges Diara Maps.

				No. of copies.	
Collector of Patna	15	} For their respective districts.
" " Shahabad ...	...	...	...	6
" " Muzaffarpur ...	...	...	...	25
" " Darbhanga ...	...	...	...	8
" " Saran (thanas Manjhi, Chapra, Dighwara and Sonepur).	...	...	...	2
" " Monghyr ...	...	...	...	10
" " Bhagalpur ...	...	...	...	9
" " Purnea	10	} For their respective divisions.
Deputy Commissioner of the Santal Parganas	...	...	...	10
Commissioner of the Patna Division	...	...	...	3
" " Tirhut "	3	} For their respective divisions.
" " Bhagalpur "	...	...	...	3
Director of Land Records, Bihar and Orissa	5	} All sheets.
Board of Revenue, Bihar and Orissa	...	...	...	1
Revenue Department of Government of Bihar and Orissa	...	...	...	1
Public Works Department of Government of Bihar and Orissa.	...	...	...	10
Bengal Drawing Office	...	...	...	1
Spare sets for future unforeseen requirement	...	...	...	5

The District Officers are also being supplied with 1-inch thana maps showing the position of the special reference pillars which have been numbered serially. They have been requested to take custody of these pillars and make proper arrangements for their preservation as in the case of boundary marks. These pillars will be inspected by the district staff at least once a year, preferably after the rains, and their condition reported to the Board of Revenue through the Director of Land Records and Surveys.

COST OF THE OPERATIONS.

44. A summary of the actual and estimated cost of the operation has been given in the table in page 14. Rupees 5,375 was spent from 1904-05 to 1906-07 in experimental work until a definite scheme could be worked out. The total cost (actual) of the survey was Rs. 29,029: about Rs. 23,016 has been expended in the preparation and publication of the maps and another Rs. 22,000 is estimated as the probable cost of the preparation and publication of the remaining sheets. The incidence of the cost is given in the following table :—

Kind of work.	Cost per linear mile.	Cost per square mile.	Cost per sheet.	Cost per mark.	Remarks.
1	2	3	4	5	6
	Rs.	Rs.	Rs.	Rs.	
Traverse ...	107	9	210	35	(Actual.)
Preparation and publication of maps.	165	14	326	55	(Actual and estimated.)
Total ...	272	23	536	90	

45. The preparation and publication of the remaining sheets of the special *diara* maps will probably take two years more to complete. The duty of re-erecting any missing *diara* marks should be entrusted to the Traverse Department. The question of the preservation of the marks was discussed in Board's letter No. 391-A., dated 7th March, 1912, when it was decided that the cost of upkeep should be borne by Government. So long as the Traverse Section of the Bihar and Orissa Surveys exists, the cost may be met from the provision made in the budget of that section, and thereafter in that of the Drawing Office.

PROPOSALS FOR SIMILAR WORK IN THE RIVER GOGRA WEST OF MANJHI AND IN THE GANGES WEST OF CHAPRA.

46. There remain now two stretches of *diara* areas in which no pillars have been erected, *viz.*, the tract of the Gogra river lying between the districts of Saran and Ballia (U.P.), a distance of about 40 miles from Darauli to Manjhi, and the Ganges *diara* extending from Chausa, west of Buxar, to the trijunction of the districts of Saran, Shahabad, and Ballia (U.P.) opposite Chapra, a distance of about 63 miles. The question of erecting special reference pillars in this area is still under the consideration of the Settlement Officer of North Bihar and the Director of Land Records and Surveys.

DEPARTMENT OF LAND RECORDS, AND SURVEYS, BIHAR AND ORISSA.

No. 297.

FROM

J. REID, Esq., I.C.S.,
DIRECTOR OF THE DEPARTMENT OF LAND RECORDS AND
SURVEYS, BIHAR AND ORISSA,

TO

THE SECRETARY TO THE BOARD OF REVENUE,
BIHAR AND ORISSA.

Dated Ranchi, the 19th January, 1916.

SIR,

I HAVE the honour to submit a copy of a note or report on the Ganges Diara Survey, prepared by my Personal Assistant, Babu Rajani Kanta Sen, in consultation with the Officer in charge of the Traverse Section who controlled the survey operations.

2. The report gives an account of the discussions, which led to the initiation of the operations, and of the course of the survey, its cost and general results.

3. It is yet too early to express any opinion on the general utility of the survey. I have consulted various Collectors; but, there is yet little evidence that the reference pillars put down are utilized to any great extent. The report should, however, serve the purpose of explaining the methods and objects of the survey, and I propose, if the Board has no objection, to send copies to each of the Collectors and Subdivisional officers concerned for use in their offices.

Copies will also be sent to Commissioners of Divisions and to the Board of Revenue.

I have the honour to be,

SIR,

Your most obedient servant,

J. REID,

*Director of the Department of Land Records
and Surveys, Bihar and Orissa.*

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