

REPORT
OF THE
COMMITTEE OF ENQUIRY
INTO THE
PROPOSED EXTENSIONS
OF THE
GANGES CANAL HYDRO-ELECTRIC GRID.

JANUARY 1934.



D26.252RG.N31

PRINTED AT THE ADVERTISER PRESS,

SAHARANPUR.

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TABLE OF CONTENTS.

	PARAS.	PAGES.
CHAPTER I. Introductory	1- 4	1- 2
CHAPTER II. The Scheme and the Cost of the Works	5-30	3- 7
CHAPTER III. Working Expenses	31-41	8-10
CHAPTER IV. Tariffs and Load Development	42-46	11-12
CHAPTER V. The Financial Aspect of the Scheme and its Revenue Forecast	47-56	13-16
CHAPTER VI. Summary of Conclusions	57	17
CHAPTER VII. Acknowledgements	58-59	18

LIST OF APPENDICES.

APPENDIX A— General abstract of financial results.

APPENDIX B— Establishment chart.

APPENDIX C— Wholesale and retail rates on the Grid.

APPENDIX D— Comparative statement showing Hydel rates and rates in other licences.

APPENDIX E— Forecast of load development.

APPENDIX F— Statement showing revenue anticipated.

APPENDIX G— Resident Engineer's load forecast.

APPENDIX H— Note on sugar cane production.

APPENDIX J— Note on State tube well irrigation.

APPENDIX K— System curves to-date.

LIST OF MAPS.

MAP No. 1.— Index map of the Present Stage.

MAP No. 2.— Index map showing the Ultimate Development.

APPENDICES AND MAPS.

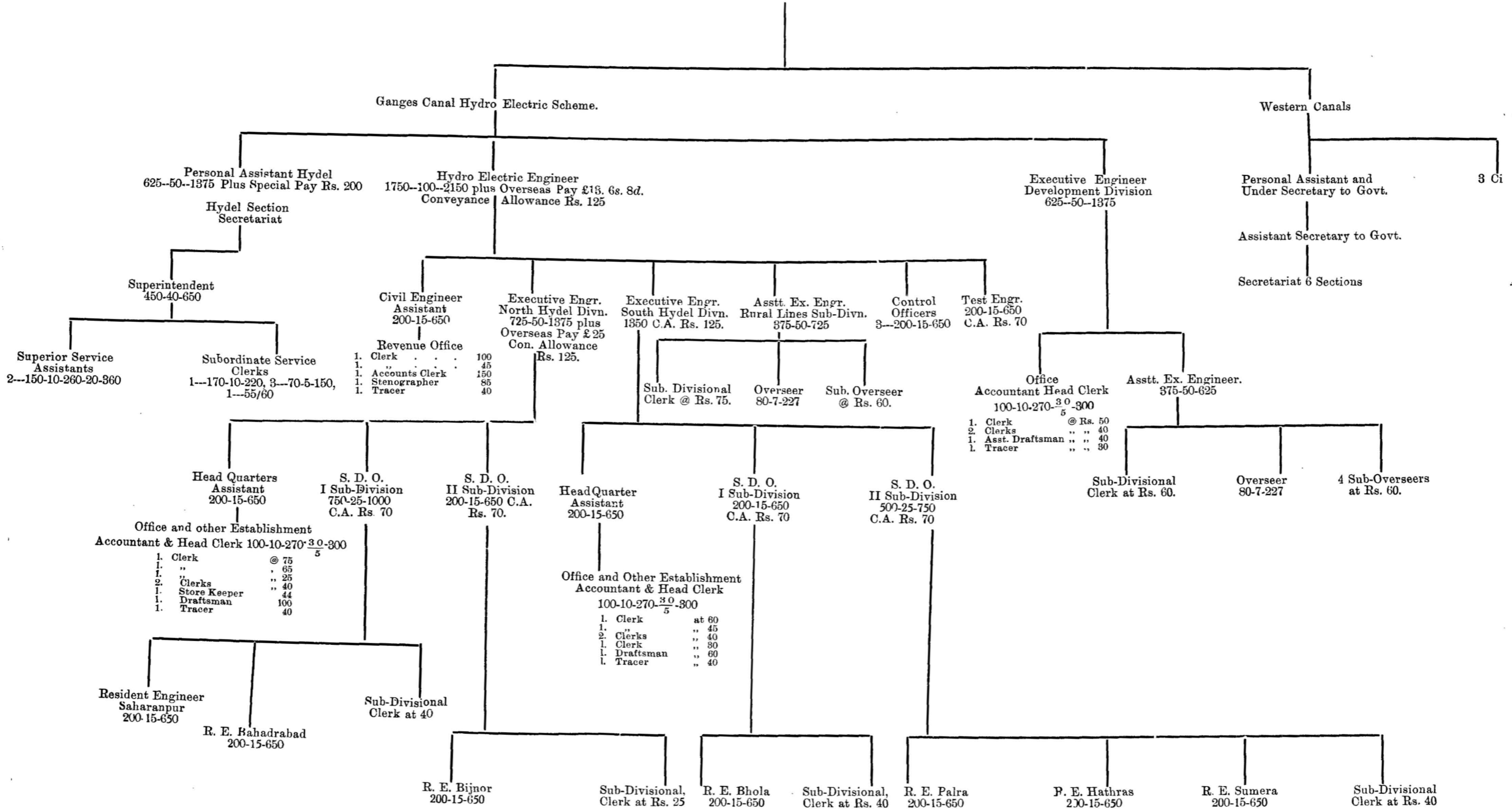
APPENDIX A.
Ganges Canal Hydro-Electric Scheme
THE ULTIMATE DEVELOPMENT.
General abstract of financial results.

YEAR.	CAPITAL OUTLAY TO END OF THE YEAR.			Accumulated arrears of simple interest to end of the year.	Total of columns 4 and 5.	Gross Revenue for the year.	WORKING EXPENSES.					Net revenue column 7—column 12.	Simple interest for the year.	Net gain or loss column 13—column 14.	Percentage of net revenue or deficit Col. 13 Col. 6
	Direct charges.	Indirect charges.	TOTAL.				Establishment including Operating Staff.	Maintenance and repair charges.	Depreciation.	Indirect charges.	TOTAL.				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
1932-33	1,37,94,438	1,14,163	1,39,08,601	13,11,434	1,52,20,035	10,46,581	4,59,559	2,24,473	...	1,175	6,85,207	3,61,374	7,61,464	-4,00,090	2'4 %
1933-34	1,53,95,779	1,28,070	1,55,23,849	13,64,210	1,68,88,059	13,56,000	3,38,897	2,47,200	...	2,472	5,88,569	7,67,431	8,20,207	- 52,776	4'5 ..
1934-35	1,68,74,816	1,41,021	1,70,15,837	14,59,447	1,84,75,284	16,67,000	3,89,694	2,61,000	2,11,716	2,610	8,65,020	8,01,980	8,97,217	- 95,237	4'4 ..
1935-36	1,92,01,381	1,61,119	1,93,62,500	13,33,959	2,06,96,459	19,75,000	2,97,936	3,25,912	2,30,048	3,259	8,57,155	11,17,845	9,92,357	1,25,488	5'4 ..
1936-37	2,00,93,643	1,68,868	2,02,62,511	12,05,765	2,14,68,276	22,96,000	5,01,311	3,26,886	2,63,514	3,268	10,94,979	12,01,021	10,72,827	1,28,194	5'6 ..
1937-38	2,29,72,728	1,93,865	2,31,66,593	7,00,297	2,38,66,890	26,11,000	2,95,821	3,61,756	2,77,228	3,617	9,38,422	16,72,578	11,67,110	5,05,468	7'0 ..
1938-39	2,39,95,558	2,02,733	2,41,98,291	2,77,792	2,44,76,083	29,41,000	5,37,790	3,73,440	3,38,873	3,734	12,53,837	16,87,163	12,64,658	4,22,505	6'9 ..
1939-40	2,71,76,943	2,30,378	2,74,07,321	...	2,74,07,321	32,24,000	3,15,733	4,03,790	3,53,076	4,038	10,76,637	21,47,363	13,69,764	7,77,599	7'8 ..
1940-41	2,86,65,330	2,43,221	2,89,08,551	...	2,89,08,551	35,36,000	5,30,532	4,14,953	4,17,872	4,149	13,67,506	21,68,494	14,86,509	6,81,985	7'5 ..
1941-42	3,14,05,680	2,66,945	3,16,72,625	...	3,16,72,625	38,28,000	4,11,776	4,68,484	4,33,121	4,684	13,18,065	25,09,935	15,92,228	9,17,707	7'9 ..
1942-43	3,50,26,948	2,98,899	3,53,25,847	...	3,53,25,847	41,20,000	3,88,662	4,70,250	4,74,898	4,702	13,38,512	27,81,488	17,51,269	10,30,219	7'9 ..
1943-44	3,70,51,203	3,16,449	3,73,67,652	...	3,73,67,652	44,12,000	5,52,053	5,11,270	5,76,193	5,113	16,44,634	27,67,366	18,92,407	8,74,959	7'4 ..
1944-45	3,91,66,284	3,35,068	3,95,01,352	...	3,95,01,352	47,04,000	5,93,747	5,34,964	6,08,709	5,349	17,42,769	29,61,231	19,95,890	9,65,341	7'5 ..
1945-46	4,00,85,409	3,43,038	4,04,28,447	...	4,04,28,447	50,05,000	7,35,080	5,55,943	6,55,324	5,559	19,51,906	30,53,094	20,71,745	9,81,349	7'6 ..
1946-47	4,19,60,022	3,59,287	4,23,19,309	...	4,23,19,309	53,06,000	6,49,321	5,91,158	6,75,931	5,911	19,22,321	33,83,679	21,41,588	12,42,091	8'0 ..
1947-48	4,24,47,397	3,63,437	4,28,10,834	...	4,28,10,834	56,07,000	8,32,900	5,89,091	7,08,891	5,891	21,36,773	34,70,227	22,00,637	12,69,590	8'1 ..
1948-49	4,29,14,772	3,67,587	4,32,82,359	...	4,32,82,359	59,08,000	8,59,900	5,91,966	7,17,518	5,919	21,75,303	37,32,697	22,24,505	15,08,192	8'6 ..

APPENDIX B.

GANGES CANAL HYDRO ELECTRIC GRID
ESTABLISHMENT CHART
PRESENT STAGE.

CHIEF ENGINEER AND SECRETARY TO GOVT. I.B.
(2,750—125—3,000 Plus £ 13-6s-8d.
Special pay Rs. 250)



APPENDIX C.

Statement showing wholesale and retail rates on the Grid.

Class of load.	Rate.	Discount.	Nett Rate.	Rate to Licensees.	Ratio cost to Consumer Licensees.	Minimum charges.
Domestic lights and fans	annas. 6	annas. $\frac{1}{2}$	annas. $5\frac{1}{2}$	annas. $2\frac{1}{2}$	annas. 2'2	Rs. 2 p. m.
Ditto ...	8	2	6	$2\frac{1}{2}$	2'4	" 3 "
Street lighting ...	contract			$2\frac{1}{2}$
Domestic Power ...	3	...	3	$1\frac{1}{2}$	2'0	Rs. 2 p. m.
Agricultural purposes	1	...	1	$\frac{10}{18}$	1'2	600 units per B.H.P. per annum.
Cinemas ...	$3\frac{1}{2}$...	$3\frac{1}{2}$	$1\frac{1}{2}$	2'2	Rs. 5 p. m.
Tube-wells. ...	12 pies.	...	12 pies.	$11\frac{1}{2}$ pies	1'04	600 units per B.H.P. per annum.
Industrial— (A) Sliding scale...	6'1 pies to 18 pies per unit.	...	6'1 pies to 18 pies per unit.	4'5 pies to 12 pies per unit.	1'36 to 1'50	600 units per B.H.P. per annum.
(B) Two part ...	Rs. 6 per B. H. P. connected.	...	Rs. 6 per B.H.P.	Rs. 4 per B.H.P.	1'5	Rs. 6 per B.H.P. per mensem.
	and 9 pies per unit.	3 pies per unit.	6 pies per unit.	4 pies per unit.

APPENNDIX D.

Comparative Statement showing *Hydel* rates and rates in other licences.

B.H.P. of motor.	Process for which used.	Number of months per year during which the motor works.	Average number of working hours per day.	Approximate num- ber of units consumed per month.	THROUGH RATES IN PIES PER UNIT.									
					The U. P. Electric Supply Co., Ltd. Lucknow & Allahabad.	Cawnpore Electric Supply Corporation Limited.	Delhi Electric Supply & Traction Co., Ltd., Delhi.	Uhl river Hydro- electric Scheme Punjab.	Lahore Electric Supply Co., Ltd. Lahore.	Hydro- electric Scheme Mysore State.	Pykara Hydro- electric Scheme Madras.	Tata Hydro- electric Power Supply Co., Ltd. Bombay.	The Bombay Electric Supply and Tramways Co., Ltd. Bombay.	The Ganges Canal Hydro- electric Grid United Provinces.
H.P.		Months.	Hours.	Units.	Pies.	Pies.	Pies.	Pies.	Pies.	Pies.	Pies.	Pies.	Pies.	Pies.
5	Brass polishing ...	12	8	750	17'3	25'3	16'2	14'76	27	12	14'56	...	24'0	13'7
10	Flour mill ...	12	10	1875	15'8	18'00	16'2	13'31	16'2	12	12'9	...	14'27	12'1
10	Rice hulling ...	4	16	5000	13'4	14'90	16'2	11'13	14'64	12	13'92	...	11'36	9'8
25	Sugar centrifugal and crusher ...	4	16	7500	13'4	14'90	16'2	11'16	14'64	13'5	10'99	...	11'36	9'8
60	Cotton ginning factory	3	20	22500	12'7	13'87	Special rate.	8'19	Special rate.	8'1	9'6*	...	10'69	9'1
60	Oils mills ...	12	20	22500	12'7	13'87	Special rate.	8'19	Special rate.	8'1	8'86	...	10'69	7'8
70	Ice factory ...	6	24	31500	12'16	13'18	Special rate.	7'74	13'76	8'1	9'6†	...	9'6	8'56
125	Rolling mills ...	12	8'5	19922	16'8	19'44	Special rate.	10'98	16'9	8'4	10'3	...	13'47	13'2
200	Strawboard factory ..	12	24	90000	12'16	13'18	Special rate.	6'91	Special rate.	7'2	6'44	7'75	8'22	6'62

*The actual rate calculated is 8'1 pies per unit but the minimum chargeable is 9'6 pies per unit.

†The actual rate calculated is 8'46 pies per unit but the minimum chargeable is 9'6 pies.

N.B.— It is assumed that motors will only be working on an average for 25 days in a month.

APPENDIX E.

Ganges Canal Hydro-Electric Grid.

FORECAST OF LOAD DEVELOPMENT.

Year.	Power station peak load.	Losses.	State canal pumps.	Balance column 2-(3+4) available for the allotment for other loads.	Domestic.	Industrial.	Agricultural.	State tube-wells.	Railway loads.	Miscellaneous.	Total.	Diversity factor.
1	2	3	4	5	6	7	8	9	10	11	12	13
1931-32	3,200	320	1300	1,580	1,220	2,800	300	Nil	500	Nil	4,820	3.0
1932-33	4,200	440	1400	2,360	1,560	4,100	600	100	500	250	7,110	3.0
1933-34	5,300	540	1400	3,360	1,750	5,200	1300	400	700	250	9,600	2.9
1934-35	7,050	850	1900	4,300	2,000	6,700	1700	700	700	300	12,100	2.8
1935-36	8,350	1050	1900	5,400	2,200	8,200	2100	1100	700	300	14,600	2.7
1936-37	9,550	1250	1900	6,400	2,400	9,700	2500	1600	700	300	17,200	2.7
1937-38	10,750	1450	1900	7,400	2,600	11,200	2900	2100	700	400	19,900	2.7
1938-39	12,000	1700	1900	8,400	2,800	12,700	3300	2700	700	400	22,600	2.7
1939-40	13,700	2000	1900	9,800	3,000	14,200	3700	3400	700	400	25,400	2.6
1940-41	15,100	2300	1900	10,900	3,200	15,700	4100	4100	700	500	28,300	2.6
1941-42	16,500	2600	1900	12,000	3,400	17,200	4500	4800	700	500	31,100	2.6
1942-43	17,800	2900	1900	13,000	3,600	18,700	4900	5500	700	500	33,900	2.6
1943-44	19,200	3200	1900	14,100	3,800	20,200	5300	6200	700	500	36,700	2.6
1944-45	21,300	3600	1900	15,800	4,000	21,700	5700	7000	700	500	39,600	2.5
1945-46	22,900	4000	1900	17,000	4,200	23,200	6100	7800	700	500	42,500	2.5
1946-47	24,400	4400	1900	18,100	4,400	24,700	6500	8600	700	500	45,400	2.5
1947-48	26,200	5000	1900	19,300	4,600	26,200	6900	9400	700	500	48,300	2.5
1948-49	28,000	5600	1900	20,500	4,800	27,700	7300	10200	700	500	51,200	2.5

APPENDIX F.

Ganges Canal Hydro-Electric Scheme

THE ULTIMATE DEVELOPMENT.

Statement showing Revenue anticipated.

Year.	Domestic.	Industrial.	Agricultural.	State tube-wells.	Railways.	Miscellaneous.	State canal pumps.	Total.	Revenue per K. W. year.
Col. 1	2	3	4	5	6	7	8	9	10
1931-32	2'40	1'90	'10	Nil	1'10	Nil	1'6	7'10	222
1932-33	2'78	2'99	'31	'10	1'11	1'42	1'61	10'32	246
1933-34	3'24	4'92	'52	'20	1'67	1'42	1'59	13'56	256
1934-35	3'72	6'03	1'09	'35	1'89	1'69	1'90	16'67	236
1935-36	3'96	7'79	1'47	'63	2'00	1'70	2'20	19'75	237
1936-37	4'32	9'70	1'75	'99	2'00	2'00	2'20	22'96	240
1937-38	4'68	11'76	2'03	1'44	2'00	2'00	2'20	26'11	243
1938-39	5'04	13'97	2'31	1'89	2'00	2'00	2'20	29'41	245
1939-40	5'40	15'62	2'59	2'43	2'00	2'00	2'20	32'24	237
1940-41	5'76	17'27	2'87	3'06	2'00	2'20	2'20	35'36	234
1941-42	6'12	18'92	3'15	3'69	2'00	2'20	2'20	38'28	231
1942-43	6'48	20'57	3'43	4'32	2'00	2'20	2'20	41'20	231
1943-44	6'84	22'22	3'71	4'95	2'00	2'20	2'20	44'12	230
1944-45	7'20	23'87	3'99	5'58	2'00	2'20	2'20	47'04	220
1945-46	7'56	25'52	4'27	6'30	2'00	2'20	2'20	50'05	218
1946-47	7'92	27'17	4'55	7'02	2'00	2'20	2'20	53'06	218
1947-48	8'28	28'82	4'83	7'74	2'00	2'20	2'20	56'07	214
1948-49	8'64	30'47	5'11	8'46	2'00	2'20	2'20	59'08	211

NOTE:— Figures in columns 2 to 9 represent lacs of rupees and those in column 10 rupees.

APPENDIX G

Upper Jumna Valley Electricity Supply Co., Ltd.,

(1) Statement of past and Anticipated Development in Meerut, Muzaffarnagar & Saharanpur Districts.

Year	1930	1931	1932	1933	1934	1935	1936	1937
No. of Connections.								
Lights and Fans	315	858	1226	1876	2870	3470	3920	4270
Power	32	77	143	289	423	527	630	730
Total	347	935	1369	2165	3293	3997	4550	5000
Street Lights	929	1228	1386	1968	2148	2250	2275	2300
Connected Load.	K. W.	K. W.	K. W.	K. W.	K. W.	K. W.	K. W.	K. W.
Power	225	600	1125	1950	2900	3615	4205	4985
Lights and Fans	126	343	490	770	1345	1630	1810	1930
Street Lights	42	54	71	88	99	103	103	103
Total	393	997	1686	2808	4344	5348	6118	7018
Units Sold.								
Light and Fans	35852	132234	223245	304239	740000	1039500	1119250	1207000
Power	109292	490765	891303	1501067	2280000	2900000	3260000	3392000
Street Lights	56129	124613	135587	186344	203200	215800	215800	215800
Total	201273	747612	1250135	1991650	3223200	4155300	4595050	4814800

(2) Power Abstract upto 31-12-33.

Flour mills	124	1266.5 H.P.
Workshop	23	243 "
Cotton gins	3	16.5 "
Oil mills	9	141 "
Pumps	73	566 "
Chaff cutters	3	6 "
Cinema	3	25 "
Sugar processing	49	257.5 "
Unclassified	1	40 "
Disintegrator.	1	25 "

(Sd.) J. D. GULLICK,

Resident Engineer,
Meerut.

APPENDIX H.

Note on Sugarcane Production.

1. The economic value of the sugarcane industry to the province and the demand for hydel power which it is expected to create are of considerable importance. The Committee therefore were particularly interested in obtaining information in the various localities as to the possibility of the saturation point of production being reached in the near future, resulting eventually in over production and low prices. The opinions of two Commissioners and a Collector were obtained and the views of local industrialists and landowners ascertained. The Sugar Technologist to the Government of India was also consulted.

2. The general opinion is that saturation point has not yet been reached, but that some form of control of production within the province and by agreement between other provinces should be attempted in order to safeguard the industry. It was generally admitted that an economic need existed for small factories of about 50 tons capacity per day situated away from railway stations, and that such factories should be encouraged by Government. They could compete with the larger factory situated near towns, for they could obtain their cane at a comparatively low price and, moreover, as the cane would in their case always be fresh, a higher average percentage of sugar might be obtained. The grower would also benefit as his expenses would be less due to lower transport costs. In fact the small factory was more likely to become a permanent feature of the Provincial industrial structure than the large one.

3. At present there are 135 factories in India of which 70 are in the United Provinces and 34 in Behar. Of the factories in this province 12 are located in the hydro-electric area with a daily capacity of 4900 tons. The acreage necessary to meet these factory requirements is estimated to be 28,150 while more than 500,000 acres are under cultivation indicating that there is scope for the small factories. A table showing the distribution of sugar factories in the Grid area prepared by the Sugar Technologist to the Government of India is submitted for reference.

4. An interesting feature of these returns is that the estimated acreage under production for 1933-34 is actually less than the actual figures for 1932-33 which would appear to confirm that more factories are needed rather than that saturation point has been reached.

5. In this connection the Sugar Technologist stated that at present India is consuming 900,000 tons of sugar, which is less than formerly. Out of this 250—270 thousand tons is made by the open pan system—which may be gradually replaced by the vacuum process and the rest is made or refined from gur. The imports of sugar for the current year are expected to be 300,000 tons. This amount is likely in future to be gradually reduced by increased production in India, a consideration which confirms the view that saturation point has not yet been reached. The actual problem seems to be competition between provinces, which has been referred to already.

6. The price of sugar at present is the lowest for 15 years and it would be reasonable to assume that prices will tend to rise for some time in spite of competition rather than fall still lower.

7. There is an increasing tendency for the large sugar factories to use hydel power, for lighting and auxiliaries, while it would seem that it would be economical for the small 50 ton factory, using the vacuum process and situated away from transport facilities to use hydel power for crushing and refining in combination with a small low pressure boiler for process steam, utilizing bagasse as fuel.

8. The Chief Engineer estimates that about 7.5 units of electrical energy are required to crush one ton of sugarcane (22 units per 80 maunds).

(ii)

The yield of sugarcane per acre is estimated as follows :--

	Fertilized land.	Unfertilized land.
Canal irrigated	20 tons	15 tons
Dry	13'3 ..	10 ..

Provided the small factory can be partially electrified as already proposed an approximate average consumption of 750,000 units with a corresponding demand of about 300 K.W. could be expected for every 1000 tons crushed per day in a season of 100 days. An additional load might also be derived from the centrifugals.

It would thus appear that the possibilities of this industry as a consumer of hydro-electric power are favourable.

Statement showing distribution of sugar factories and cane acreage in the hydro-electric districts.

DISTRICT.	Total number of factories working during 1933-34.	Total capacity during 1933-34. (Tons cane crushed per day).	Estimated acreage of cane for meeting factory requirements.	Actual cane acreage in district during 1933-34.
Moradabad	1	500	3150	62,336
Bijnor	3	1,050	6600	94,725
Meerut	5	2,400	13200	143,781
Muzaffarnagar	1	400	2200	114,946
Saharanpur	2	550	3000	88,501

NOTE.—There are no sugar factories in the districts of Aligarh and Bulandshahr.

Statement showing acreage under cane during the last six years in the hydro-electric districts.

DISTRICT.	1928-29	1929-30	1930-31	1931-32	1932-33	1933-34
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Saharanpur	47,575	52,974	68,043	73,421	90,735	88,501
Muzaffarnagar	77,800	100,435	111,028	101,669	118,000	114,946
Meerut	129,745	138,017	142,030	122,309	154,320	143,781
Bulandshahr	39,511	43,162	50,805	47,025	59,383	51,872
Aligarh	6,573	7,510	10,910	15,581	22,120	15,653
Moradabad	47,958	48,856	55,420	58,582	63,698	62,336
Bijnor	87,391	81,218	96,292	80,395	91,140	94,725

NOTE.—Figures for 1928-29 to 1932-33 are final, whilst those for 1933-34 are provisional.

APPENDIX J.

Note on State tube well irrigation.

With reference to the forecast of load development for State tube wells in column 9 of the Chief Engineer's schedule II reproduced as Appendix E of this report which shows an estimate of 2700 K. W. in the year 1938-39, we understand that subsequent to the preparation of this schedule a five year plan for State tube well irrigation has been submitted to Government which involves the construction during the years 1934-35 to 1938-39 of some 949 wells. This would represent instead of the figure of 2700 K.W. for 1938-39 estimated in column 9 of the schedule referred to the figure of 5200 K. W.

2. In connection with the Chief Engineer's estimate under this head we have discussed generally with the various witnesses who came before us in the course of our tours the subject of State tube well irrigation. On the technical side we are advised that no difficulty stands in the way of the Chief Engineer's scheme owing to the risk of its depleting the supplies of sub-soil water, that the proposed density of wells in relation to area is technically sound and that the risks of failure from technical causes are negligible. The Agricultural Engineer told us that of about 100 wells installed during his tenure of office of about three years only two had failed and that for very special reasons. In the area covered by the scheme conditions for tube well construction are we understand extremely favourable. Extension of State tube well irrigation was welcomed by the revenue officers as affording increased protection against famine. In the Moradabad District we understand that owing to geological conditions ordinary well irrigation cannot be extended.

3. On the financial side, the only figures of actual expenditure and revenue available to us in this connection relate to the working of the Moradabad District tube wells for 1932-33. This was only the first year of operation, and therefore even in the case of those wells which were constructed in time to operate for the full year, the results cannot be taken as the basis of a reliable estimate for the future. (In the case of ordinary irrigation schemes the test of productivity is applied to the results after the tenth year of operation). We understand however that on results and experience already obtained, the Irrigation Branch has decided not to pursue in future any project on the lines of the Dingarpur Agricultural Canal, which was a scheme of pumping from large wells into small State owned canals and the sale of water therefrom at acre watering rates. With this decision we are in complete agreement. In regard to the tube wells operating on the prepayment meter system of sale by units the poor percentage return (which incidentally was calculated without taking into account the interest charges on capital) shown in the case of all the wells except one was attributable, we believe, to the excessive capital cost of the wells and to the abnormal rainfall during rabi which diminished the demand for tube well water. The project was then moreover in the experimental stage. We have therefore used the results of that year only for general reference in examining the Chief Engineer's estimates of capital cost, working expenses and revenue for a single cusec tube well (which we consider has been demonstrated to be the most suitable type) with one mile of lined channel on the basis of which we understand Government is being asked to provide funds for future tube well construction. We reproduce this estimate at the end of this note. Under present conditions the estimated capital cost per well (Rs. 5,000) is susceptible of considerable reduction. It has worked out at an average figure of slightly below Rs. 4000 on 13 wells recently constructed in the Meerut District. The suggestion has been offered that the cost of the strainer can be reduced by having it made departmentally. This may be considered by the Chief Engineer. A reasonable assumption for the average working hours per annum is, we calculate, 2800. The estimates on which the Chief Engineer is basing the tube well scheme are, we consider, reasonable and the revenue anticipated will, we think, be earned. In the course of our discussions on tour it was suggested that the rates charged could, if such a step proved necessary to ensure the commercial success of the project, be raised

by 25 per cent without imperilling the demand for water. In drawing any comparison with rates charged for canal water, the fact should not be lost sight of that in the prepayment meter system the cultivator only pays for water when he requires it, and he is already, we understand, learning in the tube-well area to use it much more economically than when it is derived from canals. The fact that tube-well water costs more than canal water does not therefore necessarily prejudice the success of the tube-well scheme. Its financial success will however, we believe, be more readily secured if the scheme proceeds in the early stages in *do fasli* areas, with good communications facilitating close supervision and prompt repairs. Above all we would emphasise the necessity on the part of the officers running the scheme for constant consultation with the local officers of the Civil Department generally and with particular reference to propaganda, the selection of sites for wells and measures calculated

- (a) to diminish any hardship that a system involving prepayment might tend to create, and
- (b) to induce to take water those cultivators whose holdings are so small as to make it not worth their while to buy even the amount available for a single token. In regard to the last point there appears room for efforts by the Co-operative Department to organize cultivators into societies so that they may obtain the maximum benefit from the scheme. There appears to us a fair prospect of commercial success for State tube-well irrigation, and while we presume that funds will be made available for it by Government from year to year only after the most careful review of the results obtained from expenditure already incurred, we feel we are not unduly optimistic in accepting the Chief Engineer's estimated load of 2700 K.W. in the 5th year. So far as the hydro-electric project alone is concerned, we note that the price of energy charged to the Irrigation Branch by the Hydel Branch is low and extremely favourable.

4. The question was raised in our deliberations of the comparative merits of irrigation from State owned and private tube-wells. We see no objection to a zamindar's constructing a tube-well to give supply to himself and his tenants—in fact we would encourage his doing so, subject to suitable regulations being imposed by Government as to (1) the maximum rate he could charge for water and (2) the specification of the well he could install.

(iii)

State Tube-well Irrigation.

Financial statement for a single cusec well including cost of one mile of lined gul.

(a) Cost of well.	1. Works	...	Rs. 1300-0-0
	2. Equipment	...	" 3000-0-0
	3. Overhead	...	" 700-0-0
(b) Cost of lining gul.	1. Works	...	" 2000-0-0
	2. Overhad	...	" 600-0-0
	Total cost	...	" 7600-0-0

$$\text{Units consumed per hour} = \frac{36' \times 22000 \times 10 \times 100 \times 0.746}{33000 \times 60 \times 55}$$

$$= 5.4 \text{ or, say, } 5.5 \text{ units.}$$

		(1)	(2)
Working hours assumed	...	2,500	3,000
(a) Units consumed per hour	...	5.5	5.5
(b) " " " year	...	13,750	16,500
(c) Gross revenue @ annas 2 per unit	...	1,718	2,062
(d) Annual charges—			
(1) Interest on Rs. 7,600 @ 5%	...	380	380
(2) Depreciation on Rs. 3,000 at 7%	...	210	210
(3) Repairs, oil grease etc.	...	80	80
(4) " to gul	...	80	80
(5) Establishment—			
[i] Share of mistry for 20 wells	...	Rs. 2 per mensem.	
[ii] Operator with commission per unit	...	" 20 "	
[iii] Overhead supervision on 150 wells	...	" 10 "	
[iv] Leave and pension charges	...	" 3 "	
	Total per year	...	Rs. 35 × 12
			= 420
(6) Cost of energy at 0-0-7 per unit	...	501	601
	Total annual charges	1,671	1,771
(e) Profit (c)—(d)	...	47	291
(f) Equivalent cost per unit	$\frac{(d) \times 16}{(b)}$	1.9 as.	1.7 as

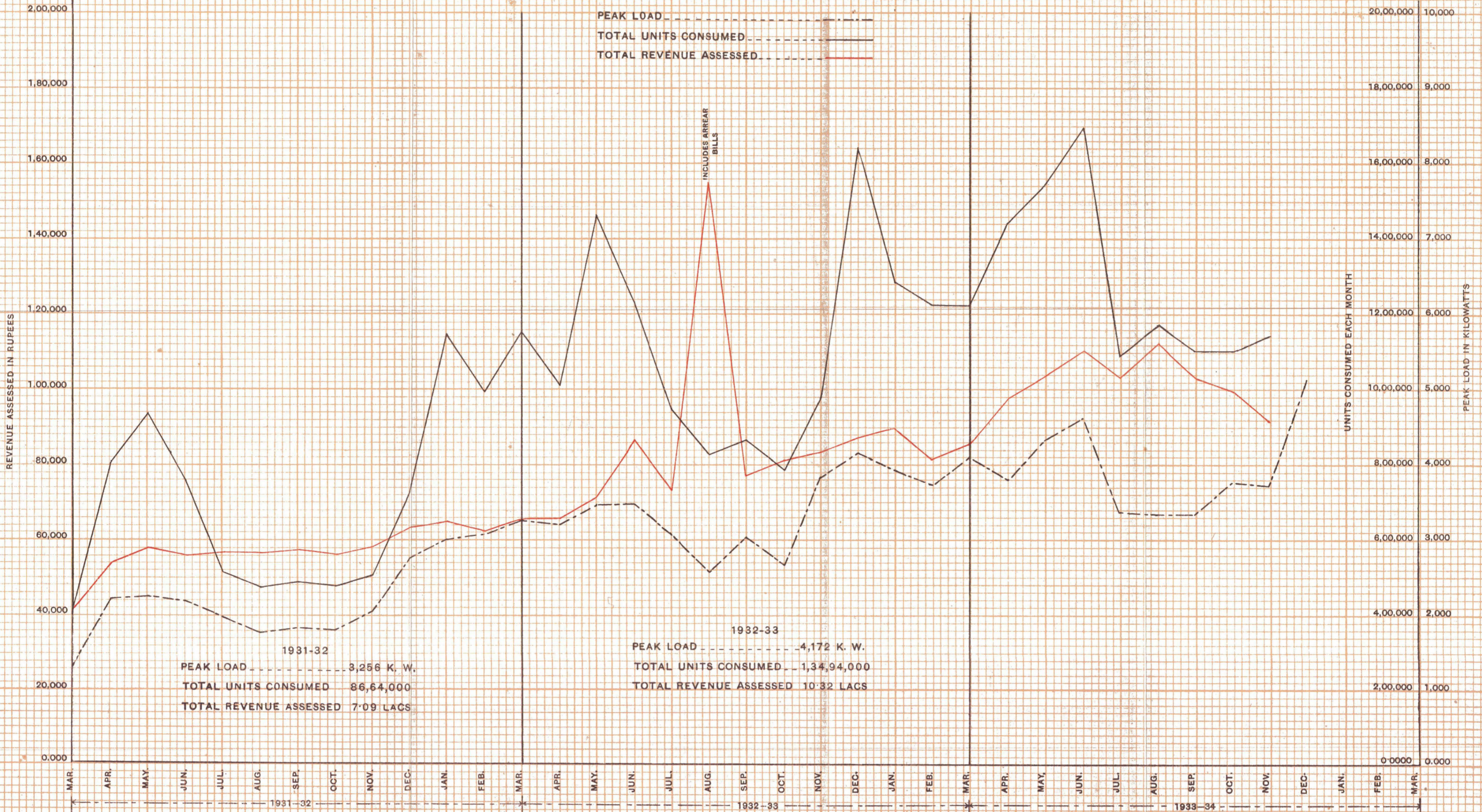
State Tube-well Irrigation.

Abstract of estimate of cost of a single cusec well.

		Rs.
1. A Preliminary		53
2. B. Land		72
3. K. Building		826
4. L. Earthwork		315
5. O. Miscellaneous		9
6. Q. Equipment		
Switchboard	Rs. 12-0-0	
Notice board	" 4-0-0	
V. notch	" 20-0-0	
7½ H.P. Motor, pump, taper, starter and switch	" 720-0-0	
Ammeter	" 24-0-0	
6" sluice valve	" 90-0-0	
90° Bend with 2 flanges	" 40-0-0	
Foot valve	" 60-0-0	
20 ft. delivery pipe with flanges, @ 3/- per ft.	" 60-0-0	
1 Galvanised sheet expanding funnel with flanges and cover	" 35-0-0	
1 Prepayment meter	" 100-0-0	
200 ft. boring @ 1-12	" 350-0-0	
56 R. ft. of 5" Tej Patent strainer @ 16/- per ft.	" 896-0-0	
128 R. ft. of 6" W. I. pipe @ 2-8	" 320-0-0	
Wiring of pump house, with cables, lamps etc.	" 100-0-0	
Mechanical mistry for fitting	" 10-0-0	
Special T. & P. for fitter and electrician	" 5-0-0	
Contingencies on Rs. 2,846 @ 5%	" 142-0-0	
Total	<u>Rs. 2,988/-or, say, 3,000</u>	
7. Overhead charges on items 1 to 5 Rs. 1,275		
at 28 per cent	... 357	
Overhead charges on item 6 Rs. 3,000		
at 11 per cent	... 330	687
GRAND TOTAL		<u>4,962</u>
		<u>or say Rs 5,000.</u>

G. C. H. E. GRID.

GRAPHS SHOWING PEAK LOADS, TOTAL UNITS CONSUMED AND THE REVENUE ASSESSED FOR EACH MONTH

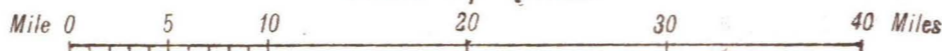


GANGES CANAL HYDRO-ELECTRIC GRID

MAP No. 1.

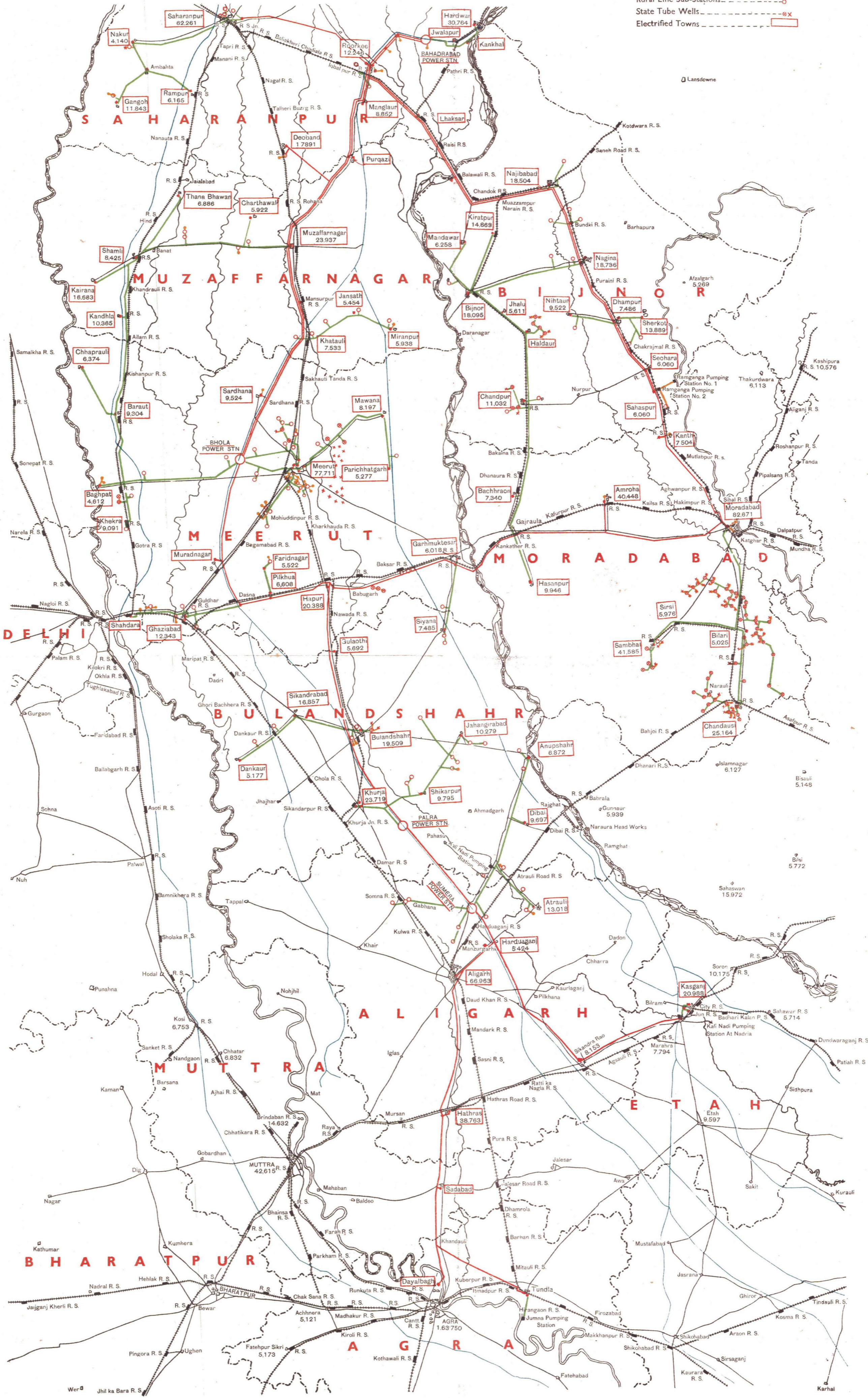
MAP SHOWING WORKS INCLUDED IN THE PRESENT STAGE 1928-34.

Scale of Miles.



REFERENCES.

- Power Stations
- 37,000 Volt Transmission Lines
- 11,000 Volt " Lines
- Other " Lines
- City Sub-Stations
- Rural Line Sub-Stations
- State Tube Wells
- Electrified Towns



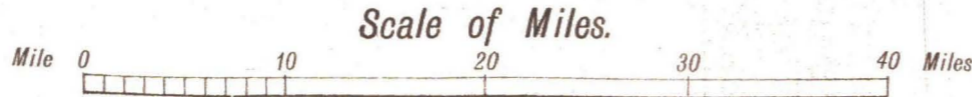
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Chief Engineer,
Western Canals,
U. P.

Govt. Photo-Litho. Press, Roorkee

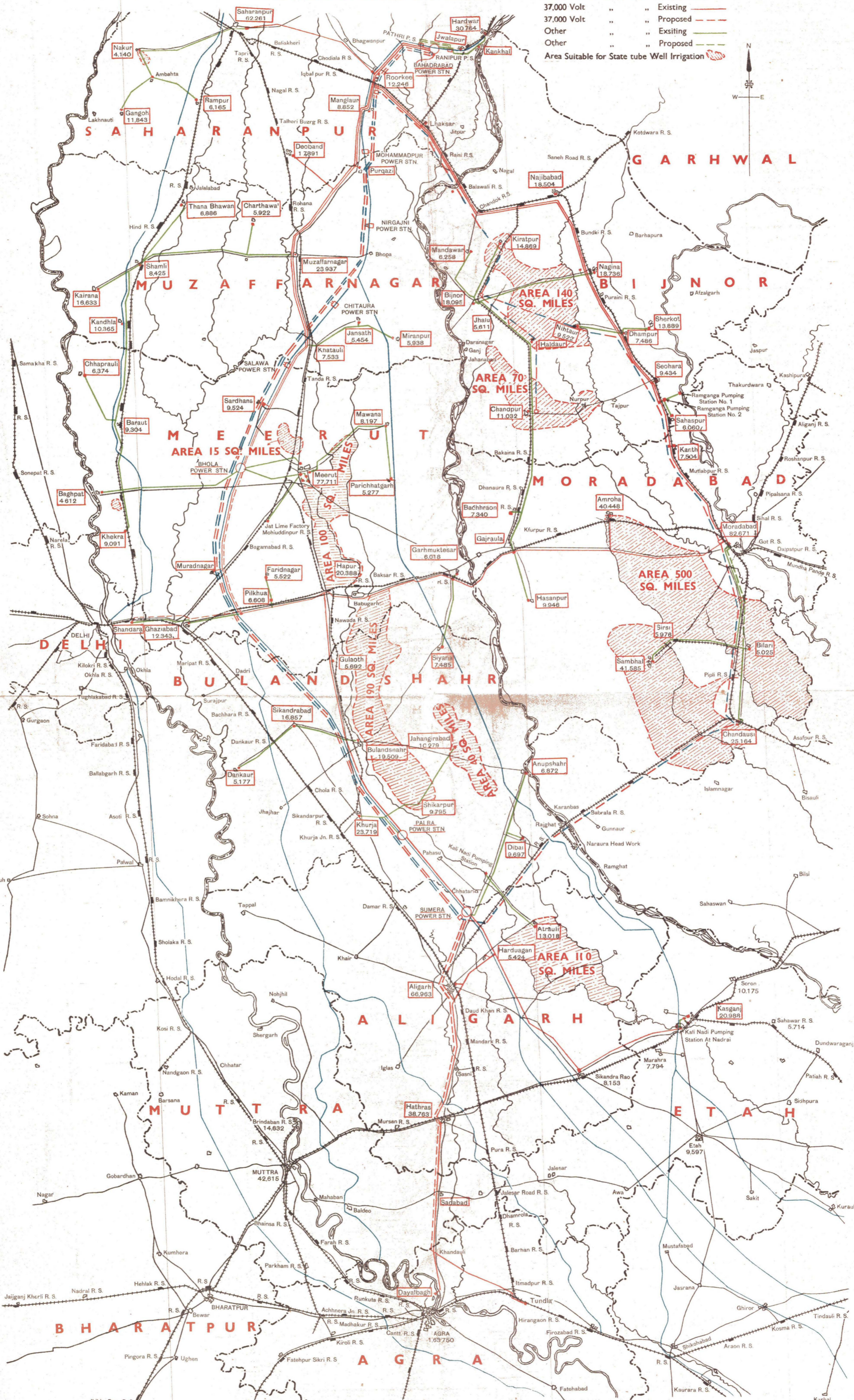
GANGES CANAL HYDRO-ELECTRIC GRID

MAP No.2.

MAP SHOWING THE ULTIMATE DEVELOPMENT.



- REFERENCES.
- Power Stations Constructed ———— ○
 - Power Stations Proposed ———— □
 - 66,000 Volt Transmission Lines Proposed ————
 - 37,000 Volt " " Existing ————
 - 37,000 Volt " " Proposed ————
 - Other " " Existing ————
 - Other " " Proposed ————
 - Area Suitable for State tube Well Irrigation



W. L. STAMPE I.S.E.,
Chief Engineer,
Western Canals,
U. P.

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GANGES CANAL HYDRO-ELECTRIC GRID