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GENERAL REPORT

ON THE

Revenue Survey Operations

OF THE

BENGAL PRESIDENCY,

UPPER & LOWER CIRCLES

FOR SEASON

1869-70.

COLONEL D. C. VANRENEN, R. A.,

SUPERINTENDENT OF REVENUE SURVEYS, UPPER CIRCLE.

AND

MAJOR JOHN MACDONALD B. C.

OFFG: SUP: OF REV: SURVS L. C.

CALCUTTA :

OFFICE OF THE SUPERINTENDENT OF GOVERNMENT PRINTING.

1871.

GENERAL REPORT

15/10

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FOR SEASON

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COLONEL D. C. VANRENEN, R. A.,

SUPERINTENDENT OF REVENUE SURVEYS, UPPER CIRCLE.

CALCUTTA:

OFFICE OF THE SUPERINTENDENT OF GOVERNMENT PRINTING,

1871.

Abstract of General Statement of Professional Work of season 1869-70 exhibiting area and cost of the Revenue Surveys in Upper and Lower Circles of the Bengal Presidency.

Divisions.	Number of Village Circuits.	Sqr. Miles.	Total Expenditure.	Average rate per Sqr. Mile in each Circle.	REMARKS.
Upper Circle	5,578	14,494	5,11,025	35	{ The Holdings refer to an elaborate Survey of the environs of Calcutta on a large scale which raises the cost.
Lower Circle	Circuits 1,721 Holdings 8,361	6,560	3,32,735	50	
Total	Circuits 7,299 Holdings 8,361	21,054	8,43,761	40	

SUPDT. OF REVENUE SURVEYS' OFFICE, }
Calcutta, 15th February 1871.

(Sd.) D. C. VANRENEN Colonel.

JOHN MACDONALD, Major.

Superintendents of Revenue Surveys,

Upper and Lower Circles.

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GENERAL REPORT

ON THE

Operations of the Revenue Surveys

OF THE

BENGAL PRESIDENCY,

UPPER CIRCLE,

AND OF THE

DRAWING AND COMPUTING BRANCH OF THE OFFICE OF SUPERINTENDENT
OF REVENUE SURVEYS,

For Season 1869-70.

Calcutta, 20th December 1870.

NUMBER OF PARTIES.—Ten parties were employed in the Upper Circle during the season under review, 1869-70, *viz.*, 4 in the Central Provinces, 1 in Oudh, 2 in the North-Western Provinces, 2 in the Punjab, and 1 in Sindhi.

2. The names of the Superintending Officers, the amount of work performed by their Divisions, with the total expenditure and average cost per square mile, are detailed in the following tabular statement, to which is appended an abstract of the total area and cost for each jurisdiction, and a list of districts completed since publication of last report:—

(6)

General Return of Professional work for season 1869-70, exhibiting area and cost of the Central Provinces, Oudh, North-Western Provinces, Punjab, and Sindh Surveys, Upper Circle.

Divisions and Superintending Officers.	Names of Districts.	Number of Villages or Waste Land Blocks.	Average size of Village Circles in acres.	SQUARE MILES OF AREA.		Linear Miles of check Survey.	Total expenditure exclusive of charge for Levelling Operation.	REMARKS.
				Triangulated.	Completed in detail.			
1ST DIVISION, CENTRAL PROVINCES.								
Major R. E. Oakes, Deputy Supt. of Revenue Survey	Chindwara	Villages ... 685 Waste Land Blocks ... 80	1,056	...	1,064	210	Rs. 68,251 6 5	160 square miles of village boundary survey were also done in advance for 1870-71.
2ND DIVISION, CENTRAL PROVINCES.								
R. B. Smart, Esq., Deputy Supt. of Revenue Survey	Raeipoor	Villages ... 575 Waste Land Blocks ... 97	965 3,945	...	1,465	163½	48,461 14 7	
3RD DIVISION, CENTRAL PROVINCES.								
Capt. H. C. B. Tanner, Deputy Supt. of Revenue Survey.	Ninnar	Villages ... 107 Waste Land Blocks ... 46	6,968	...	1,666	60	53,238 7 1	130 square miles of traverse work in District Baitool have also been done in advance.
4TH DIVISION, CENTRAL PROVINCES.								
Capt. F. Coddington, Deputy Supt. of Revenue Survey	Chanda	Villages ... 72 Waste Land Blocks ... 106 River Circuits ... 3	3,386	...	1,453	30	53,692 0 1	395 square miles of village boundary survey were also done in advance for 1870-71.
1ST DIVISION, OUDH.								
Major F. C. Anderson, Deputy Supt. of Revenue Survey	Gonda	Villages ... 1,143	541	...	1,078	100	60,430 10 1	Includes 107 square miles of the adjoining district of Butee, and also 5 square miles of environs of Fyzabad Cantonment; scale 8 inches = 1 mile.
1ST DIVISION, N. W. PROVINCES.								
Major A. D. Vanrenen, Deputy Supt. of Revenue Survey.	Bijnour	Villages ... 1,216 Grants ... 9 River Circuits ... 6	489	...	1,020	147	57,204 6 1	Includes 40 square miles of District Baraich in Oudh.
ROHILKUND, N. W. PROVINCES.								
J. Campbell, Esq., Assistant Supt. of Revenue Survey	Bareilly	Villages ... 675	462	...	411	70	25,519 1 10	Includes 5 square miles of Cantonment and environs of Nynce Tal; scale 20 inches = 1 mile.
N. W. FRONTIER, PUNJAB.								
Lieut. Col. H. C. Johnstone, c. b., Depy. Supt. of Revenue Survey.	Peshawar	Villages ... 306	1,506	467 { Topographical	832 } 1,400	129	70,832 8 0	
BHAWULPOOR.								
T. S. Johnson, Esq., Asst. Supt. of Revenue Survey	Bhawalpoor	Villages ... 341 Cantonment Blocks ... 30 River Circuits ... 2	1,253	...	717	114½	23,523 13 0	Includes 21-78 square miles of Cantonment and environs of Phillor; scale 12 inches = 1 mile; and also 9 blocks, area 11-42 square miles of overlap on District Goograhal.
SINDH.								
Capt. D. Macdonald, Deputy Supt. of Revenue Survey	Shabbander	Villages ... 116 River Circuits ... 3 Topographical Cantonment & environs	4,085	...	851 } 2,361 } 98 } b	123	50,351 12 4	a Includes an overlap of 109 square miles on District Jhirrak including River Indus. b Namely, 23 square miles of environs of Hyderabad Cantonment; scale 8 inches = 1 mile; and 73 square miles of Cantonment and environs of Kurrahe; scale 16 inches = 1 mile.
Grand Total for 1869-70		...	...	...	14,494 } 13,973 }	1,166½ } 1,311½ }	511,095 15 6 5,29,238 10 10	
Ditto for 1868-69		...	...	...	+ 621	- 144½	- 18,212 11 4	

Abstract.

Number of Parties.	JURISDICTION.			Area surveyed in Square Miles.	Total Cost.			General average Cost per Square Mile.			REMARKS.
	...	...	...		Rs.	A.	P.	Rs.	A.	P.	
4	Central Provinces	...	...	5,629	2,23,663	12	2				
1	Oudh	...	...	1,078	60,430	10	1				
2	North-Western Provinces	...	...	1,431	82,623	7	11	35	4	8	
2	Punjab	...	...	3,049	93,956	5	0				
1	Sindh	...	...	3,308	50,351	12	4				
10				14,494	5,11,025	15	6				

Districts completed since last Report.

DISTRICTS.	When commenced to be surveyed.	When finished.	By whom surveyed.	AREA IN		Cost, inclusive of contingent expenses.	Rate per Square Mile.	REMARKS.
				Acres.	Square Miles.			
Nimar	1867-68	1869-70	Captain H. C. B. Tanner	2,224,212	3,475	Rs. 1,83,250	Rs. 52 11 9	a. In addition to this area, 1,509 square miles were surveyed beyond the North-West Frontier. b. Inclusive of the River Indus ... 56 Sqr. Miles. Overlap on Cutch ... 137 "
Peshawur	*1863-64	1869-70	Lieut. Colonel H. C. Johnstone, C. B.	1,579,110	2,467 ^a	1,15,250	46 11 6	Total ... 193 Sqr. Miles.
Shahbunder	1867-68	1869-70	Captain D. Macdonald	2,774,063	4,334 ^b	79,669 ^c	18 6 1	c. Inclusive of the cost of the Hyderabad and Kurrachee Cantonnments' Survey, which has not been separately given by the Surveyor.

* The survey was in abeyance from 1865-66 to 1869-69.

3. These returns show an increase in completed area of 521 square miles, and a decrease in cost of Rs. 18,212-11, giving a decrease in average cost per square mile of annas 7-7, as compared with the preceding season.

4. As compared with last year, the number of linear miles of Check Survey is less; but on the other hand, the work of the plane tablers has frequently been checked *in situ*, and portions of villages have been surveyed in block, where it was not possible to spare time and money in cutting rays through difficult ground. Executives unanimously testify to the accuracy of the detail measurements so thoroughly and extensively checked by them.

5. The efforts made by the Head Quarters' Office for some time past, by the distribution of type and suitable specimens, to introduce uniformity in the style of mapping throughout the various survey parties, have at length been crowned with success, and Executives have now so fully appreciated the requirements of photography that they have (with very few exceptions) been relieved of their 1 inch = 1 mile general maps, the preparation of which has hitherto been a heavy strain on their time and energy during recess. The time thus economized is turned to better account in drawing the 4 inch = 1 mile sheets, adapted for reduction to the 1 inch = 1 mile scale. The minutiae not intended to appear on the general maps are inserted in blue on the original sheets, so that the reductions are generalised without the least sacrifice of the most minute details required on the large scale maps.

6. The field books and plane table sheets received annually from the various surveys are now on the whole so neatly and methodically arranged and indexed that the labor of examination in the Head Quarters' Office is reduced to a minimum, while the result of the examination shows, generally, a strict adherence by the Executives to departmental orders and modes of procedure.

7. The work performed in the Revenue Survey Head Quarters' Office, drawing and computing branch, during season 1869-70, is tabulated below :—

TITLE OF MAPS.		SCALE.	REMARKS.
COMPILATIONS.			
<i>Sindh, in 13 Sheets.</i>		<i>Miles. Inch.</i>	
GEOGRAPHICAL MAPS.	Sheet No. 1. Districts Jacobabad, Larkhana and Shikarpoor.	4 = 1	The Shikarpoor Collee orate, District Nowshera of the Hyderabad Collectorate, and the Khyrpoor territory have already been published separately, but the whole province has now been divided into 13 uniform sections. Portions of these sections were drawn last year, but have since been completed and sent to the Lithographic Press for publication, with the sole exception of sheet No. 11, which awaits District Shahbunder surveyed in 1869-70.
	.. No. 2. Districts Jacobabad, Shikarpoor and Rohree.	4 = 1	
	.. No. 3. Districts Larkhana, Mehur, Sehwan, Nowshera and Khyrpoor.	4 = 1	
	.. No. 4. Districts Rohree and Khyrpoor	4 = 1	
	.. No. 5. Districts Sehwan, Nowshera, Kurrachee and Halla.	4 = 1	
	.. No. 6. Districts Nowshera, Halla, Khyrpoor and Oomerkot.	4 = 1	
	.. No. 7. District Kurrachee ...	4 = 1	
	.. No. 8. Districts Kurrachee, Sehwan, Jhirruk, Shahbunder and Hyderabad.	4 = 1	
	.. No. 9. Districts Mahomed Khan's Tanda, Halla and Oomerkot.	4 = 1	
	.. No. 10. District Oomerkot ...	4 = 1	
	.. No. 11. Districts Shahbunder and Jhirruk.	4 = 1	
	.. No. 12. Districts Shahbunder and Mahomed Khan's Tanda with Ruin of Cutch.	4 = 1	
	.. No. 13. Ruin of Cutch ...	4 = 1	

	TITLE OF MAPS.	SCALE.	REMARKS.
	<i>Central Provinces.</i>	<i>Miles. Inch.</i>	
GEOGRAPHICAL MAPS.	District Seonee	4 = 1	Completed and sent to press. Completed to extent of available materials, drawn for photographic reduction to $\frac{1}{4}$ scale.
	District Chanda	2 = 1	
	<i>Oudh, in 4 sheets.</i>		
	Sheet No. 1	4 = 1	{ Completed by the addition of remainder of District Kheree. Cannot be completed till the survey of Gonda is concluded. Completed by addition of portion of District Gonda. N. B.—Sheet 3 has been published complete.
	„ No. 2		
	„ No. 4		
	<i>Punjab.</i>		
	District Shahpoor	2 = 1	Old compilation commenced in the Surveyor General's Office; completed in Revenue Sur- vey Office. Awaits examination.
	<i>Lower Provinces.</i>		
	Ganges Dearchs in 3 Sections	4 = 1	All published.
District Kamroop	4 = 1	Being completed by the addition of the sur- vey of 1868-69, the records of which have only recently been received.	
East Dooars of District Goalpara	4 = 1	Completed. Under examination.	
West Dooars of District Julpigoorce	4 = 1	Ditto ditto.	
<i>Sindh, in 103 sheets.</i>			
STANDARD SHEETS.	{ 30' longitude by 20' latitude (4 sheets having been added for the Runn of Cutch).	1 = 1	74 Sheets projected and sent to press up to date. Of these 14 were prepared by the Surveyor, 12 more containing the Shah- bunder Survey have also been drawn by the Surveyor and will soon be submitted for publication. There will then remain 17 sheets to be projected for press.
	<i>Central Provinces.</i>		
	District Seonee, in 10 sheets, 30' longitude by 20' latitude.	1 = 1	All re-drawn for photographic reduction, and sent to press for publication.
	District Dumoh, in 12 sheets, 30' longitude by 15' latitude.	1 = 1	
	District Chanda, in 26 sheets, 30' longitude by 15' latitude.	1 = 1	
	<i>Punjab.</i>		
	District Peshawur, in 14 sheets, 30' longitude by 15' latitude.	1 = 1	Projected. Being drawn for photographic re-production.
	<i>Lower Provinces.</i>		
	District Cachar, in 7 sheets	} 30' longitude by 15' lati- tude.	{ 1 = 1 Re-drawn for photozincography. All pub- lished. 1 = 1 Projected. To be drawn for photographic re-production. 1 = 1 Projected and sent to press for lithography.
	„ Kamroop, in 15 „		
„ Palamow, in 17 „			
<i>Oudh, in 53 sheets.</i>			
{ 30' longitude by 20' latitude	1 = 1	49 sheets sent to press up to date, leaving 4 which contain the unsurveyed portion of Gonda.	
The following Index Maps for the standard 1 inch sheets have also been prepared:—			
INDEX MAPS.	District Seonee	4 = 1	{ All photozincographed to $\frac{1}{4}$ scale, and published, except Manbhoom, which is now ready for publication.
	„ Nimar	4 = 1	
	„ Hoshungabad	4 = 1	
	„ Manbhoom	4 = 1	
	„ Cachar	4 = 1	
	„ Sindh	8 = 1	

Miscellaneous Maps and Tracings, &c.

TITLE OF MAPS.	SCALE.	REMARKS.
	<i>Inches. Miles.</i>	
Boundary of sheets 7 and 8 of District Kooch Behar, and trace of detached villages of District Rungpoor.	4 = 1	For Deputy Superintendent, 5th Division, Lower Provinces.
31 Villages of Thana Chukeria } District Chit- 23 " of " Rungoonea } tagong.	4 = 1	For the Collector of Chittagong, 16 villages of Chukeria, and 26 of Rungoonea remain to be done.
Grants in District Luckimpoor	4 = 1	For Board of Revenue, Lower Provinces.
Trace of Bijnour Forest Map	2 = 1	For Deputy Superintendent, 1st Division, North-Western Provinces.
Boundary between Moradabad and Rampoor Jagheer	2 = 1	For ditto ditto.
" between Oudh and Nepal	2 = 1	For ditto 1st Division, Oudh.
Trace of Levels in District Peshawur	4 = 1	For Lieutenant-Governor, Punjab.
Do. do. do. do.	4 = 1	For Superintendent of Irrigation, Punjab.
Trace of 4 miles of country in Illaka Tonk, District Dera Ishmael Khan, along the Mahsood Wuzeri border.	2 = 1	For Lieutenant-Governor, Punjab.
Do. do. do. do.	2 = 1	For Deputy Superintendent, North-West Frontier Survey.
Levels inserted on the Maps of District Peshawur to illustrate Lieutenant Colonel Johnstone's leveling operations.	1 = 1	For Lieutenant-Governor, Punjab.
Trace of main Circuits 10 and 11, District Kamroop, along the Bhootan Frontier.	1 = 1	For Deputy Superintendent, 1st Division, Lower Provinces Survey.
Trace of the Sonai River	1 = 1	For Deputy Commissioner, Cachar.
M. C. 30 of District Bhundara reduced from 4" sheets	1 = 1	Preliminary Map, for publication.
Sheets 2 and 3 of Hazareebagh re-survey	1 = 1	Original sheets completed for publication.
Skeleton Tracing of Districts in Assam	1 = 4	For His Excellency the Commander-in-Chief.
Sheet Index Maps of Cantonments Jullundhur, Phillor, Nowshera, and Peshawur.	Various scales	For press guidance, and publication.
Traverse of M. Cts. 2 and 3, District Luckimpoor	...	For Deputy Superintendent, 2nd Division, Lower Provinces Survey.
" of 44 Cachar Tea Grants ... ..	...	For Deputy Commissioner, Cachar.
" of District Bhundara ... ..	...	For Deputy Superintendent, 4th Division, Central Provinces Survey.
Boundary of the West and East Dooars along the Bhootan Frontier.	1 = 1	For the Commissioner, Kooch Behar Division.

8. The following is a Statement of extra work done out of Office hours for landholders and other applicants, and examined in the Drawing Department :—

DESCRIPTION OF MAPS, &c.	SCALE.	REMARKS.
	<i>Inches. Miles.</i>	
Oudh Forest tracts contained in (then unpublished) sheets 48 to 53, Districts Kherree and Buraitch.	1 = 1	For Conservator of Forests.
Maps of Main Circuits 1, 7, 8, 9, and Sheet No. 7 of Pergunnah Kulmaishwar, District Nagpoor.	1 = 1	For the Deputy Commissioner, Nagpoor.
Main Circuit Maps of District Purneah	1 = 1	For the Collector of Purneah.
Portion of ditto	...	For Consulting Engineer, Bengal Government.
Trace of the country 2 miles east and west of the road leading from the Moradabad and Bijnour boundary through Pergunnah Seora, Dhampur and Nugeena, of District Bijnour.	4 = 1	For the Executive Engineer, State Railway.
2 Traces of Perg. Kasheepoor, District Moradabad	1 = 1	For Superintendent, Turrai Pergunnahs.
2 Traces of Perg. Kasheepoor, District Moradabad	1 = 1	For Commissioner of Kumaon.
List of areas in Kasheepoor, District Moradabad ... ..	...	For Superintendent, Turrai Pergunnahs.
Traces of 9 sheets of District Nimar	4 = 1	For Supdg. Engineer, Indore State Railway.
Skeleton Map of the Chota Nagpoor Division	1 = 8	For the High Court, Bengal.
Insertion of Thakbust Nos. and Thannah boundaries on 1 inch maps of District Bograh.	...	For Collector of Bograh.
11 Pergunnahs of District Bhaugulpoor	1 = 1	For Collector, Bhaugulpoor.
13 Maps of Sonthal Pergunnahs	1 = 1	For Commissioner of Bhaugulpoor.
Map of Pergunnah Futehsing, District Moorshedabad.	1 = 1	For Messrs. Thacker, Spink and Co.
237 Manuscript copies of village plans	4 = 1	{ For landholders. { For Joint-Magistrate, 24-Pergunnahs. { For Superintendent, Turrai Pergunnahs. { For Irrigation Branch, D. P. Works, N. W. P. { For a Pleader of the High Court.
40 ditto ditto		
188 ditto ditto		
733 ditto ditto		
Trace of the River Ganges between Moorshedabad and Malda.	4 = 1	

9. The payments made by applicants on account of the above amount to Rs. 2,235, of which Rs. 133 have been credited to Government as fees on village plans.

10. Proofs of 106 lithographed and 108 photozincographed maps have been examined for publication.

11. Five hundred and forty-seven copies of maps (in 1,565 sections) on various scales, also cantonment and city plans on large scales, have been colored and examined, for issue to the public, and a copy of each map colored and retained for Office record.

12. All the published 1 inch standards of Oudh have been colored to show the revised district and tehseel boundaries according to the "Moojmillee" maps and village lists furnished by the Oudh Government. These boundaries have also been transferred to the 4 miles = 1 inch sheets.

13. The village boundaries inserted by the Deputy Superintendent North-West Frontier Survey, have been transferred to 10 copies of the 15 photozincographed sheets (1 inch = 1 mile) of District Huzaruh, for issue to the Civil authorities, and for Office record.

14. The records of 1865-69 received from the various surveys were	subjected to the usual
	rigorous examination, and
	the remarks of this Office
	on the state of the maps and
	computations were commu-
	nicated to the Executive
1st Division, Central Provinces.	Sindh Division.
2nd " " "	1st Division, Lower Provinces.
4th " " "	2nd " " "
1st Division, Oudh.	4th " " "
1st Division, N. W. Provinces.	5th " " "
Rohileund Division.	Upper Assam Party.

Officers in charge of the parties marginally noted.

15. The Superintending Engineer of the Indore State Railway, Mr. Crawford Campbell, bears gratifying testimony to the assistance he derived from the Survey maps. In a letter to this Office he remarks:—"We found the plans of Nimar, both on the 1 inch and 4 inch scale, prepared and furnished to us by your Department, of the very greatest assistance in our preliminary work of last season. They saved us the necessity of making fresh surveys of our own, and aided and expedited our progress very materially."

16. Leveling, in connection with the regular survey, has been carried out	in certain districts* in the
	North-Western Provinces,
	in the Punjab, and in Oudh.
	A large number of level
	bench marks has been
	embedded at convenient
	distances throughout the
	districts traversed. Their
* Peshawur } Punjab.	
Bhawalpoor } North-Western Provinces.	
Bijnour } North-Western Provinces.	
Barceilly } North-Western Provinces.	
Roy Barceilly } North-Western Provinces.	
Oonao } Oudh.	
Lucknow } Oudh.	
Barabunkee } Oudh.	
Hurdul } Oudh.	
Sectapoor } Oudh.	

position *in situ* is indicated on the 4 inch sheet maps with the heights above sea level duly recorded thereon, and as they have been invariably connected with the more extended leveling operations of the Great Trigonometrical Survey, the value of our maps will be greatly enhanced by this additional information, and prove of great service to those Officers of the Public Works Department, employed more especially in the Irrigation Branch.

17. The progress of each survey party in leveling will be found published in the Appendices. The result is very satisfactory, because the work has not only been well executed but most economically, at a cost of Rs. 4-13-8 per running mile, including all contingencies, such as salaries for extra establishments and in the erection of bench marks. This, when contrasted with previous rates, is very encouraging, showing that as our Surveyors gain experience in their new work, their progress is more rapid, and, therefore,

more economical. An improvement on the present very low rates, however, can scarcely be expected.

18. In the several districts where revenue survey was carried on, whether in the North-Western Provinces, the Punjab, in Sindh, in the Central Provinces, as well as in Oudh, the local Governments were alive to the importance of having masonry pillars, or stones, fixed at the tri-junction of all village boundaries; and the necessity of having some permanent record, on the ground, of our labors, in case of boundary disputes, has been fully recognised by those who possess any practical knowledge of the subject. The extreme difficulty, and in fact at times the impossibility of adjudicating without some such land marks, is admitted by all competent authorities. Notwithstanding this, I regret to state, little progress has been made since last season's report, in the way of securing our stations in the Hooghly District of Bengal, where no masonry pillars have been raised, although the Governments, both of India and of Bengal, have authorised their construction, and their being paid for by the Zemindars. I would suggest that no further time be lost in giving effect to the very positive orders of Government.

19. INSPECTION.--During the season under review, all the survey parties were inspected by me, except the North-Western Frontier Establishment under Colonel Johnstone. The inspection extended through the Central Provinces to Poonah, to Sindh, and the North-Western Provinces of India; a distance of 6,503 miles being traversed between the 23rd July and 31st October, or in a little more than three months, when I returned to Calcutta. These close inspections are fraught with benefit to the State, because the Inspecting Officer has the advantage of becoming personally acquainted with the Officers, both Covenanted and Uncovenanted, and of learning much, which cannot be attained without a close personal inspection. Where shortcomings were apparent in carrying out details of work, they were noticed and promptly checked. I have much pleasure in bearing testimony to the co-operation and assistance received from the Executive Officers, their careful attention to duties, at times very arduous, and the gradual improvement noticeable in the 4 inch maps, which are now drawn in pen and ink, and in a style susceptible of reduction by photography. This is a move in a right direction, inasmuch as the reduction by means of photography is far more correct than the old system of reducing by the pentagraph. The maps, too, are more uniform in appearance, in consequence of a more rigid style being exacted in their rendering.

20. It is gratifying to record the approval of my colleague in the Lower Provinces and myself of the very valuable aid afforded by the Assistants in the corresponding and drawing branches of the Head Quarters' Office. Mr. Adels, of the former, is very assiduous and hard-working; and Mr. Kelly, of the latter, or drawing and computing branch, is very able and efficient.

D. C. VANRENNEN, *Colonel, R. A.*,

Supdt. of Revenue Surveys, Upper Circle.

REPORT

ON THE

Revenue Survey Operations

OF THE
PROVINCE OF OUDH,
For Season 1869-70.

1st DIVISION.

DISTRICT GONDA.

1. LIMITS OF SURVEY.—The party re-entered District Gonda on 25th November 1869, and the field season extended to the 18th April 1870, giving a total area of 1078.48 square miles, comprised in that portion of District Gonda which is limited east by District Bustee of the North-Western Provinces, west by District Baraitch, north by the unsurveyed area of District Gonda, south by the Gonda Circuits surveyed in 1867-68.

Major F. C. Anderson, Deputy Superintendent, 1st grade.
ASSISTANTS.
Lientenant D. C. Andrew, Assistant Superintendent, 1st grade.
Mr. C. W. Campbell, Surveyor, 2nd grade.
" H. T. Hanby, Assistant Surveyor, 2nd grade, transferred to 1st Division, N. W. P., 1st May 1870.
" G. W. Jarbo, Assistant Surveyor, 3rd grade.
" J. R. Scott, Assistant Surveyor, 3rd grade.
" A. Lane, Proby. Surveyor, 4th grade, transferred to 4th Division, L. P., 7th November 1870.
" A. C. W. Lemarchand, Proby. Surveyor, 4th grade.
" B. Anderson, Proby. Surveyor, 4th grade, transferred from Rohileund Survey, joined 1st August 1870.
25 Sub-Surveyors, &c.

2. DISTRIBUTION OF AREA.—The gross area includes 5 square miles of the environs of Fyzabad, 8"=1 mile, surveyed subsequent to the area of 16 square miles returned last year, to complete the cantonment plan, and an area of 106.84 square miles contained in a strip of villages of District Bustee, North-Western Provinces, surveyed along the common boundary to ensure a perfect junction between the two Districts. The entire area is thus distributed :—

DISTRICTS.	No. of Traverse Circuits.	Area in Square Miles.	REMARKS.
Pergunnah Munkapoor	209	177.72	
.. Kusba Gonda	375	204.10	
.. Ootrowla	312	261.44	
.. Bulrampoor	247	323.38	
Total area, District Gonda	541	966.64	
Outlying Villages of District Bustee ... ..	...	106.84	
Environs of Fyzabad Cantonment ... ..	...	5.00	
Total Out-turn	541	1078.48	

3. BOUNDARY BETWEEN OUDH AND NORTH-WESTERN PROVINCES.—The Provincial boundary between Districts Gonda and Bustee was demarcated during the winter of 1868-69, by Captain Hastings on the part of the Oudh Government, and Mr. Ridsdale on that of the

North-Western Provinces' Government. This boundary, 103 miles of which were taken up by the survey, is thus defined:—Commencing from the village of Munccepoor, it runs for 2 miles along the midstream of the Munour nulla, which is here more a swamp than a stream. For 20 miles further, it is demarcated by substantial masonry pillars, about 7 feet high, up to the village of Bhugwanpoor, beyond which, for 4 miles, it is the midstream of a nulla (without name) that falls into the Bisoe. Leaving the Bisoe, it is again, for 1½ mile, marked by the same description of large masonry pillars up to the Kohanee nuddee, the midstream of which, for 29 miles, forms the boundary, as far as the Gujpoor graut, situated at the tri-junction of main circuits 7 and 8, and the Bustee District, from which point the boundary is again demarcated by masonry pillars, for 3½ miles, up to the Soowaon nulla, the course of which it follows for 6 miles, to its junction with the Raptée river. For a distance of 25 miles further north, the boundary runs along the midstream of the Raptée river, from the village of Russoolabad up to that of Mutereah Kurma, whence it is defined by masonry pillars for about 12 miles, up to the village of Ruttanpoor on the north-eastern extremity of main circuit No. 8 (of Tehseel Ootrowlee). The above description is given by the Deputy Superintendent, who adds that the remainder of the provincial boundary of Oudh will be taken up during the ensuing cold season, 1870-71.

4. BOUNDARY BETWEEN OUDH AND NEPAL. - Regarding the remainder of the Oudh and Nepal frontier boundary (referred to in para. 19 of the last Survey Annual Report) extending from

* *Idé* No. 831P, dated 20th May 1870, from Officiating Secretary to Government of India, Foreign Department, to the Chief Commissioner of Oudh.

Bhugoura Tal on the west to the Arrah nuddee on the east up to the confines of District Bustee of the North-Western Provinces, it has been decided by the Viceroy and Governor General* in Council that the water-shed of the Dhoondwa range of hills is the boundary, as declared in the closing words of Government letter No. 2534, dated 9th July 1860, to the Resident at Nepal, "which contained final orders on the report of the Oudh—Nepal Boundary Commissioners of 1859-60." Para. 25 of this letter states:— * * * "If the question should be raised, you will inform the Durbar distinctly, that as the Nepalese possessed no low lands to the eastward of Bhugoura Tal at the time of the cession in 1815, and all such lands were then in possession of the Oudh Government, none can be given now, and that the boundary between Nepal and British India to the east of Bhugoura must continue to be the range of hills as heretofore." The Deputy Superintendent of Survey has accordingly been directed to give effect to the orders of the Supreme Government in a manner which shall not only clearly define the territorial limits, but which shall also prevent any doubts or misgivings in future, as to which is the frontier boundary. Full authority is given by Government to the Officers of the Survey Department "to erect boundary pillars wherever, but only wherever, in their judgment such pillars are indispensable." Notice will be given to the Nepalese authorities as the demarcation proceeds from point to point or village to village, and if there be any serious or important point disputed, a reference will be made to Government for special instructions, as directed. The entire boundary on Nepal, however, does not run along the Dhoondwa hills. The frontier boundary maps, furnished by Major (then Lieutenant) Anderson in 1861, show a portion of the boundary, running in a north-easterly direction from Bhugoura Tal to a spur at the foot of the Dhoondwa range, as having already in (1859-60) been demarcated, surveyed and defined by masonry pillars. Major Anderson's point of departure in the ensuing season (1870-71) will therefore be the large conical pillar on the said spur, and not from Bhugoura Tal itself. The boundary to be defined along the water-shed of the Dhoondwa range will, after quitting the hills, pass down from them in a south-easterly direction to the Arrah nuddee, which then becomes the boundary, down to the village of Doomree of the Bustee District.

5. THAKBUST MAPS.—The Deputy Superintendent reports that the Thakbust Maps of villages in main circuit No. 6, Pergunnah Munkapoor, were indifferent, but the remainder were remarkably good.

6. DEMARCATIONS.—The demarcation was commenced in September 1869, but owing to the protracted rainy season a great number of the boundary pillars were washed away, and great delay would have occurred in the boundary survey of so large a number of villages, but for the energetic action of the Superintendent of Demarcation. Attention is drawn to the bad materials used in the construction of masonry platforms. The Deputy Superintendent remarks that the orders of the Oudh Government, directing the use of good and durable material, have been disregarded, and these valuable land marks are ill calculated to stand the wear and tear of time.

7. SETTLEMENT DETAIL SURVEY.—The settlement detail survey, during the season in review, was confined solely to main circuits 4 and 5 of Gonda surveyed in 1868-69. During the present season (1870-71) the Deputy Superintendent understands that arrangements have been made for a second Settlement Officer to bring up the detail survey of the portion of District Gonda, professionally surveyed during 1869-70; but it is hoped that the opportunity of prosecuting the professional and settlement detail surveys, simultaneously over the tract in hand during 1870-71, will not be neglected.

8. PROFESSIONAL DETAIL SURVEY.—The interior details were tested by 100 miles of Check Survey, run through the several main circuits by the Deputy Superintendent and his assistants. The Native Surveyors were also visited frequently by the assistants, while actually working in the field, and their boards checked by numerous lines of re-survey, “so that every portion of the work was thoroughly tested.” The Deputy Superintendent adds:—“The favorable comparison of the Check Surveys with the congregated village sheets bears the most convincing testimony to the carefulness and accuracy with which the interior detail survey has been executed.” The details of the few villages, which had been tested by a Native Surveyor, last season, as mentioned in para. 14 of the report for 1868-69, were again tested during this season by the Deputy Superintendent himself, and the accuracy of the detail survey placed beyond all doubt. The check lines were minutely examined by me with the original surveys on the occasion of my inspecting the Office, and I was well satisfied that the details have been thoroughly portrayed and closely checked.

9. SICKNESS.—Survey work was somewhat impeded by sickness. Cholera broke out early in February in the village of Ruttanpoor in Tehseel Ootrowlee, and gradually spread over other parts of the Tehseel, till it centred early in April in the crowds assembled at the Dehee Patun Fair, whence the people were dispersed by order of the Civil authorities, and the epidemic then extended generally over the district. The detail parties had to be shifted about from village to village to evade the plague, and thus much time was lost.

10. CONNECTION WITH GREAT TRIGONOMETRICAL SURVEY.—Eight tower stations* of the Great Trigonometrical Survey have been connected by traverse with the main circuits of the season, and the results of comparison with Great Trigonometrical Survey data are tabulated below:—

GREAT TRIGONOMETRICAL SURVEY STATIONS.				DIRECT DISTANCES IN FEET.		Total Difference.	Error per mile in feet.
				By Revenue Survey.	By Great Trigonometrical Survey.		
Tekeria	to Subanjot	...	...	59805.9	59829.8	— 23.9	— 2.1
Do.	to Kopa	...	...	58582.9	58614.8	— 31.9	— 2.9
Kopa	to Subanjot	...	...	61768.7	61797.5	— 28.8	— 2.4
Do.	to Manapara	...	...	53495.6	53531.6	— 36.0	— 3.5
Do.	to Gurunagar	...	...	67570.1	67613.9	— 43.8	— 3.4
Manapara	to Subanjot	...	...	65722.8	65746.7	— 23.9	— 1.9
Do.	to Gurunagar	...	...	65182.3	65261.1	— 78.8	— 6.4
Do.	to Bansidila	...	...	66999.2	67010.4	— 11.2	— 0.9
Bansidila	to Gurunagar	...	...	58619.2	58676.6	— 57.4	— 5.2
Do.	to Saibarra	...	...	63501.2	63550.8	— 49.6	— 4.1
Do.	to Lohapania	...	...	57263.6	57254.1	+ 9.5	+ 0.9
Do.	to Majhawa	...	...	68572.0	68578.8	— 6.8	— 0.5
Saibarra	to Gurunagar	...	...	59301.7	59312.4	— 10.7	— 0.9
Do.	to Lohapania	...	...	64033.2	64040.0	— 6.8	— 0.5
Do.	to Manichaok	...	...	59613.8	59555.7	+ 58.1	+ 5.1
Manichaok	to Lohapania	...	...	57604.8	57624.9	— 20.1	— 1.8

Average where the error is ... $\left\{ \begin{array}{l} + \\ - \end{array} \right.$ 3.1
2.6

11. LEVELING.—The leveling party attached to this survey commenced work at the end of November 1869 from the Great Trigonometrical Survey bench marks on the Grand Trunk Road between Cawnpoor and Futtehpoor. The out-turn comprises eleven series entirely completed, with portions of three series lying north of the metalled road between Seetapoor and Shahjehanpoor. These eleven complete, and three half, series aggregating 1,626½ miles, traverse Districts Barabunkee, Roy Bareilly, Oonao, Lucknow, Seetapoor, and portions of Hurdui and Kheree. Connection has been made with fourteen Great Trigonometrical Survey bench marks, nineteen Great Trigonometrical Survey tower stations, and nine Oudh Irrigation bench marks. Eighty-three Revenue Survey stone bench marks have been laid down along the several series, prismoidal in shape, being 2.25 feet in length, and 12" × 12" × 16.1"; 5.49 tri-junction platforms, and 153 other permanent masonry points have been taken up. Full details connected with the leveling operations will be found in the Appendix. They have been most carefully and systematically supervised by Major Anderson, the Deputy Superintendent of Survey; and when it is borne in mind that the work is first class, and that it has been rigidly checked by sectional levels, the rates are trifling, being Rs. 5-1-5 only per running mile, including all charges for establishment and for contingent expenses in the purchase, carriage and fixing of the bench marks,—a result very creditable to the Deputy Superintendent's able management, whose Office I found, during my recent inspection tour, in

a very satisfactory state of efficiency. The rates, too, would seem to be only about one-third of what similar work can be turned out for by the Public Works Department, as given in 30th para. of the Appendix.

12. There now remain only seven short series, aggregating 520 running miles, to complete the programme proposed for the Revenue Survey by the Superintendent of Irrigation in Oudh. This section, extending from the Oudh and Shahjehanpoor boundary to the Sohelee or Sarjoo nuddee, the Deputy Superintendent hopes to complete by the middle of January 1871, after which levels will be run according to instructions to be received from the Oudh Irrigation Department; or failing such, the party will be employed in leveling along the left bank of the river Ghogra in District Gonda.

13. PERSONNEL.—The Deputy Superintendent reports very favourably of all his European assistants.

14. PROGRAMME FOR 1870-71.—The area remaining to complete District Gonda, and with it the Province of Oudh, is estimated at between 900 and 1,000 square miles, which being under the average out-turn of this division, will, it is expected, be completed during 1870-71. This area is inclusive of a small area estimated at 122 square miles in Pergunnah Toolseepoor, noticed in para. 38 of the Survey Annual Report for 1867-68 as having been transferred from District Gonda to District Baraitch.

D. C. VANRENEN, *Col., R. A.,*
Supdt. of Revenue Surveys,
Upper Circle.

SUPDT. OF REVENUE SURVEYS' OFFICE,)

UPPER CIRCLE;)

Calcutta, 30th November 1870.)

APPENDIX.

Extract from Annual Report on the Revenue Survey Operations, Season 1869-70, by MAJOR F. C. ANDERSON, Depy. Supdt., Revenue Survey, 1st Division, Oudh.

LEVELING.

16. The last series run in 1868-69 was No. XXI $\frac{1}{2}$.

Starting from the Great Trigonometrical bench mark at Mow on the Great Trunk Road, 10 miles south of the Civil Station of Futtehpoor, and near the Berhampoor Railway Station, Hurgoo Lall crossed the river Ganges and laying down his first Revenue Survey stone bench mark No. 37 at Khodacepoor, struck off at right angles to his Series XX $\frac{1}{2}$ about 8 miles further up, from the tri-junction of villages Sydunpoor, Bela Bhela and Khageepoor Sundwa, whence he ran his first cross section of 9 $\frac{1}{2}$ miles, and closed his first parallelogram at Jumowree on Series XXI $\frac{1}{2}$, leveled by Mr. Swiney in 1868-69.

The value of this point was calculated last year (without corrections for the adjusted Great Trigonometrical heights between Lucknow and Fyzabad) to be	...	...	...	=	345-8577	feet above sea.
And by Hurgoo Lall's levels brought up from the Great Trigonometrical bench marks at Mow along Series No. XX $\frac{1}{2}$, it was found to be	...	...	...	=	346-2540	" "
Showing a correction applicable on his first parallelogram (73 miles in circuit)	...	...	...	=	-3963	" "

The second parallelogram of the series was started from the tri-junction of Bela Bhela, Sydunpoor and Khageepoor Sundwa; from which point Hurgoo Lall proceeded northwards along Series XX $\frac{1}{2}$, laid down the Revenue Survey stone bench marks Nos. 38, 39, and 40 at the tri-junctions of the villages noted on the map, and striking off at right angles, drove across section of 9 $\frac{1}{2}$ miles to the Revenue Survey stone bench mark at Sindirooa on Series XXI $\frac{1}{2}$ of season 1868-69, of which the value above sea-level had been computed in the preceding year to be (without corrections for the adjusted values of Great Trigonometrical levels between Lucknow and Fyzabad) = 351-0119 feet. While by Hurgoo Lall's Field Book of Series No. XX $\frac{1}{2}$ it stood = 351-3150 "

Making a correction to be applied to the 2nd parallelogram 80 miles in circuit = -3031 "

Starting from the Revenue Survey stone bench mark No. 40, Hurgoo Lall proceeded further northwards, laying down the Revenue Survey stone bench mark 41 at the tri-junction of Belpoor, Russoolpoor, and Suroha; and connecting with the Oudh Irrigation bench mark at Koondra, he closed on the Great Trigonometrical bench mark of Soonace, on the metalled road between Lucknow and Fyzabad. He then went back and continued his Series No. XX $\frac{1}{2}$ to the Revenue Survey stone bench mark No. 42, on the Ghogra, which had been laid down by Mr. Swiney. This completed the first series of the season's work.

17. In like manner Mr. Murphy, starting from the Great Trigonometrical bench mark at Futtehpoor on the Grand Trunk Road, leveled along Series No. XIX $\frac{1}{2}$ and laying down five Revenue Survey stone bench marks took up the Great Trigonometrical bench mark at Sonace, on which Series No. XX $\frac{1}{2}$ had already been connected, and forming three parallelograms, closed in each case on Hurgoo Lall's Series XX $\frac{1}{2}$ which lay on his east.

18. Mr. Swiney commencing his Series XVIII $\frac{1}{2}$ from the Great Trigonometrical bench mark at the Mulwa Railway Station, crossed the Ganges, and laying down six Revenue Survey stone bench marks he closed his four parallelograms on Mr. Murphy's Series No. XIX $\frac{1}{2}$.

19. These three first series having been thus completed, four downward series from the Ghogra to the Ganges were taken up. No. XVII $\frac{1}{2}$ by Hurgoo Lall, No. XVI $\frac{1}{2}$ by Mr. G. Campbell, who, having by this time had sufficient practice with his instrument, was considered quite equal to the task of working independently along one of the series, No. XV $\frac{1}{2}$ by Mr. Swiney and No. XIV $\frac{1}{2}$ by Mr. Murphy. These four downward series were closed on the Great Trigonometrical Survey bench marks of Aong, Maharajpoor and Cawnpoor on the Grand Trunk Road between Cawnpoor and Allahabad.

20. At Cawnpoor, the adjusted height of the Great Trigonometrical bench mark was taken as the datum above sea-level for all the series lying west of Series No. XIV $\frac{1}{2}$. Mr. Swiney, starting from this point, drove his level along the Grand Trunk Road to Futtehgurh for about 55 miles, and laid down five Revenue Survey stone bench marks on the right bank of the Ganges, from which four series were run across the Doab to the Ghogra, No. XIII $\frac{1}{2}$ by Hurgoo Lall, No. XII $\frac{1}{2}$ by Mr. George Campbell, No. XI $\frac{1}{2}$ by himself and X $\frac{1}{2}$ by Mr. Murphy. A connection was effected with the Great Trigonometrical bench mark at Rudhuiparao near Buxee-ka-talao, at Atariaparao and at Jelalpurparao, all situated along the metalled road between Lucknow and Seetapoor. Portions of three other Series numbered IX $\frac{1}{2}$, VIII $\frac{1}{2}$, and VII $\frac{1}{2}$, completed the leveling operations of the season, two of which connected the metalled road between Seetapore and Shahjehanpoor with the river Ghogra, and were referred to the Great Trigonometrical bench mark of Guddee-ka-porewa near Doctor Carter's grant in District Seetapore.

21. ABSTRACT OF FIELD WORK.—Eleven series numbered from X $\frac{1}{2}$ to XX $\frac{1}{2}$, both inclusive, have been entirely completed during the season under review, with portions of three other series numbered VII $\frac{1}{2}$ to IX $\frac{1}{2}$ lying north of the metalled road between Seetapore and Shahjehanpoor.

Fourteen Great Trigonometrical Survey bench marks have been taken up, of which two, being situated east of Lucknow where the Great Trigonometrical heights have not been published, cannot be compared with the Revenue Survey results.

Nineteen Great Trigonometrical tower stations have been connected.

Nine Oudh Irrigation bench marks have been connected after a satisfactory identification.

Eighty-three Revenue Survey stone bench marks have been laid down along the several series, prismatic in shape, being 2.25 feet in length and 12" × 12" × 16.1".

Five hundred forty-nine tri-junctional platforms and 153 other permanent masonry points including temples, mosques, &c., have been taken.

22. CORRECTIONS APPLIED FOR DIFFERENCE BETWEEN REVENUE SURVEY AND GREAT TRIGONOMETRICAL RESULTS.—As the Great Trigonometrical Survey values east of Lucknow have not been furnished, the work can be finally completed, only along Series Nos. XV $\frac{1}{2}$, XIV $\frac{1}{2}$, XIII $\frac{1}{2}$, XII $\frac{1}{2}$, XI $\frac{1}{2}$, and X $\frac{1}{2}$, with portions of Nos. IX $\frac{1}{2}$, VIII $\frac{1}{2}$, and VII $\frac{1}{2}$, and it will not be necessary to allude further to the five series lying east of Lucknow numbered from XVI $\frac{1}{2}$ to XX $\frac{1}{2}$, both inclusive. With the Great Trigonometrical corrected value of the Great Trigonometrical bench mark at Cawnpoor for origin, the Revenue Survey levels taken for 55 miles along the Grand Trunk Road to Futtehghurh, then across the Ganges, and for 65 miles along Series No. X $\frac{1}{2}$ to Jelalpurparao, have been compared with the value of the Great Trigonometrical Survey bench mark at Jelalpur, with the following results:—

Value of the Great Trigonometrical bench mark at Cawnpoor on the Ganges Canal, extracted from the book of published Great Trigonometrical heights above sea =	407.75 feet.
Revenue Survey values extracted from Mr. Swiney's field books of levels run along the Grand Trunk Road between Cawnpoor and Futtehghurh for 55 miles and then along series No. X $\frac{1}{2}$ to Jelalpurparao 65 miles	... .. = + 25.855 "
Revenue Survey value of Great Trigonometrical bench mark at Jelalpur from Cawnpoor Great Trigonometrical bench mark as origin	= 433.605 "
Great Trigonometrical value of Great Trigonometrical bench mark at Jelalpur near Seetapoor extracted from the book of published Great Trigonometrical heights =	433.440 "
Difference between Revenue Survey and Great Trigonometrical levels compared at Jelalpur	... .. = 0.165 "

23. It will be observed that the Revenue Survey and Great Trigonometrical Survey results in a circuit of 208 miles, of which 120 miles have been leveled by the former along the right bank of the river Ganges, and 88 miles by the latter along the metalled road from Seetapoor to Cawnpoor *via* Lucknow, shows a difference of feet 0.165. Accepting the Great Trigonometrical data as correct, this error or difference has been dispersed along the 120 miles leveled by the Revenue Survey, proportionately to the distance traversed; thus, as miles 120: 0.165 feet :: distance between back and forward staves: correction applied to each observation. This correction + or - has been noted in red in column headed "Mean rise and fall" in the field book, and has been carried forward into the column of reduced levels of each station, so as to make the results of the Revenue Survey observations accord with those of the Great Trigonometrical Survey.

24. Corrected data referable to the Great Trigonometrical heights above sea having thus been determined between Cawnpoor and Futtehghurh for the origins of the five Series Nos. XIV $\frac{1}{2}$ to X $\frac{1}{2}$, the levels run along these series have been again compared with the Great Trigonometrical Survey bench marks at Rudhui, at Ataria and Jelalpur, the results of which are as follows:—

Value of Great Trigonometrical bench mark at Cawnpoor on the Ganges Canal taken from the book of published Great Trigonometrical heights	Feet above sea. = 407.75
Value of rise from Cawnpoor of the Revenue Survey stone bench mark No. 73 at Kuliaupoor on Grand Trunk Road between Cawnpoor and Futtehghurh taken from Mr. Swiney's field book, and corrected for Jelalpur Great Trigonometrical bench mark	... .. + 8.170
Value of fall of Great Trigonometrical Survey bench mark at Rudhui-parao, from Revenue Survey stone bench mark No. 73 taken from Mr. Murphy's field book of Series No. XIV $\frac{1}{2}$	... .. = - 13.354
Revenue Survey value of Rudhui Great Trigonometrical bench mark from Cawnpoor along Series No. XIV $\frac{1}{2}$	... .. = 402.566
Great Trigonometrical Survey value of Rudhui Great Trigonometrical bench mark extracted from book of published Great Trigonometrical heights	... .. = 402.15
Difference or Revenue Survey error dispersed over 55 miles of southern position of Series No. XIV $\frac{1}{2}$	... .. = 0.416

Similarly the difference or error on the northern portion of Series No. XIV $\frac{1}{2}$, amounting to feet 0.0123, has been dispersed over 38 miles of this series, the argument being the distance in chains between the metalled road from Lucknow to Seetapoor and the river Ghogra, where the series terminates.

Value of G. T. B. M. at Cawnpoor taken from the book of published G. T. heights above sea	... .. = 407.75
Value of rise from Cawnpoor, origin of Sheorajpoor on Grand Trunk Road, to Futtehghurh, taken from Mr. Swiney's field book and adjusted to G. T. B. M. at Jelalpurparao	... .. = + 20.4759
Value of fall of G. T. Survey, B. M. at Rudhuiparao from Sheorajpoor along Series XIII $\frac{1}{2}$ taken from Hurgoo Lall's field book	... .. = - 26.0130
Revenue Survey value of Rudhuiparao G. T. B. M., brought up from Cawnpoor along Series No. XIII $\frac{1}{2}$	... .. = 402.2129
G. T. value of Rudhuiparao G. T. B. M., extracted from book of published G. T. heights	... .. = 402.1500
Difference or Revenue Survey error dispersed over fifty-four miles of the southern portion of Series No. XIII $\frac{1}{2}$	... .. = 0.0629

Similarly an error of + 0.0519 feet on the northern portion of Series No. XIII $\frac{1}{2}$ was dispersed over thirty-six miles, the argument being the distance in chains from Rudhuiparao G. T. B. M. to the river Ghogra.

Value of G. T. B. M. at Cawnpoor taken from the book of published G. T. heights above sea	Feet.	
Value of rise from Cawnpoor, origin of Bilhour on Grand Trunk Road to Futtehgurh, taken from Mr. Swiney's field book and adjusted to Jelalpur G. T. B. M.		= +29.7443
Value of fall between Bilhour and G. T. Survey B. M. at Ataria, taken from Mr. Campbell's field book of Series (southern portion) No. XII $\frac{1}{2}$		= -19.2400
		<u>+ 10.5043</u>
Revenue Survey value of G. T. Survey B. M. at Ataria, brought up from Cawnpoor along Series XII $\frac{1}{2}$		= 418.2543
G. T. Survey value of G. T. B. M. at Ataria, extracted from book of published G. T. heights		= 418.490
Difference or Revenue Survey error dispersed over fifty-seven miles of southern portion of Series No. XII $\frac{1}{2}$		= 0.2357
The error on the northern portion of this series was 0.1273 feet, dispersed over thirty-two miles.		
Value of G. T. B. M. at Cawnpoor, taken from book of published G. T. heights above sea		= 407.750
Value of rise from Cawnpoor origin of R. S. Stone, B. M. No. 100 at Urowl on G. T. Road to Futtehgurh, taken from Mr. Swiney's field book and adjusted to Jelalpur G. T. B. M.		+ 37.3192
Value of fall between Urowl and G. T. Survey B. M. at Jelalpur, taken from Mr. Swiney's field books of southern portion of Series No. XI $\frac{1}{2}$		= -11.8845
		<u>+ 25.4347</u>
Revenue Survey value of G. T. B. M. at Jelalpur, brought up from Cawnpoor along Series No. XI $\frac{1}{2}$		= 433.1847
G. T. Survey value of G. T. B. M. at Jelalpur, extracted from book of published heights above sea		= 433.440
Difference or Revenue Survey error dispersed over 62 miles of southern portion of Series No. XI $\frac{1}{2}$		= 0.2553

The error on the northern portion was 0.0495 feet, which has been dispersed over 32 miles of this series.

25. In like manner the portions of the three Series Nos. IX $\frac{1}{2}$, VIII $\frac{1}{2}$ and VII $\frac{1}{2}$, lying north of the metalled road between Seetapoor and Shahjehanpur, with the G. T. value of the Jelalpur G. T. B. M. for origin have been referred to the G. T. B. M. at Guddi-ka-poorwa, and the difference between Revenue Survey and G. T. results amounting to 0.4286 feet, has been distributed over 150 miles of these three series.

26. The average error applied to 684 miles along the nine series of the Revenue Survey leveling operations, of which the records have been completed is 0.0027 feet per running mile.

27. ERROR IN LEVELING STAFF HOW ADJUSTED.—One of the staves supplied last year from the Roorkee workshops was found to be considerably bent, making it nearly one-seventh of an inch shorter than the others. This staff was used by Mr. Swiney himself, and the error of reading has been adjusted as follows:—

Three reliable staves were set up on the same pin one after another, and the readings, 6 inches apart from zero upwards were recorded, the means of which were compared with the readings on the shorter staff at the same distances apart up the scale and on the same pin. The differences were called the "error of the staff" and have been applied to the heights recorded in the field book, thus:—

Error at 6 feet	= .002	These corrections have been noted in blue in the field book, above the observed height of the bent staff.
Error at 6.5 "	...	...	= .003
Error at 7 "	...	...	= .006 and so on.

At all the readings of the curved staff, recorded between 5.75 feet and 6.25 feet, the correction of .002 has been deducted, between 6.25 and 6.75, the deduction applied has been .003 and between 6.75 and 7.25, .006, for example—

Reading recorded in field book of curved staff	...	...	= 5.922 feet.
Correction in blue	...	...	= -0.002 "
Corrected reading	...	...	= 5.920 "

Reading recorded in field book of curved staff	...	...	= 7.015 feet.
Correction shown in blue in field book	..	..	= -0.006 "
Corrected reading	...	...	= 7.009 "

28. RECESS WORK AND MAPS COMPLETED.—The Recess Office of the Leveling Establishment, opened at Nynce Tal on the 14th May, since which date the following records have been completed :—

For Oudh Irrigation Department.

1. Twenty sheets of the Oudh Revenue Survey 1 mile = 1 inch maps on which have been plotted in blue, every alternate Level Station of all the fourteen series and cross sections; and in lake, each Revenue Survey stone bench mark, village tri-junctional platform, G. T. Station, culvert, mosque, &c., &c., to which observations have been made. The stations have all been lettered and connected with lines of blue.
2. Three hundred and nineteen sheets of vertical sections of the fourteen series, numbered from XX $\frac{1}{2}$ to VII $\frac{1}{2}$, both inclusive, on scale, horizontal 6 inches = 1 mile, and vertical 8·8 feet = 1 inch.
3. A table of heights showing every permanent object to which observations have been made, excluding only the common level pegs and level stations, with a careful description of each, extracted from the field book.

For Revenue Survey Department.

1. CALCUTTA OFFICE.—One sheet of the "Index to sheet maps of the Province of Oudh" on scale 16 miles to the inch.
2. One sheet of vertical sections on scale, horizontal 6 inches = 1 mile, and vertical 1 inch = 8·8 feet, as a sample of the 319 sheets supplied to the Irrigation Department.
3. The original field books of the several series and cross sections.
4. Returns of work performed by each leveler during the field and recess seasons.
1. REVENUE SURVEYOR'S OFFICE.—Three degree sheets of Oudh, scale 4 miles to the inch, on which all the 14 series and their cross sections have been pentagraphed from the 1 mile = 1 inch map supplied to the Irrigation Department. These degree sheets show the series and cross sections in blue, and the Revenue Survey bench marks, tri-junctional platforms, G. T. tower stations, culverts, wells and other permanent objects in red.
2. Duplicate of table of heights, described as No. 3, furnished to the Irrigation Department.

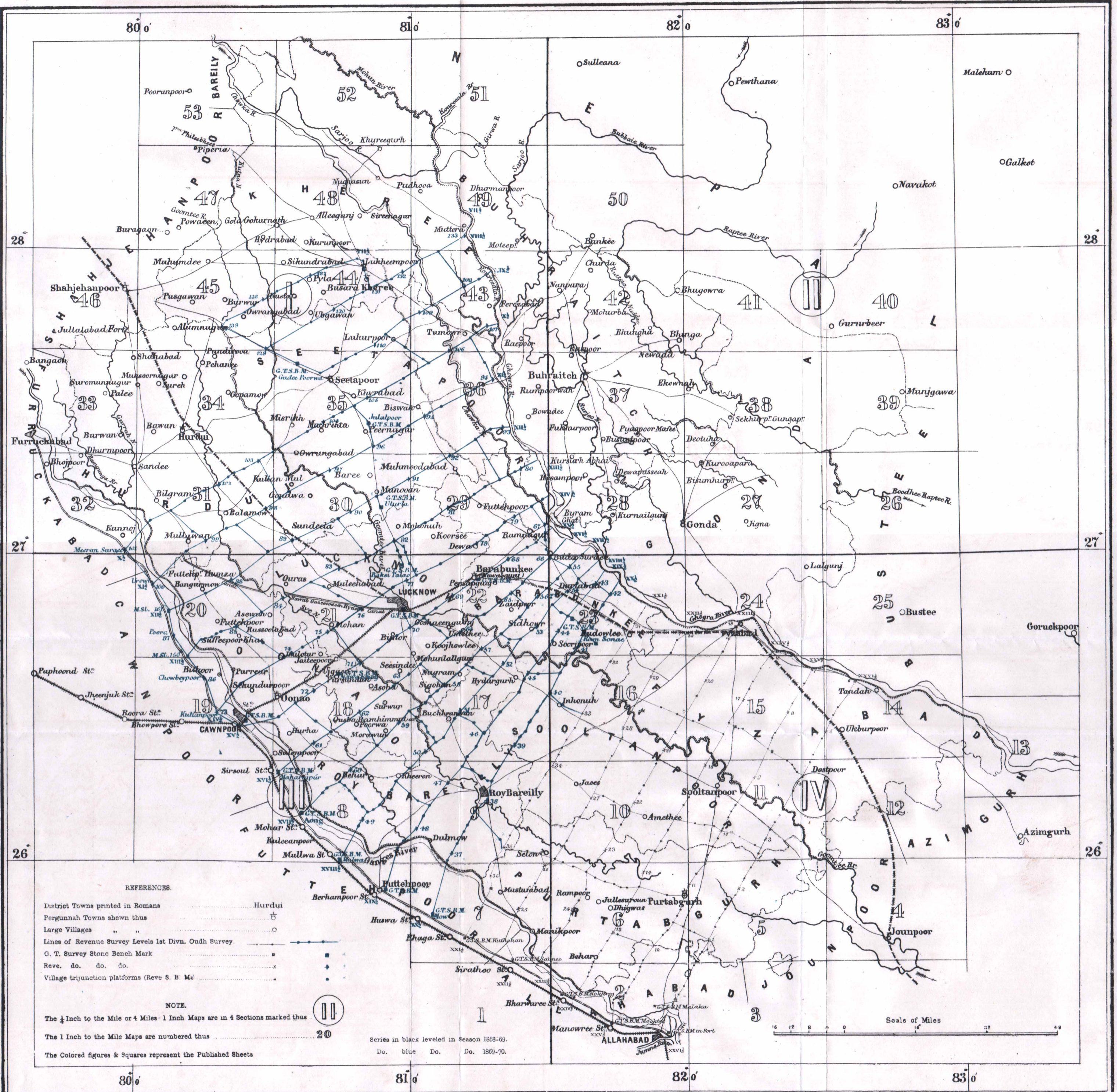
29. COST AND RATE PER MILE.—The cost of the Leveling Establishment, during the season under review, has been Rs. 5,949-8, adding to which the sums expended for contingent charges, including travelling allowances and the purchase, carriage and embedding of 83 Revenue Survey stone bench marks, aggregating Rs. 2,331-9-1, raises the total cost to Rs. 8,281-1-1. The total number of miles leveled over is 1626·5 miles, and the rate therefore for running mile is Rs. 5-1-5.

33. For the Leveling Party there remain only seven short series to complete programme laid down for the Revenue Survey Establishment by the Superintendent of Irrigation in Oudh. These extend from the Oudh and Shahjehanpore boundary to the Sohelee or Sargoo, and aggregate about 520 running miles, including cross sections. The leveling operations will be commenced by about the 20th November 1870, and should, making all due allowance for the heavy line cutting in the north-west or forest portion of District Kheree, be completed by the middle of January. After that, levels will be run according to the instructions received from the Oudh Irrigation Department, or failing such, they will be employed in leveling on the left bank of the Ghogra in District Gonda.

INDEX MAP SHEWING THE WORK PERFORMED IN OUDH

BY THE LEVELING PARTY

in seasons 1863-69 & 1869-70, the former in black & the latter in blue.



REFERENCES.

- District Towns printed in Romans Hurdul
- Pergunnah Towns shewn thus ⚭
- Large Villages ○
- Lines of Revenue Survey Levels 1st Divn. Oudh Survey ———
- G. T. Survey Stone Bench Mark ■
- Reve. do. do. do. ×
- Village trijunction platforms (Reve S. B. M.) ◆

NOTE.

- The 1/4 Inch to the Mile or 4 Miles - 1 Inch Maps are in 4 Sections marked thus
- The 1 Inch to the Mile Maps are numbered thus
- The Colored figures & Squares represent the Published Sheets

Series in black leveled in Season 1863-69.
Do. blue Do. Do. 1869-70.

REPORT

ON THE

Revenue Survey Operations

OF THE
NORTH-WEST PROVINCES,

For Season 1869-70.

1ST DIVISION.

DISTRICT BIJNOUR.

1. **OUT-TURN OF WORK.**—The survey of District Bijnoor was resumed early in November 1869, and field work extended to the end of May 1870, resulting in an out-turn of 980 square miles in Bijnoor, and 40 square miles in District Baraich. This small area of 40 square miles had been in abeyance for two seasons, owing to the demarcation of villages contiguous to the forest reserves in Pergunnah Bhingra of Baraich not having been completed in time, as alluded to in paragraph 5 of the Annual Report for 1868-69.

Major A. D. Vanrenen, Deputy Superintendent, 2nd grade.
Assistants.
 Lieutenant A. F. Cumberlege, Assistant Superintendent, 2nd grade, died on the 21st March 1870.
 Mr. W. H. Patterson, Surveyor, 2nd grade.
 " W. Sinclair, Surveyor, 3rd grade, transferred from 6th Division, Lower Provinces, 6th July 1870.
 " H. Wray, Assistant Surveyor, 2nd grade.
 " T. Patterson, Assistant Surveyor, 3rd grade, on leave to Europe for 12 months, without pay, from 15th July 1870.
 " S. O. Madras, Assistant Surveyor, 4th grade.
 " J. W. Lincoln, Assistant Surveyor, 4th grade.
 34 Sub-Surveyors, &c., &c.

Leveling Party.
 Mr. W. Bourne, Assistant Surveyor, 3rd grade, and Leveler, resigned 27th May 1870.
 " H. T. Hanby, Assistant Surveyor, 2nd grade, and Leveler, transferred from 1st Division, Oudh, joined 18th May 1870.
 2 Native Levelers.

2. **DISTRIBUTION OF AREA.**—The area surveyed in District Bijnoor is thus distributed:—

		Sqre. Miles.
MAIN CIRCUIT No. 5	... { Pergunnah Nugeena ... } " Akberabad ... }	505 Traverse Circuits ... } 188.38
		477 Villages ... }
MAIN CIRCUIT No. 6	... { " Bijnoor ... } " Mundawur ... }	573 Traverse Circuits ... } 282.08
		528 Villages ... }
MAIN CIRCUIT No. 7	... { " Burrapoora ... } " Nujeeabad ... }	149 Traverse Circuits ... } 203.76
		109 Villages ... }
MAIN CIRCUIT No. 8	... { " Nujeeabad ... } " " " " ... }	6 Grants ... }
		134 Traverse Circuits ... }
	River Ganges, overlap on right bank ...	102 Villages ... } 238.53
		3 Grants ... }
		6 Traverse Circuits ... } 67.24
	TOTAL ...	{ 1367 Traverse Circuits ... } { 1216 Villages ... } { 9 Grants ... }
	Add gap surveyed in Pergunnah Bhingra of District Baraich ...	40.00
	GRAND TOTAL SURVEYED	1,019.99

3. **POSITION AND LIMITS.**—The tract surveyed in District Bijnoor lies between parallels North Latitude 29°-20'
 29-58

and Meridians East Longitude 78°-01'
 78-42

being limited south-east by the area surveyed in 1868-69; north-east by Gurhwal and Dehra Doon; west by Districts Saharanpoor and Mozuffernuggur.

4. **SMALL AREA REMAINING IN BIJNOUR.**—The survey of District Bijnour is now completed with the exception of a small area of 30 square miles, which remains among the hills of the Chandee Illaka, at the northern apex of the district. The failure of water in this direction compelled the withdrawal of the survey parties, but as the drainage has already been mapped, the rest can easily be filled in by a small party which will be detached in the spring of the present season. The final area of the district will not therefore be returned in this report.

5. **SYMMETRY OF PERGUNNAHS.**—As noticed in the last report, the pergunnahs were found to be compact and symmetrical, which will tend to prevent future transfers of villages and re-adjustment of areas among pergunnahs. "If any changes of boundaries have to be made," says the Surveyor, "it will be probably owing to streams which were at one time the common boundary, having deviated from their course, thus placing villages which were situated on the near bank, to the further, and *vice versa*."

6. **CONNECTION WITH GREAT TRIGONOMETRICAL SURVEY.**—The Revenue Survey was connected by traverse with three principal stations of the Budhon Meridional series, of which Mahesari and Chandiapahar fall within the work, and Harpalsid just out of the boundary, in Gurhwal. The subjoined table of comparative distances furnished by the Surveyor, also shews the connection with the Great Trigonometrical Survey Stations of Huldour and Sarkara, which were taken up by him in 1868-69. The result is very satisfactory.

GREAT TRIGONOMETRICAL SURVEY STATIONS.	DISTANCES IN FEET.		Error of Revenue Survey.	Error per mile in feet.
	By Great Trigonometrical Survey.	By Revenue Survey.		
Mahesari to Huldour	91031.52	91049.31	17.79	+1.03
Mahesari to Harpalsid	142018.46	142067.24	48.78	+1.81
Harpalsid to Huldour	167536.16	167639.19	103.03	+3.21
Mahesari to Chandiapahar	153172.40	153195.51	23.11	+0.79
Sarkara to Harpalsid	145956.36	146062.26	105.90	+3.83
Average error ... ..	...	...	...	+2.25

7. **FAILURE IN CONNECTING WITH KUMAON AND GURHWAL SURVEY.**—An attempt was made to connect on the triangles of the Kumaon and Gurhwal Topographical Survey, some of whose minor stations were some years ago fixed in the Bijnour Terai, but the Deputy Superintendent reports that, owing to the lapse of time, all traces of these stations had disappeared.

8. **DETAIL SURVEY.**—The interior survey which was on the full scale of 4 inches = 1 mile, was precisely of the same character as described in paragraph 8 of the report for 1868-69. The detail Surveyors were constantly visited in the field by the Deputy Superintendent and his Assistants, who, besides inspecting the work and seeing that instructions were rigorously adhered to, ran 147 miles of check survey, so directed as to pass through the work of every detail Surveyor.

9. **VILLAGE BOUNDARY PILLARS.**—The village boundary pillars and tri-junction platforms were all up and in good order, but, as remarked last year, the platforms are not likely to last long, owing to the bad quality of the masonry.

10. **SETTLEMENT SURVEY.**—The settlement detail survey having preceded the professional, as stated in paragraph 8 of last report, no comparison could be instituted in the field; but the Deputy Superintendent promises to furnish, if possible, the result of comparison of village areas by the two surveys, which will be reported on (if received in time) in the next report, when submitting the final area of the district. The boundaries of villages were compared in the field with the settlement maps, and passed as correct.

11. **PRINCIPAL TOWNS.**—The following large towns were surveyed on the large scale of 8 inches = 1 mile:—

Chandpoor	...	} In District Bijnour.
Dhampur	...	
Nugeena	...	
Bijnour	...	
Nujeebabad	...	
Hurdwar	...	} In District Saharunpoor.
Kunkul	...	

12. **DIFFICULTIES.**—The chief difficulties experienced were presented by the nature of the ground, especially in the Pergunnah of Burrapoor, the greater part of which is situated in the Terai, is almost uninhabited, intersected with deep ravines, and covered with dense jungle. Burrapoor forms the Jagheer of the Rajah of Kasheepoor who rendered prompt and effectual assistance in supplying coolies to clear survey lines. The Deputy Superintendent describes the Chandee Illaka and the eastern portion of the Nujeebabad Pergunnah as similar to Burrapoor.

13. **PERSONNEL.**—This party has sustained a severe loss in the death of Lieutenant A. F. Cumberlege, Assistant Superintendent, who fell ill whilst surveying in the Terai, and soon after his return to camp in Bijnour, died of abscess in the liver. The Deputy Superintendent remarks:—"He was devoted to the profession he had chosen, was an excellent draftsman and energetic officer, and his untimely death I much deplore, it quite cast a gloom on the party as we were terminating our field labors." The Deputy Superintendent reports very favorably on the qualifications and merits of his assistants, especially Mr. W. H. Patterson, Revenue Surveyor, and Messrs. Wray and Hanby, Assistant Surveyors.

14. **LEVELS.**—Spirit leveling operations initiated last season, were, during 1869-70, brought to a successful issue. The number of miles leveled over was 692, of which 651 were main lines, and 41 branch lines. The number of bench marks was 656 and the number of stations 5,593. The whole has been effected at the small cost of Rs. 4,185-9, including contingent charges, or at Rs. 6-7-8 per running mile, which is very satisfactory indeed, and very creditable to the parties employed. The levels were generally run along the main roads which intersect the district. A detailed report on the leveling in Bijnour has been furnished by the Deputy Superintendent, and is printed in the Appendix.

15. **PROGRAMME FOR 1870-71.**—**DISTRICT MORADABAD.**—During the present season, 1870-71, this division will work in District Moradabad, the survey of which has been sanctioned by the Lieutenant-Governor, whose memorandum, dated 20th October 1870 on the subject, was forwarded to this office with the Junior Secretary's docket No. , dated 23rd October 1870. The Collector of Moradabad has furnished the Deputy Superintendent with the following information regarding the district. "It is divided into six Tehseelees,—there being no other sub-divisions, such as Pergunnahs," viz.,—

	TEHSEELEES.			No. of contained Villages.
Moradabad	327
Billaree	531
Sumbhul	451
Amroha	608
Hussunpoor	648
Thakoordwara	282
			TOTAL	2,847

the area of which is estimated at 2,273 square miles. The Moradabad Tehseelee is pronounced ready for survey; Billaree was to have been ready by the 30th November 1870, and Sumbhul by the end of January 1871. The approximate area of these three Tehseelees is 1,100 square miles, which will give ample employment for the season.

16. But if it be of importance to utilise the labors of the professional survey *in extenso*, then undoubtedly the two operations of the professional and Khusreh measurements should proceed simultaneously. Unless this is done, during one and the same season, there can be no efficient check on the proceedings of the Khusreh, or native measurements. The Khusreh measurements in the Moradabad District, which had been commenced last season, and a fair beginning made, have been, I understand, stopped by the Revenue Board, North-Western Provinces, the establishments being moved elsewhere, where the professional survey is not being conducted, a proceeding, which, for the real interests of Government, is greatly to be regretted.

ROHILCUND DIVISION.

DISTRICT BAREILLY.

17. LOCALITY OF SURVEY.—Early in October 1869, this party resumed the survey of District

Mr. J. Campbell, Assistant Superintendent, 1st grade.

Assistants.

Mr. J. H. O'Donel Jr., Assistant Surveyor, 2nd grade.

„ B. Anderson, Probationary Surveyor, 4th grade, transferred to 1st Division, Oudh, 1st August 1870.

„ G. L. R. Scott, Probationary Surveyor, 4th grade.

„ E. J. Martin, ditto ditto ditto, promoted from Office Assistant, 1st August 1870.

„ W. D. Corbett, Probationary Surveyor, 4th grade, promoted from Office Assistant, 1st August 1870.

19 Sub-Surveyors, &c.

Leveling Party.

Mr. J. S. Swiney, Probationary Surveyor, 4th grade, and Leveler.

1 Native Leveler.

18. SICKNESS.—The officer in charge so ordered his movements as to keep as clear as possible of the unhealthy tracts during the early part of the field season, but notwithstanding all his care, he reports that nearly a third of his establishment suffered from fever in the eastern portion of Pergunnah Beesulpoor and in the low swampy lands of Pergunnah Fureedpoor. The survey of the season completes Pergunnahs Beesulpoor, Aonla, and Suneha, but the southern portion of Pergunnah Fureedpoor lying between Districts Budaon and Shahjehanpoor still remains to complete this pergunnah.

19. TOTAL OUT-TURN OF WORK.—The total out-turn of the season comprises 406 square miles, and 565 villages in District Bareilly, besides 5 square miles of the Nynce Tal Cantonment Survey. The area is thus distributed :—

PERGUNNAHS.	NO. OF VILLAGES.	AREA IN SQUARE MILES.	REMARKS.
Beesulpoor	244	177.24	The remainder of Beesulpoor was surveyed in 1867-68, and the remainder of Suneha in 1868-69.
Fureedpoor	130	75.89	
Suneha	88	57.95	
Aonla	103	94.89	
District Bareilly	565	405.97	
Nynce Tal Cantonment ... ..	...	5.00	
TOTAL AREA ... ..	...	410.97	

20. DETAIL SURVEY.—The interior details, on the full scale, were of the same character as noticed in paragraph 20 of the report for 1868-69. Every topographical and geographical feature has been delineated. Cultivation, fallow, and lands lately thrown out of cultivation, have been surveyed and mapped together, under the head of cultivation.

21. CHECK SURVEY.—The interior survey was tested by a re-survey, 10 chains wide and 70 miles in length, carried through 98 villages out of 565, in addition to which check, the plane-tables were frequently visited in the field by the Assistant Superintendent and Assistant Surveyors.

22. CONNECTION WITH GREAT TRIGONOMETRICAL SURVEY.—Traverse connection was made with tower Station Gajnera of the Rangir Meridional series, the only one which fell within the season's operations. This station was also connected with the work of 1867-68 and 1868-69.

23. DEMARCATION.—The village tri-junctions were marked by masonry platforms which were, whenever possible, used as Theodolite Stations. The Assistant Superintendent reports that the platforms in Pergunnahs Aonla and Suneha “were in great part broken and dilapidated, they have been very ill-built and will not last long. The village boundaries were generally marked by little heaps of earth loosely thrown up.”

24. **SETTLEMENT BOUNDARY MAPS.**—The Thakbust Maps are described as correct, and drawn on the scale of 16 inches = 1 mile, or 4 times the survey scale. They were, with few exceptions, supplied in good time, and agreed fairly with the professional survey.

25. **SURVEY OF NYNÉE TAL.**—The elaborate and minute survey of Nynée Tal Cantonment and environs, including the civil station, on the large scale of 20 inches to the mile, now nearly completed, has heavily taxed the resources of this small party. The plan is on the scale of survey and consists of 6 large sheets measuring 40 × 28 inches.

26. About the end of April last the Assistant Superintendent detached a small party from the field to resume the survey of Nynée Tal, but he states it was impossible to continue work in the valleys after the end of June, owing to the clouds. Hill sketching was resumed after the rains, and the Surveyor hopes to submit the Nynée Tal maps complete at the end of this season, 1870-71. During my inspection of this office in October, the surveys of Nynée Tal and its environs were shewn to me. They are very minute, and the maps which have been prepared by Mr. Campbell himself, evince considerable artistic skill. He is an excellent painstaking, energetic officer. Considering the large scale of survey and its detailed character, the money spent on it during the year, Rs. 3,250, is trifling.

27. **PERSONNEL.**—Mr. Campbell reports so favorably of all his assistants that it would be invidious to single out any as more deserving than others.

28. **LEVELING.**—The leveling operations initiated late last season, were resumed on the 5th November 1869, and resulted in a successful out-turn of 1,017 running miles of levels extended over an area of 1,100 square miles in Pergunnahs Jehanabad, Pillibheet, Nawabgunj, Beesulpoor, Fureedpoor and Crore. The main lines may be generally defined as follows:—

No. 1.—Bareilly to Beesulpoor.

No. 2.—Beesulpoor to Pillibheet.

No. 3.—Pillibheet to Nawabgunj.

No. 4.—From Nawabgunj due south, closing on No. 1; thence,

No. 5.—Further south to Fureedpoor.

No. 6.—From Fureedpoor south-east along the high road, (Bareilly to Shahjehanpoor) to Futtehgunj on the border of the district; thence,

No. 7.—North-east to Negohee, continued north along the high road from Shahjehanpoor to Beesulpoor.

29. The circuits described by these lines of levels were divided into two large blocks, north and south of the common line formed by the road from Bareilly to Beesulpoor. Mr. Swiney, Assistant Surveyor, took up the minor parallel sections two miles apart, in the southern block; the northern block being filled in similarly by Kasim Ali, Sub-Surveyor. Kasim Ali also carried a line of levels from Pillibheet to the village Goojrowla on the Mala or Kutree Nuddee, then along that stream to Beesulpoor. After completing these two blocks, the levelers moved westward. Commencing from the Great Trigonometrical Survey bench mark at the Bareilly Church, as before, Mr. Swiney leveled along the right or southern bank of the Ramgunga, and Kasim Ali along or near the high road from Bareilly, towards Moradabad. Mr. Swiney also leveled along both high roads leading from Bareilly to Budaon, up to the limits of District Bareilly, and skirted the district boundary of Budaon adjoining Pergunnahs Bullea, Suncha, and Aonla of Bareilly. The main lines above described were all connected with cross sections 2 miles apart.

30. The Assistant Superintendent states that the Great Trigonometrical Survey data have been fully utilised. The levels emanated from the Great Trigonometrical Survey bench mark

1. Pillibheet.
2. Beesulpoor.
3. Fureedpoor.
4. Buzgool Bridge on the road from Bareilly to Shahjehanpoor.

at the Church in Bareilly Cantonment, and closed on the Great Trigonometrical Survey bench marks noted in the margin. These leveling operations have been completed for the very small sum of Rs. 3,237 only, giving Rs. 3-3-1 per running mile,—a result most satisfactory to the Govern-

ment, as well as creditable to those employed on the work.

31. **PROGRAMME FOR 1870-71.**—The Surveyor proposes this ensuing season to finish up Pergunnah Fureedpoor, and then proceed in order, with Serowlee, Shahee, Ajaon, Kauber, Richah, and, if possible, complete also Pergunnah Sirsanwan during 1870-71.

32. Since the survey of Bareilly was commenced, the area of the district has been enlarged by the transfer of Pergunnah Poorunpoor Subna from District Shahjehanpoor, and now the

Assistant Superintendent reports, the transfer from 1st November 1870 of the Kumaon Terai Pergunnahs of Bilherce and Nanuck Mutha to District Bareilly. He estimates that, with this addition, his party will be fully occupied in Bareilly till 1872-73.

D. C. VANRENNEN, *Colonel, R. A.,*
Superintendent, Revenue Surveys,
Upper Circle.

SUPDT. OF REVENUE SURVEYS' OFFICE, }
 UPPER CIRCLE ;
 Calcutta, 2nd December 1870. }

Extract from Annual Report on the Leveling Operations carried on in the Bijnour District, by Major A. D. VANRENNEN, Depy. Supdt., Revenue Survey, 1st Divn., North-Western Provinces, Season 1869-70.

2. STRENGTH OF PARTY.—The strength of the party was as follows, *viz.* :—

Mr. Bourne, Assistant Revenue Surveyor, resigned on the 27th May 1870.

Mr. H. T. Hanby, transferred on the 1st May 1870.

1 Native Leveler : 1 Native Recorder, &c.

3. ORDERS OF GOVERNMENT.—The orders of Government sanctioning the formation of a party to carry on, in addition to our ordinary survey operations, leveling, will be found in your letter No. 20 of the 6th January 1869, forwarding copies of letters No. 1122, dated the 29th December 1868, from Government of India, Home Department, and No. 21, dated 30th December 1868, from Surveyor General.

4. WORK HOW DIVIDED.—The field work was entirely done by Mr. Bourne, and the office or recess work by Mr. Hanby.

5. INSTRUMENTAL EQUIPMENT.—The instrumental equipment consisted of one 14" Dumpy, and two 12" Dumpsies by Messrs. Troughton and Simms. As I found the two 12" levels too small for our requirements, you were good enough to exchange them for two 14" ones, as soon as a fresh supply had been received from England. The staves used were two pairs of the Great Trigonometrical Survey pattern, also one pair of double staves Roorkee pattern, one of each of the latter being attached to each party for use, in dips of ground and in nullahs.

6. EXPENDITURE.—The expenditure on the leveling, during the survey year ending on the 30th September, amounted to Rs. 4,485-9, of which the sum of Rs. 3,376-15-9 was for salaries, and Rs. 1,108-9-3 for contingencies.

7. OUT-TURN.—The number of linear miles actually leveled, excluding re-levels, was 692, of which 651 were main lines, and 41 branch; the number of stations was 5,593, and the bench marks laid down amounted to 656. I trust that this will be deemed by you a good out-turn for the small party employed, and which only consisted of one European and one Native. The field was taken about the end of October and the parties were not broken up till the end of April, by which time the hot winds had commenced, preventing any further work.

8. PROCEDURE.—The rigid procedure laid down by you for this Department, in this new branch of our operations, has been followed—and to it is owing the fair results which have been obtained. I may briefly state what has so much contributed to this, *1st*, the staves being graduated on both faces with different zeros, preventing that fruitful source of error, misreading of staves. Also their having been invariably plumbed; *2nd*, adopting the circuit system; with exception of two short river sections, it will be noticed, I have invariably closed my series or lines, on my starting point; *3rd*, the instrument being in every case, and there were nearly 6,000 stations, midway between the staves; *4th*, the bubble at each reading being brought into the middle of the scale; or occupying the same position when the telescope was pointed to the forward staff, as it did when pointed to the back staff; this does away with the subsequent application of corrections for dislevelment. To these precautions, and to the greater experience of the observers, (this having been their 2nd season) are attributable the successful completion of so many hundred miles of leveling.

9. MR. BOURNE'S OUT-TURN.—Mr. Bourne leveled 12 series or 405 linear miles; and the native leveler 362; as the latter has now acquired greater experience in working with that simple, but extremely delicate instrument, a level, he has done better work, and some of his closing differences were very small.

10. SYSTEM OF LEVELING.—The system adopted in taking the lines has been to follow the different roads, taking care that the lines should be equally dispersed over the district, and a reference to the maps will show that Bijour is now covered with them. Every pergunnah has one or more lines of levels passing through it, and is covered with a large number of permanent bench marks. I am of opinion that taking the lines along the roads is preferable to taking them at equal distance across country, as I did the first season, and for the following reasons, *1st*, a better line of country for leveling is got, and bad swampy ground is avoided; *2nd*, there is no expense for ray clearing; *3rd*, our bench marks are made more accessible; as along the main roads they are more easily found and identified, than in isolated villages, and in the midst of long crops, where they must be, when lines across country are taken, when we are not carrying on our leveling for any specific projects of irrigation, or drainage, &c., and as in Bijour, where the two extensive canal projects had been completed, before we commenced our operations. I should strongly recommend this system for general adoption, and which Colonel Gastrell also approved of, when I sketched out the programme of leveling for 1869-70 to be done in Bijour.

11. SERIES LEVELED AND THEIR RESULTS.—The first line numbered XIII, started from the Great Trigonometrical Survey Moradabad Church bench mark, the height of which above mean sea level was 654.54 feet, it was then carried along the road to Nugeena *via* Seohara: from thence one line was taken to Mozuffernuggur *via* Bijour; and another line was taken *via* Nujeebad and Hurdwar on to the Great Trigonometrical Survey Office at Dehra. The amount of error along these lines was as follows, *viz.* :—

<i>1st.</i> —Great Trigonometrical Survey value of bench mark at			
Moozuffernuggur, situated at northern corner of Post	Office	...	790.010
Revenue Survey value of ditto	ditto	...	788.875
Difference or Revenue Survey error which has been dispersed along this line of 96.3 miles			—1.135
<i>2nd.</i> —Great Trigonometrical Survey value of bench mark at			
Dehra, situated on top of the iron bolt at the north-east angle of the Office of the Superintendent of the Great Trigonometrical Survey	...	...	2,229.100
Revenue Survey value of ditto	ditto	...	2,228.812
Difference or Revenue Survey error which has been dispersed along this line of 126 miles			—0.288
<i>3rd.</i> —Great Trigonometrical Survey value of bench mark on 9th			
milestone from Moradabad on Grand Trunk Road from Moradabad to Meerut	...	...	670.320
Revenue Survey value of ditto	ditto	...	670.227
Difference or Revenue Survey error which has been dispersed along this line of 127 miles			—0.093

These differences were obtained from the field books, as soon as the reduced level were run down; and our reduced level of every Great Trigonometrical Station taken up has been given. After the discrepancies, as above given, had been distributed over the three main lines, the other lines in Bijour were closed by them; the argument being, the main lines emanating and closing on Great Trigonometrical Survey Stations. It will be noticed, that our values were invariably less than the Great Trigonometrical Survey ones, and which also occurred in the Oudh leveling operations of 1868-69.

12. DIFFERENCES OR ERROR.—The differences as they stood in the field books of the other 28 series, as they were closed on some bench mark, common to two, or more series, were as follows, *viz.*, maximum in a line of 20 miles 0·707 feet. Minimum in a line of 13 miles ·0010; these figures speak for themselves, and I think, it must be admitted that our leveling has been attended with great success; and considering the out-turn, nearly 700 miles done by two levelers, greater nicety could only be obtained at a sacrifice of quantity, which would not be desirable, as I feel certain, that our leveling, as at present conducted, will meet the requirements of every other Department, and will be found hereafter of the greatest value in furthering all road, canal, and drainage projects.

13. SERIES FOR IRRIGATION DEPARTMENT.—Series XX, taken from near Nujeeabad, down the Doab, between the Ban and Gangun Nuddees to their junction, and series XXI, from the same town, down the Doab between the Gangun and Kuroola Nuddees, with cross lines between the two series, at intervals, were done at the special application of the Irrigation Department, and to further their extensive projects in this district, consisting of the two large canals, the Easteru Ganges and the Ramgunga, with their numerous irrigation channels.

14. BENCH MARKS LARGELY USED TO CHECK LEVELING OF OTHER DEPARTMENTS.—You will be glad to hear, that our carefully leveled bench marks were largely used for purposes of check by both the Irrigation and State Railway Officers, and I was in constant communication with Mr. Roberts, Executive Engineer, East Ganges Canal, and Mr. White, Executive Engineer, in charge of the projects of a State Railway through Bijnour, to compare their reduced levels of our bench marks. Although my reduced levels had not been compared or checked, yet as I saw what an advantage it would be to these officers to have their work checked by our levels. I responded to their constant demand, and every bench mark they took up of ours, was checked by me. I explained to them that it was hardly fair on us, my giving the reduced levels as they stood in the field books, and that only the urgency of the case made me do so. Also, that the reduced levels would be merely provisional, as they would in the recess have to be checked and corrections applied; they received them on this understanding, and I feel certain that we must have saved them much expense in releveling. As our bench marks are now scattered all over Bijnour, and our lines intersect every Pergunnah, they will, I am sure, hereafter be extensively used for all local projects, and save the State much expense in leveling; and where it has to be carried on for any special project, it will enable it to be done more economically and accurately, as no leveler need now go far without having the means of checking his survey by one of our bench marks and which are to be met with everywhere, and in localities easy of access.

15. SURFACE WATER OF RIVERS, &C., ABOVE SEA DATUM.—The following table giving the reduced levels above sea datum, of the surface of the water, of some of the principal rivers, and streams crossed by our lines, at different times during the cold weather, will be interesting:—

LOCALITY.	Ganges River.	Ram Gunga River.	Khoh Nuddee.	Ban Nuddee.	Gangun Nuddee.
Near bridge of Boats on Road to Hurdwar	888·1	...	...	...	...
At Nagul Ghat	757·2	...	...	...	...
Opposite Mouzah Mujlispoor of Mozuffernugger	730·5	...	...	...	...
At Raolce Ghat	714·1	...	...	...	...
At Kalaghur ... ..	...	850·4	...	...	...
At crossing of Nugeena and Ufzulghur Road ... ..	...	732·8	782·8	...	...
Near ditto Dhampoor and ditto ... ..	...	724·8	735·2	...	...
At ditto Nugeena and Burrapoora Road ... ..	...	...	796·4	...	...
At ditto Burrapoora and Nujeeabad Road ... ..	...	...	824·1	...	..
At ditto of Nugeena and Keeruthpoor Road ... ..	...	...	...	814·1	797·9
At ditto Haldour and Dhampoor E. and W., Nehtour ... ..	...	...	...	760·1	766·2

16. RECORDS PREPARED.—The following records have been prepared for the Departments named; their number and care we have been compelled to bestow on them, will give a fair idea of how much the leveling increases the work of an Executive, and as I had not the usual complement of European Assistants this recess, it has been with the greatest difficulty that we have been able to get the records completed.

FOR REVENUE SURVEY DEPARTMENT.

Field books of 31 Series, and Sections, 2 River Sections, and 5 Cross Sections completed in every respect, with the heights therein shewn, corrected and assimilated to Great Trigonometrical Survey bench mark values.

Sketch or Index Map shewing the lines of levels of 1869-70, done on a lithographed map of Bijour. Scale 2 miles = 1 inch.

All the level lines projected, and bench mark levels entered on the atlas sheets of 1869-70; and traces on vellum cloth, made of the lines intersecting the atlas sheets of 1868-69. Description of all the bench marks taken up.

FOR IRRIGATION DEPARTMENT.

Traces of all the lines of levels taken in Bijour, contained in 62 atlas sheets, with the reduced level of every Station, and bench mark entered; also many Topographical details have been entered to admit of the localities of bench marks to be easily identified. Description of all the bench marks taken up.

Index Map of line shown in the lithographed Map of Bijour, scale 2 miles = 1 inch.

17. In conclusion, I would bring to your favorable notice the excellent services rendered by Mr. Hanby, who has had charge of the leveling computations and records. Since his arrival, although the work was quite new to him, he has succeeded in mastering all the details, and by sheer hard work, has nearly completed the records. The Native leveler, as he acquired more experience, did likewise good work towards the end of the season, and gives promise of becoming an excellent leveler.

REPORT
ON THE
Revenue Survey Operations
OF THE
NORTH-WESTERN FRONTIER, PUNJAB,
For Season 1869-70.

DISTRICT PESHAWUR.

This survey left recess quarters for District Peshawur on the 22nd October 1869, its departure having been postponed owing to the prevalence of cholera and a bad type of fever in District Peshawur. In spite of this precaution, however, the establishment, Europeans and Natives, suffered greatly, and the Deputy Superintendent reports that among the measurers there were several deaths from cholera and fever during the winter.

Lieut.-Colonel H. C. Johnstone, c. b., Deputy Superintendent, 1st Grade.
Assistants.
Lieut. J. E. Sandeman, Assistant Superintendent, 1st Grade, on furlough to Europe.
Mr. G. Housden, Surveyor, 1st Grade.
" W. H. Reynolds, Assistant Surveyor, 2nd Grade, on special duty to Cashmere, from 13th July 1870.
" A. J. Gibson, Assistant Surveyor, 2nd Grade.
" G. B. Scott, ditto ditto.
Baboo Hurree Singh, ditto 3rd Grade.
Mr. W. J. Smith, Probationary Surveyor, 4th Grade.
16 Sub-Surveyors, &c.
Leveling Party.
2 Native Levelers.

2. PLOTTED FIELD SHEETS.—Two hundred square miles of boundary survey having been executed in advance during 1868-69, as mentioned in para. 4 of the Survey Report for that year, the villages were plotted in sheets up to margin in recess, and issued to the detail surveyors on the opening of the field season, 9th November 1869.

3. AREA SURVEYED IN DISTRICT PESHAWUR.—The total area surveyed in District Peshawur during 1869-70 comprises 396 villages and 932·12 square miles, surveyed in detail on the full village scale of 4 inches to the mile. The 5 main circuits have been numbered 10 to 14, in continuation of the Peshawur Survey of 1863-64-65. The Pergunnahs Doaba, Daoodzai, Peshawur, and portion of Khalsa Khuttuk came under survey during the season in review.

4. TOTAL AREA OF PESHAWUR.—The entire District of Peshawur, the survey of which was commenced in 1863-64, continued in 1864-65, and resumed and completed in 1869-70, embraces an area of 2167·35 square miles.

5. SURVEY BEYOND THE BORDER.—During 1869-70 Colonel Johnstone surveyed and sketched an area of 1,400 square miles beyond the north-west frontier of Peshawur, extending from Fort Abazai on the north, to Fort Mackeson on the south, on the scale of 1 mile to the inch. A map to scale has been prepared of this tract, which is situated, roughly, between north latitude $\begin{matrix} 33^{\circ}-35' \\ 34^{\circ}-35' \end{matrix}$ and east longitude $\begin{matrix} 71^{\circ} 00' \\ 72^{\circ} 00' \end{matrix}$. The Deputy Superintendent states that "a great deal, both from actual sight and from information, has been added to the new frontier map, on a scale of 4 miles to the inch, now being completed in this Office."

The frontier survey was carried out by the Deputy Superintendent and Mr. G. B. Scott, Assistant Surveyor. The value of this survey beyond the border, whereby much information has been obtained and many geographical errors brought to light, will be best told in the words of the Deputy Superintendent himself—"Commencing on the south bank of the Swat River near Abazai, we went right round the border of the peak of Cherat. This is in the Khuttuk Hills to the south of the Cantonment of Nowshera, and is used, in seasons of sickness especially, as a sanitarium for the troops of that station and Peshawur. It is 4,415 feet above sea-level, and is situated close to some of the settlements of the Independent Afreedees.

"Between Abazai and Eimul Chabootra, at the mouth of the Kohât Pass, several passes were entered, routes explored, and commanding peaks ascended. It was impossible to encamp beyond the border in those parts, though night often fell before the survey party got out of the hills. Several errors were discovered in the old maps, notably one in the course of the Kabul river; instead of flowing tolerably straight, from west to east, from Dukka to Michni, it takes a bend to the north, and flows many miles in that direction before it turns to the south again. Owing to this mistake, both the sizes and positions of Bajour and adjoining valleys

have hitherto been shown wrong, and much out of their proper places. Between the Swat and Kabul rivers two high peaks beyond the border were ascended. A hill in Momund country over the village of Hyder Khan, which is the first march on the Kafila route, from Michni to Jellalabal and Kabul, was visited. The spurs of Tartara were also ascended; on one occasion to a point not very far from the summit. By these trips the error about the Kabul river was established beyond a doubt, a great deal of surveying and sketching done, and much information gained. In the valleys of Gundao, Alizai, Pundaili, &c., several new villages were accurately laid down, and the drainage from the west into the Swat river properly shown. The course of the Khyber Pass required to be corrected, and some fresh detail was obtained regarding both hills and plains to its south. To the west of the Bara Fort is a broad valley, extending for several miles before the base of hills is reached. It is inhabited by Spahis, a section of the Independent Afreedees. A few miles from the fort is their principal village of Lumgoolhur with its half-dozen towers. The Spahis took the Deputy Superintendent and his Assistant all round this valley.

"It was amusing to watch the excitement created among those wild, cut-throat borderers, true Puthans, when allowed to use the Snider rifle. Many had served in the regiments of the Punjab Frontier Force. They had been accustomed to the use of that excessively inferior weapon, the two-grooved rifle with which that Force is armed. Some had used, or seen used, the Enfield, but very few had ever touched a breech-loader. Many a man professed friendship in the hope that he would be allowed to fire a few shots with this wondrous weapon, and the effect of allowing was good and of use. The metal cases of the cartridges were carefully collected and carried off!

"An amusing incident one day occurred. Somehow the crest of the Deputy Superintendent was seen, the "flying spur," and its meaning asked by some Afreedees. They were told how that in former days in Scotland men were lawless like themselves; that when the larder was getting low, a dish would be placed before the chief of the clan, who sat at the head of the board, containing only a spur and a pair of feathers attached; that this was a signal to the followers to boot and spur, and be off to raid the cattle of the southern over the border, and that this flying spur then became the badge worn by the clan, and by which they were recognized. Verily the hearts of the North-West Frontier Afreedees warmed to the speaker when they found he was the descendant of the British Afreedee!

"On another occasion the usual early morning start was made. By the time the pass had been traversed, and the foot of the hill proposed for ascent reached, the instrument carriers were done up. This was an unexpected predicament. The inhabitants of a neighbouring, of course independent, Momund village turned out, and supplied milk, &c. Having thus received and made guests of the survey party, they agreed to carry all the instruments up the hill. With those men as sole companions, the ascent was made. Both a pleasant and profitable day it proved. The Momunds were handsomely rewarded, and went away pleased.

"More exploring might perhaps have been managed, but there were great difficulties in the way. It would never have done to compromise the Government by rash action. The Khyber tribes were at feud among themselves. The Afreedees about the Kohât Pass were having daily fights. As it was, when the ascent of Mount Jelala, at the west extremity of the Cherat range, was attempted from the British side, the crest being the proper British boundary, large numbers of men turned out from the villages on the other side. Down the slopes they came, and opened a rather smart fire. A retreat was of course imperative. They would listen to no overtures. They said they claimed the whole hill right down to the base on the British side. Their advice to the survey party was, to be off. It was discovered when too late, unfortunately, that the confidential agent of a Momund Jagheerदार who accompanied, had been exciting the people beyond the border with all kinds of tales about the Surveyor's intentions. This accounted for much that latterly occurred to prevent our going about as before."

6. **DETAIL SURVEY.**—The detail area within the limits of District Peshawur was very carefully surveyed, and shows every topographical feature of which the scale admitted, as well as the cultivation by wells, distinct from cultivation by canals, and that dependent on rain only. These details were extensively checked by 129 linear miles of re-survey "with satisfactory results," except in the case of one Sub-Surveyor, whose survey, extending to portions of two plane table sheets, was rejected and re-done. The services of this Sub-Surveyor have since been dispensed with.

7. **DEMARICATION.**—When the survey took the field the demarcation was backward in some places, but though the work was pushed on by the settlement, a few village boundaries still remain for adjustment, and will be taken up this season (1870-71). This will delay the completion of the Peshawur survey records until the remaining boundaries have been surveyed, compared with the demarcation maps, and all discrepancies adjusted. The thâkbust maps in the remaining portion of the district agreed well with the professional survey.

8. **ORIGIN OF SURVEY.**—The Great Trigonometrical Survey station of Pir Sabak, which had been used as the origin of the Peshawur circuits of 1863-64-65, has been maintained for the work of 1869-70, so that the entire District of Peshawur has been referred to one meridian.

9. **TRIANGULATION.**—A net-work of triangulation, covering an area of 467 square miles, has been thrown over the Khuttuk Hills and the North-Western Frontier, adjoining District Peshawur. The Revenue Survey triangulation is based on the principal and secondary triangles of the Northern Trans-Indus Frontier series of the Great Trigonometrical Survey. The average triangular error on the principal and secondary Revenue triangulation was under 4 inches,—principal sides 1·4 per mile; secondary 4·2 inches, and intersected points 8·5 inches per mile.

10. **HUZARUH MAPS.**—The Huzaruh survey was mapped by this party in sheets 10' latitude by 10' longitude on the scale of 2 inches to the mile, which have been reproduced at the Head Quarters Photographic Office on the scale of 1 inch to the mile, and the entire district published in 15 sheets, measuring 30' longitude by 15' latitude. These Huzaruh sheets are fine specimens of hill drawing.

11. **PERSONNEL.**—The Deputy Superintendent bears willing and ample testimony to the continued zeal and efficiency of his European Assistants, and states he has had every reason to be satisfied with the conduct of the Native Establishment. The Military Assistant, Lieutenant Sandeman, who is stated to have worked zealously and well, having left on furlough to England, another Officer, Lieutenant Beavan, has been sent in his room; he has during this year been transferred from the Topographical to the Revenue branch of this Department, having been instructed in his duties under that able Officer Major Godwin Austen. Mr. Reynolds too, in whose behalf Colonel Johnstone writes in terms of commendation, has ceased to be a member of the survey, having at his own request resigned for a higher paid appointment in the Forest Department. The gap so caused has likewise been filled up by the transfer to this party of Mr. W. S. Buttress from the Central Provinces, an able, hard-working, efficient Assistant.

12. **CLOSE OF WORK.**—The party closed work on the 15th April 1870, and returned to recess quarters, but the Deputy Superintendent himself did not get back till 4th May, having had matters to arrange with the Settlement Officer, and to see the few remaining village boundaries adjusted, if possible, before the close of the field season. In this attempt, however, he was unsuccessful, as noticed in para. 7 of this report.

13. **PROGRAMME FOR 1870-71.**—The party left Murree on the 10th October for the survey of District Derah Gaze Khan, sanctioned under the orders of Government, marginally cited.

From Secretary to Government, Punjab, to Secretary, Financial Commissioner, Punjab, No. 924, dated 30th July 1869.

14. **LEVELING.**—The leveling operations carried out in District Peshawur during 1869-70 are thus described by the Deputy Superintendent:—"As no leveling was required in the neighbourhood of Peshawur by any Department, a line of levels was run from above Abazai, where the Swat river leaves the hills, down to Attock, along the banks of that, and the Kabul or Lundai rivers, and back across the Ensofzai plain. This was done with reference to a canal that has been spoken of to irrigate this plain, which is entirely dependent on rain. The number of linear miles was 172, and the cost Rs. 1,831-12-9, as follows:—

				Rs.	A.	P.
Establishment	...	...	...	1,315	0	0
Contingent expenses	...	...	...	516	12	9
			TOTAL	1,831	12	9

or Rs. 10-10 per running mile.

BHAWULPOOR SURVEY.

BHAWULPOOR STATE.

15. **OUT-TURN OF SEASON.**—On the 1st November 1869 this establishment, under the charge of Mr. E. T. S. Johnson, Assistant Superintendent of Revenue Survey, commenced field operations by taking up the survey of the cantonment and environs of Phillor, which occupied them about 20 days; the

Mr. E. T. S. Johnson, Assistant Superintendent, 1st Grade.

Assistants.

Mr. P. A. G. Cowley, Assistant Surveyor, 1st Grade.

„ C. W. F. Seyers, ditto, 3rd Grade, transferred from 3rd Division, Central Provinces, joined 6th February 1870.

13 Sub-Surveyors, &c.

Leveling Party.

2 Native Levelers.

area surveyed is 21.76 square miles, or 13926.85 acres, and at a cost of Rs. 3,804-3-2. The work has been very well done, and on the large scale of 12 inches to a mile, at a trifling charge to Government.

16. On completion, the party, under the orders of the Government of India, Home Department, dated 8th May 1869, moved down to the Independent State of Bhawalpoo, where they arrived on the 1st December 1869, when work was commenced. Field operations terminated on the 30th April. The area accomplished was 694.93 square miles, sub-divided into 371 village circuits.

17. POSITION OF THE WORK.—The portion of Bhawalpoo surveyed lies at the north-east portion of the State, between the parallels 29°—55' and 30°—25' north latitude and 73°—24' and 74°—05' east longitude. It is bounded on the north by the Sutlej river, on the south by the Bikaner Raja's territory, on the east by the British District of Bhuttianah or Sirsa, and on the west by the unsurveyed portion of Bhawalpoo.

18. MODE OF SURVEY.—The survey of this tract was strictly Mouzahwar; all lands which were demarcated, and all chucks and chahs, or lands irrigated by wells, have been separately shown. For the convenience of survey it was divided into two main or grand circuits. Besides the above, the Assistant Superintendent of Survey reports that two river circuits and 9 blocks were surveyed on the Punjab side of the river for the purpose of connecting with the nearest village tri-junction platforms of the Barea Doab Survey. Eight stations of the Great Trigonometrical Survey of India have likewise been taken up and closed upon, and the result of comparison between the Great Trigonometrical and Revenue Surveys is noted below :—

Names of Great Trigonometrical Stations.	Distances by Revenue Survey.	Distances by Great Trigonometrical Survey.	Total error of Revenue Survey.	Average error.
Jhambera to Dubber	71197.50	71122.66	+ 74.84	5.55
Dubber to Jobarki	54001.86	53954.63	+ 47.23	4.62
Jhundehla to Futtehgurh	56427.36	56350.55	+ 76.81	7.19
Futtehgurh to Moni Dhai	53101.62	53011.93	+ 89.69	8.93
Moni Dhai to Akbarda Boonga	63758.64	63752.18	+ 6.46	0.53
Akbarda Boonga to Chooriawala	58501.74	58362.55	+ 139.19	12.58
Chooriawala to Joharki	50193.00	50144.34	+ 48.66	5.12
Futtehgurh to Jhambera	63018.12	62864.86	+ 153.26	12.86
Jhambera to Moni Dhai	62620.14	62523.51	+ 96.63	8.16
Moni Dhai to Dubber	69556.74	69460.48	+ 96.26	7.31
Dubber to Akbarda Boonga	72231.06	72121.86	+ 109.20	7.99
Dubber to Chooriawala	65835.66	65757.55	+ 78.11	6.27
Average error ... ..	.....	.....	.....	+7.24

19. The work of every Sub-Surveyor has been regularly inspected by the Assistant Superintendent in charge and his Assistants; 114.25 miles of check lines were run through the work. The result is stated to have been very satisfactory, no re-survey being necessary. In my tour of inspection, these check lines were compared by me with the original surveys on the board plans, and I was much gratified in remarking the great care which had been taken to achieve such excellent results.

20. PLANS AND RECORDS PREPARED.—The maps of the season which have been received are admirable specimens of drawing. Mr. Johnson is a first class draftsman, and certainly possesses the happy faculty of so controlling his establishment that the work turned out is first rate, the Assistants, both European and Native, vying with one another for that purpose.

21. LEVELING OPERATIONS.—Two leveling parties are attached to this Division, but the men employed on them were new to their work and had to be instructed in the first instance, consequently their work progressed but slowly. One circuit has been completed. The line of levels have been run at a mile apart, and all tri-boundary platforms, and other pukka buildings which fell near the lines, are reported to have been fixed as bench marks. The Great

Trigonometrical Survey bench marks have been taken up, and from them the datum line of the sea-level has been obtained. The small leveling establishment completed 396 miles of levels, at the very trifling cost of Rs. 1,111-8-11, or at Rs. 2-12-10 only per mile : a most creditable result.

22. HEALTH OF ESTABLISHMENT.—The Assistant Superintendent states that, “during the time the establishment was at Phillor it suffered very much from a low kind of fever, which was very prevalent at the time all through the Jullundhur District ; but as our stay was short there, most of the men attacked got over it by their march to the Bhawalpoor State. I however lost four men on their arrival ; these were too far gone to benefit by the change of air. In the Bhawalpoor territory the establishment kept in very good health.”

23. CIVIL AUTHORITIES.—The Officers of the Bhawalpoor Agency rendered every assistance required of them. Major Minchin, the Political Agent, and his Assistant, Captain Beckett, are said to have in no small degree helped the Surveyor, by their good management, to get over so large an area. Testimony is likewise borne to the great assistance received from Moorad Shah, the Assistant Superintendent, and from the Tehseeldar, Phulloo Ram.

24. PERSONNEL.—The Assistants, both European and Native, are reported to have worked cheerfully and well. Mr. Cowley has again this year been prominently noticed.

25. PROGRAMME FOR 1870-71.—In season 1870-71 this party will return to Bhawalpoor and there resume operations, where there is an ample field to keep it employed for several seasons. It should be noted that

under the orders of Government marginally quoted, two-thirds of the expenses of the survey will be met from the revenues of the Bhawalpoor State, and one-third defrayed by Government.

No. 987, 7th September 1868, from Officiating Under Secretary to Government of India, Foreign Department, to the Secretary to the Government of Punjab.

26. An account of the tract of country surveyed will be found in the Appendix.

SUPDT. OF REVE. SURVEYS OFFICE. }
UPPER CIRCLE ;
Calcutta, 9th December, 1870.

D. C. VANRENEN, Colonel, R. A.,
Supdt. of Revenue Surveys,
Upper Circle.

APPENDIX.

Description of the Phillor Cantonment and Town, also of the portion of the Bhawalpoor State, in the Punjab, surveyed in Season 1869-70 by E. T. S. JOHNSON, Esq., Assistant Superintendent of Revenue Survey, in charge, Bhawalpoor Survey.

PHILLOR CANTONMENT.—Phillor is now no longer a cantonment; its houses are going to ruin, and such as remain are occupied by the Railway officials employed upon the Sutluj bridge works, and the lands have been made over to the Civil Authorities, and are being planted by them as nurseries for forest trees.

2. **FORT.**—The Fort is also fast going to ruin, it was at the time of Survey, occupied by about 50 men from one of the Native Regiments located at Jullundhur. A temporary Dāk Bungalow was fitted up in the fort for the convenience of the Railway passengers, but will be done away with on the opening of the bridge.

3. **TOWN.**—The town is a small one, situated between the fort and cantonment, it is famed for nothing in particular, and appears to be very unhealthy, for the last two or three seasons it has suffered much from a low fever.

4. **RAILWAY BRIDGE.**—The Railway bridge over the Sutluj river is a vast undertaking, and is expected to be opened by the first week in October; the original design of the bridge was much smaller, but in consequence of the difficulty of narrowing the bed of the river, about 20 more piers have been added; even after this addition, a very high embankment had to be raised at both ends to connect the bridge with the rails on the higher lands.

BHAWULPOOR STATE.

5. **BHAWULGHUR.**—In the tract surveyed there are only three places of any importance; 1st, Bhawalghur, the *Tehseel* Station, so called from Bhawal Khan, the first Nawab. It possesses an old mud fort which is now in ruins, but temporarily employed as a jail; the village is composed of mud huts, and like most native places very filthy.

MINCHINABAD.—The second place of note is Minchinabad, called after the present Political Agent; it has been well laid out, and the houses regularly built. The main part of the buildings are of sun-dried bricks, but the verandahs and shop fronts are of *pucka* bricks plastered and painted.

This town, although commenced a short time ago, boasts of a number of shops and private dwellings; a pretty brisk trade is carried on here in grains, salt, and sugar, it being on the high road to Bikaner.

The raw sugar from the surrounding districts is sent in from here, and received back in a highly refined state as "Bikaner Sugar-candy." A Dāk Bungalow has lately been built for the convenience of the officials and travellers.

MCLEODGUNJ.—McLeodgunj is the third place of note, called after the late Lieutenant Governor of the Punjab; it has also only been in existence a short time, but its progress has not been so rapid in consequence of its not being well situated for trade.

FORDWAH OR FORD CANAL.—About three years ago a canal 100 feet wide at bottom was commenced upon from the Sutluj river, a little distance below the British boundary of Sirsa, and continued along the low country at the foot of the ridge called the *Dunda* or old bank of the Beas river (the Sutluj river having supposed to have flowed still further south, or through the Bikaner and Bhawalpoor Desert).

This canal has been extended for about 100 miles in the direction of Bhawalpoor, and will be carried still further as labor can be procured; it has and will be of very great benefit in reclaiming portions of the country which are at present nothing but a waste of bush jungle, affording, in former years, hiding places for hordes of robbers. This canal has been called the Fordwah or Ford Canal after Mr. Ford, the Commissioner of Mooltan. The new towns of Minchinabad and McLeodgunj are built a short distance from the canal.

ROADS.—The only road through this portion of the State is the one from Fazilka or Bungla to Bhawalpoor, and it was only marked out the year before for the benefit of the Lieutenant Governor, who was on his tour through the State; but it is entirely unbridged, although there are numerous water-cuts, and the canal to be crossed. Carts can only be got along it during the winter months, when the canal is dry. The other means of communication are only camel tracks, camels being the chief mode of conveyance in the country.

THE DESERT.—The Desert of Bhawalpoor, as it is called, is not a vast plain of sand as is generally supposed, but a country that could be well cultivated and which would produce almost anything; but water is the great want in these parts, a few ponds are found at long distances in which a little dirty water may be procured for a few months in the year after the rains. A project is at present in contemplation to carry a canal along this tract, the water to be obtained from the great *Bund* which the British Government intend to put across the Sutluj near Ferozepore for the purpose of carrying a canal through their own territory along the north or right bank of the Sutluj. The British Government have however allowed the right of the Bhawalpoor State to have a portion of the water for their canal; but as a sufficient quantity of water is not expected in the canal all the year round, it is proposed to make vast reservoirs, by *bunding* up openings between sand hills when they run in a circular or horse-shoe shape. From these reservoirs the country could be irrigated during the dry months. This tract on account of the want of water is uninhabited. A few camel breeders are occasionally found during the winter months. The short grass and shrubs which spring up during the rains are considered very nutritive, and therefore large herds of camels, cows, and goats are driven to this part for grazing purposes, but move down to the river side when the water dries up in the ponds or tanks.

REPORT

ON THE

Revenue Survey Operations

IN
SINDH,

For Season 1869-70.

DISTRICT SHAHBUNDER.

Captain D. Macdonald, Deputy Superintendent, 3rd Grade.

Assistants.

Mr. H. E. Gastrell, Assistant Superintendent, 2nd Grade.

„ E. Loftie, Surveyor, 3rd Grade.

„ H. Dowman, Assistant Surveyor, 2nd Grade.

„ P. Ford, ditto ditto, 2nd Grade.

„ J. Connor, ditto ditto, 3rd Grade, transferred to Head

Quarters' Office, Calcutta, from 9th May 1870.

„ T. Dunne, Assistant Surveyor, 3rd Grade.

27 Sub-Surveyors, &c.

FIELD OF OPERATIONS.—The operations of this party during the season embraced the whole of Talooka Shabbunder and the remainder of Talooka Jatec, which completed District Shabbunder and, with it, the Province of Sindh.

2. **POSITION AND LIMITS.**—The tract taken up in 1869-70, lies between parallels $23^{\circ} 35' 24''$ North Latitude, and meridians $67^{\circ} 25' 68''$ East Longitude, and is limited north by the formerly surveyed area of District Shabbunder; east by District Mahomed Khan's Tanda and Runn of Cutch; south by the Korea Creek (which separates Sindh from Cutch) and by the Arabian sea; west by the river Indus which flows between Districts Shabbunder and Jhirruk.

3. **AREA.**—The gross area amounts to 3212.4 square miles, distributed as below:—

	Sqr. miles.
Talooka Shabbunder	1516.6
„ Jatec	1449.5
River Indus and overlap on right bank	108.8
Korea Creek and portion of Cutch	137.5
TOTAL	3212.4

4. **SCALE OF SURVEY.**—Of this area, 851 square miles of the cultivated and inhabited parts of the Shabbunder Talooka were surveyed in detail on the full village scale, 4 inches to the mile, and the remainder of this Talooka, and Jatec, covering an area of 2,361 square miles of a barren, salt waste, was surveyed topographically, on the scale of 1 inch to the mile.

5. **DETAIL SURVEY.**—The detail surveyors were furnished with plotted polygons, and on the 4 inch scale they filled in all the details of cultivation, land fit for cultivation, jungle, waste, &c.; while on the 1 inch scale all the items which the scale admitted, were entered. The villages in this part of Sindh are extensive tracts of land called “Dehs”. Out of 127 Dehs, check survey lines were run through 66, by European Assistants, the linear miles aggregating 123. The Deputy Superintendent reports that the board plans of the detail survey stood this test very well.

6. **SICKNESS.**—The year 1869 had been very unhealthy owing to the unusually large rainfall in Sindh. Cholera and epidemic fever of a malarious type prevailed for some months all over the Province in the autumn and early winter. The Deputy Superintendent therefore resolved not to risk the health of his party in Shabbunder (a District notoriously unhealthy towards the close of the year) by moving into camp too early, and the result of this decision justified its soundness, for the health of the party, which took the field between the 15th December and 10th January, was excellent throughout the season.

7. **CANTONMENT SURVEYS, HYDERABAD AND KURRACHEE.**—The time spent in recess before departure for the field, was however not lost. The survey of the town and cantonment of Hyderabad was completed by the addition of 2 miles of environs all round, on the scale of 8 inches=1 mile. A party was also detached on the 25th October 1869 to take up the survey of Kurrachee cantonment, town, and environs, embracing Clifton and Ghizree Sanataria, Manora, Keamaree, and the Harbor, and the surrounding country within municipal limits. This small survey party under an Assistant was engaged on the Kurrachee survey during

November and December 1869, and then proceeded to complete its allotted area in district Shahbunder, after completing which, it again resumed the survey of Kurrachee in May, and concluded it about the middle of October 1870, or in all about $7\frac{1}{2}$ months. This minute and elaborate survey is on the scale of 16 inches to the mile, and covers an area of 46,626 acres or 72.85 square miles. The plan is on 53 sheets, each measuring 28×20 inches. The drawing of these maps, says the Deputy Superintendent, "has taken up a great deal of the time of this establishment, and delayed us very considerably, and is the principal cause of our not having been able to leave Sindh at an earlier period."

8. **DEMARCATIION.**—The entire area in District Shahbunder is reported to have been demarcated with stone pillars, which were in almost every case adopted as theodolite stations, so that "nearly every traverse station is permanently marked on the ground by a stone pillar."

9. **SETTLEMENT MAPS.**—The huddust or settlement boundary maps were furnished to the surveyors before the commencement of the field season. The professionally surveyed boundaries agreed well with the huddust maps. No comparison could be instituted between the professional and settlement detail surveys, as the former was too far in advance. The Deputy Superintendent has for the last two seasons submitted his one inch maps in graticule sheets $30' \times 20'$, uniform with the published sheets of Sindh. These manuscript sheets have been submitted for publication to the Lithographic Branch of the Surveyor General's Office, where the old work will be fitted in, and the sheets rendered complete.

10. **OLD SURVEY STATIONS WASHED AWAY.**—In the survey of District Shahbunder in 1869-70, it was found impossible to effect a perfect junction with the right bank of the Indus. The Deputy Superintendent states that, owing to the encroachment and fluctuations of the river, none of the old survey stations could be found with the exception of a stone pillar on a rock in the Indus. Ample connection between the two Districts, Jhirruk and Shahbunder, however, is afforded by the stations of the Great Western and Guzerat Longitudinal Series of the G. T. Survey.

11. **TRIANGULATION.**—In the area under review no triangulation was necessary, the traverse work having been connected with 10 stations of the Great Western Longitudinal and Guzerat Series. The comparison between the Great Trigonometrical and Revenue Surveys furnished by the Deputy Superintendent, is appended:—

From	To	Great Trigonometrical Survey distances in feet.	Revenue Survey distances in feet.	Difference in feet.	REVENUE SURVEY DIFFERENCE PER MILE.		
					Feet in excess.	Feet in defect.	
Nindamani	Abunshah	65,490.61	65,416.56	74.05	...	5.96	
Ditto	Koti	54,913.06	54,797.16	115.90	...	11.14	
Ditto	Nurshah	77,579.17	77,501.46	77.71	...	5.08	
Abunshah	Koti	69,281.30	69,219.48	61.82	...	4.71	
Nurshah	Patta ka Bedhi	55,716.11	55,684.86	31.25	...	2.96	
Ditto	Koti	62,456.00	62,525.10	69.10	5.84	...	
Ditto	Jim	47,612.30	47,694.90	82.60	9.16	...	
Jim	Patta ka Bedhi	59,902.70	59,942.84	41.14	3.62	...	
Guni	Ditto	56,332.00	56,362.68	30.68	2.89	...	
Ditto	Hakru	56,091.32	56,090.76	0.56	...	0.05	
Ditto	Sugandia	61,147.85	61,471.08	23.23	1.99	...	
Ditto	Syed Alli	53,005.16	53,048.16	43.00	4.27	...	
Hakru	Ditto	63,474.20	63,557.34	83.14	6.91	...	
Sugandia	Putta ka Bedhi	76,361.44	76,416.78	55.34	3.82	...	
Ditto	Pinjor Pir	62,083.05	62,086.86	3.81	0.32	...	
Ditto	Luckput	98,733.73	98,746.56	12.83	0.68	...	
Ditto	Syed Alli	63,377.14	63,375.84	1.30	...	0.01	
Pinjor Pir	Ditto	91,261.27	91,252.92	8.35	...	0.48	
Ditto	Luckput	86,508.63	86,514.12	5.49	0.33	...	
Syed Alli	Ditto	57,462.30	57,466.20	3.90	0.36	...	
Average difference in feet per mile					...	3.35	3.79
Mean average difference both plus and minus in feet per mile					3.53

12. **DIFFICULTIES.**—The only obstacle the Surveyors experienced was the difficulty of getting fresh water and provisions in the inhospitable tracts of the Shahbunder and Jatec Talookas. In these immense salt wastes the wells are 20 or 30 miles apart, and camel carriage had to be organized to keep the survey parties supplied with fresh water. The southern portions of Talooka Shahbunder are of the same character as Jatec. The traverse lines were

for the most part carried along tidal creeks, and the Deputy Superintendent remarks that, Mr. Dowman, Assistant Surveyor, and party moved about in boats in which they carried supplies of water in hogsheads, and "they were often 8 and 10 days without getting a fresh supply of water. In the Seer Creek and along the coast during the prevalence of high winds, Mr. Dowman and his party had very narrow escapes of being swamped on more than one occasion. A good deal of the ground traversed was subject to tidal inundations. On the tide receding, the ground was soft and 3 or 4 feet deep in mud ***. The assistant deserves great credit for the perseverance and pluck with which he accomplished his task."

13. **NATIVE OFFICIALS.**—The Deputy Superintendent records his appreciation of the aid rendered by the Native Officials, "who did all in their power to assist our parties in every way, and I feel much indebted to them for their exertions, without which I fear we should have fared but badly."

14. **PROGRAMME FOR 1870-71.**—The Survey of the Province of Sindh, commenced

* Home Department, No. 198, dated 17th June 1869, to the Punjab Government.

in 1855-56, having now been completed, this party will, as stated in para. 17 of the survey

report for last year, enter on the survey of the Delhi and Hissar Divisions in 1870-71, under the orders* of the Government of India, commencing with District Kurnal of the Delhi Division.

15. The areas of the 15 Districts and 3 Collectorates of Sindh are given below:—

No.	NAMES OF DISTRICTS.	Area in Sqr. Miles.	Collectorates.	REMARKS.
1	Jacobabad	2,009	Shikarpoor, 18,492 Sqr. Miles.	The Areas of Kurrachee, Sehwan and Jhirruk are subject to revision on redistribution of the Kohistan area.
2	Shikarpoor	1,238		
3	Rohree	4,259		
4	Khyrpoor	6,241		
5	Larkhana and Hills	2,241		
6	Mehur ,,	2,504		
7	Sehwan ,,	3,646	Kurrachee, 16,109 Sqr. Miles.	
8	Jhirruk	3,010		
	Kurrachee Collectorate Kohistan	4,058		
9	Kurrachee	1,253		
10	Shahbunder	4,142	Hyderabad, 21,947 Sqr. Miles.	
11	Nowshera	3,067		
12	Halla	2,558		
13	Hyderabad	416		
14	Mahomed Khan's Tanda	3,177		
15	Oomerkot (Thur Parkur)	12,729		
	TOTAL AREA OF SINDH	56,548		

16. **INSPECTION.**—This office was visited by me at Hyderabad in August, on my tour of inspection. It was very gratifying to me to notice the care and attention bestowed on his work by Captain Macdonald, and the systematic way in which his duties were conducted. He is a zealous, painstaking Officer, and evinces much interest in all that he undertakes.

17. **THE COMMISSIONER'S OPINION.**—The Commissioner of Sindh, Sir W. L. Merewether, K. C. S. I. and C. B., in a letter to my address, thus records his opinion of the conduct of the Sindh survey on the eve of its departure for the Punjab:—"The work has been satisfactorily done and well carried out, under the judicious superintendence and careful management of Captain Macdonald. No difficulties whatever appear to have arisen in carrying out the surveys, and I would request that my thanks be conveyed to that officer on completion of the work."

18. **PERSONNEL.**—The Deputy Superintendent acknowledges the efficient and zealous aid rendered by the European Assistants, and adds that, as a rule, the Sub-Surveyors have worked well.

19. The Deputy Superintendent's descriptive report is published in the Appendix.

SUPDT. OF REVE. SURVEYS' OFFICE, }
UPPER CIRCLE; }
Calcutta, 13th December 1870. }

D. C. VANRENNEN, Colonel, R.A.,
Supdt. of Reve. Surveys, Upper Circle.

APPENDIX.

Description of Country surveyed in District Shahbunder, Season 1869-70, by CAPTAIN D. MACDONALD, Deputy Superintendent of Revenue Survey in Sindh.

The Shahbunder district forms a part of the Kurrachee Collectorate and is the only portion of it situated on the left bank of the river Indus.

It lies between the parallels of $\frac{23^{\circ}35'}{25^{\circ}00'}$ of north latitude, and the meridians of $\frac{67^{\circ}25'}{68^{\circ}50'}$ of east longitude.

Forming a portion of the delta of the Indus, this district is somewhat triangular in shape with the apex near Jhirruk on the Indus, and the base on the sea.

From north to south the extreme length is about 92 miles, and the extreme breadth from east to west about 84 miles. The contained area is 2,649,274.97 acres or 4,139.49 square miles.

Shahbunder is bounded on the north and east by the Tanda District of the Hyderabad Collectorate, and by the Great Runn of Cutch; on the south by the Koree creek, which forms the mouth of the Runn and separates Sindh from Cutch, and by the Arabian sea. The river Indus on the west separates Shahbunder from the rest of the Kurrachee Collectorate.

The whole district consists of 4 Talookas, viz., Meerpoor—Buttora, Belo, Jatee, and Shahbunder, each forming the jurisdiction of a Subordinate Magistrate. These Talookas are sub-divided into 23 "Tuppas" and 379 "Dehs", both being purely fiscal circles. The District is under the jurisdiction of a Deputy Collector who visits the District during the cold season, and whose permanent head quarters are at Jhirruk on the right bank.

Shahbunder is decidedly an unhealthy district. The country is very low, flat and level, subject to very extensive inundation when the water rises in the Indus. This inundation lasts for many months. The most unhealthy months are October and November, when the water begins to recede and dry up. The rays of a hot sun acting on a marshy soil produce a state of atmosphere very favorable to the propagation of epidemic diseases. European officials rarely visit the district till well on in December. The cholera committed great ravages there in 1869, and was followed by a type of fever which was very little less fatal. There is only one dispensary in the district and that is at Meerpoor—Buttora.

The prevailing winds are much the same as in other parts of Sindh. In the cold season, a cold and penetrating wind blows from the north and heavy fogs are no uncommon occurrence. During the monsoon, the wind blows pretty steadily from the south-west. The general temperature in the cold season is very pleasant, and it continues to be very bearable up to the middle of March; April, May, and June are very hot months, but when the monsoon breaks it becomes milder. Taken as a whole, the range of the thermometer during the hot months is lower than in the Hyderabad Collectorate.

The general aspect of the country particularly in the northern Talookas is like that of the Tanda district which adjoins it. As one proceeds southward, the aspect becomes more bare and dreary till one ultimately arrives at a vast expanse of salt waste, a tract utterly devoid of inhabitants, cultivation, fresh water, or vegetation, with the exception of a few stunted shrubs scattered about sparsely over the plain, and mangrove jungle which fringes the banks of the tidal creeks which intersect it in every direction. This plain is dotted here and there with lagoons from which salt is extensively manufactured. These remarks apply more particularly to the southern portion of Jatee and south-eastern portion of Shahbunder. The portion of Shahbunder which lies near the Indus, though cut up by a perfect net-work of creeks, has both inhabitants and cultivation, nearly all rice.

In Meerpoor—Buttora and Belo, and even in the north of Jatee, there are some few mango "topes," but to the south the only tree to be found is the "babool". Roads run in the usual Sindh fashion, namely in straight lines from one principal village to another. They are all unmetalled, but generally bridged, and in the cold season are passably smooth and serviceable. The soil is alluvial. The staple is rice, the other crops are bajree, jowaree, wheat, barley, dal, tobacco, country vegetables, &c. The climate does not seem to be favorable for the growth of cotton, and little of it seems to be raised, and none exported.

The imperial revenue of the district amounted in 1868-69 to Rs. 3,14,229, the largest share of course being derived from land, viz., Rs. 2,92,213. The revenue has been steadily increasing, the amount realized in 1868-69 being Rs. 95,334 in excess of the yield of 1859-60 or nearly 33 per cent. increase in 10 years. The local taxes in 1868-69, amounted to Rs 41,475. This money is expended in local improvements, such as repairing roads, building bridges, travellers' bungalows, schools &c. The sources from which this local revenue is derived are a one anna cess, municipal taxation, fisheries, ferries, &c.

The tenure of land in Shahbunder is precisely the same as that described in my report on the "Tanda" district.

The principal exports are rice, bajree, ghee, barley, wheat, and "goor". The value of the rice exported in 1868-69 amounted to upwards of 3½ lacs of Rupees.

The principal imports are, cloth of various kinds, rice, ghee, sugar, tobacco, &c.

The value of exports of 1868-69 is estimated at 4½ lacs, and of imports nearly 3 lacs of Rupees

The most important township in the district is Meerpoor—Buttora, which has a population of upwards of 2,000.

Shahbunder, Moograbhun and Sajawul have each over 1,000 inhabitants, and these are the only places of note.

The entire population of the district amounts to 63,277 or about 15 souls to the square mile. It must be remembered, however, that close on $\frac{3}{4}$ of the area is "barren waste", and the remaining $\frac{1}{4}$ only partially cultivated.

Cattle are plentiful, and large flocks of sheep and goats are constantly met with. Wolves are rather common and do a good deal of mischief. The other wild animals are the wild pig and the "para" or hog deer. No other kinds of large game are found in these parts. The game birds are the partridge, black and grey snipe, quail and duck of various kinds.

The great bane of the country are snakes. Sindh is a bad country for snakes, and I imagine Shahbunder is the very worst part of it in this respect. I have walked along dusty roads of a morning and could trace their course across the path literally every three or four feet apart, they appear to be of all sizes. During the monsoon particularly I believe the mortality from snake bites is very heavy.

I am indebted to Mr. Walker, c. s., Deputy Collector at Jhirruk, for much of my information, which he kindly furnished from his office.

REPORT

ON THE

Revenue Survey Operations

OF THE
CENTRAL PROVINCES,
For Season 1869-70.

FIRST DIVISION.

DISTRICT CHINDWARRA.

This party left recess quarters at Jubbulpoor on the 16th November 1869 for the field, and on the 20th resumed the survey of District Chindwarra, where a skeleton survey had already been made during the previous season of 256 villages, covering an area of 620 square miles, as noticed in para. 2 of the annual report for 1868-69.

Major R. E. Oakes, Deputy Superintendent, 2nd Grade, on furlough, private affairs, from 3rd August 1870.

Assistants.

Captain W. H. Wilkins, Assistant Superintendent, 1st Grade, in temporary charge, from 3rd August 1870.

Mr. F. Grant, Revenue Surveyor, 3rd Grade.

„ G. Rae, Assistant Revenue Surveyor, 1st Grade.

„ T. W. Reilly, Assistant Revenue Surveyor, 1st Grade.

„ E. Little, Assistant Revenue Surveyor, 2nd Grade.

„ G. B. Youngs, Assistant Revenue Surveyor, 3rd Grade.

36 Sub-Surveyors, &c.

2. AREA COMPLETED.—The total out-turn of the season, including the above area, amounts to 565 villages and 80 waste land blocks, embracing 1064.39 square miles, all comprised in Tehseelee Chindwarra.

3. POSITION.—The tract is situated approximately between North Latitude $\frac{21^{\circ}-55'}{22-47}$, and East Longitude $\frac{78^{\circ}-30'}{79-26}$, and lies north-west of District Seonee, being limited north by the Jagheers of District Chindwarra, surveyed by the Topographical Survey Party No. 2. On the south-west extend the unsurveyed portions of District Chindwarra.

4. BOUNDARY SURVEY IN ADVANCE.—A skeleton boundary survey of a main circuit and contained villages, including 180 square miles, has also been made in advance for season 1870-71. This excellent system of preparing boundary work in advance enabled the Deputy Superintendent during recess to prepare plots of villages ready for issue early in 1869-70 to the detail Surveyors, who surveyed up to the margins of the plotted sections. The convenience of these compact sections when transferring field-work to the final sheets, as well as in the comparison of details in the Deputy Superintendent's and Head Quarters' Offices, is at once apparent.

5. DETAIL SURVEY.—The detail survey was on the full scale of 4 inches to the mile, and is stated by the Deputy Superintendent to have been "carried out to a considerable degree of minuteness." It has been tested by a check survey executed by European Assistants, to the extent of 210 linear miles, and the result of comparison is reported as satisfactory, and completely establishing the accuracy of the interior survey.

6. COMPARISON WITH TOPOGRAPHICAL SURVEY.—An over-lapping belt, 2 miles broad, was surveyed by the Topographical Survey over the common boundary, and the result of comparison with Revenue Survey details is reported "first rate."

7. TRIANGULATION.—The Topographical Survey party having extended their triangulation across the district, no further triangulation was undertaken by the Revenue Survey. A close traverse connection was, however, made with the Topographical Survey stations, and the result of comparison between Revenue and Topographical Survey direct distances, is satisfactory.

8. HEIGHTS.—No heights were determined by the Revenue Survey, but the heights obtained by the Topographical Survey have been recorded on the Revenue Survey maps.

9. PERMANENT MARKS.—All the exterior triple-junction points have, as in the preceding season, been marked by small masonry platforms, and two theodolite stations, one on each

side of the triple-junction, have been secured in like manner, while all the main circuit stations have been marked by piles of large stones, and fenced in.

10. **DEMARCATON.**—The Deputy Superintendent states that the only impediment during the season was due to the number of Settlement Ameens supplied being inadequate to deal with the numerous rectifications of boundary which were found necessary. "Eight Ameens only were sent, and as, I am sorry to say, a large proportion of the waste land chunks (blocks) were incorrectly demarcated, that number was totally inadequate to the work required. I was therefore obliged to defer the rectification of boundaries in main circuit No. 7 till next season." In all the remaining circuits, however, the boundaries were compared with the Hudbust maps, and all discrepancies adjusted. The village demarcation is pronounced excellent, and it is only in the waste lands that "boundary pillars are either incorrectly placed, or have not been erected at all."

Captain Wilkins, the Assistant Superintendent at present in charge, adds that "great delay was caused by the waste land of each village being treated as a separate block (with a few exceptions), instead of massing them into conveniently large blocks, as in the Seonee District. This was done in accordance with the Hudbusts supplied by the Deputy Commissioner of Chindwarra. These blocks are very small (one being only 22 acres), and there are 48 under 400 acres. Many of these small blocks are isolated amongst Malgoozaree (village) lands."

11. **HUSBUST MAPS.**—The Hudbust maps were all lodged with the Deputy Superintendent before he took the field. They are reported to have been very carefully prepared, and, in the cultivated portions of the district, agreed well with the demarcation.

12. **COMPARISON OF SETTLEMENT AND PROFESSIONAL AREAS.**—The settlement detail or *Khusrah* areas were this year furnished by the Deputy Commissioner, and compared with the professional areas. "The results," says the Deputy Superintendent, "may be considered satisfactory. The professional areas are in excess, the average difference being 5 per cent. A few of the villages are very much out, but, as a rule, they are very fairly calculated."

13. **PERSONNEL.**—The Deputy Superintendent brings to notice the zeal and efficiency of Captain W. H. Wilkins, Assistant Superintendent, Mr. F. Grant, Revenue Surveyor, and adds that the Assistant Surveyors, especially Messrs. Rae and Reilly, have shown themselves careful and industrious. The Sub-Surveyors have, with one exception, worked hard and willingly.

14. **PROGRAMME FOR 1870-71 AND 1871-72.**—The area to be surveyed during the present season, 1870-71, lies south-west of that completed. The entire area now remaining for survey in District Chindwarra is estimated at 1,800 square miles, which will be completed in 1871-72; after which it is proposed that this party shall enter on the survey of the cultivated and open portions of District Baitool, which adjoins west, the rest having been already topographically surveyed.

15. The field season of 1869-70 closed at the end of May, and the survey party returned to recess quarters at the beginning of June 1870.

16. The Assistant Superintendent in charge adds a few words on the features of the country, which will be found in the Appendix.

SECOND DIVISION.

DISTRICT RAEPOOR.

17. **LOCALITY AND AREA.**—Survey operations were resumed early in December 1869, it

Mr. R. B. Smart, Deputy Superintendent, 2nd Grade.

Assistants.

Mr. E. C. Barrett, Assistant Superintendent, 2nd Grade, transferred from 4th Division, Central Provinces, 1st November 1869.

„ J. S. Pemberton, Assistant Surveyor, 1st Grade.

„ W. S. Buttress ditto, ditto

„ L. Evans, ditto, 3rd Grade, resigned, 5th June 1870.

„ J. McHatton, ditto, 3rd Grade.

„ A. Hutcheon, Probationary Surveyor, 4th Grade, died 3rd July 1870.

6 Sub-Surveyors, &c.

the south-west portion of District Raepeer, and closed early in May 1870, resulting in a total out-turn of 146,178 square miles, surveyed in detail, in Pergunnahs Balod, Sunjaree and Patun; and Zemindarees of Lohara, Gondurdehee, Khoojee, and portion of Kankier, and 238.10 linear miles of boundary surveyed in the waste lands and forest reserves of Per-

gunnahs Kularee and Sehawa, the details of which had been topographically surveyed by No. 3 Topographical Survey Party. This boundary survey covers an area of 1111.07 square miles.

18. **DETAIL SURVEY.**—The portion taken up in detail, on the Revenue and Topographical Survey scales, comprises 575 villages and 97 waste land blocks. The survey is classified by the Deputy Superintendent as follows:—

1st.—*Mouzahwar*, in which the boundaries of the villages have been separately defined and laid down, with all the interior details, waste, fallow, rivers, tanks, &c., the area of which portion amounts to 866·78 square miles contained in 575 villages.

2nd.—*Waste land* tracts in Pergunnahs Balod and Sunjaree, surveyed in a similar manner as the villages on the full scale of 4 inches = 1 mile, and containing 35 blocks with an area of 151·08 square miles.

3rd.—Portions surveyed topographically, on the scale of 2 inches = 1 mile, showing rivers, streams, hill torrents, roads, village sites, and hills, containing an area of 383·86 square miles. The Zemindaree Khoojee, however, was surveyed (topographically) on the full scale of 4 inches = 1 mile, in order to have the congregated village sheets of main circuit 21 in one unbroken series and uniform scale. The items are abstracted below:—

	No. Of polygons.	Square Miles.
1st Class.—Villages surveyed in detail, 4 inches = 1 mile	... 575	= 866·78
2nd Class.—Waste lands surveyed in detail, 4 inches = 1 mile	... 35	= 151·08
3rd Class.—Topographical Survey in detail, 4 inches and 2 inches = 1 mile	62	= 446·88
		<hr/> <hr/>
		672 = 1464·74

19. **DIFFICULTIES AND SICKNESS.**—The Deputy Superintendent dwells on the difficult nature of the country in Pergunnahs Balod, Lohara, and Sunjaree. During the hot months, water in the hilly and jungly tracts is scarce, and has to be brought from long distances. The population, moreover, is very scanty. Fever was very prevalent between the months of December and February, and told most on the Khalasees or measurers, seven of whom died. Not a single man of the six survey parties employed in Pergunnahs Khularee and Sehawa escaped fever. The two Assistants, Messrs. Pemberton and Hutcheon, in charge of the operations in these pergunnahs, both suffered constantly and severely from the effects of malignant fever during the field season, but still kept the field and completed their work satisfactorily. The Deputy Superintendent reports with regret that Mr. Hutcheon died in recess quarters on the 3rd July: in him the Department has sustained a severe loss; he is reported on as an excellent Assistant, and to have possessed acquirements of a very high order.

20. **HEIGHTS.**—The relative heights of banks to beds of rivers were ascertained and recorded on the maps. The heights of some principal places noted in the margin were determined by boiling point, and the results are considered by the Deputy Superintendent as sufficiently near the truth for most practical purposes.

	<i>Height above sea level in feet.</i>	
Balod	...	965·8
Lohara	...	1023·5
Sunjaree	...	924·7
Kumrode	...	848·3
Rengadubree	...	1195·7
Burgaon	...	1024·1
Bunjaree	...	1202·8
Moochur	...	1238·8
Kossum Kussan	...	1272·2

21. **CONNECTION WITH TOPOGRAPHICAL SURVEY.**—The Deputy Superintendent reports that a perfect connection has been made with the work of the Topographical Survey Party, No. 3, working south in Kankier. Two hill stations were identified and connected on, and an overlap 1½ mile broad was surveyed along 21 miles of the Topographical Survey; 17 village sites common to the two surveys were also fixed, and the work rigorously tested.

22. **PERMANENT MARKS.**—All triple-junction platforms of masonry were adopted as theodolite stations, and main circuit traverse connection was made with 20 conspicuous objects, consisting of temples, trees, and masonry buildings, a description of which will be found in Table G at the end of the Surveyor's narrative report in the Appendix. These numerous fixed points will serve for future connection with the Great Trigonometrical Survey triangulation.

23. **CHECK SURVEY.**—The detail survey was tested by 163½ miles of linear survey, run through the work in various directions. The Sub-Surveyors were visited twice a month by the Assistant Surveyors, who tested the board plans on the spot by intersections and chain measurements. "The comparison of the check surveys with the board plans was highly satisfactory."

24. **DEMARCATON.**—The Deputy Superintendent notices at length the unsatisfactory demarcation of waste lands, and the numerous discrepancies in the areas as returned by the professional and settlement surveys:—"The unsatisfactory and defective state of the demarcation in the Government waste lands, or jungle villages, has been brought to notice for the past two seasons. The village people distinctly declare that boundary pillars or marks were never erected by the Ameens of the Settlement Department. The boundaries

were pointed out to the surveying parties by the Ameens, who were sent by the Deputy Commissioner of Raepoor when the difficulties and slow progress of the work were brought to his notice. The thakbust map boundaries cannot be identified in the field, and the maps are useless for comparison with the professional survey or for any future reference; in fact, the boundaries exist only on paper. The usual triple-junction platforms of masonry have not been built in several places. The Settlement Officer in his printed report on the Land Revenue Settlement, remarks:—‘ But though the maps agree with the survey measurements, yet the areas, as extracted in the settlement papers, show very considerable discrepancies when compared with those of the survey; and in 8 per cent. of the villages in that part of the district where the survey has been completed, the area in the settlement papers is more than 10 per cent. less than those of the surveyor’s.’ The Settlement Officer’s area being less than the true area, and more than 10 per cent. in each village, the loss to the Government must be very heavy. It is difficult to understand how the maps (thakbust) agree with the survey measurements when considerable discrepancies exist between the survey areas and the areas in the settlement papers. The comparison of the waste land boundaries was very unsatisfactory, although the boundaries were pointed out by the Settlement Ameens. The thakbust maps are not countersigned by the Settlement Officer, and it is impossible to say if true copies of the original thakbust maps were supplied for comparison; should discrepancies be discovered at any future time, or the boundaries be disputed by the Mouzahdars, it will be impossible to rectify the errors without a resurvey, and all for the want of proper demarcation. The following examples will show clearly the utter worthlessness of the demarcation. The Mouzahdar of Rujolee, No. 861, Pergunnah Balod, cultivates in the adjoining waste-land tract, an extent of land more than three times the area of his own village, and the village site of Rujolee is situated in the waste land. In the Government waste land tract of Keeshunpoory, adjoining the Zemindaree of Kankier, there are two small villages, Geedalee and Thirkadund, surrounded with extensive cultivation. These two villages have been established by the Kankier Raja’s ryots, who pay no revenue to the Government; in fact I believe it is not known that they are in possession of the land. The Government waste lands are studded with patches of cultivation unknown to the civil authorities; the soil is highly productive, and the produce must be in abundance: the total loss of revenue must be very heavy. The following list of waste lands and villages, taken at haphazard, will at a glance shew the value of the Settlement Officer’s areas:—

Thakbust Numbers.	NAMES OF WASTE LANDS.	Settlement Officer's areas in acres from Khanashomaree Statement.	Professional survey areas in Acres.	Difference.	Difference per 100 acres.
785	Dihan Jungle	4034-00	4677-19	- 643-19	} -1140-75 acres. + 3681-20 " - 7723-55 20-50 per cent.
809	Phagoondah do.	3000-00	593-48	+ 2406-52	
816	Soograsurar do.	1104-00	1829-36	- 716-36	
817	Moola do.	2790-00	6202-47	- 3412-47	
819	Ghoteea do.	2112-00	3406-73	- 1354-73	
821	Putelee do.	2037-00	2251-62	- 214-62	
827	Murrecakutta do.	2000-00	1771-41	+ 228-59	
846	Gongley do.	732-00	463-16	+ 268-84	
854	Cheehro do.	3631-00	4273-69	- 642-69	
855	Jebkussa do.	2812-00	7232-69	- 4420-69	
882	Buloda do.	5684-00	4906-75	+ 777-25	
	TOTAL	29,936-00	37,659-55		

Villages held by Mouzahdars.

Thakbust Numbers.	NAMES OF VILLAGES.	Settlement Officer's areas in acres from Khanashomaree Statement.	Professional survey areas in Acres.	Difference.	Difference per 100 acres.
885	Nugjhur	570-26	778-12	-217-86	} 40-98 per cent.
873	Muthena	679-05	1286-49	-607-44	
874	Pooturwahee	132-65	1002-54	-869-89	
875	Purundel	1532-55	1871-41	-338-86	
	TOTAL	2914-51	4938-56		

25. PERSONNEL.—All the Assistants are mentioned in terms of high praise. The Deputy Superintendent says—“ the success of the work is entirely due to the exertions of the

Assistants and Sub-Surveyors. All worked well and cheerfully; it is difficult to select one as better than the other."

26. PROGRAMME FOR 1870-71.—The area under survey during the current season lies in the Khalsa Pergunnahs of District Raepoor, *viz.*, Dooroog, Dhumda, Deorbeejah, and Nowagurh, and portions of the Zemindarees of Kankier, Nandgaon, and (most probably) Khyragurh; the entire area being estimated at 1,400 square miles.

27. LEVELS.—In the Appendix will be found an elaborate account of the levels run along the imperial road from Raepoor to Nagpoor, a distance of 177 miles, the terminal difference in which, between two independent observations, was only 1.106 feet, or 0.006 feet per mile, a result due to Mr. Smart's able management, and the care bestowed by him in first instructing, and then supervising the work of his subordinates. The table of heights is appended to the Deputy Superintendent's report on leveling operations.

28. A description of the country surveyed during the season, with notices of the various castes of inhabitants, also Appears in the Appendix.

THIRD DIVISION.

DISTRICT NIMAR.

29. OUT-TURN.—The field season extended from the first week in December 1869 to the first week in June 1870, resulting in a total out-turn of 1,666 square miles, embracing portions of Tuhseels Mortukka and Khundwa, and the whole of Burhanpoor, which completed the survey of District Nimar. The work of the season comprises 153 polygons including 107 settled villages.

Captain H. C. B. Tanner, Deputy Superintendent, 3rd Grade.

Assistants.

Lieut. H. S. Hutchinson, Assistant Superintendent, 2nd Grade, on furlough, medical certificate, to Europe, from 21st May 1870.

Mr. P. H. W. Brady, Assistant Surveyor, 1st Grade.

" A. M. Lawson,	ditto	ditto
" J. H. Barter,	ditto	2nd Grade.
" C. W. F. Seyers,	ditto	3rd Grade, transferred to Bhawalpoor

Survey, 1st December 1869.

" R. L. Thompson, Assistant Surveyor, 3rd Grade.

27 Sub-Surveyors, &c.

In anticipation of District Baitool being allotted to this party during 1870-71, the Deputy Superintendent prepared 130 square miles of boundary survey, but withdrew his parties on his destination being changed. This work will be utilized by the 1st Division, Central Provinces, which will move into Baitool after completing Chindwarra.

30. LIMITS.—District Nimar is bounded north and west by Indore; east by District Hoshungabad; south-west by Khandeish; south-east by Berar, and contains a total area of 3,475 square miles.

31. TRIANGULATION.—In the triangulation of the entire district, which has been connected, as stated in para. 30 of last report, with the Kanpishura Great Trigonometrical Survey Series and the secondary triangulation of the Hyderabad Topographical Survey, observations were made at 94 stations, fixing 155 points, of which 61 are inter-sections from two or more bases. The angular error in the main series of triangles is 7 seconds. The discrepancy between common sides of secondary triangles is 0.4 feet per mile, and for intersected points 0.6 feet per mile.

32. INTERIOR DETAILS.—The topographical detail work is based on triangulated and traversed points combined. In the Sathpoora Hills and the Taptee Valley, the average of triangulated and traversed points is .03 and 1.1, respectively, per square mile. The Deputy Superintendent states:—"I can confidently report that the truthfulness of the details, as shown on the maps of the past season, is superior to any thing we have before done in Nimar. I believe that the great mountain ranges are depicted as accurately as can be looked for in such a country. Those Sub-Surveyors who were engaged in mountainous and difficult country have been constantly supervised by myself and by the European Assistants. Several of them have become thoroughly efficient and trustworthy Surveyors, capable of turning out topographical work of excellent quality. * * * The topographical features of the Salanee Pergunnah have, during the past season, been tested in a very satisfactory manner. In the survey of that pergunnah in 1867-68 we did not lay down the boundaries which were, many of them, under dispute with Holkar. The traverses of the villages have been completed during the past season, and where they have been taken along streams, roads or other features, they have been found to coincide remarkably well with those shown on the maps."

The Indore State Railway will pass through the country surveyed by this party in 1867-68, and the 4 inch=1 mile sheets of the survey have been in great request among the Engineers employed on this line. The Superintending Engineer, Mr. Crawford Campbell, has been furnished with copies of several sheets embracing this tract, and others are in preparation at his request.

33. NUMBER OF PLANE TABLE FIXINGS AND CHECK SURVEY.—The number of plane table fixings varied considerably, according to the nature of the ground, ranging from 4 to 21 per square mile. The Surveyor and his Assistants effected 80 miles of check survey. The lines run by the Deputy Superintendent himself were laid down directly on the plane table sections, and the discrepancies shown in red on the maps. Besides this linear test, several field sections were examined by means of sight-vane intersections, and some by interpolation in the hilly tracts.

34. ORIGINAL AND EXAGGERATED MAPS.—The original field sections, after being remounted and touched up, will be submitted for record in this Office. These original maps are not suited for reduction to the one inch scale, as they contain minute details which are not needed in a general map. For purposes of photography they have been traced in exaggerated style with special reference to their reduction to the scale of 1 mile=1 inch, those features which would not show on the reduced maps, being omitted altogether. District Nimar has been mapped in 13 sheets, measuring 30' of Longitude by 15' of Latitude. These exaggerated maps are admirable specimens, and will no doubt when reduced yield the same good results as are shewn in the 1 inch sheets 5, 6, and 7, already reduced.

35. JUNCTION WITH CONTIGUOUS SURVEYS.—During the past three seasons a junction has been formed with the work of the 1st Division, Central Provinces, in District Hoshungabad, and that of No. 2 Topographical Party in Berar. "The boundary common to Hoshungabad and Nimar, as shewn by Major Oakes, agrees with ours, throughout the entire distance (about 55 miles) in a most satisfactory manner, his stations having been used by us whenever they could be identified."

36. DEMARCATION.—The marks on the ground agreed well with the demarcation maps of contiguous villages lying in blocks, but not so in the case of isolated villages situated in the jungle, where the Deputy Superintendent reports he had great difficulty in obtaining a proper correspondence. Our Surveyors were led astray by the Malgoozars, who invariably pointed out to them the old and obsolete boundaries which existed before the new waste land rules came into force, and which in most instances greatly curtailed the limits of villages. The endeavours of the Malgoozars to recover lost ground will, it is feared, lead to the demolition of boundary marks, unless constant and vigilant supervision is exercised. "The new marks had in many places been allowed to become obliterated, if indeed they were not purposely removed. To restore them will not be easy, for when villages do not adjoin each other, there are no masonry tri-junction platforms, and consequently no fixed points on which to lay down the boundaries from our maps." The attention of the Chief Commissioner, Central Provinces, has been drawn to this subject.

37. FRONTIER BOUNDARY.—The long deferred adjustment of the common boundary between Nimar and Indore has at length been brought about. The 1st Assistant Agent Governor General for Central India in his No. 368, dated 10th March 1870, communicated to the Surveyor General that the whole of the Nimar and Indore frontier, south of the Nerbudda, had been demarcated, and a Commission of British Officers was engaged in laying down the frontier of British Pergunnahs, north of the Nerbudda. In regard to the other frontier on Berar, the Assistant Resident at Hyderabad in his No. 336, dated 22nd September 1870, states that:—"the Resident sees no objection to the adoption of the boundary line laid down by Mr. Mulheran (of the Topographical Survey) between Nimar and Berar, and accordingly sanctions its authoritative acceptance." The Deputy Superintendent of Survey remarks:—"The pillars which (I hope) have been laid down lately between Nimar and Holkar's territory with so much trouble by a special Commission, will also require constant supervision, or I fear the labors of the officers lately engaged on these demarcations will be thrown away."

38. LARGE SCALE PLANS.—The town and civil station of Khundwah, and the hill fortress of Aseergurh have been surveyed and mapped on the large scale of 16 inches=1 mile. Regarding Aseergurh the Deputy Superintendent gives the following particulars:—

"The map of the hill fortress of Aseergurh being Mr. Lawson's original drawing done in the field, is an excellent specimen of hill shading with pen and ink. The survey on the scale of 16 inches=1 mile embraces the upper and lower forts and the town of Aseergurh situated at the foot of the mountain. This fortress has often before been minutely described, and former writers have, I think, left few points of interest regarding it for me to remark on here. Colonel Blacker in his memoir of the Maharatta war of 1817-19 gives a complete description

of the place, and his account of the siege and the capitulation of the garrison to General J. Doveton, c. B., in 1819, is interesting. A very faithful plan of Aseergurh accompanies Colonel Blacker's report, which in the minutest detail agrees wonderfully well with the one submitted by me this season. Aseergurh is certainly a fortress of great strength, and the native Governments by whom it has at different times been held, have, at great cost and labor, added considerable works to the natural defences of the place. To a force without good siege artillery it may almost be considered impregnable, and the duration of a siege would only be determined by the amount of provisions the besieged might possess. The imposing appearance of the fortress is much heightened by the excessive blackness of the scarped trap rock on which the walls of the upper fort are built. The scarp averages about 100 feet, and only in two places was it accessible before the present defences were erected. An immense amount of labor has been bestowed on the south-east corner at the Sath Darwaza, and a great mass of solid masonry which has been raised there would offer a long resistance even to heavy artillery. These seven gates (posterns) are placed at different positions in an intricate and winding passage, which in some places is cut through the rock and leads from the upper fort into the defensive works of the outer walls which run all round the hill below, and a short distance from the scarp. The outer works are provided with numerous strong gateways, now fallen into ruin, and also many old tanks which receive the surface drainage. There are others which form a peculiar feature in most old fortresses built on hills of the trap formation. They are subterranean, and receive their supply of water from the porous rock in which they have been excavated. Some of these rock-hewn cisterns are, I believe, of great antiquity, many are of considerable dimensions and could only have been formed with great labor, for, to excavate them, the rock, which is excessively hard, must have been chipped away bit by bit. The roofs of the larger ones are supported on rows of plain square pillars.

"At Mailgurh, a fort similar to Aseergurh, but of smaller dimensions, Lieutenant Hutchinson found an extensive subterranean rock-cut tank, the roof of which was supported by pillars which were highly carved. These underground reservoirs generally contain, even at the end of a long dry season, an abundant supply of good clear water, and the natives assert that they do not dry up even after a long continued drought.

"The fortress of Aseergurh rises about 900 feet from the surrounding country. The roof of Júma Musjid (now a barrack) is by the latest measurements 2,204 feet above mean sea level, a height quite sufficient to render the climate far superior to that of the adjacent plains. During the rains the air is fresh and pleasant, and the scorching winds which during the summer months sweep across the jungles at the foot of the mountain, and strip off every green leaf, are sufficiently tempered to make the climate bearable even during the hot days of June. During and immediately after the rainy season, the vegetation which clothes the slopes of the hill and the steep sides of the ravines, is very beautiful, ferns and creepers growing luxuriantly in all the moist crevices of the rock. There are many views from the different zig-zag paths which wind up the mountain, which are strikingly wild and pretty. Old Maharatta buildings and Mahomedan gateways, now in ruins and half hidden with creepers, are seen on nearly every available point, and add greatly to the picturesque appearance of the place.

"Altogether there are many points of interest at Aseergurh, and which need a much longer notice to describe them than I can afford to give here."

39. PERSONNEL.—Captain Tanner records his complete satisfaction with the work and conduct of his able staff of Assistants and Sub-Surveyors, noticing specially the zeal and skill displayed by Lieutenant Hutchinson, Assistant Superintendent, and Messrs. Brady and Lawson, Assistant Surveyors.

40. PROGRAMME FOR 1870-71.—The employment of a second survey party in the State of Bhawalpoor having been sanctioned by the Supreme Government, this survey has been transferred there, and will, during 1870-71, work from Bhawalpoor southwards, instead of commencing as formerly intended from the south-western frontier resting on Sindh, and proceeding northwards. This change in programme has been rendered inevitable owing to the demarcation being backward in the southern portion of Bhawalpoor. To keep the operations of the two parties now employed perfectly distinct, the meridian $72^{\circ}30'$ has been adopted as the limit of Mr. Johnson's work on the west, and Captain Tanner's on the east.

41. INSPECTION.—This party was inspected by me in Kurrachee in August last. I have much pleasure in recording the high sense I entertain of Captain Tanner's ability and zeal. He works earnestly and well, taking great interest in all the details of his profession. His survey of a difficult country has been well executed, and the maps turned out under the immediate supervision of this accomplished Officer, are among the very best I have seen. They reflect great credit on his able management.

FOURTH DIVISION.

DISTRICT CHANDA.

42. DURATION OF THE FIELD SEASON.—The party* reached Chanda (from recess

* Captain F. Coddington, Deputy Superintendent, 3rd Grade.

Assistants.

Lieut. H. L. Smith, Assistant Superintendent, 2nd Grade.

Mr. E. C. Barrett, ditto ditto transferred to 2nd Division,
Central Provinces, 1st November 1869.

„ S. M. Smylie, Assistant Surveyor, 1st Grade, transferred from British
Burmah Survey, 1st April 1870.

„ J. U. T. Coxew, Assistant Surveyor, 2nd Grade.

„ J. Newland, ditto ditto 3rd „

„ A. Hall, Probationary Surveyor, 4th „ services dispensed with
from 1st May 1870 on reduction of Establishments.

„ W. H. Peurose, Probationary Surveyor, 4th Grade.
22 Sub-Surveyors, &c.

and have in consequence (as the less of two evils) to bear the heat and exposure of the hottest months in the year.

43. POSITION AND AREA OF THE COUNTRY.—The country surveyed is situate between North Latitude $\frac{19^{\circ}-28'-30''}{20^{\circ}-26'-10''}$ and East Longitude $\frac{79^{\circ}-50'}{80-35}$ and covers an area of 1,433.14 square miles surveyed in detail, inclusive of 219.46 square miles, of which only the village boundaries had been surveyed previously, as noticed in para. 39 of the report for 1868-69. Besides this area of 1,433.14 square miles completed in detail, a boundary survey was made of 395.17 square miles, in advance, to admit of plotted polygons being given out to the detail Surveyors during the present season, 1870-71. The completed area comprises 72 villages and 199 Zemindaree and waste land blocks, distributed among the Khalsa and Zemindaree lands appertaining to Tehseels Moolh and Berhampoore. The Pergunnahs Ghote and Arpeillee were once Zemindarees, but have been resumed by Government, being the same lands alluded to in para. 48 of the last Revenue Survey Annual Report.

44. LIMITS.—The surveyed tract is bounded east by Bustar and the Aheree Zemindaree; north and west by the surveyed portion of Chanda; south by the Rivers Weingunga and Preheta which separate it from the Nizam's dominions.

45. DISTRIBUTION OF AREA.—The area within these limits is thus distributed :—

SUB-DIVISIONS.	Tehseelee.	No. of Polygons.		Area in square miles.	REMARKS.
		Villages.	Blocks.*		
Pergunnah Ghote ...	...	24	25	229.48	Waste land.
Ditto Arpeillee ...	...	48	48	330.70	Waste land & 3 River circuits.
Zemindaree Geelgaon ...	Moolh...	...	16	179.47	Zemindaree.
Ditto Potegaon ...	...	...	...	...	...
Ditto Maroonda ...	...	...	...	...	...
Ditto Chandarra ...	...	...	...	...	...
Ditto Kotegaon ...	Berham- pooree.	...	39	182.77	38 Zemindaree, 1 waste land.
Ditto Aheree (portion) ...	Moolh ...	...	31	262.90	Zemindaree.
Ditto Rangee ...	...	...	...	...	...
Ditto Doodmara ...	...	...	40	247.82	33 Zemindaree, 7 waste land.
Ditto Dhanora ...	...	...	...	...	...
TOTAL AREA SURVEYED IN DETAIL ..	Berham- pooree.	72	199	1,433.14	
ZAMINDAREES {	Moorungaon ...	...	...	...	...
{	Sirsoondee ...	...	...	...	...
{	Jhanappra ...	...	...	...	...
{	Aoundee ...	...	...	...	...
BOUNDARY SURVEY ONLY ...	...	...	51	395.17	

* Zemindaree and Waste land Blocks.

46. SCALE OF SURVEY AND CHARACTER OF COUNTRY.—The Khalsa Pergunnahs Ghote and Arpeillee, containing an area of 560.18 square miles, were surveyed on the full scale, 4 inches = 1 mile, while the Zemindarees comprising 872.96 square miles were surveyed on the $\frac{1}{2}$ scale or 2 inches = 1 mile. The detail survey in the case of both Khalsa and Zemindaree lands shews, as far as the scale permitted, the geographical features of the country, as well as the details of cultivation, fallow, &c. Some of the minor streams, however, could not be followed up through the dense jungle, owing to the great difficulty and labor of line clearing.

The country is described as a vast expanse of heavy forest ; it is generally undulating, but is in parts hilly. The village sites are small, and often widely separated from each other. There is usually a very small patch of cultivation and cleared land round each village, the area under cultivation being estimated at only one-tenth the entire area brought under survey. Each Zemindaree forms a complete and compact estate in itself, no internal sub-divisions are recognised, and only the exterior boundaries are demarcated. There is no inter-mixture of lands.

47. CHECK SURVEY.—Owing to the expense, loss of time, and difficulties entailed by clearing lines through dense forests, only 30 linear miles of check survey were run through the work, but “an area of 188 square miles of detail survey was examined on the ground by the Deputy Superintendent and his Assistants, and found to be good and trustworthy.”

48. CONNECTION WITH GREAT TRIGONOMETRICAL SURVEY.—The Revenue Survey has been connected by traverse with two Great Trigonometrical Survey stations of the Jubbulpore Meridional Series, *viz.*, Ghote and Theka, which fall within the season's area, and with the Great Trigonometrical Survey station Polam Rajul, of the same series, situate in Aheree Zemindaree, out of the limits of this year's main circuits. The following tabular statement furnished by the Surveyor gives the result of comparison between Great Trigonometrical Survey and Revenue Survey direct distances, including the connection with Great Trigonometrical station Rajuli and Parasgaon, taken up in 1868-69. It is very satisfactory and creditable to the superintending officer, Captain Coddington, who is a painstaking careful officer :—

GREAT TRIGONOMETRICAL SURVEY STATIONS.	DISTANCES IN FEET.		Total difference.	Error of Revenue Survey per mile.
	Great Trigonometrical Survey.	Revenue Survey.		
Ghote to Theka	185,888·24	185,920·60	32·36	+0·92
Rajuli to Theka	182,929·75	182,825·47	104·28	—3·01
Polam Rajul to Ghote	107,025·67	106,905·57	120·10	—5·92
Theka to Parasgaon	151,561·81	151,473·22	88·59	—2·91
Average, where the error is plus ... ..	...	...	...	0·92
Ditto ditto minus ... ..	...	...	...	3·94

49. STATE OF THE GREAT TRIGONOMETRICAL SURVEY STATIONS.—The Deputy Superintendent states that the Great Trigonometrical Survey stations visited were all found in good preservation.

50. PERMANENT MARKS.—Numerous permanent marks were furnished by the stone boundary marks and masonry tri-junction points of villages, which were used as theodolite stations, whenever practicable. “Several Revenue Survey stations on conspicuous hills have also been marked, so that at any time complete connection can be effected.” Table G. in the Appendix contains a description of the positions of these Revenue Survey hill stations, and will be found most useful for future reference.

51. SICKNESS.—During the whole of December and January, and part of February, the Survey party suffered severely from fever. In January, one-fourth of the Establishment was on the sick list, and there was not a single measuring or line cutting party in which there were not some men sick, while others were wholly prostrated. The Deputy Superintendent reports “there were nine deaths during the field season, eight from fever and one from small-pox ; three children and one woman connected with the establishment also died, and many men had to be sent away to prevent their dying. One man went mad, and several cases of night-blindness occurred. One Sub-Surveyor had through continued sickness to be sent away to his home, and has since died.”

52. IMPEDIMENTS.—Among the chief difficulties which beset the Surveyors may be mentioned the dense jungle, which necessitated laborious line clearing, “almost every yard of traverse work had to be cleared of jungle before an angle or chain measurement could be made.” The country is very sparsely inhabited, the villages being often far distant from each other. This, combined with “want of water in the dry season, bad communication, and a people who do not understand a word of the Hindoostani language,” all tended to impede the work. The out-turn shews with what endurance and energy these various obstructions were met and overcome.

53. THAKBUST MAPS.—The Thakbust maps were lodged with the Surveyor before commencement of professional survey, and were found to agree well with the latter. “The boundary marks were for the most part found standing, and no difficulty was experienced in tracing them with the help of the inhabitants.”

54. COMPARISON WITH SETTLEMENT SURVEY.—The settlement detail survey preceded the professional by two years. The results of comparison between the two surveys is thus stated by the Deputy Superintendent :—

“COMPARISON OF KHUSRAH FIELD MEASUREMENTS.—Of the three main circuits of which the details have been surveyed in the Zemindaree lands, the professional survey area is in excess of the settlement area, by 10,464 acres or 2·6 acres per 100 acres.

“In the Khalsa lands of Arpeilee and Ghote (excluding the waste lands of which no settlement details are furnished) the result of comparison in 81 villages is as follows :—

“In the total area, the settlement area is in excess by 2,178 acres in 27,861 acres, or 7·7 acres per 100 acres. In the item of jungle the settlement is also in excess by 3,534 acres in 20,188 acres, or 17 acres per 100 acres. In the item of cultivation the settlement is less by 1,308 acres in 6,274 acres, or 20 acres per 100 acres ; also in land fit for cultivation, it is less by 1,041 acres in 1,812 acres, or 5·7 acres per 100 acres.

“It will thus be seen that the settlement deficiencies in cultivation and fit for, have been thrown into jungle ; perhaps since the settlement was made, more land may have been brought under cultivation : the total area results may be considered to agree fairly well.”

55. PROGRAMME FOR 1870-71 AND 1871-72.—The area now remaining for survey in District Chanda is estimated by the Surveyor at 1,655 square miles, all Zemindaree land, to be surveyed on the scale of 2 inches = 1 mile. It depends on the health of the Establishment whether this area will be completed during the present season, 1870-71. Besides the above-mentioned area, there are 2,500 square miles of the immense Aheree Zemindaree, the survey of which will remain in abeyance until the richer and more valuable parts of the Central Provinces shall have been surveyed, as stated in paragraph 48 of the last Annual Report. Should the programme proposed for the current season be successfully carried out, this division will enter on the survey of District Bhundara in 1871-72.

56. PERSONNEL.—The Deputy Superintendent testifies to the zeal and efficiency of his Assistants, making special mention of Lieutenant Lees Smith, Assistant Superintendent, and Messrs. J. U. T. Coxen and J. Newland, Assistant Surveyors.

SUPDT. OF REVENUE SURVEYS' OFFICE ;
UPPER CIRCLE,
Calcutta, 16th December 1870.

}

D. C. VANRENEN, Col., R. A.,
Supdt. of Revenue Surveys,
Upper Circle.

APPENDIX.

Extract from Annual Report on the operations of the 1st Division, Central Provinces Revenue Survey, by Captain W. H. WILKINS, Assistant Superintendent in temporary charge; Season 1869-70.

Description of the country surveyed in District Chindwarra.

10. NAMES OF PRINCIPAL RIVERS.—The country is thoroughly well watered, the number of rivers and streams being very great; the principal ones are, the Pench, Sookree, Ghatamalee, Gunnowur, Thail, Golbehra, Pathreye, Oura.

11. The portions of the district known under the old pergunnah names of Chindwarra, Chowrye and Umurwara (comprising main circuits Nos. 1, 2, 3, 4 and 5) are very highly cultivated, nothing but fields for miles and miles. The portion known as Pergunnah Oomrait (comprising main circuits Nos. 6, 6^a and 7) in the north-western corner of the district is very hilly indeed, the hills extending far into the work.

12. The district is divided into the two Tehseelees of Chindwarra and Soursur. The whole of this season's work, with probably the majority of next, lies in the Chindwarra Tehseelee.

13. In addition to the hilly portion in Nos. 6 and 7, hills also skirt the northern boundary of 4 and 5. The 2nd Division, Central Provinces Topographical Survey Party, surveyed the Sathpoora range, comprising the Chindwarra Jagheers, and surveyed a strip 2 miles over our common boundary. A one inch = 1 mile general map was made of this 2-mile strip, from our marginal sheets, and forwarded for comparison to Mr. Girdlestone. He informs me that the result is first-rate, which is satisfactory to both parties.

APPENDIX.

Extract from Annual Report on the Leveling Operations of the 2nd Division, Central Provinces Revenue Survey, by R. B. SMART, Esq., Season 1869-70.

2. **COMMENCEMENT OF WORK.**—The two leveling parties left the Deputy Superintendent's camp at Kamrood on the 25th March, and commenced operations on 2nd April. They started from the substantial stone platform on which the temple of Mahadeo stands at Raepoor, and marked the spot by an arrow to point where the staff had been set up. The line was carried by Mr. A. Hutcheon, Probationary Assistant Surveyor, and Ungamothoo, Sub-Surveyor, along the imperial road from Raepoor to Nagpoor. To prevent the possibility of error, Mr. Hutcheon was directed to close frequently on Ungamothoo's work; this was done during the early part of the operations at every mile. In testing the work, they had to re-do the two first sections; the time thus lost was fully compensated by the experience they had gained.

3. **METHOD PURSUED.**—Two sets of readings were always taken to the back and forward staves and duly recorded in the field book; if a mistake occurred, it was at once rectified. The staves are not divided on both faces similar to those in use in the Great Trigonometrical Survey of India, but to eliminate minute errors, the order of observations was alternated, for the first reading the back staff was observed first, and for the second observation the forward staff was read first; this was steadily and scrupulously adhered to the whole way. The staves were set up on wooden pegs, driven firmly in the ground, and a common iron nail let into the wood. The terminal pegs after each day's work were larger and more firmly driven in the ground. The forward staff was always used as the back staff at the next station.

4. **ELIMINATING ERRORS.**—The circuit system in each section was strictly followed, but instead of one observer closing on his origin, the circuit or sectional lines were leveled by both parties having different intermediate stations, but starting from the same origin, and closing on the same point; if the final result shewed a difference greater than 0.01 of a foot per mile between the two levelers, the work was re-done. Independent of the final result, Mr. Hutcheon was directed to close frequently on the work of the sub-surveyor and test the work as it progressed.

5. **CORRECTIONS.**—The closing error of each circuit having been ascertained, half the difference of the two observers was applied as a minus correction and half as a plus correction; a mean result was thus obtained and the whole series reduced to the same datum, *viz.*, the mean sea level. In the absence of the Great Trigonometrical Survey stations, the work was closed at the Nagpoor Railway Station, or the line of rail in the running shed of the Great Indian Peninsula Railway, the height of which, 1,005.89 feet above the sea, was given by the Railway Engineer and the Executive Engineer of the Nagpoor Division.

7. **PERMANENT STATIONS.**—The following stations have been adopted as permanent bench marks for any future reference:—

Stone Platform, Mahadeo Temple (Raepoor)	1
Church (ditto)	2
Dak Bungalow (ditto)	7
Bridges	29
Mile-stones	71
Pucka Wells	14
Engineer's Bungalow, Public Works Department	1
Teelsee	1
Village Boundary Pillars	10
Pucka trough at Wells	1
Village tri-junctional pucka platforms	2
Pillar (stone) near a bridge	1
Cantonment Boundary Pillar (Bhundara)	1
Nagpoor Railway bench mark, on the line of rail, in the running shed	1
TOTAL	142

Table of Heights from Raepoor to Nagpoor.

The levels were carried along the Imperial Road from Raepoor to Nagpoor. The line was divided into eighteen sections, giving an average of 10 miles to each section. The instruments were always placed midway between the back and forward staves, the distance varying from 2 to 7 chains. Two independent sets of observations were taken, and on closing the work at the end of a day, results were carefully compared. Whenever a difference exceeding .01 of a foot per mile appeared between the results of the two observers, the observations were repeated. As a test of the accuracy of the results, it may be stated that in bringing up independently the results obtained from two different observers, the terminal difference in 176.64 miles was 1.106 foot, or 0.006 foot per mile.

The heights given in this table are reduced to the mean sea level.

The work was closed at the Nagpoor Railway Station or on the line of rail in the running shed, the height of which is 1,005.89 feet above the sea.

Table of Heights from Raepoor to Nagpoor.

NAMES OF STATIONS.	Mile-stones.	HEIGHT IN FEET ABOVE MEAN SEA LEVEL.	REMARKS AND DESCRIPTION OF STATIONS.
		Deducted by Spirit Leveling Opera- tions.	
Mahadeo Temple (Raepoor) ...	...	962.560	Station on the eastern side of the pukka platform on which the temple stands, marked with a broad arrow head. This temple is situated on the west side of the road from Raepoor to Sumbulpoor on the bund of Telecbund Tank.
Raepoor Church ... Lat. 21° 14' 22".59 Long. 81° 41' 42".39	...	975.760	Stone in the foundation of the church beneath the eastern corner of the large window in the southern end of the church.
Raepoor Dāk Bungalow ...	...	982.548	Sill of the eastern door on the south side of the bungalow.
Bridge ...	...	975.353	Top of south parapet wall. This is the first small bridge after leaving the city.
From Raepoor to Nagpoor ...	1	957.933	Top of mile-stone.
Bridge ...	...	935.539	Top of north parapet wall. This bridge is situated about 1 chain from the western corner Mohan tank in the village of Doomurtullao.
From Raepoor to Nagpoor ...	2	936.635	} Top of mile-stone.
	3	932.211	
Pucka Well ...	...	908.118	Top of surface of pukka well, one chain from the road on the south side, and 60 chains west of the village site of Sateebund.
From Raepoor to Nagpoor ...	4	901.812	Top of mile-stone.
Karoon nuddee, level of water ...	...	867.909	Surface of Karoon nuddee.
Bridge ...	...	910.482	Top of north parapet wall, 20 chains east of the 6th mile-stone from Raepoor.
From Raepoor to Nagpoor ...	6	924.759	Top of mile-stone.
	7	925.584	} Top of surface of pukka well, close to the 6th mile-stone from Raepoor.
Pucka Well ...	...	935.048	
	8	949.523	
	9	931.378	
Engineer's Bungalow ...	...	993.247	Sill of the middle door, on the north side of the bungalow at Bhelai.
Bridge ...	...	990.380	Top of north parapet wall. This is the 2nd bridge from Bhelai westward.
Pucka Well ...	...	995.023	Top of surface of pukka well, 4 chains from the road on the north side and about 12 chains from the village site of Koosreepar.
Bridge ...	...	989.923	Top of north parapet wall. This bridge is 18 chains west of the well described above.
Pucka Well ...	...	985.619	Top of surface of pukka well, close to the Dāk runners' huts in the village of Soopela.
Bridge ...	...	946.166	Top of north parapet wall. This is a small bridge of four arches, about 1½ mile west of Dāk runners' huts in the village of Soopela.

Table of Heights from Raepoor to Nagpoor,—continued.

NAMES OF STATIONS.	Mile-stones.	HEIGHT IN FEET ABOVE MEAN SEA LEVEL.	REMARKS AND DESCRIPTION OF STATIONS.
		Deducted by Spirit Leveling Operations.	
Bridge	{ ...	975.054	Top of north parapet wall of a small bridge about 5 chains from Phurnese tank in the village of Amdec.
	{ ...	974.342	Top of north parapet wall of small bridge about 10 chains from Pujeree tank in the village of Chitojee.
Pucka Well	{ ...	952.769	Top of surface of pucka well on the north side of the road and about 3 chains from the Dooroog Dâk Bungalow.
Dooroog Dâk Bungalow	{ ...	954.069	Sill of the door on the western side of Dooroog Dâk Bungalow.
Dooroog Tehseelee +	{ ...	951.980	Plinth of Dooroog Tehseelee at south-east corner.
Bridge	{ ...	919.340	Top of north parapet wall of the first bridge west of Dooroog.
Seonath River level of water	{ ...	890.780	Surface of Seonath River.
Pucka Well	{ ...	956.287	North-east corner of surface of pucka well on the north side of the road at the village of Unjora.
Village Boundary Pillar (Stone)	{ ...	955.770	Top of boundary pillar, 5 chains from the road on the north side, and about 30 chains east of the Dâk runners' huts near the village of Terrasurra.
	{ ...	1001.142	Top of boundary pillar, 3 chains from the road on the north side, and 4.50 chains west of the pucka well at the village of Somnee.
Pucka Well	{ ...	999.987	Top of surface of pucka well at the village of Somnee.
Village Boundary Pillar (Stone)	{ ...	970.336	Top of boundary pillar on south side of road, 20 chains from the village of Soondra. Bearing of Soondra = 205°.
	{ ...	1004.533	Top of boundary pillar on the south side of the road about 60 chains from the village of Nandgaon. Bearing of Nandgaon = 220°. Bearing of Chiplee = 340°.
Pucka Well	{ ...	1012.618	Top of surface of pucka well on the south side of the road close to the Dak runners' huts near Pendree Dâk Bungalow.
Pucka trough +	{ ...	1010.693	Centre of pucka trough beside the pucka well at Pendree Dâk Bungalow.
Pendree Dâk Bungalow +	{ ...	1014.183	Plinth at north-west corner of Pendree Dâk Bungalow.
Village Boundary Pillar (Stone)	{ ...	1011.531	Top of boundary pillar on the south side of the road about a mile west of the village of Indermara.
	{ ...	995.597	Top of boundary pillar on the south side of the road, 20 chains east of the Harr nuddee.
Village tri-junctional pucka platform	{ ...	1022.357	Top of village tri-junctional platform on the north side of the road about a mile west of the Harr nuddee.
Village Boundary Pillar (Stone)	{ ...	1091.176	Top of boundary pillar, 3 chains from the road on the south side and close to where the village road to Koka leaves the high road.
Village tri-junctional pucka platform +	{ ...	1099.921	Top of village tri-junctional platform on the north side of the road about 60 chains east of the village site of Wornarbandh.

Table of Heights from Raepoor to Nagpoor,—continued.

NAMES OF STATIONS.	Mile-stones.	HEIGHT IN FEET ABOVE MEAN LEVEL.	REMARKS AND DESCRIPTION OF STATIONS.
		Deducted by Spirit Leveling Operations.	
Pucka Well	1112·925	Surface of pucka well close to a large pepul tree in the village of Worarbandh.
Bridge	1111·568	Top of south parapet wall of small bridge about 5 chains west of the village site of Worarbandh.
Spur Stone of a Bridge +	...	1113·144	Top of the spur stone set up to protect the eastern corner of the south parapet wall of the 4th small bridge from Worarbandh.
Bridge ...	}	1089·541	Top of north parapet wall of the bridge over the Tendoo nullah near the village of Jenackpoor.
		1104·923	Top of north parapet wall of the bridge over the Koosoom nullah.
Pucka Well	1102·338	Surface of pucka well on the north side of the road near Chicholee Dāk Bungalow.
Chicholee Dāk Bungalow	1101·822	Sill of the door on the western side of Chicholee Dāk Bungalow.
Bridge	1107·131	Top of north parapet wall of the large bridge about 5 chains from Chicholee Dāk Bungalow.
Village Boundary Pillar (Stone) ...	}	1148·107	Top of a boundary pillar on the north side of the road two chains west of a small bridge and about 20 chains south of the first hill on the north side of the road from Chicholee.
		1171·032	Top of boundary pillar on the south side of the road, about 15 chains north of the village site of Rancetullao.
Bridge	1188·714	Top of north parapet wall of a large bridge about 20 chains west of the village site of Rancetullao.
Village Boundary Pillar (Stone)	1213·775	Top of boundary pillar on the south side of the road, and 24 chains east of the village site of Bunjarree.
Pucka Well	1255·864	Top of surface of well at the south side of the village site of Futtehgunge.
Bridge ...	}	1187·283	Top of north parapet wall of a bridge near the first Dāk runners' stage from Gortalow.
		1180·959	Top of north parapet wall of the bridge over the Chabook nullah.
		1099·074	Top of north parapet wall of a small bridge of three arches about 10 chains east of the Engineer's Bungalow at Bag nuddee.
		1125·549	Top of north parapet wall of the 2nd small bridge west of Bag nuddee.
		1135·928	Top of south parapet wall of the 3rd small bridge west of Bag nuddee.
		1099·015	Top of north parapet wall of the bridge over the Deoree nullah; this bridge is about a mile west of the village of Deoree.
		+	1128·507	Top of south parapet wall of a small bridge close to the rock, cutting about half a mile west of the village site Massulkussa.
	...	976·130	Top of south parapet wall of a small bridge about 20 chains east of a large tank on the south side of the road in the village of Koosreepar.

Table of Heights from Raepoor to Nagpoor,—continued.

NAMES OF STATIONS.	Mile-stones.	HEIGHT IN FEET ABOVE MEAN SEA LEVEL.	REMARKS AND DESCRIPTION OF STATIONS.
		Deducted by Spirit Leveling Operations.	
Bridge	944·742	Top of north parapet wall of a small bridge 40 chains east of the village of Dongergaon.
	...	936·360	Top of south parapet wall of a small bridge 10 chains west of the village site of Dongergaon.
	...	860·705	Top of north parapet wall of a small bridge about 65 chains east of the 71st mile-stone from Nagpoor.
From Nagpoor to Raepoor	71	842·472	} Plinth of mile-stone.
	70	843·321	
	69	827·366	
Bridge	848·455	Top of north parapet wall of a large bridge 28 chains west of the 69th mile-stone from Nagpoor.
From Nagpoor to Raepoor	68	860·583	} Plinth of mile-stone.
	67	847·230	
	66	872·282	
	65	832·689	
	64	815·346	
	63	823·798	
	62	849·010	
Sackolee Dāk Bungalow	...	811·842	} Sill of the door on the west side of Sackolee Dāk Bungalow.
	...	818·311	
From Nagpoor to Raepoor	59	797·524	} Plinth of mile-stone.
	58	810·330	
	57	843·471	
	56	849·822	
	55	870·033	
	54	856·419	
	53	852·181	
Bridge	829·317	} Top of south parapet wall of a bridge about 50 chains west of the 52nd mile-stone from Nagpoor.
	...	825·565	
From Nagpoor to Raepoor	51	380·205	Plinth of mile-stone.
Bridge	831·667	Top of south parapet wall of a bridge close to the 50th mile-stone from Nagpoor.
From Nagpoor to Raepoor	50	832·267	} Plinth of mile-stone.
	49	849·940	
	48	861·123	

Table of Heights from Raepoor to Nagpoor,—continued.

NAMES OF STATIONS.	Mile-stones.	HEIGHT IN FEET ABOVE MEAN SEA LEVEL.	REMARKS AND DESCRIPTION OF STATIONS.
		Deducted by Spirit Leveling Operations.	
From Nagpoor to Raepoor	47	903·586	Plinth of mile-stone.
	46	865·254	
	45	841·302	
	44	868·875	
	43	832·078	
	42	823·175	
	41	807·597	
	40	829·969	
39	822·591		
Wein-Gunga River	...	775·047	Surface of water of Wein-Gunga River.
Cantonment Boundary Pillar +	...	800·323	Top of Cantonment boundary pillar 4·50 Chains west of the 38th mile-stone from Nagpoor.
Bhundara Dāk Bungalow	...	825·384	Sill of the middle door on the south side of the Bhundara Dāk Bungalow.
Bhundara Church +	...	829·617	Top of the lowest step of the door at the west end of the Bhundara Church.
From Nagpoor to Raepoor	37	826·770	Plinth of mile-stone.
	36	809·704	
	35	835·063	
	34	809·846	
	33	826·869	
	32	819·927	
	31	817·190	
	30	854·138	
	29	865·161	
	28	848·284	
	27	845·667	
	26	835·580	
25	861·613		
24	857·886		
23	867·749		
22	871·392		
21	870·746		
Mohada Dāk Bungalow	...	875·624	Sill of the middle door on the north side of Mohada Dāk Bungalow.
Kunhan River	...	813·522	Surface of water of Kunhan River.

Table of Heights from Raepoor to Nagpoor,—continued.

NAMES OF STATIONS.	Mile-stones.	HEIGHT IN FEET ABOVE MEAN SEA LEVEL.	REMARKS AND DESCRIPTION OF STATIONS.
		Deducted by Spirit Leveling Operations.	
From Nagpoor to Raepoor ...	20	860·762	Plinth of mile-stone.
	19	878·560	
	18	884·793	
	17	888·451	
	15	881·547	
	14	892·596	
	13	910·505	
	12	903·754	
	11	899·763	
	10	899·002	
	9	890·232	
	8	914·142	
	7	934·402	
	6	955·692	
5	931·642		
4	947·242		
3	986·832		
Railway Bench Mark	1005·890	Level of rails in the running shed at Nagpoor Railway Station.

Note.—The broad arrow is engraved on all the stations, (with the exception of those marked thus + and the mile-stones) to mark the point where the staff had been set up.

Description of country surveyed in the district of Raepoor, Central Provinces, Season 1869-70, by R. B. SMART, Esq., Deputy Supd. of Revenue Survey, 2nd Division, Central Provinces.

EXTENT AND GENERAL DESCRIPTION.—The tract of country surveyed occupies the south-western corner of the district, and embraces an area of 1464·67 square miles. The southern portion consists of hills and high plains or table-lands, the mean elevation of which is probably not less than 1,100 feet above the sea. The highest hill is near the village of Dullee in the Zemindaree of Lohara, and rises about 700 feet above the plains. The hills do not compose regular chains, and between the clusters of hills there is a considerable extent of land, in which, mixed with a good soil, there are fragments of rocks, of a size that does not impede the plough. During the rainy season, such lands are preferred. The stones preserve the soil cool and moist, and encourage vegetation. To the north the surface is undulating, poorly cultivated and scantily populated. A large extent is occupied by mere rocks, totally incapable of cultivation. The soil is varied, but the parts fit for the plough are rich and want only care to become highly productive.

IRON.—In the hilly portion the quantity of metallic matter in the form of ore is not very considerable, iron alone has been discovered. The ore is worked with imperfect skill. The heat of the furnace is so trifling, that it cannot vitrify the stony particles of the ore. The iron near Dullee is reckoned the best, selling at 10 seers for the rupee. The crude iron is never sent to a distance for market; the blacksmiths, who are employed in making the implements of agriculture, reside near the mines.

ROADS.—The greater part of the internal commerce of the district is carried on by carts and back loads, but the roads are exceedingly bad; the descents into many of the streams are so steep as to impede very much the passage. There is an abundance of hard materials, with which permanent roads, with little cost, might be made. No attention is paid in keeping up the great lines of communication.

RIVERS.—The principal river or stream is the Seonath, which rises in the hills of the Panabarus Zemindaree, and its tributaries are the Goomurria, Am, Soorie, Garaghat, Ghogwa and Huhap on the left bank; on the right bank are the Korkura, Tendoola and Khorsee. The Karoon, though a tributary of the Seonath, is the only one that merits any description; it rises in Pergunnah Dhumterry and flows almost due north for 75 miles, till it joins the Seonath a little below Sungah. The Kunhun is a tributary of the Karoon.

PERGUNNAHS AND ZEMINDAREES SURVEYED.—The pergunnahs and Zemindarees that were surveyed during the season are as follows:—

Pergunnah	Balod.	Pergunnah	Khullaree.
"	Patun.	Zemindaree	Lohara.
"	Sunjarree.	"	Khoojee.
"	Sehawa.	and a portion of Kankeir.	

BALOD.—Pergunnah* Balod lies to the south of the district between Dhumterry and Lohara. The southern portion consists of low rocky hills and dense jungle; the northern part is open and well cultivated, possessing a very fertile soil, and well adapted for wheat and rice, producing two crops in the year. The population is 79,213 souls. The revenue assessed is Rs. 42,343. A small tract of land belonging to Balod is situated in the Zemindaree of Lohara, lying below the Dulce Hill, and contains 14 villages. During the hot weather water is scarce in most villages. The town of Balod is situated 43 miles south-west of Raepoor, contains 802 houses and 1,800 inhabitants. There is an old fort, said to have been built at the close of the fifteenth century by the Rajpoot Kings of Ruttunpoor. In A. D. 1778 it was taken by the Maharattas. Height above the sea, 966 feet.

PATUN.—Pergunnah Patun lies in the very centre of the district. The surface is undulating and bare of foliage. The population amounts to 43,802 souls. The revenue is Rs. 57,655. When the first Maharatta invasion of Chutteesgurh took place in A. D. 1741, and when Blasker Pundit while on his way to attack Bengal, defeated Rughoonath Singh, the representative of the older branch of the Hylyunsee race at Ruttunpoor, Ummer Singh, the representative of the younger branch, was ruling at Raepoor; he continued to administer the government till 1750, when he was quietly ousted, and Patun, with Rajun and Raepoor, was one of the Pergunnahs he received for his maintenance. On his death, in 1753, the Maharatta Government confiscated the Pergunnahs. The village of Patun contains 492 houses and 1237 inhabitants.

SUNJARREE.—Pergunnah Sunjarree also contains a jungle and cultivated tract; the hills and jungles occupy the south of the pergunnah. The northern portion is well cultivated, and occupies the area between the Korkura and Seonath rivers. The total population is 25,835 souls. The revenue assessed is Rs. 3,452. The people are migratory in their habits; water scarce during the hot months, and wild animals are numerous. At the village of Sunjarree, there is an old fort. Height above the sea, 925 feet.

SEHAWA.—Pergunnah Sehawa is situated east of Pergunnah Dhumterry, and lying to the south-east of the district, is in a great measure unfit for the plough, being over-run with dense jungle and rocky and broken ground. This tract of country is considerably elevated above the sea, the villages being about 1,500 feet above the sea level, and the highest hill is 2,500 feet above the same level. In many places bare rocks pierce the surface and present bold naked masses. The surface is covered with forest in a state of nature. The large quantity of water that is drained off during the rainy season rushes down the numerous hill streams and flow in one common bed, the Mahanuddy. Many good paths fit for wheeled conveyance intersect the Pergunnah, one especially, leading from Sehawa to Dhumterry. In the valley of the Mahanuddy, the soil is good, and excellent crops of rice are raised, and the villages are fairly prosperous. The Mahanuddy river, which falls into the Bay of Bengal, near Cuttack, takes its rise a few miles to the east of the village of Sehawa, where it is an insignificant puddle in the middle of a rice field. The total area of the Pergunnah is 512673·78 acres, or 801·05 square miles. The population is only 10,891 souls; the revenue is Rs. 3,092.

KHULLAREE.—Pergunnah Khullaree is situate to the east of Pergunnah Raepoor, and embraces an area of 19842·88 acres, or 310·02 square miles. In many places bare rocks or stones encumber the ground, and numerous low hills are scattered over its surface, but a large portion of this tract is admirably suited for the growth of rice; the jungles yield large quantities of lac, mulwa and thatching grass. The land is watered by the Korar, Kesho and Bugdie nullahs. The village of Khullaree has about 50 houses and about 150 inhabitants. An annual religious fair is held in the month of March and lasts only one day. The fair is held for the worship of Khullaree Devee, to whom is dedicated a small Chubootra, at the top of the adjacent hill. The four temples in the village are said to have been built by the Hemar-pantees, or giants of former ages. The population is about 20,876 souls. The revenue assessed is Rs. 8,723.

LOHARA.—Zemindaree Lohara lies between Pergunnahs Balod and Sunjarree. It is hilly and covered with dense jungle. The principal hill is Dulce Pahar, it rises about 2,000 feet above the sea. The area is 179294·74 acres, or 280·15 square miles. The jungles contain large quantities of mulwa, koosum and beejasal trees. Lac, wax and honey are produced in large quantities. Iron is smelted from the ore, and sold on the spot, or the neighboring market villages. The country is well watered by numerous hill streams, but cultivation is in a backward state, though hemp and cotton are exported in small quantities. The Lohara Zemindar is a Raj Gond, and the estate was originally granted to his ancestors in A. D. 1538, in return for military service, by one of the Ruttunpoor Rajahs. He is of simple habits and has always been lenient to his ryots. The revenue assessed is Rs. 1,500. Lohara is 1,029 feet above the sea level.

KHOOJEE.—Zemindaree Khoojee is situated between Pergunnah Sunjarree and Zemindaree Nandgaon. The ground is rocky and covered with low jungle. The low lands produce excellent crops of rice. The Khoojee Zemindaree is of recent date, being given by the Maharattas to a Mussulman family. The Zemindar is a minor. The revenue is Rs. 1,370, and contains an area of 40285·64 acres or 62·95 square miles.

GOONDURDEHEE.—Zemindaree Goondurdehee is situated in the northern portion of Pergunnah Balod. The soil is fertile and well cultivated; the number of villages is 54, embracing an area of 53096·68 acres, or 82·96 square miles. The revenue is Rs. 4,290. The Zemindar is a Raj Koor, and the estate has been in the possession of his family for 300 years.

* Abridged from the Gazetteer of the Central Provinces, 1867.

INHABITANTS, GONDS.—Gonds* are found in all parts of Chutteesgurh. They generally observe

* Abridged from the Report of the Ethnological Committee.

Hindoo customs, but worship Nurbur Deo and Thakoor Deo, and sacrifice fowls and pigs. They pay reverence to the spirit of the dead, supposed to reside in a fish, caught in the village tank soon after the death of a relative. They burn their dead. The Raj Gonds claim descent from the Pandoos, and worship one great god, called by them Phersa Pend. They are broken up into four sections, and members of different tribes cannot intermarry.

The Phersa Pend is held in great veneration, and its emblem consists of small pieces of iron about six inches long, corresponding in number to that of the minor gods of the section by whom it is worshipped. These pieces of iron are placed in an earthen pot, and hung on a tree distant from the village, or from any highway of traffic. Previous to visiting it, the worshipper must bathe and put on clean clothes, and the women are required to dress in white, to leave the head bare and to abstain from painting their eyelids or faces.

There are several kinds of deities which are worshipped in the peculiar way of Gonds. Thakoor Deo is supposed to preside over the village and household and is considered the highest of all. The Gonds that live away from the jungles have become partly Hindooized. The jungle Gonds speak a separate dialect; those in the cultivated portions of the district speak the Chutteesgurhee.

Marriages are of two sorts, "Marmee" between a man and a virgin, and "Pat" between a married man or a widower, and a married woman relinquished by her husband, or a widow. Towards Bustar it is customary for all young men and women of marriageable age to live together for a month before marriage.

The women are all more or less tattooed; this work is performed by the Purdhan sect, who are looked down upon as a low caste and despised by the Gonds, although they have the same language, manners and customs, and occasionally marry Gondnee women who lose their caste. The Dholya sect supplies the servants and the musicians of the tribe.

All the women have considerable quantities of ornaments, and they are by no means above the vanity of false hair, occasionally mixing with their own hair long tresses of sheep or goat's wool. The women are kept as it were for beasts of burden and have to do the greater part of the field work; they are often reckoned among a man's possessions like so many cattle.

As soon as a woman is known to be with child, neither she nor her household perform any religious ceremonies during the nine months that she is pregnant, and the woman is put on a diet of rice-water and dal-bat. The day the child is born the woman is allowed nothing to eat but the root and leaves of the dwarf palm, cheend, which she eats like pan, always keeping a piece in her mouth. The married women whose husbands are living, tie their hair into a big knot behind, round which they wind red cord, a fashion forbidden to maidens and widows.

The belief in witchcraft is strong. Witches are supposed to have amours with the spirit of darkness, and to assemble at nightly meetings in the forest, where, stripped naked, they dance and sing with their demon lovers. The modes of testing a witch are various, but the following are the two principal: the suspected woman is beaten with castor-oil rods, and if she suffer pain she is deemed a witch, or, she is tied hand and foot and thrown into deep water, when, if she swim, her guilt is looked upon as proved.

BHOONJIAS.—Bhoonjias are numerous in Pergunnahs Sehawa and Khullaree, and speak the Chutteesgurhee dialect. They are stunted in height, with protruding jaws, broad faces and narrow foreheads. They live in the densest jungles and are by no means industrious. The Sehawa Bhoonjias worship Bhowance and Bheem Sing; the Khullaree Bhoonjias worship a deity called Kalbhyro; the former burn their dead, and the latter bury them marking the grave with a broad flat stone. Some days after death they take a pot of flour to the village tank or grave of deceased, and bring back the soul of the dead man. The Bygah officiates as priest at marriages.

BINJWARS.—The Binjwars are found in Pergunnah Khullaree and worship Doola Deo. They observe Hindoo festivals and adore the spirit of the deceased relative; they bury their dead and mark the place with stones. Three days after death of a relative, they take a pot of water with a leaf in it to the village tank, and bring back the soul of the deceased; the leaf is buried in the house and poojah is done at the spot where the leaf is buried.

The Binjwars live principally by collecting jungle produce and rarely cultivate the soil. They desert their houses if entered by any but the members of their own caste.

KAWURS.—Kawurs are principally to be found in Pergunnah Sehawa. They worship Dabee and observe Hindoo feasts. They burn their dead. After the death of the head of the household, a goat is set apart for one year and then eaten in honor of the deceased.

BYGAHS.—Bygahs sacrifice cocks and pigs. Three days after a man's death, his son throws grain before a fowl, if it eat any, then he believes that the spirit of his father has entered the house and the fowl is sacrificed.

NAHURS.—Nahurs bury their dead, marking the grave with stones; the graves are dug north and south, but they pay no reverence to the dead. Their religious customs are like the Binjwars.

SONRAS.—Sonras worship Maha Luchmee and observe Hindoo customs. They burn their dead. Brahmins officiate at marriages.

CLIMATE AND FEVER.—Fever is general every year, and it is followed by enlargement of the spleen and liver, and frequently by chronic rheumatism that long debilitate the patient. In the vicinity of the jungles, fever is less violent than in the parts where there is much cultivation. The clothing and lodging of the people are very bad, while the food, although plentiful, is in general destitute of seasoning. Dysentery is by no means uncommon. This year the district has been spared from cholera. The highest temperature during the past season was 104°·20, on the 23rd of April, the minimum at the same place was 45° on the 10th of January. The local character of the temperature depends on the rocky nature of the soil, and the bare rocks that encumber the ground. The solar rays during the months of March and April impart to the extensive rocky tracts a considerable quantity of heat, which is not uniformly diffused over the entire surface; it is thus evident that owing to this local qualification, a variety of climates prevail in the district. In the burning plains which stretch for miles, the surface is almost entirely bare of foliage and the intense heat accelerates evaporation. In the region of the forests, and in the valleys between the hills, the atmosphere is comparatively humid, and the land is clothed with vegetation.

The existence of clouds during the month of May modifies the heat of the rays of the sun, but the lowest strata of the atmosphere being in contact with the earth, and the radiated heat being in a great measure intercepted by the clouds, the weather becomes close and oppressive. The vicinity of the surrounding hills has also a great influence upon the temperature of the Chuttesgurh plateau. They attract the vapours of the air and radiate heat into the atmosphere. The hills also alter the prevailing winds and create local currents of air, which have a considerable effect upon its temperature. A strong, warm westerly wind, during the warmest days of March and April, is almost certain to be followed by north-westerly winds of extreme violence but of short duration. When the storm is near, a dead calm prevails, as it comes nearer, eddies of winds catch up the dust and leaves and whirl them aloft, and the temperature of the air rapidly sinks. A burst of loud thunder with vivid lightning clears the passage for a torrent of rain. After this commotion of the elements has subsided, the weather for a day or two becomes cool and pleasant. The sudden humidity of the air and the noxious exhalations from the vicinity of the great ranges of hills, give rise to those fevers which are regarded as so dangerous and intractable. The poorer classes seem to be the greatest sufferers. The prevalence of the disease and the great mortality occasioned by it may be accounted for in the deficiency of proper food, scantiness of clothing, and the use of bad water. The cold season is not characterized, as in Bengal, by the presence of fogs or dense vapors, only one foggy morning was observed in the month of March, after a heavy fall of rain the day before. The dews are copious, but when the west wind blows, they are scarcely observable.

TABLE G.

Annual Return of conspicuous objects met with by the 4th Division, Central Provinces, Revenue Survey, in Season 1869-70.

Number.	Description of object.	In what Village situated.	Pergunnah.	District.	DISTANCES ON THE MERIDIAN AND PERPENDICULAR FROM ○				REMARKS.	
					MERIDIAN.		PERPENDICULAR.			
					North.	South.	East.	West.		
1	G. T. S. Theka	Survey Block No. 1042.	Khootgaon Zemindaree.	Chanda.	...	100 61	6638 08	...	A principal station of the Jubbalpoor Meridional Series, on top of high hill, about 3½ miles south of the village Leka, station in good preservation, protected with a mound of stones.	
	G. T. S. Polam Rajál	Extension of work.	Aheree Zemindaree.		...	3905 19	5537 97	...	A principal station of the Jubbalpoor Meridional Series, on top of spur of a hill, about a mile south of the village of Elzoor, station in good preservation, protected by a mound of stones.	
	Topographical Survey Station "Korsnee".	Ditto	Hyderabad Territory.	Hyderabad.	...	4084 28	4639 84	...	A station of Topographical Survey, on top of an isolated hill about—miles south-east of the village of Korsnee on the Preheta in the Hyderabad territory—A mound, of loose stones and earth, marks the station, which is in fair preservation.	
4	Topographical Survey Station of "Chukleekussa".	Survey Block No. 1120.	Jarappara Zemindaree.	Chanda.	...	459 74	7000 17	...	Station on the south spur of a range of hills running nearly north and south, about ¼ mile north-east of the small village of Chukleekussa, main circuit 32. The station is in fair preservation, marked by a pile of stones about 14 feet high. The natives state it was constructed between 40 and 50 years ago. Station visible a long distance off. The hill is situated near the north of Jharappara Zemindaree.	
5	"Kaladoongree" Revenue Survey Hill Station.	Survey Block No. 848○D¹.	Ghote		2185 32	5044 30	...	Station on northern spur of the Kaladoongree Hill, ¼ mile south-west of the small village of Murraswey Peth, in main circuit No. 25, station marked by a pile of stones.
	"Pandga" Revenue Survey Hill Station.	Survey Block No. 846○C¹	Ditto		2170 56	6030 18	...	Station about a mile nearly due east of last station, situated on southern spur of the Pandga Hill. A pile of stones marks the station.
	"Afruzondee" Revenue Survey Hill Station.	Survey Block No. 853○O⁴.	Ditto		2542 42	0350 09	...	Station on the summit of the ridge of a high hill about ½ a mile north of the village of Soorgaon M. C. 25; about 10 links to the east of the station, is a masonry platform, marking the junction of the Talooka Waisur of the Aheree Zemindaree; the station is on the boundary of Aheree and Ghote, and marked by a pile of stones. The platform is in a hollow in the rocks which prevented its being made use of as a survey station.
	"Onrangee" Revenue Survey Hill Station.	Survey Block No. 852○E.	Ditto	...	...	2117	0227 20	...	Station on high hill over the village of Onrangee ¼ mile to the north-west; a pile of stones marks the spot.

TABLE G—continued.

Number.	Description of object.	In what Village situated.	Pergunnah.	District.	DISTANCES ON THE MERIDIAN AND PERPENDICULAR FROM				REMARKS.
					MERIDIAN.		PERPENDICULAR.		
					North.	South.	East.	West.	
10	"Peth" Revenue Survey Hill Station.	Survey Block No. 845○C.	Ghote ...	Chanda.	...	1954 38	6769 49	...	Station near the summit of a hill about 1½ mile north-west of the small village of Murreweye Peth. N. circuit 25, and close to the boundary between Maroonda Zemindaree and Ghote Pergunnah, a pile of stones is erected over the station.
	"Kondee" Revenue Survey Hill Station.	Survey Block No. 1095○L.	Aheree Zemindaree		...	2243 70	6431 50	...	About 2 miles south of the village of Kondee, N. circuit 31 Aheree Zemindaree, on the northern spur of a group of hills about ½ of a mile from the boundary of the Aheree Zemindaree and Ghote Pergunnah, station marked by a mound of stones.
	"Assoondee" Revenue Survey Hill Station.	Survey Block No. 1099○A.	Ditto ...	Chanda.	...	1780 33	6578 92	...	Station on a long hill about 1½ mile north-east of village of Assoondee in Aheree, and about a mile from the boundary of Maroonda. Station covered with a pile of stones.
	"Maroonda" Revenue Survey Hill Station.	Survey Block No. 987.	Maroonda Zemindaree.		...	1726 30	6726 84	...	An old station to the south-east of the village of Maroonda covered with a pile of stones near which iron ore is worked. Peak precipitous.
	"Jangda Meta" Revenue Survey Hill Station.	Survey Block No. 1068.	Rongee Zemindaree.	Chanda.	614 62	...	6716 20	...	Hill a mile to the south-east of the village of Jangda, a pile of stones has been erected over station.
	"Joona Meta" Revenue Survey Hill Station.	Survey Block No. 1067.	Ditto ...		614 83	...	6663 29	...	Hill peak 2 miles to the north of Jangda, marked by a pile of stones, hill conical in shape.
15	"Neelmeta" Revenue Survey Hill Station.	Survey Block No. 1073.	Ditto ...	Chanda.	611 50	...	6344 50	...	Hill peak 1 mile to the north of village of Sygondee. A pile of stones marks the station.
	"Dewul Meta" Revenue Survey Hill Station.	Survey Block No. 1068.	Ditto ...		760 77	...	6529 79	...	Hill peak 1 mile to south-east of the village of Moholee, near this intersected point is a stone worshipped by the Gondis; hence the name of the hill.
	"Pooasawundee" Revenue Survey Hill Station.	Survey Block No. 1085.	Ditto ...	Chanda.	445 30	...	6440 04	...	Small hill a mile to the south-west of the village of Pooasawundee. Marked by a pile of stones.
19	"Jurrgaon" Revenue Survey Hill Station.	Survey Block No. 991○C.	Maroonda Zemindaree.		...	1606 14	6217 19	...	Hill peak a mile to the south of village of Jurrgaon, a Revenue survey Station.

THE
FORTRESS OF ASEERCURH
AND
TOWN OF ASEER

Scale 6 Inches = 1 Mile

True Meridian



REPORT
 ON THE
REVENUE SURVEY OPERATIONS,
 IN
BRITISH BURMAH
 FOR
SEASON 1869-70.

.....

THE Establishment under Mr. Lane, after the despatch of the records of the preceding season, left Akyab on the 6th December for Kyouk Phyoo, and work may be said to have been commenced about the middle of the month.—

- Mr. W. Lane, Deputy Superintendent, 3rd Grade.
- ASSISTANTS.
- Mr. G. S. Swiney, Surveyor, 1st Grade.
- Mr. J. Pickard, Surveyor, 2nd Grade, transferred from 5th Division, Lower Provinces, 20th November 1869.
- Mr. R. Barclay, Surveyor, 4th Grade, transferred to 5th Division, Lower Provinces, 1st November 1869.
- Mr. S. M. Smylie, Assistant Surveyor, 1st Grade.
- Mr. D. A. King, Assistant Surveyor, 3rd Grade.
- Mr. G. C. Swiney, Probationary Surveyor, 4th Grade.
- 24 Sub-Surveyors, &c.

2. DIVISION OF ESTABLISHMENT INTO CAMPS.—The Establishment was divided into two camps, one placed under Mr. Pickard, and the other under Mr. Smylie, Mr. Swiney, senior, having been absent at the time on duty at Head Quarters in Calcutta.

3. THE TRACTS ALLOTTED FOR SURVEY.—To Mr. Pickard was allotted the section of the District abutting Mr. O'Donel's previous surveys, and bounded to the east by the River Aeng, this was to have been geographical, on the scale of 1 mile to the inch, and to Messrs. Smylie and King was made over the remainder of the island of Ramree, Cheduba and its adjacent islands, to complete on the usual Mouzahwar scale of 20 Gunter's chains to an inch.

4. NATURE OF THE COUNTRY FOR SURVEY.—Dense jungle, hills, and tidal creeks prevailed every where, and retarded proceedings beyond all ordinary instances. The work, however, was just beginning to proceed smoothly when, exactly a month from its beginning, a Telegram was despatched directing its immediate stoppage. This order left no alternative, and within half an hour from its receipt messengers were despatched to call in all the Field Parties.

Sudden stoppage of operations.

5. RESUMPTION OF OPERATIONS UNDER MR. SMYLIE FOR THE COMPLETION OF RAMREE.—As reported, it was arranged subsequently, under the sanction of the Chief Commissioner of British Burmah, that the island of Ramree should be completed; accordingly Mr. Smylie, with a party of five Field Sub-Surveyors and a proportionate Field and Office Establishment, was sent back to the southern portion of the Island, and in good time he accomplished this work and reported himself at Calcutta on the 21st March 1870.

6. TRANSFER OF FOUR OUT OF THE FIVE SUB-SURVEYORS TO THE FOURTH DIVISION IMMEDIATELY ON THEIR ARRIVAL AT CALCUTTA.—Immediately on Mr. Smylie's arrival four of his best men were drafted off to the Hooghly survey, leaving but one experienced Sub-Surveyor and two computers to cope with the Office work, and at the end of April this Sub-Surveyor was also sent off to the same Party. Two Draftsmen were taken on temporarily, one of whom proved rather incompetent.

7. **AREA SURVEYED BY MR. SMYLIE.**—The work accomplished by Mr. Smylie is 115.12 square miles; the average corrections in the main circuit, which was surveyed by Mr. Smylie in person, are much below the maximum allowance, and the village proofs are also fair.

8. **MAIN CIRCUIT OF CHEDUBA SURVEYED BY MR. KING AND CAUSES THAT INTERFERED WITH ITS COMPLETION.**—The main circuit of Cheduba island was surveyed by Mr. King. It has been set up and roughly proved by Traverse; rechainning could not be undertaken, nor can it be utilized. Had the work been less suddenly put a stop to, the whole of this island would have been got through by the middle or end of February, as all the difficult jungle cutting had well nigh been accomplished, and the boundaries and interiors were commenced. Owing to the peculiar circumstances, advantage could only be taken where clearances had been effected, to measure the boundaries. So there is not that completeness in the surveys made which would admit of their being put up, proved, and mapped. A good portion of the boundary on the circuit, moreover, was not surveyed, when the order for the stoppage arrived.

9. **EXTENT OF THE ISLAND OF CHEDUBA.**—The Island is upwards of 176 square miles in extent, and of volcanic origin; in fact during the survey progress, one of the volcanoes burst forth with great activity, preceded by a disturbed sea, whilst a calm atmosphere prevailed. It sent forth streams of flame, and threw up showers of stones, which could be seen on the shores of Ramree Island, right across the Bay.

10. **NATURE OF THE SOIL.**—The soil, where adapted for agriculture, is rich and highly fruitful. The whole of Arracan is visited with heavy periodical rains, favorable to rice cultivation.

11. **MEASURES TAKEN FOR THE PRESERVATION OF STATION MARKS WITH A VIEW TO FUTURE OPERATIONS**—With reference to the future resumption of operations in Cheduba, due steps were taken by Mr. Lane to impress upon the District Officer the necessity of carefully preserving our station marks, although without constant repair there is little hope of their enduring long the ravages of white ants, and the heavy monsoons, &c., &c.

12. **EXTENT COVERED BY A NETWORK OF TRIANGLES.**—As shewn in Return D., about 225 square miles were covered with a series of long sided triangles, and but very little Interior and Boundary surveys had been attempted when operations were discontinued.

13. The same table shows how the Assistants were disposed of. Mr. Smylie was the last attached to the Party, and he left by train for the 4th Division, Central Provinces, on the evening of the 1st June 1870.

14. **AZIMUTHS.**—For No. 2 Circuit, Mr. Smylie laid down a test Azimuth to the south of the Island, and Mr. King observed on Cheduba. The Field Book, and calculations have been affixed to the circuit.

15. **INSTRUMENTS AND CAMP EQUIPAGE HOW DISPOSED OF.**—The Instrumental equipment was good; 7-Inch Theodolites were employed for the Circuits and triangulation. The whole of the Ordnance Stores and Camp Equipage have been disposed of by return into the Mathematical Instrument Department, Arsenal Fort William, &c.

16. **MAPS AND RECORDS HOW DISPOSED OF.**—The records have all been lodged in the Superintendent of Revenue Surveys' Office, including the Maps of the current season that have been prepared. The duplicate Atlas sheets for the Civil Authorities have been bound and made over for despatch to the Deputy Commissioner of Ramree, and that Officer solicited to send a receipt direct to Superintendent of Revenue Surveys' Office.

17. LISTS OF GOVERNMENT PROPERTY, &c., LODGED IN THE HEAD QUARTERS' OFFICE.—Detail lists of the Government property, records, and a statement of the disposal of office kit, with the Bank of Bengal's receipt for Government on account of those sold, together with the auctioneer's account sale, &c., have all been deposited in the Head Quarters' Office.

CIRCUMSTANCES WHICH INTERFERED WITH A PROPER CALCULATION OF THE COST OF THE AREA SURVEYED.—No attempt has been made to calculate the cost of the area accomplished, because the expenditure has been materially affected by extraordinary causes. Whilst the Survey was actually at work for barely more than one month, the maintenance of an Establishment for the purpose of being employed a full season, the cost of passages, freight and other contingent out-lay on the abrupt stoppage and withdrawal from the Field of the Party just when the machinery was attaining full speed, cannot well be debited against the small out-turn. The heavy preliminary expenditure has been entirely sacrificed, owing to the stoppage of work by the orders of Government at that period, and acted on immediately.

SUPDT. OF REVE. SURVEYS' OFFICE,
CALCUTTA,
The 15th November 1870.

} JOHN MACDONALD, MAJOR,
} *Offg. Supdt. of Revenue Surveys, Lower Circle.*

No. 1 A.

SUPERINTENDENT OF REVENUE SURVEY'S OFFICE,

LOWER CIRCLE,

Calcutta, 9th November, 1870.

FROM

MAJOR JOHN MACDONALD,

Offg. Superintendent of Revenue Surveys,

Lower Circle,

TO

ROSS L. MANGLES, Esq., V. C.,

Secretary to the Board of Revenue,

Lower Provinces, Fort William.

SIR,

I HAVE the honor to submit the following report on the Survey Operations of Season 1869-70, for the information of His Honor Sir W. Grey, Lieutenant-Governor of Bengal.

2. On the departure to England, on Furlough, of Colonel James Eardley Gastrell, Superintendent, Revenue Surveys,

Military Department, No. 1280, dated 28th December 1869.

Upper Circle, under orders marginally quoted, Colonel D. C. Vanrenen assumed charge of the Upper Circle, and I was* gazetted to this office, which I joined on the 27th April, after my return from special duty in the Lushai Hills east of Sylhet.

* Home Department Notification, No. 07, dated 10th February 1870.

3. During the past season an area of 6,445 square miles was surveyed in District Hazareebagh of Chota-Nagpoor, District Hooghly, and the Suburbs of Calcutta in the Presidency Division, District Cooch-Behar, and Districts Nowgong, Sebsaugor, and Luckimpoor of Assam. The area and cost are shown in the tables accompanying this report. The mileage rate is Rs. 15-2-0 less than it was last year.

4. In immediate consequence of the financial crisis and its pressure as acting on the expenditure of our Department, the 5th Division, Revenue Survey, which had just completed the survey of the Western Dooars and Cooch-Behar, has been broken up, from the 1st instant. Mr. O'Donel was directed to take charge of the 1st Division, to re-place Captain Butter, whose services have been re-placed at the disposal of His Excellency the Commander-in-Chief. The servicable men and equipment of the 5th Division, have been utilized, to re-place vacancies in the other surveys, and some subordinates who were deprived of their situations in consequence of the abolition of their office, have been recommended for gratuities according to their length of service, under the orders of the Government of India, Financial Department, No. 4088, dated 26th August 1863.

5. During the past year there has been no inspection of the Assam Surveys. In para. 9 of my report to His Honor for the season 1867-68, dated 27th November 1868, I stated that the condition of the 1st Division under Captain Butter was unsatisfactory. In the 11th para. of my predecessor's letter, No. 12, dated 12th January 1870, to your address, covering this office report for the year 1868-69, my dissatisfaction with the state of the 1st Division was again noted. On the 1st June 1869, previous to making over charge of this Circle of Superintendence to Colonel Vanrenen, I made a special report on Captain Butter to the Surveyor General, and also wrote very severely to that Officer, warning him regarding his neglect of duty. Copies of this correspondence have been duly forwarded to the Secretary, Government of Bengal, with the letter noted in the margin.* His Honor will, therefore, see that this office was slow to punish

* No. 1, dated 17th October 1870.

Captain Butter, who was last reported on the 12th January to His Honor, as having then failed to submit his records for 1867-68; on first examination they were found to be very defective, and quite unequal to the requirements from the Departmental standard of excellence. In this Office No. 55, dated 1st April last, Colonel Vanrenen notified to Captain Butter that he would be relieved from the charge of his establishment as soon as it was feasible to send up an Officer to re-place him. This has been done. Captain Butter's connection with this Department ceased on the 30th September last.

6. In July last I proceeded to Hazareebagh and visited Captain Sconce's Survey. I found everything in the best possible state of efficiency. Captain Sconce is an Officer who is completely devoted to his duty, and consequently he instils equally rigid notions in the minds of his subordinates. His re-survey is being done in a most thorough manner, and shows to such advantage in comparison with the mapping of seasons 1863-64-65, which was not rejected with the rest of Major Thompson's work, that, considering the known mineral resources of that part of the country, I most strongly and respectfully urge upon His Honor's consideration the extreme value of retaining Captain Sconce's superintendence to re-survey the whole District. It is most important that the matter should be determined at once, to enable the preliminary triangulation in Palamow to be done in advance.

7. I urge this, because Purgunnah "Torce," which is a portion of the work that had not been rejected, has since been tested by an overlap from Captain Depree's Topographical Survey. It must be done over again, as it is not possible to fit the topography, shown in adjacent maps, to the work done in 1863-64. Perhaps the Palamow work was considered sufficiently accurate for the present requirements, but I think its value should be placed on record. I am confident that the comparison of the overlap, which will be surveyed in the course of the present season, 1870-71, will justify my opinion that Captain Sconce's working power should be employed in completing the whole District in uniform style.

8. I next inspected the 4th Division, employed under Captain Stewart in Punchannogram and Hooghly Districts. The efficiency of this party has greatly deteriorated through long employment in scattered portions and different

Districts. This opinion was commented upon by me in my report for 1867-68, and again supported by my colleague's opinion in his report to your Board on our work of 1868-69. Captain Stewart has ability, but he has had peculiar difficulties which have overtaxed his energies. I have rejected portions of the Hooghly work, because it was undertaken too late in the season to ensure good results in angles on low lying swampy grounds. I would like to say more in Captain Stewart's favor. The mapping of the Suburbs of Calcutta, on the large scale of 100 feet to the inch, is magnificently rendered, and is a credit to his office.

9. I have warned some of Captain Stewart's Sub-Surveyors, preparing them, to be content with half their present salaries unless I am pleased with their field maps, when I inspect them next February; and I have urged Captain Stewart to exercise a very rigid supervision over his establishment, and show better administrative arrangement regarding his season of labor. The best establishment in the country would soon become disorganized if compelled to work in the rainy season. The small area surveyed in Hooghly has been obtained by keeping part of the establishment out during the whole of the rainy season. Captain Stewart takes the field for season 1870-71, warned that his work must be finished before the 1st July 1871, after which date he will not be permitted to keep up any field establishment. He will not be allowed to take up new work until his arrears have been completed.

10. It is with regret that I report the temporary loss of Mr. O'Donel's services. That experienced old officer has been obliged to proceed to Sea: he could now be very valuably employed in clearing up the confusion caused by the late neglect of the 1st Division.

11. Captain Willoughby Osborne, in charge of the 2nd Division at Luckimpoor, and Mr. Talbot in charge of the small Seebaugor party, have both done well; and by good management with their personal co-operation in the field, have reported the completion of larger areas than had been previously submitted from their establishments.

12. With the exception of the maps of the 1st Division, I am glad to report that the general standard of excellence is fully maintained, and the maps boldly and clearly drawn. As an experiment, I have consented to accept only large scale maps from the 2nd Division, and their reduction to the mile scale will be made for this Office by Photography.

13. I add, at the end of this report, a letter detailing the work done in the Boundary Commissioner's Office. The Head Writer and Head Draftsman continue to merit favorable mention.

14. I append a list of the Revenue Survey maps which have been published during the year.

15. In conclusion I beg to bring to His Honor's favorable notice the steady application to their duties shown by Messrs. J. P. Adels and A. C. Cunningham in the Correspondence Branch; Mr. F. W. Kelly has continued to

improve the style of working in the drawing and computing rooms, and our Head Accountant, Mr. Gopal Chunder Laha, deserves very cordial acknowledgment of his zeal and industry. The office duties have been well carried on; there are no arrears, and work is expeditiously completed.

I have the honor to be,

SIR,

Your most obedient Servant,

JOHN MACDONALD, MAJOR,

Offg. Superintendent of Revenue Surveys,

Lower Circle.

A.
General Return of Professional work for Season 1869-70, exhibiting area and cost of the Bengal Surveys.

Survey Division.	District in which employed.	No. of Villages or Waste Land Blocks.	Square Miles.	Expenditure.	REMARKS.
1st Division ...	Nowgong ...	103	1,105	Rs. As. P. 62,391-2-3	
2nd Division ...	Lachimpoor ...	42	1,282	65,590-0-2	
4th Division ...	{ Hooghly ... Panchannogram ...	855 9,361 Holdings	415 15	53,062-4-2	
3rd Division ...	Cooch-Behar ...	650	709	47,933-8-7	
5th Division ...	Hazareebagh (Topographical) ...		2,524	52,659-3-10	Includes 207 square miles of overlap on the adjoining Districts.
UPPER ASSAM ...	Seebsaugor ...	61	415	20,062-15-2	
	Total	{ 1,731 Villages— 5,361 Holdings	6,445	3,02,113-2-2	
	REVENUE CHARGES	"	"	"	
	GRAND TOTAL FOR 1869-70 ...	...	30,712	3,02,113-2-2	

SUPD. OF REVENUE SURVEYS' OFFICE, }
 Calcutta, 9th November, 1870.

JOHN MACDONALD, Major,
 Offg. Superintendent of Revenue Surveys,
 Lower Circle.

B.

State completed in the Lower Provinces.

1869-70.

STATE.	Commenced.	Finished.	By whom surveyed.	AREA IN		Cost.	Rate per Square Mile.	REMARKS.
				Acres.	Square Miles.			
Cooch-Behar	Season. 1868-69.	Season. 1869-70.	J. H. O'Donel, Esquire	8,39,972	1,312	83,875	63-14-10	

SECT. OF REVENUE SURVEYS' OFFICE, }
Calcutta, 9th November, 1870.

JOHN MACDONALD, MAJOR,
Offg. Superintendent of Revenue Surveys,
Lower Circle.

List of Revenue Survey Maps of the Lower Provinces published in 1869-70

OCTOBER 1869.

Ganges River, Main Circuits Nos. 1, 22, 23 & 24, & 25, scale 1 mile=1 Inch.

NOVEMBER 1869.

General Map of Chittagong District in 3 sections, scale 4 miles=1 Inch.

Noacolly District, Main Circuit No. 7, scale 1 mile=1 Inch.

Cuttack District (in 9 sheets), scale 1 mile=1 Inch.

Commillah Station, scale 8 miles=1 Inch.

DECEMBER 1869.

Portions of Ganges River, sheet No. 2, scale 4 miles=1 Inch.

Cantonments and Environs of Barrackpore, scale 6 Inches=1 mile.

JANUARY 1870.

District Noacolly, Main Circuits Nos. 3, 4, & 5, scale 1 mile=1 Inch.

Pubna Dearah Survey, Main Circuits, Nos. 28, 29 & 30, scale 1 mile=1 Inch.

Town of Sylhet, scale 8 Inches=1 mile.

Berhampore Cantonment and Environs in 6 sheets, scale 8 Inches=1 mile.

Berhampore Cantonment and Environs in 4 sheets, scale 6 Inches=1 mile.

Plan of Rampore Bauleah, in 4 sheets, scale 16 Inches=1 mile.

District Pooree (second edition), scale 1 mile=1 Inch.

FEBRUARY 1870.

District Balasore (in 9 sheets), scale 1 mile=1 Inch.

MARCH 1870.

District Noacolly, Main Circuit No. 6, scale 1 mile=1 Inch.

District Secbsaugor, Assam Circuits, Nos. 5 & 6 (re-prints).

APRIL 1870.

District Cuttack, in 9 sheets (re-print), scale 1 mile=1 Inch.

MAY 1870.

District Jessore, sheets 1, 2, 3, 4, 5, 6, 7, 8, & 9, scale 1 mile=1 Inch.

District Hazarcebagh, sheets Nos. 7, 8, & 9, scale 1 mile=1 Inch.

Ganges River, Survey, sheets Nos. 1 & 3, scale 4 miles=1 Inch.

District Pooree in 8 sheets (re-print), scale 1 mile=1 Inch.

District Balasore, 9 sheets, (re-print), scale 1 mile=1 Inch.

Cantonment of Ballygunge, 2nd edition, scale 24 Inches=1 mile.

Cantonment of Allypore, 2nd edition, scale 24 Inches=1 mile.

JUNE 1870.

Index to Sheets of District Jessore.

District Lohardugga, Sub-Division Palamow & Toree, scale 4 miles=1 Inch.

Akyab Cantonment and Environs, scale 12 Inches=1 mile.

JULY 1870.

District Noacolly, Main Circuit No. 8, scale 1 mile=1 Inch.

District Furreedpoor, Main Circuits Nos. 2 & 8, scale 1 mile=1 Inch.

District Furreedpoor, Main Circuits Nos. 4, 5, & 6, scale 1 mile=1 Inch.

District Moorshedabad, (re-print), scale 4 miles=1 Inch.

District Hazareebagh, (2nd edition), Preliminary Map, scale 4 miles=1 Inch.

AUGUST 1870.

Noacolly District, Main Circuit No. 9, scale 1 mile=1 Inch.

District Cachar, sheets Nos. 1, 2, 3, 4, 5, 6, & 7, scale 1 mile=1 Inch.

District Furreedpoor, Main Circuits, Nos. 1 & 3, 7 & 7½, & 9, scale 1 mile=1 Inch.

District Dacca, Main Circuits Nos. 5 & 6, scale 1 mile=1 Inch.

SEPTEMBER 1870.

Dacca District, Main Circuits Nos. 1 & 2, 3 & 4, 7 & 8, 10, & 13 & 14, scale 1 mile=1 Inch.

SUPDT. OF REVENUE SURVEYS' OFFICE, }
Calcutta, the 9th November, 1870. }

JOHN MACDONALD, MAJOR,
Offg. Superintendent of Revenue Surveys,
Lower Circle.

GENERAL REPORT

ON THE

REVENUE SURVEY OPERATIONS OF THE LOWER PROVINCES

FOR

SEASON 1869-70.

FIRST DIVISION.

District Nowgong—Assam.

This Division entered on the Survey of the new District of Nowgong early in November 1869, leaving a small party at Gowhatty to bring up the mapping of 1868-69, as well as to survey the 233 Lakhiraj estates which had remained over from the work of 1868-69, as noticed in para. 2 of the Report for that year. This small party completed its work about the end of January 1870, and then moved into District Nowgong.

Mr. J. H. O'Donel, Deputy Superintendent, 1st grade, took charge from Captain Buttor, 1st August 1870, and is on sick leave from 12th September 1870.
 Captain A. D. Buttor, Offg. Dy. Superintendent, 3rd grade in charge up to 31st July 1870.

ASSISTANTS.

Mr. W. Sinclair, Surveyor, 3rd grade, transferred to 4th Division, 1st January 1870.
 Mr. C. Brownfield, Surveyor, 3rd grade.
 " L. G. Hill, Assistant Surveyor, 2nd grade, on sick leave from 11th September 1870.
 Mr. R. B. Smart, Jr., Assistant Surveyor, 3rd grade.
 " J. O'Toole, Probationary Surveyor, 4th grade.
 " S. Scallan, Ditto, Ditto, appointed 10th November 1869.
 25 Sub-Surveyors, &c., (for Professional Survey.)
 10 Ameens (for Civil Demarcation.)

2. The entire survey returned to Recess Quarters at Gowhatty in May and June 1870.

3. *Position and Limits.*—The portion of District Nowgong surveyed during this season lies approximately between North Latitude $25^{\circ}32'$ and East Longitude $92^{\circ}32'$ and extends north to the Brahmapootra; south to the Khasia Hills; east to the meridian of the station of Nowgong; west to the Kamroop boundary.

4. *Area.*—The total outturn is 1,105.32 square miles, thus distributed:—

Description of Area.	No. of Polygons.	Acres.	Square miles.
Villages (Government land)	61	5,15,451.3	805.39
Lakhiraj land, paying $\frac{1}{2}$ rent & rent-free	32	24,770.7	38.70
Grants rent-free & under 99 years' tenure	13	9,440.9	14.75
Brahmapootra River ... ..	...	1,40,377.2	218.34
Hills along the southern boundary ... ..	...	17,368.0	27.14
Total	100	7,07,408.1	1,105.32

5. *Overlap on the Khasia Hills' Survey.*—The last item of 27.14 square miles represents an overlap surveyed along the work of the Khasia and Garrow Hills' Topographical Survey, with which, the Surveyor states, "it was found to agree very fairly." He says he could not identify any stations of the Topographical Survey, but adds that "several village sites in the plains, although differing in orthography, agree remarkably well as to position with those shown on the sketch map of the Topographical Survey."

6. *Junction with District Kamroop.*—A perfect junction is reported to have been made with District Kamroop, the main circuit stations along the common boundary having all been found.

7. *Connection with G. T. S. Triangles.*—The Traverse Survey of District Nowgong was connected with four Great Trigonometrical Survey Stations of the Assam Valley Triangulation, three in Nowgong, and one in Kamroop.

8. *Detail Survey.*—The Surveyor states that “the whole tract (in Nowgong) was surveyed on the full scale of 4 inches=1 mile, the boundaries of all lakhiraj holdings being also shown on double that scale.” The *churs* or islands of the Brahmapootra river belonging to District Durrung were surveyed on the scale of 2 inches=1 mile. “The Survey of the interior details has been carried out with considerable minuteness, the numerous patches of cultivation scattered about in large tracts of jungle have all been carefully marked; streams, roads, village paths, and all other topographical features, throughout the work, have been scrupulously surveyed, except a few impassable swamps in the southern half of Mouzah Sohory * * * * The relative depths of beds to banks of the Sonai, Kullung and Demal rivers have been shown at distances of one to two miles apart.”

9. *Check Survey.*—The Interior Surveyors were constantly visited by the Assistants in charge of camps who tested the work in the field. The detail Survey was further checked by 67 linear miles of Survey run through it by two European Assistants and two Sub-Surveyors. The check Survey “agreed very fairly with the board plans.”

10. *Permanent Marks.*—Numerous substantial mounds have been raised, to mark the tri-junctions and boundaries of Villages, Grants and lakhiraj holdings throughout the season's work.

11. *Grants.*—The Surveyor remarks that out of thirteen grants surveyed during the season, ten are situated at the foot of the Khasia Hills, and all, except five grants, appeared to have been abandoned. “Where no responsible agent or owner was found, the boundaries were surveyed as pointed out by the village people who had worked on the grant.”

12. *Lakhiraj Lands.*—The areas of the thirty-two pieces of lakhiraj lands surveyed in District Nowgong, calculated by the professional survey, showed that in all but one or two cases the lakhirajdars possessed far more land than they were entitled to. This discrepancy, the Surveyor reports, was brought to the notice of the Deputy Commissioner of Nowgong, but “as the lakhiraj question was under consideration at the time, no action was taken, and the boundaries are still undecided.”

13. *Boundary Disputes.*—The subjoined extract from para. 19 of the Surveyor's Annual Report points out the delays and difficulties caused by needless boundary disputes among Mouzahdars, and the inconvenience which results from the alteration of village boundaries subsequent to survey.

“Another serious cause of delay to the work, occurred in the numerous disputes raised by neighbouring Mouzahdars for strips of land, often extending the whole length of one boundary of the Mouzah, the needless loss of valuable time thus occasioned to Sub-Surveyors in being obliged to survey two lines of boundary, and to the Officer in charge of the camp in having to enquire into the dispute, to map and explain the bearings of the case for the Deputy Commissioner, was all the more to be regretted, because the Mouzahdars being simply Collectors of Revenue, Government through its Officers, was obviously at liberty to prescribe any limits to the extent of land from which each Mouzahdar should collect the taxes. No proprietary rights whatever being involved in such cases they might with advantage have been disposed of by the Surveyors on the spot, taking permanent marks, or natural features of the country, as the boundaries where Mouzahdars could not be brought to agree to one line. Or a better plan would perhaps be, for the Surveyors to measure symmetrical blocks of land; marking the boundaries distinctly on the ground. By this means, disputes between Mouzahs would be done away with altogether, and the value of the survey enhanced. The present system of constantly altering the limits of Mouzahs by amalgamating two or more, and calling them by one name, or dividing one into parts, with separate Collectorate numbers and names, will tend to render the present maps extremely

" confusing, for instance, if a tract of land has been surveyed as Mouzah Jagialgaon and shortly after survey, " it be divided into two distinct Mouzahs, one retaining the original name, and the other called by another, " future civil officers will seek, in vain, for the second Mouzah on our maps. Grants and Lakhiraj holdings " which were said to be in one Mouzah when they were first sold, or granted, have been found in others at " the time of survey, for instance, Grants Nos. 46 and 47 were given in the Collector's list, as being in " Mouzah Oottur Khola, but in consequence of the curtailment of the limits of that Mouzah the grants were " found in Mouzah Nelly, and accordingly shewn on the Revenue survey maps and Registers in that " Mouzah; but if the two Mouzahs be amalgamated at some future time, and be called by one name (Oottur " Khola) the survey records instead of being valuable documents, will only tend to mislead civil officers; " this state of affairs would not be worth mentioning, if only solitary cases occurred, but the number of men " capable of taking charge of a Mouzah is so limited, that transfers and changes are constantly necessary. " If the proposal, to survey blocks of convenient size, giving them local names, and distinct numbers be adopt- " ed, the confusion referred to above would be obviated; for Mouzahdars could have a certain number of well " defined blocks of land made over to each to collect the revenue from, and all necessary changes could be " made by adding to, or subtracting from, the charge of a Mouzahdar one or more of the blocks. The maps " would thus be permanent records of *existing* Revenue Divisions, and the measurements for settlement " purposes, which are so tedious now, would be greatly facilitated."

14. *Personnel*.—The European Assistants and Sub-Surveyors are all reported to have worked well.

15. *Future Operations, 1870-71*.—During the coming season, 1870-71, the boundary on the Khasia Hills' Frontier will be laid down and mapped. The survey of District Nowgong will be continued eastward, and the Surveyor calculates on completing 1,000 square miles.

16. *Demarcation*.—The Surveyor's report on the Demarcation Branch of the Survey, will be found in the Appendix. I do not quote it, as it is not very intelligible.

17. When Mr. O'Donel took charge, from Captain Butter on the 1st August 1870, he found the work of District Kamroop in great confusion, and boundaries that ought to have been settled in the field season of 1868-69-70 were still unfinished.

18. *Civil Demarcation*.—Through want of method the board plans of grants have been mixed up with the villages in which they were surveyed. None had been prepared as separate maps, to be lodged as Demarcation Records. Mr. O'Donel wrote that all this work was " more or less unintelligible." Mr. O'Donel has accordingly declined to be responsible for the work of 1868-69, of which I have ordered 20 per cent to be re-opened, or double the usual examination test.

19. *British Boundary District Kamroop*.—In 1867-68, the Bhootan and Goalpara District boundaries were left unfinished. The whole line of boundary on Bhootan is not marked in any way, except by our traverse lines. The Hills for several miles adjacent to this boundary have not been laid down. Colonel Agnew, the Acting Commissioner, is opposed to any further survey of the Dewangiri boundary; but he has asked for an Assistant to survey the disputed boundary between Goalpara and an Island in the Brahmapootra.

20. *Boundary on Khasia Hills*.—In 1868-69 the Khasia Hill boundary was left unsurveyed; a tract of about two or three hundred square miles has been left unsurveyed, which it was supposed would be included within the limits of Major Godwin Austin's survey; thus the maps of Kamroop north and south of the Brahmapootra are still incomplete. It is certain that the information submitted to this office last year, stating that District Kamroop had been finished and returned as such in Table B. accompanying the letter to the Board, is incorrect, so far that survey work is still required to complete it finally, in case the unsurveyed portion is decided on as belonging to Kamroop.

21. *Lakhiraj*.—All the lakhiraj lands, with the exception of a few surveyed in 1867-68-69 in south Kamroop, require to be re-surveyed, the areas being in excess of those decreed by the Special Commissioner. In North Kamroop the lakhiraj lands are generally scattered in fields within the work of seasons 1865-66-67, which was done before the Professional Survey had anything to do with the matter. The lakhirajdars are chiefly non-resident proprietors and

can give little or no information about boundaries. The resumed and rent-free lands are much intermixed in fields, and in Bengal would be measured as "Mehalwar Chucks," by Ameens. A Professional Survey of detached fields would be of little value. When lakhirajdars hold estates within specified boundaries, I do not think the Revenue Courts have the power to alter those boundaries if the area within those assigned limits is in excess of the recorded areas. Such alterations if made, will undoubtedly be contested in the Civil Courts.

22. It is a matter of regret that the Officiating Deputy Superintendent, Captain Butter, did not approach the lakhiraj work in the season of 1868-69. It has only been within the last few months that my enquiry has been directed to this subject. The correspondence between the Survey Officer and the Deputy Commissioner is of the most meagre description, and shows that no attempt was made to grapple with the whole matter, and bring it to the notice of the Board. I have looked at it, because the lakhiraj question has been submitted as the cause of the great difficulty that the 1st Division has had to contend with, but when I find that the work has not been done, and that no preliminary enquiries have been made to ascertain whether the lakhiraj lists can be traced in the field from the khusrah file, it is impossible to accept this as a cause for the backward state of the 1st Division Survey, and the extreme irregularity with which it was administered. It was incumbent therefore on this office to remove Captain Butter from its charge, and as the Department was to be reduced by one party, Captain Butter was removed from it as its least efficient Officer.

A description of the country surveyed will be found in the Appendix.

SECOND DIVISION.

District Luckimpoor—Assam.

23. *Preliminary Arrangements.*—Lieutenant W. Barron, the Officer in charge of this party, being compelled by ill-health to take furlough towards the end of 1869, was on the 8th December relieved by Captain J. H. W. Osborne, Assistant Superintendent. Owing to the late arrival of the measurers, the field parties could not be formed till the beginning of December. A portion of the Survey was told off for work on the 1st, and the remainder followed on the 11th of that month. The Survey being weak in lascars or measurers, some Assamese willing to take service, were enrolled, but proved a failure, owing to their extreme indolence; though under strict vigilance they were utilized as line cutters, in which occupation their expert use of the dhow rendered them more useful.

Lieutenant W. Barron, Deputy Superintendent, 3rd Grade, on Furlough, M. C. to Europe.
 Captain J. H. W. Osborne, Deputy Superintendent, 3rd Grade, took charge on the 8th December 1869.

ASSISTANTS.

Lieutenant E. H. Steel, Assistant Superintendent, 2nd Grade.
 Mr. G. H. Blith, Revenue Surveyor, 3rd Grade.
 " W. A. Wilson, Asst. Rev. Surveyor, 1st Grade.
 " O. Lincoln, Ditto, 3rd Grade.
 " T. F. Freeman, Probationary Surveyor, 4th Grade.
 " T. Shaw, Ditto, Ditto.
 35 Sub-Surveyors &c., (for Professional Survey.)
 10 Ameens (for Civil Demarcation.)

24. *Area and Limits.*—The season's area comprises twenty mouzahs, sub-divided into forty-two traverse circuits, embracing 1,261.69 square miles, and consists of two portions lying east and west of the intervening work of season 1868-69. The eastern portion lies mostly to the south of the Brahmapootra river, but includes a small piece beyond this river and limited north by the Dibong river, and the country of the Mishmee Tribes. On the east the tract abuts on the territory of the Singphoo Tribes, while on the south and west it touches on the work of 1868-69. The western portion is situated west of the Brahmapootra river, which runs between it and the work of 1868-69, and District Sebsaugor; on the north are the Abors; on the south and west extends the unsurveyed part of District Luckimpoor. The entire surveyed area is situated approximately between $24^{\circ}44'$ North Latitude, and $94^{\circ}23'$ East Longitude.

25. *Features of the country.*—The country under survey is described as totally devoid of hills, the general level being varied only by slight undulations, and tracts of low lands, which

in the rains and early part of the cold season form swamps. The tract is for the most part covered with extensive and dense forests, and intersected by numerous small streams, which flow into the Brahmapootra. Patches of cultivation and clearings for cultivation are scattered about here and there.

26. *Interior Survey.*—“The interior details,” the Surveyor states, “were all surveyed with the plane table and compass and plotted in the field; all details of waste, cultivation, &c., being taken up minutely and with accuracy. The work was frequently checked and examined in the field by Assistants who inspected the parties.” Owing to the difficulty of line-cutting, the system of running check lines across the interior survey was not carried out, but blocks were surveyed, compared with the original board plans; and in the few cases of discrepancy which occurred, the faulty portion was entirely re-surveyed.

27. *Extra work.*—The Surveyor says that in addition to the actual out-turn of the season, he brought up the whole of the lakhiraj holdings in the former season’s work, and parties had to be detached, “to re-demarcate several grants where grantees had failed to erect the necessary boundary mounds.”

28. *Permanent marks.*—The following masonry platforms were erected, for future connection with the G. T. Survey :—

1st.—At the point where the boundary of Tengthoomook touches the Nooa Dehing river on the Singphoo frontier.

2nd.—At the extreme east of the Oojan Suddia on the north bank of the Brahmapootra river.

3rd.—At the junction of main circuits 6 and 7 with the Brahmapootra river, and nearly opposite the mouth of the Pobha Nulla.

4th.—At the junction of the Khalkata Sotee with the Brahmapootra, on the north bank of the river.

5th.—On the left bank of the Brahmapootra river near the village Lasoon in District Sebsaugor.

6th.—On the right bank of the Brahmapootra river, opposite the 5th pillar, and near the village Kherkutia, District Luckimpoor.

29. *Slight impediments.*—In addition to the usual obstructions presented by the heavy tree jungle, scarcity of labor for line-clearing, heavy fogs on the Brahmapootra river, and frequent rain, the Surveyors working along the northern frontier were somewhat impeded by the Abors, who claimed the territory down to the Brahmapootra, “but a small guard of Police and other arrangements made by the Deputy Commissioner effectually put a stop to their giving any further trouble.”

30. *Health of the Party.*—During the field season the health of the establishment was good, except in the case of a few Sub-Surveyors recently transferred. On their return to recess quarters at Debroogurh, however, all the European Assistants suffered from fever, and there was a daily average of four or five sick among the native establishment.

31. *Duration of Field Work.*—The field season extended from 1st December 1869 to 15th June 1870.

32. *Personnel.*—The Surveyor writes in high terms of the energy and efficiency of his Assistants, making special allusion to Licutenant Steel, and Messrs. Blyth and Wilson.

33. *Work for 1870-71.*—The area proposed for survey during the ensuing season 1870-71 extends south-west of that now reviewed, and consists of the Mouzahs (which in Assam are equivalent to Pergunnahs elsewhere) Dhokooa Khana and Luckimpoor, lying north-west of the

Brahmapootra and estimated at 1,000 square miles. The Surveyor states that "most of this tract of country lies very low and is often flooded as early as May, and should it happen next season it will put a stop to our work." He, therefore, proposes to take the field as early as possible in November. It is difficult to estimate the area which will still remain for survey after the field season of 1870-71, but it cannot be considerable, and can be surveyed by a detached party in 1871-72 when the main body enters on the survey of District Durrung.

34. *Descriptive Report.*—The Surveyor's Narrative Report will be found in the Appendix.

35. *Demarcation.*—The demarcations were, as in the preceding season, conducted under professional superintendence.

36. I have been obliged to detach Mr. Lincoln temporarily to afford assistance to the 1st Division at Gowhatty.

37. Captain Osborne has shown a very good season's work, and I have great pleasure in reporting favorably on his energy and active co-operation in the field work of his survey. He has submitted a very creditable Index map of the work done during the season under review. I have little doubt that the rest of his records will be as satisfactorily rendered.

FOURTH DIVISION.

District Hooghly and Panchannogram Estate.

38. I have not received the report of the 4th Division under Captain Stewart, which took the field (as per margin) in December last, and remained out in Hooghly till October last. This Survey has completed 414·9 square miles in Hooghly and the remaining portion of Panchannogram, comprising 8,361 holdings=9,674·06 acres=15·12 square miles, but I regret to state that there has not been a thorough rendering of the altered numbering of holdings, and it is still necessary to employ at least a couple of intelligent surveyors to render our records identical with the register list of the Deputy Collector.

Captain W. J. Stewart, Deputy Superintendent of Survey, 3rd Grade.

ASSISTANTS.

Lieutenant S. H. Cowan, Assistant Superintendent of Survey, 2nd Grade, on private affairs, Furlough for two years, vide Military Department Notification, No. 214, dated 3rd March 1870.

Mr. B. H. Billon, Assistant Surveyor, 1st Grade.
" C. David Ditto Ditto, transferred to the Deputy Surveyor General's Office from the 17th November 1869.

Mr. H. R. Littlewood, Assistant Surveyor, 1st Grade.
" J. N. Stoelke, Ditto Ditto, 2nd Grade.
" A. C. Low, Probationary Surveyor, 4th Grade, entertained from 27th October 1869, resigned 1st July 1870.

Mr. G. C. Swiney, Probationary Surveyor, 4th Grade, transferred from the British Burmah Survey, 1st March 1870.

Mr. A. Lane, Probationary Surveyor, 4th Grade, transferred from 1st Division, Oudh, 7th November 1869, resigned 1st February 1870.

Thirty Sub-Surveyors, &c.

39. Such a difficulty would have been averted if the Surveyor had taken full possession of all the information regarding alteration in numbers that the Deputy Collector had in his office, which was undoubtedly withheld from the surveyor, because he did not ask for it. Supposing an original number 20 altered into 4 holdings, and that the original number of holdings in the Division extended from 1 to 314, No. 20 being the 1st serial number sub-divided into, say 4 numbers—according to the Deputy Collector's arrangement, they have been numbered 20, 315, 316, 317. We have recorded them 20, No. 20A, No. 20B, No. 20 C; I think our rendering is the simplest in procedure, but it is not according to the register. The only traces which Mr. Heysham, furnished the Surveyors, were from the old survey volume of work done by Major Smyth and Mr. Crow, in which the recent changes had not been entered, such traces were of very little assistance, as the corrections for the additional numbering, consequent on changes of boundary in holdings encroached upon by the Railway or New Canal, were not shewn on them.

40. When Baboo Ram Coomar Bose was appointed as Special Deputy Collector, the existence of another set, of what Mr. Heysham was pleased to call "working plans," was discovered to the Surveyors. Mr. Heysham was perfectly well aware of these changes on the maps, and knew how much he could have helped our department by making them over to our Surveyors, at the commencement of our operations, undertaken for the express purpose of bringing to

20.	315.
316.	317.

light all changes which had taken place since the former survey, to render them thoroughly valuable to the Revenue Department. Had our Surveyors been furnished with Mr. Heysham's "working plans," they would have been able to identify every holding, and register its altered numbering.

41. Of the Hooghly work 414.9 square miles and 855 villages have been surveyed. I have rejected 112 villages and 165 square miles of Hooghly.

42. I regret to report I have been obliged to recommend that Mr. Davey should succeed Captain Stewart in charge of the Hooghly District, until the latter Officer has completed his arrears; and as I have been unable to prepare a thoroughly complete report on the season's work for the 4th Division, I append a letter No. 15, dated 17th instant, from the Officer in charge, which partly explains the causes of delay in submitting the report in full.

FIFTH DIVISION.

Cooch-Bihar State.

43. *Orders on its taking the Field.*—There remained but 709 square miles to complete the Survey of the Cooch-Bihar State, and as no other District could be assigned to this party, it was decided that a reduced establishment should suffice. Mr. O'Donel

Mr. J. H. O'Donel, Deputy Superintendent, 1st Grade, transferred to 1st Division, Lower Provinces, was relieved by Mr. W. Lane, Deputy Superintendent, 3rd Grade, in June 1870.

ASSISTANTS.

Mr. E. J. Jackson, Assistant Superintendent, 2nd Grade, transferred from Head Quarters' Office, 1st November 1869.

Mr. J. Pickard, Surveyor, 2nd Grade, transferred to the late British Burmah Revenue Survey, 20th November 1869.

Mr. R. Barclay, Surveyor, 4th Grade, transferred from the late British Burmah Revenue Survey, 1st November 1869, on Medical leave from 9th November 1869, to 19th April 1870, and posted to Head Quarters' Office, Calcutta, 19th April 1870.

Mr. C. David, Assistant Surveyor, 1st Grade, transferred from Head Quarters' Office, Calcutta, from 1st January 1870.

Mr. T. D. Moran, Assistant Surveyor, 2nd Grade, transferred to Settlement Department, 1st October 1869, and re-transferred from Settlement Department, 1st August 1870.

Mr. W. J. Lane, Assistant Surveyor, 3rd Grade, resigned 1st December 1869.

Mr. G. C. Holt—Probationary Assistant Surveyor, 3rd Grade, from 1st January 1870.
Thirty Sub-Surveyors, &c.

commenced work at the beginning of December 1869, with two Assistants and a Probationer, but on the 20th of January 1870, Mr. David, 1st grade Assistant Surveyor, joined his party. The work started with eight Boundary and six Interior parties, Native, subsequently increased to nineteen in all. It was closed at the end of May 1870.

44. *Equipment.*—The equipment consisted of 7" and 4½" Theodolites by Troughton and Simms for the angular work of main circuits and villages. The interior details were drawn on Plane Tables.

45. *Description of area.*—The tract surveyed constitutes the eastern portion of the Cooch-Bihar State between North Latitude $25^{\circ} - 26^{\circ}$ and East Longitude $88^{\circ} - 89^{\circ}$. It is bounded on the north by Julpigoree; east by Goalpara; south by Rungpoor; and west by the previously surveyed western portion of Cooch-Bihar. In completing its survey 1,622½ linear miles of Boundary Survey were accomplished.

46. *Local Divisions for Fiscal Purposes.*—Prior to survey no fiscal divisions existed. With the consent of the Commissioner the main circuits of the season's work have each been accepted as representing a Pergunnah, and sub-divided into Thannahs; Main Circuit 4 in Pergunnah "Deenbutta;" Main Circuit 5, Pergunnah "Cooch-Bihar;" Main Circuit 6, Pergunnah Toofangunge. These three Pergunnahs contain 660 villages.

47. *Stations of previous Survey.*—Several stations of the old survey work in Rungpoor, season 1857-58, were identified, and have been shown in red ink on the circuit traverse.

48. *Alterations in Natural Geographical Boundaries.*—The rivers forming the boundary between Rungpoor and Cooch-Bihar have changed here and there in course, during the past twelve years. It has been feasible, with the aid of the old maps, to establish the original boundaries on the ground, and shew them on the maps of this season.

49. The following table shows the results of connection on seven G. T. S. Stations. The chain measurement has evidently been very much strained :—

NAMES OF G. T. STATIONS.	Distances by G. T. Survey.	Distances by Revenue Survey.	Difference in feet.	Difference per mile in feet.
Barabhita G. T. S. to Bhitagori ...	57,334·63	57,357·30	—27·63	—2·53
Jegabari „ to Ditto ...	52,582·66	52,543·92	—38·74	—3·88
Atarobanki „ to Ditto ...	49,001·56	48,942·30	—59·26	—6·38
Ditto „ to Goibaree ...	59,400·25	59,361·72	—38·53	—3·42
Ditto „ to Purub-bhag ...	56,869·26	56,839·86	—28·40	—2·63
Purub-bhag, „ to Goibaree ...	56,792·38	56,767·26	—25·12	—2·33
Goibaree „ to Bhitagori ...	63,530·50	63,453·06	—77·44	—6·43
Ditto „ to Dhadial ...	52,148·93	52,111·62	—37·31	—3·78
Dhadial „ to Bhitagori ...	62,511·24	62,465·04	—46·20	—3·90
Average error per mile ...				—3·92

50. The area surveyed was all Mouzahwar, as follows :—

Number of the Main Circuits.	No. of contained Sub-Divisions.	No. of contained Villages.	No. of Traverse Hulkas.	Area in acres.	Area in Square Miles.
4	3	269	269	135,250·75	211·34
5	5	273	273	107,909·55	309·24
6	3	118	118	120,679·67	188·66
Total 3	11	660	660	463,849·97	709·14

51. *Cost and rate per mile.*—The total cost amounts to 48,004-10-10, inclusive of contingencies which amount to Rs. 8,979-8-9. The rate per mile is Rs. 67-11-1, or 8-0-2 in excess of last season. This is to be accounted for by the limited field of operations by a smaller subordinate agency supervised at the same cost. The expense has to be defrayed by the Cooch-Bihar State.

52. *Rates of correction and check.*—On the main circuits the average correction was 1 minute in 12 angles, and 1·52 links per 100 chains in latitude, but only 0·68 links per 100 chains in departure. This is very good. The computations have all been carefully done in duplicate, and with due care. 113 linear miles of check survey were executed by Messrs. Lane and Bolst, and afforded a very satisfactory comparison to establish the general accuracy of the details. During the progress of the operations the chains were constantly tested by the standard rods. All the main circuit work was set up and proved by Mr. O'Donel himself.

53. *Masonry platforms.*—The demarcations had just preceded the survey, so there was no time to mark the triple-junction points, with masonry platforms, but each was covered with a raised earthen bank, and the Deputy Collector advancing with his “Khusrah” proceedings would continue erecting the pukka pillars.

54. *Thakbust.*—The Surveyor states that the Thakbust work was all that could be desired. Material differences were re-adjusted and rectified in the field.

55. *Detached villages.*—Nineteen villages separately demarcated and surveyed belonging to Pergunnahs “Goibaree,” “Perub-bhag,” and “Kazirhaut” of District

Rungpoor are situated within Pergunnah "Deenhutta," and four villages of Pergunnah "Ghoorla," District Goalpara, are within Pergunnah "Toofangunge."

56. Sixteen villages of Cooch-Behar, situated in the limits of Rungpoor, and surveyed by Mr. Pemberton in 1857-58, have been copied and entered in the Collector's Atlas Volume, to enable the District Officer to obtain ready access to them.

57. *Maps.*—Index Maps, scale 4 miles=1 inch, have been prepared in duplicate, to bind up with volumes.

Thirty-four Sheets on the scale of four inches to the mile worked up to margin, have been prepared in duplicate.

Three Pergunnah Maps, main circuits 4, 5, and 6, have been prepared in duplicate, on the scale of 1 mile=1 inch.

These records have been very neatly prepared, though not well adapted for reduction by photography; all the other records have been well rendered.

58. *Personnel.*—The Deputy Superintendent reports favorably of his Assistants, and particularly mentions Mr. David's efficiency and assiduity. He also says the Native

An extract from the Surveyor's Report will be found in the Appendix. Surveyors and establishment worked well and carefully.

The Survey party has always been in good order, and well disciplined by Mr. O'Donel. Mr. Lane who relieved him in June last, has finished the recess work in good style.

An extract from the Surveyor's Report will be found in the Appendix.

SIXTH DIVISION.

District Hazareebagh.

59. *Out-turn of the Season.*—Operations were resumed between 24th November and

8th December 1869 in District Hazareebagh and resulted in a total out-turn of 2,523·56 square miles, including 140 square miles of overlap on the contiguous Districts of Manbhoom and Chota-Nagpoor; 19·34 square miles on Main Circuits, 8 and 9 of Hazareebagh (which had been re-surveyed in 1862-63); and 47·59 square miles into the work of the present season, 1870-71, or in all 206·93 square miles of overlap, giving 2,316·63 square miles as the area actually surveyed within the limits of the District during the season under review.

ESTABLISHMENT.

Captain J. Sconce, Deputy Superintendent, 2nd Grade.

ASSISTANTS.

Lieutenant E. W. Samuels, Assistant Superintendent, 1st Grade, on Furlough to Europe from 16th February 1870.

Lieutenant R. Beavan, Assistant Superintendent, 2nd Grade, transferred from Topographical Survey, 1st May 1870.

Mr. G. H. Cooke, Probationary Assistant Superintendent.

Mr. W. Sinclair, Revenue Surveyor, 3rd Grade, transferred from 1st Division, Lower Provinces, 1st January 1870, and transferred to 1st Division, N. W. P., 6th July 1870.

Mr. J. Todd, Revenue Surveyor, 4th Grade.
 " W. Vyall, Ditto, Ditto, transferred to 4th Division, Lower Provinces, 1st June 1870.

Mr. G. R. Buttross, Assistant Revenue Surveyor, 1st Grade, transferred from 1st Division, Oudh, 31st October 1869.

Mr. R. C. Ewing, Assistant Revenue Surveyor, 3rd Grade.

Mr. H. Hexter, Probationary Surveyor, 4th Grade.

" C. W. Wilson, Ditto, Ditto, transferred from 4th Division, Lower Provinces, 1st October 1869.

Twelve Sub-Surveyors, &c.

completed.

60. *Position of the Tract.*—The position of the country mapped in detail by plane-table during the season is south of Latitude 24° 15' and east of Longitude 85° 30' up to which meridian the topographical re-survey of the District is now completed.

61. *Detail Survey.*—The detail survey is based on minor triangulation connected with G. T. S. Stations of the Calcutta Longitudinal and North Parasnath Meridional Series, as noticed in para. 92 of the Annual Report for 1868-69, relating to "triangulation in advance."

The proportion of interior survey executed by European and Native Assistants is :—

		SQUARE MILES.
By 7 European Assistants	...	1,167·00
By 9 Native Assistants	...	1,356·56
Total		2,523·56

The average number of plane-table stations per square mile is 6.

62. *Check Survey.*—All the detail survey parties were visited twice during the season by the Deputy Superintendent who inspected and tested their board plans in the field. The results are reported as generally very satisfactory, the only exception being in the case of two Sub-Surveyors whose work was found inaccurate in some of the minor details which were re-surveyed. Three square miles were thus re-done, besides which a check survey of 51·5 linear miles was run through the District by European Assistants.

63. *Triangulation.*—The total area triangulated in advance for 1870-71 is 2,650 square miles, over which has been thrown a net-work of thirty-three secondary triangles based on seven principal stations of the G. T. Survey, *viz* :—

1. Mahuda	} Calcutta Longitudinal Series.
2. Patal	...	...	...
3. Kasiatu	...	...	...
4. Hurilaong	...	...	...
5. Lohawur	} Chendwar Meridional Series.
6. Sarhud	...	...	...
7. Banka	...	...	... Hurilaong Meridional Series.

64. The Surveyor states that "Sindraili a station of the Chendwar Meridional Series, falls within the season's triangulation, but it was not necessary to observe from it. Four rays of the Calcutta Longitudinal, three of the Chendwar Meridional, and one ray of the Hurilaong Meridional Series have been used as independent bases for fixing secondary points. The average error + or—180° in secondary triangles is 11", and the average linear error of 17 common sides is 0·81 feet, or 0·05 feet per mile. "Besides the G. T. S. principal, and Revenue Survey secondary stations, 34 tertiary hill and village stations have been observed from both for the purpose of fixing additional intersected points, and also as a means of determining heights on the general level of the country. There are 141 intersected points, 122 fixed by two or more triangles, and 19 fixed by one triangle. The average error of 189 common sides is 4 feet, or 0·06 feet per mile."

65. *Heights.*—The Deputy Superintendent, while inspecting the Interior Survey parties, took the opportunity of fixing the heights of 36 points, in addition to the heights determined during the past season, and the number for the area surveyed in detail is 89, which gives an average of one height to every 26 square miles. For the secondary stations there were double observations with an average error between two deductions, of 1·3 feet; for the tertiary stations and intersected points there were usually single observations, with an average error between two deductions, of 3·3 feet, while the heights of fourteen points were determined by one deduction only.

66. *Mapping.*—Of the 21 standard 1 inch=1 mile sheets measuring 30' Longitude by 15' Latitude, into which the entire District of Hazareebagh is divided, sheets 2, 3, 7, 8, 9, or 5 sheets were received last season. The work of season 1869-70 is contained in sheets 4, 5, 6, 10, 11, 12 and 13, which have, like those of the previous season, been clearly drawn in pen and ink for immediate re-production by photography.

67. *Personnel.*—The Deputy Superintendent reports very favourably of his Assistants, especially of Lieutenant Leavan and Mr. G. H. Cooke; Mr. J. Todd's plane-table sections

are reported as exceedingly carefully done, and Mr. R. C. Ewing's survey of a considerable portion of broken country, including some very high and rugged hills, is pronounced as most creditable. Mr. Cooke's plane-table included the well known Parisnath Hill, of which "he succeeded in making a very accurate as well as artistic survey." During the past season Mr. Cooke has been admitted to the senior department on probation.

68. *Area remaining for Survey.*—The area now remaining for re-survey in District Hazareebagh, is estimated at 2,800 square miles, *exclusive* of the environs of the Hazareebagh Cantonment, equal to 52 square miles already surveyed in 1867-68, and *inclusive* of 212 square miles of overlap on adjoining Districts. The abstract stands thus:—

		SQUARE MILES.
Within the limits of the District	...	2,588
Overlap	...	212
Total	...	2,800

69. *Future Operations.*—During the ensuing season 1870-71 the Deputy Superintendent has also been instructed to carry on the preliminary triangulation for the re-survey of Pergunnah Toree of District Chota-Nagpoor, of which the area with the necessary overlap is estimated at 700 square miles.

The total area to be dealt with by this party thus amounts to 3,500 square miles, *viz*:—

		SQUARE MILES.
In and around District Hazareebagh	...	2,800
Ditto Ditto Chota-Nagpoor	...	700
		3,500
Of which the Deputy Superintendent proposes to take up } during 1870-71 in District Hazareebagh	... }	2,300
Leaving	... ..	1,200 for 1871-72,

but as this is only about half a season's area for this party, it will be necessary to provide more work for it in time to admit of the preliminary triangulation being undertaken during season 1870-71, should such be required in the new District. This most important matter has been treated in my letter covering this report.

70. It is with good reason that Captain Sconce reports very favorably of his Assistants, and I have great pleasure in recording the very high opinion I formed of Captain Sconce as an energetic and rigidly careful officer when I saw his very efficient and well trained establishment.

UPPER ASSAM, REVENUE AND TOPOGRAPHICAL PARTY.

District Seesaugor.

71. This party commenced work in November and December 1869 as fast as the survey

lascars could be formed into squads and sent out. It completed an area of nearly 415 square miles in the western portion of the Seesaugor District; in addition to this, an area of 25·51 square miles originally surveyed in season 1864-65 have been re-surveyed, to effect junction with the old work, but has not been included in this year's return. An early rise of the river prevented the completion of the original programme, and consequently circuits, 12 and 13, contain only portions of mouzals.

ASSISTANTS.

Mr. J. D. Lynch, Assistant Surveyor, 2nd Grade, died 1st January 1870.

Mr. D. A. King, Assistant Surveyor, 3rd Grade, transferred from British Burmah Survey, joined 10th March 1870.

Thirteen Sub-Surveyors, &c., (for Professional Survey.)
4 Ameenah (for Civil Demarcation.)

72. *Large scale Surveys.*—The station of Golaghât, which contains an Assistant Magistrate's Court, Jail and Police station, with a detachment of fifty men from one of the Local Regiments, has been surveyed on a scale of eight inches to the mile.

73. *Main Circuit Work.*—All the main circuit work was done by Mr. Talbot himself. On the 1st January, his only Assistant Surveyor, Mr. J. Lynch, committed suicide in a fit of temporary insanity. In my report to the Surveyor General, dated 1st June 1869, I commented on the advisability of strengthening this party with another European Assistant, and I again strongly urge my previously expressed opinion, which was concurred in by my colleague, Colonel Vanrenen, R. A., but not carried out, on account of the demand to lessen, rather than increase expenditure.

74. *Rates.*—I am glad to report a considerable reduction in the rate of the work, as compared with last year, a larger area having been obtained with a smaller expenditure. This is chiefly because the forest clearance has not been so expensive, and partly because the Native Establishment is more effective: the area is as 10 is to 6.17, and the cost is as 10 is to 5.80. These figures do not include Rs. 3,487-10-5 spent on account of demarcation, which is not considered in our professional operations.

75. *Demarcation.*—Sixteen Mouzahs, twenty-one Grants, and sixty-seven lakhiraj estates have been demarcated; the areas as compared with those given by the Deputy Commissioner agree generally within 2 or 3 per cent. The District Officer's figures may be accepted as nearly accurate. In the Appendix will be found a letter from the Deputy Commissioner regarding the subject of difference of area in lakhiraj lands, as surveyed in 1867-68 and his office record; as this objection was not made by Captain Clark at the time of survey I consider it is to be regretted that it has been asserted now, but I would urge, that if the original boundaries can be traced and the re-survey proves the correctness of the former operations, the Lakhirajdars be made to pay the total cost of the survey. During the past season temporary marks and posts were put up, and the Deputy Commissioner was asked to secure them on the orders, paras. 3 and 4, of the new Survey Rules.

76. *Boundaries.*—Mouzahs have been surveyed according to the Thakbust, but grant boundaries have been altered where longer straight lines have been easy to obtain, also when Grantees have thrown up portions of their grants under the operation of the orders of 1869.

77. *Disputes.*—The Surveyor reports that there were nine cases of disputed boundaries, four between Mouzahdars, two between Grantees and Mouzahdars, and three between Lakhirajdars and Government; the three last are still pending and under decision.

78. *Personnel.*—The Assistant Superintendent reports favorably of Mr. King, who joined him on the 16th March 1870. During the greater portion of the field season Mr. Talbot worked unaided, and deserves due credit and consideration. I am satisfied with the improvement and working of this party.

79. *Area remaining.*—The Surveyor estimates that 700 square miles still remain to complete District Seesaugor.

SUPDT. OF REVENUE SURVEYS' OFFICE,
 LOWER CIRCLE,
 Calcutta, 9th November 1870.

JOHN MACDONALD, MAJOR,
Offg. Superintendent of Revenue Surveys, Lower Circle.



APPENDICES.

Copy of letter No. 22, dated 25th October 1870, from C. Brownfield, Esquire, Revenue Surveyor, in charge, 1st Division, Lower Provinces, to Major J. Macdonald, Officiating Superintendent of Revenue Surveys, Lower Circle.

I HAVE the honor to submit the Annual Report and Returns as per margin, of the Demarcation branch of the 1st Division, Revenue Survey, for the year ending 30th September 1870.

No. 1.—Work performed.	
" 2.—Condition of Demarcation.	
" 3.—Condition of Survey Registers.	
" 4.—Statement of sums drawn for different classes.	
" 5.—Area, Cost and Rates.	

Extent of Work.—The tract of country demarcated, contains an area of 858·84 square miles, and is bounded on the north by the Brahmapootra River, on the south by the Khasia and Garrow Hills; on the east, the work extends as far as the station of Nowgong, and on the west, as far as the boundary of District Kamroop.

2. *Out-turn of the Season.*—Sixty-one Mouzahs, thirty-two lakhiraj holdings, and thirteen grants, have been demarcated and mapped, at a total cost of Rupees 5,479, annas 12, pie 9; giving Rupees 6, annas 6, pie 1, as the rate per square mile, and Rupees 51, annas 11, pie 1, the rate per hulka or polygon.

3. *Boundary disputes.*—Twenty-five boundary dispute cases were on the file during the year, fourteen of which were disposed of by the Deputy Commissioner of Nowgong, leaving eleven still pending; these eleven cases are between lakhiraj and Government land. Besides the disputes, thirty-one cases of excess in area of lakhiraj holdings require to be settled.

4. *Registers.*—Only one Pergunnah or Mehal, that of Roha, has been completely demarcated during the past season; the register of Mouzah or Khas lands in it will be prepared in English and Bengali and made over to the Deputy Commissioner, with the Professional records of the Survey, as soon as the boundaries and areas of the contained lakhiraj holdings are adjusted. Two other Mehals, Chaporee and Datipar, have been partially demarcated; their registers will be finished as far as the materials in hand will allow. The Register of the thirteen grants demarcated has been completed, that of lakhiraj estates, I regret to say, cannot be finished till the whole district is demarcated, in consequence of several estates being scattered about the country in small patches; so that, in order to obtain a complete record of the estates, the materials must be gathered from nearly every part of the District. The inutility of entering the sudder jumma in the register of estates, is apparent; since, the landholders pay the half rent (to which all lakhirajdars in Assam are liable) for only such portions of their estates as are under cultivation at the time of settlement. Measurements of cultivation, &c., for settlement purposes, taking place yearly.

5. *No. in Register.*—Every single block of land demarcated, has been numbered; the numbering being carried through the district continuously, so as to ensure easy identification of all revenue divisions hereafter.

6. *Lakhirajdars.*—Lakhirajdars are in possession of a considerably larger area, of the best land in the District, than they have any right to; thereby entailing a loss of revenue to Government, it is, therefore, of great importance that the boundaries of holdings should be clearly defined on the ground by durable boundary marks.

Description by Mr. C. BROWNFIELD, Revenue Surveyor, of country surveyed in District Nowgong, Season 1869-70, by Captain A. D. Butler, late Officiating Deputy Superintendent of Revenue Survey, 1st Division, Lower Provinces.

Natural Aspect.—The portion of the District of Nowgong surveyed during the past season, extends from the Brahmapootra river on the north, to the Khasia Hills on the south, and from the station of Nowgong on the east, to the boundary of Kamroop on the west. It is

for the most part low, slightly undulating land ; inundated during the rains, and covered with tall grass-jungle ; there being 1,31,032 acres of cultivation, to 3,32,909 acres of jungle. The country does not perceptibly rise continuously from the Brahmapootra, to meet the Khasia Hills, but rather gradually slopes down towards the west, following the general tendency of the Assam Valley. The hills in parts, rise up boldly like cliffs from the swamps at their bases, with foliage and vegetation clothing their craggy points, from the water's edge to the summits. From Kholā G. T. Station, the country to the north presents the appearance of a sea of verdure.

Soil.—The surface soil in the low-lands, is rich clay, mixed with sand.

Atmosphere and climate.—The climate of Assam is decidedly unhealthy, and generally fatal to delicate constitutions. Fevers, dysentery, diarrhoea, colds, catarrhs, and pulmonary complaints of every description, being frequent and most malignant. The insalubrity of the country, especially the western portion of it, arises from the numerous swamps and rank vegetation, occupying so extensive an area ; and from the peculiar conformation of the valley, running as it does from east to west, with lofty mountain ranges, on either hand.

Productions.—The principal crops are paddy, sown in the low-lands in August, and reaped in December ; kalai (*phaseolus radiatus*, and *dolichos pilosus*) and mustard seed, sown on the banks of streams and high-lands, as soon as the water has subsided after the rains ; these crops are reaped in February, when paddy is again sown on the same land, and reaped about July or August. This last is a very precarious crop, for if no rain fall in the months of February and March, the sowing is delayed, and if the rivers rise early, the whole crop is destroyed. Very little "roopit," or regular paddy land, is found north of the Sonai River, or in any large jungle tracts. Sugar-cane and tobacco are grown in the immediate vicinity of villages, both are tended with the greatest care, and fenced in, (the fields of the former, with "Urhur" dall plants, the value of which, the natives have no idea of, not using the seed for any purpose.) The tobacco is manured plentifully ; but the produce is very inferior to that of Bengal, of which quantities are imported into the district.

Rivers.—The principal rivers are the Brahmapootra, flowing to the north of the season's work ; the Sonai, the Kullung, the Demul or Killing, and the Um-Jam or Borpanee, passing through it, but these, however, calculated to excite admiration, or enrich the soil, are often destructive ; for the country is frequently inundated for miles by them, and whole villages have been swept away by the waters. When we consider the thousands of acres on the banks of these rivers, annually exposed to inundation, the numerous swamps annually refilled, and, which might by judicious embankments at no very great expense be converted into fertile fields, we can hardly wonder at the insignificant population ; being only at the rate of 87 to the square mile. The Sonai, north of the station of Nowgong, is called the Roopoe ; it flows with many windings, nearly parallel to the Brahmapootra, which river it enters near Tatimora Hill, in district Kamroop. The average depth of water in it, during the dry season is six feet. The banks are overhung with grass-jungle, which would make navigation difficult ; but the current is so sluggish, as to give it the appearance of being entirely still water, consequently boats are rowed up and down the stream with ease. The "Kullung" during the rains, has a depth of upwards of twenty-six feet of water ; being fed by the Brahmapootra, it rises and falls with that river. During the dry season it is only navigable from its confluence with the Brahmapootra at Tatimora hill to Jagee (a distance of twenty-one miles, where it receives the waters of the Demul or Killing).

Floods.—The Brahmapootra river flowing down from the north meets the Ganges, nearly at right angles at Jafferungo. When the Ganges is at full flood, its immense body of water rushes past the mouth of the Brahmapootra with such velocity, as to act as a sort of dam preventing the free egress of the water in that river. The Brahmapootra when at its highest level, has the same effect on the Ganges ; thus each river alternately raises, or rather keeps constant, (during the rains) the flood level of the other. The Ganges rising first, and when its

waters have subsided to a certain extent, then the Brahmapootra. But when both rivers rise simultaneously, when heavy continuous rain occurs, both in Upper India, and in the Eastern Provinces at the same time, extraordinarily high-floods must necessarily take place. Neither river being able to find a free outlet for its accumulating waters, the levels of both are raised throughout their courses, and the country on either side inundated for miles. The Brahmapootra river was unusually high from the 15th to 19th July, when it fell precipitately, and again on the 14th, 15th, and 16th August, was

There has been no higher rise during the last 29 or 30 years, similar floods having occurred in 1849 or 1851.

within a foot of extreme height. It caused much damage to the crops. Villagers were obliged to desert their huts, and live for days together on high platforms erected over their houses, their cattle in some cases were swept away or died for want of pasture, (the improvident people of the country, cultivating nothing as food for their animals;) and those men who had not foreseen and provided against the calamity, suffered severely.

Roads.—The present postal road from Nowgong to Gowhatty, passes through the most populous part of the district, for fifteen miles, to Roha, with long narrow villages on one side or the other, and open cultivated land appearing to stretch away to the distant high lands on the south, the rugged summits melted into a soft undulating outline. At Roha, the Kullung river is crossed by a ferry (two dug-outs lashed together) but it is fordable during the dry months, at a point about a mile lower down. The road is now carried along the southern bank of the Kullung through low paddy-lands, and on the borders of marshes, to Dhurumtool, twenty-eight miles from Nowgong, where it crosses the Demul River. The banks are steep and high, and the water deep, consequently elephants are obliged to be unloaded, and baggage ferried across, even when the water is at its lowest level. The road from this to Umlee Ghaut on the Killing or Borpanee river, forms nearly a semi-circle, avoiding the low-lands and swamps, which would have been encountered in a less circuitous route. From Umlee Ghaut to Kahakoochee, on the boundary of District Kamroop, a distance of seven miles, the road is carried along the foot of the hills, the land immediately below being low and marshy. The distance of Kahakoochee from the Station of Nowgong is $4\frac{1}{2}$ miles. The new line for the road from Gowhatty to Nowgong has been admirably well selected. The portion passing through the season's work, is carried along the crest of the water-shed between the Sonai and Kullung rivers. In its whole course from the Kullung to Nowgong (twenty-four miles) it is not crossed by a single stream of any importance, and may be an embankment throughout, preventing the waters of the Brahmapootra coming down the Kullung, from inundating the country to the north; the Sonai river being quite sufficient to drain that portion of the country of all surplus rain water. This road will be far shorter than, and will pass through as populous a portion of the country as the old road, which crosses three large streams in a distance of thirty-eight miles; besides numerous drainage lines running from the hills, which are often swollen to formidable torrents in the rains; it being carried along the foot of the hills for nearly thirteen miles. The bridges on the road are of green-wood and bamboo; they last for only a few months, and are dangerous for equestrians to cross, during the rains, when they are most needed.

Forest and Grass Jungle.—The extensive forests and grass wastes, are sources of great profit to the inhabitants; they are inexhaustible sources from which the entire building materials for the houses are obtained, and in them the cattle always find pasture. The better description of forest trees, such as Sâl, &c., on the southern slopes of the hills, are young, the best timber having been cut down about twelve years ago by bodies of Kacharees from Durrung, sent up by a contractor, who denuded the forests over a long strip of country skirting the hills, of all the finest sâl-trees; many logs may still be seen in the jungle, left by the men, who fled on the appearance of cholera, to which disease numbers succumbed.

Hills.—The country about the hills, is rich in minerals and rare botanical-plants; it often presents the most singular fantasies of nature, and is wildly romantic; the peculiarly built huts of the Khasias, thinly scattered through the lonely valleys, or hanging on the brows of

steep hills, alone told that it was inhabited by man; the few inhabitants encountered, were some of the least prepossessing of mountaineers, with irregular rough features of the Malay-type, often cruelly marked with small-pox. The fair sex, when turned thirty, are perfect witches in appearance, and even the youthful damsels anything but beautiful; still the good nature of the men, their readiness to assist, and the cheerfulness with which they work, render one always glad to meet them when surveying.

Principal Places.—The positions of Roha and the Haut to the south at Chapor-Mookh, situated at the confluence of the Huria, Kullung, Demul, and Kopelee rivers, are most advantageous in a commercial point of view. The commerce is greater than we should be led to expect from their inland situation, but to them, the Kopelee and the Huria act as useful auxiliaries; for these streams bring down the cotton, seed-lac, and rubber from the Naga-Hills, and the borders of Northern Cachar, and entering the Demul and Kullung, which run into the Brahmapootra river, afford an uninterrupted transit for merchandize from Gowhatty to the hills, a distance of about ninety miles. Nokhla and Nowgong villages situated at the south-western extremity of the District, (the first about half a mile north of the road, and the other immediately on it,) are visited by numbers of Khasias who do a very profitable trade in cotton and seed-lac. A market is held at Nokhla every Sunday.

Health and Disease.—The whole country is periodically ravaged by cholera, small-pox, fevers, dysentery, diarrhœa. Cattle disease also appeared two years ago, and destroyed about a fourth of the cattle of the District. Wild animals in a few instances, seem to have been affected by it; for tigers, buffaloes, and deer were found dead in the jungle, during the prevalence of the disease. It is not a matter of surprise that the population of the country should be “in statu-quo” for there is no sanitation. The water used in the villages north of the Demul river for drinking and culinary purposes, is of the worst description imaginable; the Kullung river during the winter, becomes a filthy drain, as also the Sonai, being generally the receptacle of all the foul matter of the villages on the banks. In villages at a distance from streams, the water is obtained from shallow holes dug in low-land, and which has the appearance of thick soup, with a green scum floating on the top. It is a most nauseating and melancholy sight to see women and girls come down to these pools with bundles of filthy rags which they wash for hours, and then return to their huts with their vessels filled with an accumulation of liquid mud and fæces; besides dirt of all descriptions abounds in every village: accumulated masses of decomposing vegetable matter, and the sweepings of pig-pens and cow sheds are to be found in large heaps almost at the very doors of the huts, destroying health and generating fevers. Putrefying carcasses of dead cattle lie about the fields closest to the villages, lending their aid to abridge life.

Trade.—The trade of the country is chiefly monopolized by the “Kyas” or “Marwarees,” numbers of whom are found at Roha and Chapor-Mookh, others are scattered over the country, each erecting a large substantial hut, (on the banks of a navigable river,) as an entrepôt for merchandise, where the produce of the country is stored during the winter months, ready to be despatched to Gowhatty and Goalpara as soon as the rains set in, and the rivers rise sufficiently to admit of large boats being brought up to the “golahs.” The village people invariably receive advances either in money or grain, from the native merchants, for the produce of their fields. The interest charged is sixty-four and seventy-five per cent. The wants of the people are few and easily supplied, the consumption of calicoes, printed cottons, and hard-ware, being very limited among the lower classes, who generally manufacture for themselves the few articles they require; but as larger tracts come under cultivation, and with increase of population, their wants increase, large quantities of “piecc-goods” will be introduced into the country. With respect to the cotton and silks of the country, their superiority in durability is not so decided over those of British manufacture, as to compensate for the advanced prices. The people will purchase nothing except it is cheap.

Population.—The population is chiefly composed of Assamese, (Hindoos) Laloongs, Kacharees, Mikirs, and Khasias, and is divided as per margin. The number of Mahomedans is very small. The Assamese who, as a rule, are addicted to opium, are a poor race when compared to the flesh-eating Laloongs, &c., who are fine broad shouldered men, often exhibiting almost Herculean proportions.

* Assamese	Hindoos ...	89,014
Ditto	Mahomedans ...	5,500
Laloongs,	Kacharees, &c.,	21,328
Total		<u>115,842</u>

Description of the country surveyed in District Luckimpoor, Season 1869-70, by Captain J. H. W. Osborne, Deputy Superintendent of Revenue Survey, 2nd Division, Lower Provinces.

General appearance.—The greater portion of the past season's work is covered with dense and almost impenetrable jungle, with small clearances for cultivation scattered about; it is very slightly undulating, but no hills or any elevations exceeding a few feet exist in any part of the season's work; in many places large tracts lie very low, these, during the rainy season, are under water, and are swamps during the first portion of the cold weather, and dry or nearly so for a short time, previous to the commencement of the rains. Numerous streams and water-courses, which, during the rains when they are full of water, form good water communication:

Principal Villages.—Not a single place has been met with during the season worthy of the name of town; and very few villages number more than a few score of inhabitants; the two following are the largest:—Suddia, the most important of all the villages met with last field season, is the extreme eastern Military outpost. It is at this station that the Frontier tribes are annually assembled for interchange of presents, to receive their usual allowance of salt, &c. The village itself is of no great size, but numerous little settlements lie in its neighbourhood; Seesee is the largest village in the western tract on the north of the Brahmapootra. A few Rayas and Assamese make up its population.

Rivers.—The tract of country now under review, is very well watered, all the streams of any size taking their rise in the mountains to the north.

The Depong, a river of no mean size, has an extremely rapid current, it is only navigable for small boats owing to its numerous rapids. The fishing in this river below the rapids, is excellent; the fish ranging up to forty lbs. or more. The Shubunsheree, which flows along a portion of the western boundary of the village of Bordulunee, also takes its rise in the northern hills; it is a large river, but only navigable for small boats, on account of its rapids. Numerous other streams of a very fair size are found, both on the north and south sides of the Brahmapootra.

Roads.—Rajgurh Alee. This is an ancient road at the top of an enormous bund, which attains the height of forty feet, it is said to go round the whole district, but traces of it have only been found in three places, to the north of the Brahmapootra, though every effort was made to follow it up. The legend regarding it is, that it was built by one of the former Rajas owing to his son on one occasion finding the whole country under water when he wished to take a walk.

Fairs.—A fair is held annually, about February, at Suddia, when the frontier tribes assemble there, bringing with them musk-pods, skins, wax, and bamboo and cane mats, to barter for salt, beads, and iron-ware, cooking-pots, called "kuraies." This is the only fair within the limits of the country just surveyed. The Abors were also assembled at the junction of the Dihong, Dibong, and Brahmapootra Rivers, when they received their usual annual presents, notwithstanding the stigma of the murder of one of the subordinates of this department was attached to them.

Cantonment.—The Cantonment of Suddia is garrisoned by a Detachment of the 42nd Assam Light Infantry, consisting of one European Officer, three Native Officers, and 160 Rank & File. An Assistant Engineer of the Public Works Department, was also stationed here until a recent date. In the vicinity of the Cantonment is a Circuit house, which is reserved, I believe, for the use of the District Officials when on tour.

Population.—The population of the mouzahs surveyed this year, including that portion of main circuit No. 7 surveyed last year, the statistics of which are included with those of the current season, is scanty in the extreme; the inhabitants of both sexes including children, only numbering 17,811, which gives an average of 12·8 souls to the square mile, or one individual to every fifty acres. Opinions, as to whether the population is on the increase, are very diverse, some contending such is the case, and others that it is dying out; my opinion, judging from the number of children to be seen in the villages is, that if on the increase at all, it must be very slow, and that it will be several generations before Upper Assam, or at least that portion on which I am now reporting, can be sufficiently populated to bring the greater portion of the land, now covered with dense forest, under cultivation.

Castes.—As far as I have been able to discover, the following are the castes, &c., of the people inhabiting this portion of the District:—

"Ahomes."—The most numerous are the Ahomes, who are descendants of the original conquerors of Assam, this sect forms the bulk of the agricultural population.

"Brahmins."—Notwithstanding the fact, that the greater portion of the inhabitants worship the various Hindoo deities, Brahmins are far from being a numerous class. They were, I believe, originally imported into Assam, by one of the former kings, and the date of their advent may be assumed as that of the introduction of Hindooism.

"Deorees."—The Deorees are another order of priesthood, the members of this sect usually give to their *Thacoor* one-half of the offerings they receive from devotees, and in addition to their priestly duties, which I presume produce insufficient means for their several necessities, they follow the profession of cultivators.

"Kolitas."—Prior to the introduction of the Brahmins, this class were the spiritual advisers of the Assamese, they have since that date, embraced the tenets of the Hindoo religion and still remain priests.

"Domes."—This class forms a large portion of the population, and are said to have come originally from the west. They follow the profession of fishermen and boatmen, and as a rule live together in small colonies near the rivers, and always on their journeys select an isolated spot for cooking their food.

"Miris."—This is another class of boatmen, and are said to be the slaves of the Abors, those now residing within British Territory are descendants of a few who escaped from bondage prior to the date of our obtaining possession of these provinces. They are extremely fond of spirits and cigars.

"Moreahs."—The best workers in brass, in this portion of the district, belong to this caste, and I believe the trade is now almost entirely in their hands.

"Kacharees."—This class obtain their livelihood by growing vegetables, and burning charcoal.

"Khamptis."—The Khamptis are iron-workers and justly celebrated for the manufacture of a species of long knife called a *dhow*, carried by every body, and used for every purpose imaginable, from felling trees to splitting cane. The rice grown by these people, is considered of an excellent quality.

"Koss or Koch."—The members of this sect obtain their living by manufacturing lime from shells.

"Harees."—When Assam was under Native rule, the Harees are said to have been divided into two classes, the first are reputed to have been Artillery men to the kings, and the second, were sweepers. Their occupation seems to have changed very much since that time, for now they are nearly all goldsmiths, their work, at least such as I have seen, is very inferior, and has a coarse unfinished appearance.

"Bhias."—The Bhias who are not a very numerous class, are cultivators.

"Lallums."—These, who are found in and about the village of Seesec, on the north bank, are also agriculturists.

"Mahomedans."—A very few only of these, live in the tract just completed, they are usually called Gorias by the Assamese, and are divided into four sects:—Sunis, Malikis, Umbellis, and Shafis or Sujas, the three first will sit together and eat, but the Sujas are, I presume, considered impure, for they are not allowed to eat with the rest, and made to sit at some distance.

Education.—This decidedly admits of very great extension, a large proportion of the inhabitants being unable to read or write their own language. There is, I believe, a school at Suddia, where Bengali is taught; at Dirak a priest teaches the boys the Khampti language, and at Seesee the Domes are said to have imported a man from Jorehaut, to instruct their children.

Police Outposts.—Police Guards of from one to two Head Constables, and from eight to sixteen Constables, are stationed at the following outposts:—Selim, Dikraug, Koondil, Doomdoom, Balijan, Diphoo and Dimoo, and a guard is stationed at Suddia, consisting of one Sub-Inspector, one Head Constable, and twelve Constables. With the exception of Suddia and Doomdoom, the above guards are all on the frontier, some miles in the vicinity of each outpost being patrolled daily to guard against any marauding excursions of the tribes on the frontier.

Soil and Crops.—The soil of this portion of Assam is without doubt most fruitful, but the paucity of the population, together with their excessively indolent habits, combine to prevent the increase of cultivation, which the country is admirably adapted for. The Assamese, so long as they can earn sufficient to feed and clothe themselves, and stupify themselves with opium, never trouble themselves about any thing further. The soil is divided into two good kinds, namely;—"bâm," or high land, on which sugar-cane, tobacco, "oord-dal," and "abu-dhan" are grown; and "dob," or rupeet, the name given to low-lying land, which produces the "lali-dhân," or transplanted rice, an inferior kind of soil which contains a large admixture of sand, and is little used for purposes of cultivation. The staple productions are rice, of which sufficient only for home consumption is produced; "muttee-kulai" or "oord-dâl," both, species of pulse; the cultivation of the potatoe is also extensively carried on in the vicinity of Suddia, where it thrives admirably, but the stock is either of an inferior kind, or else it is worn out, as the potatoes are miserably small and have but little flavour. Vegetables of all kinds, including several species of edible-roots, such as the sweet-potatoe, and yam, &c., indian corn or maize, are also raised, and fruits, of which pine-apple, plantain (*kôl*) and jack (*kuthâl*) are the most common, are grown near every village of long standing.

Silk Culture.—The culture of silk is carried on in places where the "Soom" and other trees on which the worms are fed, abound. The silk is usually called Moonga, though, I believe, there are several varieties of worms which produce it. It is generally manufactured into *dholies*, washes well, and reputed to be almost imperishable.

Forests.—The Forests cover by far the greatest part of the area surveyed this year, and are, in most places, almost impenetrable owing to the thickness of the undergrowth, which, together with the cane abounding in all the low rich-lands near the water-courses, form one tangled mass. The varieties of trees, shrubs, &c., are very great, and the numerous orchidaceous plants, found on most of the trees at the commencement of the rains, when in flower, are beautiful beyond description. Of the trees found in these jungles may be mentioned the following:—"Nahâr," "Pomâ," "Ooriejam," "Jamuck," "Hingoree," "Semul," "Borgach," "Ajar," "Tenga," Bamboos and Cane. "Nahâr," "Nohor" or "Nugessur," is an extremely slow growing tree, the wood of which is so hard that the local carpenters dislike working it, as they declare that it turns the edges of all their tools.—"Pomâ," this is a dark red wood, with a rather coarse, but most beautiful grain, somewhat resembling Mahogany, it is owing to its brittleness fitted only for making doors, tables, &c., where it is not necessary to cut it across the grain.—"Ooriejam," a hard wood, used for planks and making boats.—"Jâmuck" a wood of medium hardness, which bears the character of being imperishable under water.

Gold.—Gold exists in the sand of nearly all the Assamese rivers in very minute particles, but those rivers which flow from the mountains to the north, contain, I believe, the largest quantity of this valuable metal. Gold-washing, used to be extensively carried on in former years, and if reports are to be believed, the right to wash for gold, was farmed out by the old kings for Rs. 27,000 annually, but this branch of industry has, I think, nearly died out which

may, perhaps, be attributed to the great increase in the wages of laborers since the introduction of tea.

Diseases.—The most common disease, I know of amongst the inhabitants, is the Goitre, and affections of the eye are also very common. Fever very prevalent.

Frontier Tribes.—On the northern and eastern frontiers of the tract laid down for survey lie the territories occupied by the Abors, Bor-Abors, Mishmees, Bor-Mishmees, and Singphoos. The Abors who are found to the north, are an agricultural race, they receive annually presents, in order that they should keep quiet on our frontier. A large number were assembled in February last on the sand bank at the confluence of the Dihong, Dibong, and Brahmapootra Rivers, on which occasion I am informed, they made an attempt before the Deputy Commissioner and his police guard, to carry off a Miri into slavery, and had it not been for the man's brother making a great noise, and the exertions of the police, the attempt might probably have been successful. Their dress is most fanciful, consisting of a bear-skin hat with a red plume, not unlike an artillery busby; the remainder of their clothing, which is scanty, is grotesque, being frequently made of skins ornamented with tufts of hair, teeth of animals, &c.

Mishmees.—The Mishmees who live in the hills to the north and north-east, visited Suddia in the early part of February, when a *Mala* or Fair was held, as well as races and athletic sports; their dress is wild and barbaric, being mostly made of the skins of animals killed in the chase; their head dress is of many kinds and shapes, some being entirely made of cane and bamboo worked up together, and others of skins embellished with hair dyed various gaudy colors.

The Singphoos.—These people who live on the eastern frontier, are very like the Assamese their neighbours, in manners and customs. Their clothes are made of silk and cotton, somewhat similar to a Scotch plaid; both the women and men smoke large quantities of tobacco, out of pipes, the bowls of which are made of stone, and the stems of wood and silver, the latter only being used by the wealthier classes.

Domestic Animals.—Elephants, buffaloes, cows, ponies, goats, pigs, ducks, geese and fowls, are as far as I am aware, the only domesticated animals.

Wild Animals.—The Elephant takes precedence of all the animals in these jungles. Many of them I hear, are captured yearly by the Tippook Gohain, Mouzadhar of Oojan Nokhon Rhola. Tigers, leopards, deer, &c., are said to exist in large numbers, but owing to the density of the forest, it is extremely difficult to shoot them. Buffaloes are found wild all over the District.

Copy of letter No. 15, dated Barrackpore, 17th November 1870 from Captain W. J. Stewart, Deputy Superintendent of Revenue Survey, 4th Division, Lower Provinces, to Major John Macdonald, Superintendent of Revenue Surveys, Lower Circle.

In your No. 20 of the 14th instant, you request me to report the causes of delay in submission of my Annual Report for this season.

2. I have the honor to inform you that owing, mainly, to the protracted period of our last field season, the recess duties, *viz.*, compilations of areas both in Hooghly and Calcutta work, is still incomplete, also a considerable amount of mapping is still in hand. The Mehal registry of Punchannogram is a very heavy task, requiring continual comparison between the former and present survey records. This comparison being rendered the more difficult by the confusion caused in the Registers, by the insertion of a different series of numbers in the Deputy Collector's Office. The adjusting of these differences cannot be entrusted to Native Agency, and is being effected by myself and Mr. Billon.

3. These areas and registers are due this month for the use of the Deputy Collector in his re-settlement, and though extra Native Agency has been employed, it will not, I fear, be quite out of hand before the 15th December.

4. In District Hooghly Work, the preparations of the Statistical and Alphabetical Indices are thoroughly occupying the portion of the establishment allotted to this work, and I scarcely expect the mapping and areas of this portion of our season's work to be ready before the 15th December 1870.

5. With the continual distraction and demands upon my time made by actual supervision of current work, as well as field preparations, I have not had sufficient time at my disposal for the completion in the careful way it needs, of a detailed report on the PUNCHANNGRAM Survey and Registry.

6. It is a matter to me of deep regret that my season's work is not completed as early as other divisions of the Survey, thereby preventing my complying with the requirements of your office regarding the Annual Report, but I hope that the special nature of the work I have been engaged on may secure exemption from comparison with that of my brother Officers, and no endeavours will be spared by me to get it submitted as early as possible.

Extract from Annual Report on the operations of the 5th Division, Lower Provinces, Revenue Survey, by W. Lane, Esquire, Season 1869-70.

Orders—There remained but 709 square miles to complete the Survey of the Cooch-Bihar State, and as no other District could be assigned to this Party, when the field season was about to commence, it was decided by the Superintendent of Revenue Surveys, Lower Circle, as per letter cited in the margin, that a reduced establishment should suffice. Accordingly, Mr. O'Donel, Deputy Superintendent took the Field, at the beginning of December last, with two Assistants and a Probationer; but was, on the 20th January 1870, joined by Mr. David, 1st Class Assistant Revenue Surveyor.

No. 2, dated 4th October 1869.

2. *Number of Field Parties employed and duration of the field season.*—The work was started with eight Boundary, and six Interior Parties, or fourteen in all, subsequently augmented to nineteen Parties. Operations were closed at the end of May, or after nearly six months' duration.

3. *Instrumental equipment and Camp-equipage.*—The Instrumental equipment consisted of "Theodolites" by Troughton and Simms, in good order, of which the 7-inch ones were used for Main and Sub-Circuit Survey, those of 4½-inch diameter for ordinary boundary work. "Prismatic and Surveying Compasses," and "Plane Tables" for Interior details, together with a good supply of Gunter's chains, &c. The Camp-equipage consisted of five hill tents and ten lascars-pâls.

4. *Situation of Tract.*—The tract surveyed constitutes the eastern portion of the Cooch-Bihar State, and is situated between the parallels of North Latitude 25° 58' and 26° 40' and the meridians of East Longitude 89° 20' and 89° 55'. Its extreme length and breadth are about the same, 35 miles; and it is bounded to the north by the new District of "Julpigoree;" to the east by District Goalpara; to the south by District Rungpore, and to the west by the portion of Cooch-Bihar State surveyed during the preceding season.

Extent of work performed.—The gross area of the tract is 4,53,848·87 British acres = 709·14 square miles.

5. *Extent of boundaries surveyed.*—There were 1,622½ linear miles of boundary survey accomplished during the season.

6. *Division of country into Main Circuits.*—Prior to survey, no fiscal divisions appear to have existed, but with the consent of the Commissioner, the three Main Circuits of the season, each forming a compact block, have been transformed into Pergunnahs and Thannahs; Main Circuit No. 4 being named Pergunnah "Deenhutta," Main Circuit No. 5, Pergunnah "Cooch Behar" and Main Circuit No. 6, Pergunnah "Toofangunge"

10. *Old Stations of Rungpore found, and connected upon.*—Several stations of the old survey of Rungpore of 1857-58 were found, and have been shown in red on the Circuit area Table No. 4

11. *Alterations in river course since Mr. Pemberton surveyed it.*—The rivers forming the boundary between Rungpore and Cooch-Bihar have undergone more or less alterations in their course in the lapse of twelve years, but it was feasible, with the aid of the old maps, to establish the original boundaries on the ground and shew them on the maps of this season.

12. *G. T. Survey Stations.*—Seven G. T. Survey Stations, situated within, and adjoining the season's work, have been duly connected on, and the Tables entered in the

Report exhibit the relative values and the differences between the G. T. and Revenue Survey operations' results, by which it will be remarked that the maximum and minimum per mile are respectively 6.43 and 2.33 feet, whilst the average is 3.92 feet, and invariably the Revenue Survey is in defect, indicating that too much strain had been put upon our chain measurements by the mates.

14. *Total cost and average rates per square mile, and village.*—The total cost reckoned from 1st October 1869 to 30th September 1870, amounts to Rupees 48,004-10-10, inclusive of contingencies (or Rupees 39,025-2-1 for Establishment and 8,979-8-9 for Contingent charges.) This, over the area surveyed, would give an average rate of Rupees 67-11-1 per square mile and of Rs. 72-11-9 per

Contrast with preceding season's rate. village circuit. Contrasted with the preceding season's rates, the mileage cost is Rs. 8-0-2, and per village Rs. 6-0-11 in excess. This is to be accounted for by the limited Field for operations and a smaller subordinate agency, whilst the Superior Officers cost as much as before. The expense has to be defrayed by the Cooch-Bihar State.

15. *Azimuths.*—Dhurumpoor G. T. Station, from which the co-ordinates were calculated for Cooch-Bihar last season, was held as the origin, throughout this season's work. Check Azimuths were taken at ten different points, as exhibited on the Index map. * * * * *

16. *Ratio of Error.*—In the main circuits, the average angular correction was 1' to 12 angles, and 1.52 links per 100 Chains in the Latitude, and 0.68 links per 100 Chains in the Departure. Between the area of main circuits by Universal Theorem and by contained villages it is 0.213 of an acre per 100 acres in main circuit No. 4; 0.314 in main circuit No. 5; and 0.090 in main circuit No. 6; the average for the whole being 0.225 of an acre per 100 acres. I find that the ratio would have been still smaller had the co-ordinates been reckoned from the 1st station in each circuit series, instead of so distant a point as Dhurumpoor G. T. Station.

17. *Calculations, checking of areas.*—The traverses, multiplications, and all other computations were done by two different parties and the village areas tested with the Planimeter before being passed. Every precaution was taken to ensure correct work, Mr. O'Donel carefully examined all computations effected, before my arrival here to relieve him; and the multiplications and planimetry and offset values, since gone through, have been done with due care.

18. *Interior detail Survey.*—The Interior Survey was minutely executed with the plane table, generally, and by compass and board plan in a few cases.

Purtal, or Check Survey.—113 linear miles of purtal were executed by Messrs. Lane and Bolst, and Mr. O'Donel, who compared them, considered them as satisfactorily establishing the general accuracy of the details.

19. *Testing Chains.*—The chains were frequently tested with six feet standard rods. * * * * *

20. *Triple-junction platforms.*—The demarcations having only just preceded the Survey there was no time to erect the triple-junction marks of masonry, but the Settlement Deputy Collector had erected *pucka*-pillars over a part of the District, and was to continue their erection as he advanced with his *Khusrah* proceedings—meanwhile there was a raised platform of earth erected over each tri-junction point.

21. *Thakbusts.*—The Thakbust was well in advance of the Professional Survey. The Thakbust maps were all that could be desired, having been accurately executed with Surveying Compasses, and plotted by scale by the Ameens, and their comparison with the Professional maps shewed how well they had been got up. Material differences were rectified by re-measurement.

22. *Detached villages of Rungpoor and Goalpara situate in the season's work.*—Nineteen villages and chuks, separately demarcated and surveyed, belonging to Pergunnahs Goibaree Purub-bhag and Kazirhaut of District Rungpoor, are situated within main circuit

No. 4, and four of Pergunnah Ghoorlah District Goalpara are within main circuit No. 6.

23. *Villages of Cooch-Bihar situate in Rungpoor District.*—Sixteen villages of the Cooch-Bihar State situated within the District of Rungpoor and surveyed by Mr. Pemberton in 1857-58, have been copied, and will be entered in the Collector's Atlas Volume, to enable the Deputy Commissioner of Cooch-Bihar to obtain ready access to them.

24. *Main and Sub-Circuits set up by Deputy Superintendent.*—All the main and sub-circuits were set up and proved by Mr. O'Donel himself, as well as all the villages of the largest main circuit of season, No. 5.

29. The Index map of the season's work has been prepared, as well as the Index map to sheets, in duplicate, to be prefixed to the Atlas Volumes.

30. There are thirty-four sheets worked up to the margin, in duplicate, on a scale of twenty chains to an Inch.

To sum up, the maps and records of the season in hand and well advanced, are as follow:—

- 1 Map (in duplicate) of Cooch-Bihar Scale 10 chains=1 Inch.
- 1 Index map of the Season's operations.
- 1 Ditto. for Atlas Volume in duplicate.
- 3 Main Circuit General maps in duplicate.
- 42 Atlas Sheets (in duplicate) to be bound in one Volume with Index containing Statistical Registers.
- 1 Volume Main Circuit area Tables, Connecting Circuit, and Triangles of connections on G. T. Stations and Computations of Azimuths.
- 3 Volumes Sub-Circuit and Village Traverses.
- 1 Volume Boundary Board Plans.
- 1 „ Interior Board Plans and Purlals
- 1 „ Main Circuit Angle book and Azimuth observations.
- 1 „ „ Boundary Field Books.
- 11 „ Village Boundary Field Books.

31. Tabular Statement D. exhibits the work of each Assistant in the Field and Office. All have worked well, especially Mr. David, who is an efficient, zealous, and exemplary Assistant, who has been twenty-three years in the Department doing good service. I should be exceedingly glad if he could be promoted to the next higher grade from the 1st January next.

32. Messrs. W. J. Lane and Bolst have also given satisfaction by their diligence and attention to their duties. * * * * *

33. The Sub-Surveyors and Office Assistants attached to the Recess Office, have likewise afforded satisfaction.

Description of country surveyed by the 5th Division, Revenue Survey, Lower Provinces, during Season 1869-70.

The Tributary State of Cooch-Bihar is about seventy miles in extreme length, east and west, and about thirty-seven miles in extreme breadth, and is situated between the parallels of North Latitude $25^{\circ}-26'$ and of East Longitude $88^{\circ}-89'$ and has an area of 1,303.13 square miles, after deducting such villages of Districts Rungpoor and Goalpara as are situated within its boundary, and adding sixteen of its villages lying within the District of Rungpoor. It is bounded to the north and west by the new District of Julpigoree, to the east by District Goalpara, and to the south by District Rungpoor.

2. It is now divided into six thannahs and pergunnahs as per margin, of which three were surveyed in 1868-69, and the remaining three during the season under report.

* Mekligunge, Matabhanga, Lalbasar, Deenhutta, Cooch-Behar, Toofangunge.

3. The tract, surveyed in 1869-70, consists of a rich alluvial plain, intersected in all directions by rivers, nullahs and bheels. It lies to the east of the Rivers Toorsa and Durlah and comprises the Pergunnahs of Cooch-Behar, Deenhutta and Toofangunge. The whole of it is highly cultivated and thickly sprinkled with villages and hamlets except to the north-east, where there is heavy grass-jungle abounding with tigers, leopards, bears, rhinoceroses, wild-hog, deer, &c. &c.

4. *Crops*.—The chief crops are rice, of which there are two harvests, mustard-seed, sugar-cane, tobacco, jute, and wheat to a very limited extent, jute, rice and tobacco form the staple export of the District.

Exports.

5. *Towns*.—There are no towns of any note except Cooch-Behar, which is the residence of the Infant Rajah, and the Head-Quarters of the Deputy Commissioner, and the Engineer of the District. It possesses a small bazar and has a Post Office and a Charitable Dispensary. "Deenhutta" was at one time a place of some note from being the Head-Quarters of the Commissioner of the Division, but now it is only the Sub-divisional Head-Quarters of a Deputy Magistrate.

6. *Ruins*.—The Ruins of Komatopoor (once the seat of the Rajah) were reported upon by Mr. O'Donel last year.

7. *Hauts*.—There are several Hauts or market places scattered throughout the three pergunnahs, but the principal are "Kocha-Baree," "Poondeebaree," "Bukseegunge," "Dewanhaut," "Bulrampoor," "Chowra," and "Toofangunge". The two first are much frequented by Bhoteas; who bring down bees-wax and cotton from their Hills and Terais, which they barter for salt, grain and other necessaries. At the third a considerable trade was carried on in jute.

8. *Villages*.—The villages are generally composed of a few huts scattered here and there, with thick clusters of bamboo hiding them from view, and occasionally a few mango or jack trees, and a sprinkling of the betel-palm standing by the huts.

9. *Roads*.—The principal high roads, which are passable for wheel carriage, are the following:—From Julpigoree, passing through Cooch-Behar and leading to "Dhoobree" Ghât on the River Brahmapootra; the Telegraph line to Assam runs along this road. From Rungpoor to Buxa in the Bhootan Dooars, from Cooch-Behar to Falakata, branching off from the main line to Julpigoree at Rajar Haut, and another which branches off from this at Poondeebaree Haut, and proceeds to the westward in the direction of Julpigoree.

10. *Rivers*.—The Toorsa which enters at the north-west corner of Pergunnah Cooch-Behar and forms its western boundary till it advances about a couple of miles to the south of Barabhita G. T. Station, further down it changes its name into the "Dhurla":—"Singeemaree" to the west of Pergunnah Deenhutta and which joins the Dhurla about 3½ miles to the south-east of the G. T. Station Atarobanki.

The "Kaljane" which divides Pergunnah Cooch-Behar from Pergunnah Toofangunge, and at the southern extremity of the latter falls into the "Sunkos."

The "Rydak" divides the cultivated from the jungle portion to the north-west of Toofangunge, and then changes its name into "Sunkos."

The "Guddadhur" which for a short distance forms the boundary between the District of Goalpara and the Cooch-Behar State.

All these rivers are navigable for boats, but the principal traffic is borne on the Kaljane.

Copy of letter No. 8, dated Sebsaugor, 6th April 1870, from A. E. Campbell, Esquire, Deputy Commissioner of Sebsaugor, to the Assistant Superintendent of Revenue Survey, 2nd or Upper Assam, Revenue and Topographical Survey.

I have the honor to forward you a list of half Lakhiraj lands surveyed up to date, the areas of which do not agree with the areas in our Register.

Apparently those lands have been surveyed according to possession and not according to the areas furnished from this office, I have, therefore, to request the favor of your informing me, when you will be able to re-adjust the areas of those holdings, to enable me to issue the necessary orders to Mouzahdars and Lakhirajdars.

I have also to request that the areas of half Lakhiraj lands to be surveyed this season, be only in accordance with the areas furnished from this office.

I also beg to submit a list of full Lakhiraj lands being surveyed by you this season, with a copy of the Special Commissioner's order in each case, showing whether the land within boundaries, or a certain amount of land, was sanctioned.

Copy of Letter No. 223, dated Calcutta, 11th November 1870, from Major John Macdonald, Officiating Boundary Commissioner, Bengal, to the Superintendent of Revenue Surveys, Lower Circle.

I have the honor to forward, for submission to His Honor the Lieutenant-Governor of Bengal, the following Annual Report, together with the accompanying statement of work performed in my office in connection with my duties as Boundary Commissioner, for the past season, 1869-70.

Orissa Division.—After communication with the judge of Cuttack, I have settled the local jurisdictions of the several Moonsiffes (Civil Courts) in this Division, assimilating their boundaries with those of the sub-divisions. The matter is now awaiting the final approval of the High Court and the Bengal Government.

Bhaugulpoor Division.—The boundaries of the several Moonsiffes (Civil) jurisdictions, in districts Bhaugulpoor and Monghyr, have been decided on, after consultation with the Judge of Bhaugulpoor. The new Moonsiffie limits have been made to coincide with those of the sub-divisions. They have been sanctioned by Government and notified in the *Calcutta Gazette* of the 27th April 1870, page 991. For District Purneah, the Moonsiffie arrangements, proposed by me in May last, are still under the consideration of Government.

Dacca Division.—The jurisdictions of the Thannahs of District Dacca were settled in March 1870, after correspondence with the Commissioner, Magistrate, and District Superintendent of Police. This settled Thannah arrangement has again been proposed to be *partly* altered, according to the Commissioner's letter No. 349, dated 27th ultimo to Government. In District Backergunge, the Thannah boundaries have been adjusted. The boundary, between sub-division Moonsheegunge of District Dacca and sub-division Mudarepoor of District Backergunge, awaits the decision of Bengal Government. For District Mymensing, a scheme of the proposed Moonsiffie jurisdictions has been submitted to Government, suggesting an assimilation of their limits with those of the already approved sub-divisions. Of District Sylhet, a description of the sub-division and Thannah boundaries, as laid down on this Office map, has been lately sent to the Commissioner, on his request, with the view of enabling him to dispose of this long pending subject. In his No. 344 B. of the 19th ultimo, he "hopes that the Looshai disturbances on the frontier are now over." With regard to the District of Fureedpoor, I beg to state that the map of that District, which had been sent to the Commissioner, was returned to this Office in May 1870, without any revision of the Thannah boundaries. But a re-adjustment of the Thannah boundaries having been considered highly necessary in Fureedpoor, I subsequently proposed several changes in the existing Thannah limits which appeared to be irregular and inconvenient. The changes have lately been accepted by the Commissioner and the local officers, and are now waiting the approval of the Inspector General of Police, L. P. In District Cachar, alterations in the Thannah boundaries have been suggested by Mr. Edgar, the Deputy Commissioner of the District. These are now being marked off on the available 1 mile to 1-inch maps in this Office.

Rajshahce Division.—Descriptive statements of Sub-divisional and Thannah boundaries for Districts Rajshahce, Dinagepoor, Rungpoor, Maldah, Bograh and Pubnah, have been prepared, and are now undergoing check in this Office. They will shortly be sent to the Commissioner, for the countersignature of that Officer and District Magistrates. In District Moorshedabad, the boundaries of the city Thannahs, which were undefined last year, have now been marked on the map. Changes in the sub-divisional jurisdictions in this District have been proposed. The subject is now under the consideration of the Commissioner.

Burdwan Division.—A set of the published 1 mile to 1 inch maps of Districts Burdwan and Bancoorah, on which the Thannah boundaries have been marked by this Office, is now with the Magistrates of the said Districts, with the view of enabling them to give me an expression of their opinion on the boundaries. I have not received from Government any order on the Chota-Nagpore Commissioner's proposal* to break up the Bancoorah District:

* No. 749, dated 23rd March 1869, from the Commissioner of Chota-Nagpore, to the Secretary, Board of Revenue, L. P.

The maps of Districts Beerbhoom and Midnapoor, which exhibit the Thannah boundaries, are on the scale of 4 miles=1 inch, and do not shew village limits. Printed maps, on the scale of 1-mile=1-inch of these Districts are not available at the Surveyor General's Office. As soon as I receive a copy of the 1-mile maps of these two Districts, I will cause the Thannah limits to be indicated on the same for the final approval of the local Officers. The original survey maps and records of District Hooghly were condemned as not trustworthy. No map of Hooghly on the scale of 1 mile to the inch has yet been published, and I am obliged to wait until the resurvey of this District is completed.

Chittagong Division.—The 1-mile=1-inch map of District Chittagong, which had been sent by this Office to the Commissioner, was returned by him, in May last, with the Thannah boundaries indicated on it. The question of the proposed Moonsiffce jurisdictions for this District, is now under the decision of Government.

The Commissioner of Chittagong has informed me, that great alterations have been proposed, by the local Officers, in the boundaries of the Thannahs of Districts Tipperah and Noacolly. He will return the maps of these Districts, with information regarding the divisions and Moonsiffces and the Thannahs comprised in each, as soon as he receives required particulars from the Judges.

Conduct of Establishment.—I have reason to be satisfied with the industry and attent of the Office, the Head Writer and Head Draftsman have been noticed in the covering let of this report.

LISTS COMPILED AND EXAMINED.

1. Detailed lists of 4,176 villages of 11 Thannahs of District Monghyr, 5,507 villages of 13 Thannahs of District Purneah, and 4,299 villages of 11 Thannahs of District Bhaugulpore, have been examined, corrected and sent to be printed at the Alipoor Jail Press.
2. Detailed lists of 897 villages of three Thannahs (*viz.*, Baliapal, Basoodebpoor and Dhamnuggur) of District Balasore, have been compiled.
3. Detailed lists of 388 villages of three Thannahs of District Julpigoree have been examined, corrected and sent to the Deputy Commissioner of Julpigoree.
4. Detailed lists of 41 villages, transferred from the suburbs of Calcutta to Thannahs Dum-Dum and Tollygunge, have been compiled.
5. Descriptive statement* of the boundary between Districts Furreedpoor and Backergunge, prepared and submitted to the Government of Bengal.
6. Amended descriptions of the boundaries of Sub-Divisions and Thannahs of District Balasore, have been prepared and published, after the formation of the three Thannahs, *viz.*—Baliapal, Basoodebpoor and Dhamnuggur.

MAPS PREPARED.

Scale 1 Mile = 1 Inch.

1. A map, shewing the boundaries of Thannahs Boda, Sunnaseckata and Fukeergunge, for the District Superintendent of Police, Julpigoree.

