APPENDIX B—*Continued.*

Estimated Monthly Discharge of the Murrumbidgee River at Gundagai. Drainage Area, 8,400 sq. miles.

1905.

Month.	Discharges in Cusecs.			Total Discharge.		Run-off.	
	Max.	Min.	Mean	Acre Feet.	Millions of cubic feet.	Depth.	Sec. ft. per sq. mile.
						inches.	
January.. ..	780	420	567	34,873	1,519	·078	·068
February ..	1,360	200	497	27,578	1,202	·061	·059
March	815	152	288	17,682	770	·039	·034
April	2,810	224	778	46,279	2,016	·104	·093
May .. .	1,300	385	590	36,263	1,580	·081	·070
June	18,900	1,035	4,122	245,228	10,685	·548	·491
July .. .	53,050	4,150	11,182	687,427	29,952	1·535	1·331
August .. .	7,260	2,590	4,060	249,560	10,873	·557	·483
September ..	4,760	2,590	3,424	203,733	8,877	·455	·408
October	8,400	2,810	5,241	322,198	14,038	·719	·624
November .	7,610	1,640	3,555	211,527	9,216	·472	·423
December ..	2,400	745	1,375	84,529	3,683	·189	·164
The Year ..				2,166,877	94,411	4·838	

1906.

Month.	Max.	Min.	Mean	Acre Feet.	Millions of cubic feet.	Depth.	Sec. ft. per sq. mile.
January.. .	925	348	566	34,816	1,517	·077	·067
February .	420	175	272	15,114	662	·033	·032
March .. .	3,460	237	1,234	75,894	3,306	·169	·147
April .. .	10,990	745	3,090	183,824	8,009	·411	·368
May .. .	7,280	1,900	3,801	233,696	10,182	·522	·453
June .. .	19,350	3,050	6,882	409,410	17,838	·914	·819
July	15,450	5,380	7,347	451,648	19,678	1·009	·875
August	12,250	5,780	7,651	470,328	20,492	1·050	·911
September .	29,700	7,950	14,372	854,990	37,252	1·909	1·711
October	57,200	5,070	13,912	855,228	37,262	1·909	1·656
November ..	6,290	3,050	4,259	253,388	11,040	·566	·507
December ..	4,760	1,900	2,770	170,280	7,419	·380	·330
The Year ..				4,008,616	174,657	8·949	

APPENDIX B—*Continued.*

ESTIMATED MONTHLY DISCHARGE OF THE MURRUMBIDGEE RIVER AT GUNDAGAI. Drainage Area, 8,400 sq. miles.

1907

Month.	Discharges in Cusecs.			Total Discharge.		Run-off.	
	Max.	Min.	Mean	Acre Feet.	Millions of cubic feet.	Depth	Sec. ft. per sq. mile.
						inches.	
January... ...	1,865	925	1,398	85,953	3,745	·191	·166
February ...	1,480	490	835	46,392	2,022	·103	·099
March	1,000	570	641	39,412	1,717	·088	·076
April	1,075	455	704	41,879	1,825	.094	·084
May	1,830	610	879	54,027	2,354	·121	·105
June	2,090	890	1,461	86,935	3,788	·194	·174
July	4,760	1,150	1,477	90,782	3,955	·203	·176
August	5,380	2,590	3,665	225,328	9,818	·503	·436
September ...	6,830	1,960	3,116	185,381	8,077	·414	·371
October	4,150	1,420	2,761	169,735	7,395	·379	·329
November ...	7,280	1,540	2,715	161,565	7,039	·360	·323
December ...	9,300	780	1,830	112,535	4,903	·251	·218
The Year ..				1,299,924	56,638	2·901	

1908

Month.	Max.	Min.	Mean	Acre Feet.	Millions of cubic feet.	Depth	Sec. ft. per sq. mile.
January	1,050	452	641	39,412	1,717	·088	·077
February ..	875	372	548	31,542	1,374	·070	·066
March	620	237	338	20,784	905	·046	·041
April	479	212	307	18,287	797	·041	·037
May	1,654	345	726	44,609	1,944	·100	·087
June	3,060	519	1,327	78,963	3,440	·176	·159
July	7,475	560	2,415	148,462	6,468	·332	·290
August	6,800	1,940	2,858	175,674	7,654	·392	·343
September ...	12,100	2,000	6,545	389,342	16,964	·870	·785
October	5,550	2,280	3,353	206,153	8,982	·460	·402
November ...	2,170	1,000	1,480	88,033	3,836	·197	·178
December ...	1,310	399	728	44,738	1,949	·100	·087
The Year ..				1,285,999	56,031	2·873	

APPENDIX C.

Table II.

Reduction of Reservoir Capacity by Silt under Various Conditions.

Class	Numb'r of streams	Suspended matter in parts per million.	Maximum silt load for class. (Per cent. of stream flow)	Original Capacity of Reservoir. (per cent. of annual flow.) 25 — years required to reduce capacity 10 per cent.	50	75	100
1	47	0 to 50	·0033	760	1,520	2,270	3,030
2	39	51 to 100	·0066	380	760	1,140	1,520
3	36	101 to 200	·0132	190	380	570	760
4	9	201 to 300	·0197	130	250	380	510
5	5	301 to 500	·0329	76	150	230	300
6	15	501 to 1,000	·0658	38	76	110	150
7	24	1,001 to 10,000	·6580	4	8	11	15
8	2	14,000	·9300	3	5	8	11

95 lbs. of suspended matter is assumed to represent 1 cubic foot of compacted sediment.

Material rolled along the bed is not included in the above table, it being generally accepted that such is small in amount compared to the suspended matter.

APPENDIX D.

BEHAVIOUR OF BARREN JACK RESERVOIR.

PERIOD 1903-1908.

In supplying IRRIGATION REQUIREMENTS to CANALS at NARRANDERA to YANKO CREEK and for RIPARIAN INTERESTS.

NOTE.—All volumes in millions of cubic feet.

1903.

Month.	Gundagai Natural Flow.	Estd. Barren Jack flow (50% of Gundagai).	Reqts. for Irrign. and riparn. ints.	Excess of Gundagai flow above reqts.	Drawn from Reservoir.	Stored in Reservoir.	Evapn. Losses.	Behavr. of Reservoir.	Surplus flow of River for other purpose.
Jan.									
Feb.									
Mar.									
Apr.								1,224	
May	3,490	1,745	870	2,620		1,745	23	2,946	875
June	6,460	3,230	2,320	4,140		3,230	36	6,140	910
July	13,777	6,888	2,320	11,457		6,888	54	12,974	4,569
Aug.	8,575	4,287	2,320	6,255		4,287	88	17,173	1,968
Sep.	15,516	7,758	6,670	8,846		7,758	108	24,823	1,088
Oct.	10,838	5,419	6,670	4,168		4,168	213	28,778	nil.
Nov.	5,591	2,795	6,670		1,079		244	27,455	nil.
Dec.	3,382	1,691	6,670		3,288		233	23,934	nil.
					4,367	28,076	999		9,410

1904.

Month.	Gundagai Natural Flow.	Estd. Barren Jack flow (50% of Gundagai).	Reqts. for Irrign. and riparn. ints.	Excess of Gundagai flow above reqts.	Drawn from Reservoir.	Stored in Reservoir.	Evapn. Losses.	Behavr. of Reservoir.	Surplus flow of River for other purpose.
Jan.	8,570	4,285	6,670	1,900		1,900	209	25,625	nil.
Feb.	2,379	1,189	6,670		4,291		219	21,115	nil.
Mar.	1,941	970	6,670		4,729		187	16,199	nil.
Apr.	1,483	741	6,670		5,187		104	10,908	nil.
May	2,026	1,013	870	1,156		1,013	78	11,843	143
June	4,038	2,019	2,320	1,718		1,718	82	13,479	nil.
July	11,171	5,585	2,320	8,851		5,585	91	18,973	3,266
Aug.	8,392	4,196	2,320	6,072		4,196	117	23,052	1,876
Sep.	8,860	4,430	6,670	2,190		2,190	136	25,106	nil.
Oct.	9,850	4,925	6,670	3,180		3,180	215	28,071	nil.
Nov.	7,857	3,928	6,670	1,187		1,187	238	29,020	nil.
Dec.	2,438	1,219	6,670		4,232		246	24,542	nil.
					18,439	20,969	1,922		5,285

APPENDIX D—*Continued.*

BEHAVIOUR OF BARREN JACK RESERVOIR.

Period 1903-1908.

In supplying Irrigation Requirements to Canals at Narrandera to Yanko Creek and for Riparian Interests.

Note.—All volumes in millions of cubic feet.

1905.

Month.	Gundagai Natural Flow.	Estd. Barren Jack flow (50% of Gundagai).	Reqts. for Irrign. and riparn. ints.	Excess of Gundagai flow above reqts.	Drawn from Reservoir.	Stored in Reservoir	Evapn. Losses.	Behavr. of Reservoir.	Surplus flow of River for other purposes.
Jan.	1,519	759	6,670		5,151		212	19,179	nil.
Feb.	1,202	601	6,670		5,468		174	13,537	nil.
Mar.	770	385	6,670		5,900		136	7,501	nil.
Apr.	2,016	1,008	6,670		4,654		61	2,786	nil.
May	1,580	790	870	710		710	36	3,460	nil.
June	10,685	5,342	2,320	8,365		5,342	39	8,763	3,023
July	29,952	14,976	2,320	27,632		14,976	67	23,672	12,656
Aug.	10,873	5,436	2,320	8,553		5,436	138	28,970	3,117
Sep.	8,877	4,438	6,670	2,207		2,207	165	31,012	nil.
Oct.	14,038	7,019	6,670	7,368		2,629	260	33,381	4,739
Nov.	9,216	4,608	6,670	2,546		276	276	33,381	2,270
Dec.	3,683	1,841	6,670		2,987		276	30,118	nil.
					24,160	31,576	1,840		25,805

1906.

Month.	Gundagai Natural Flow.	Estd. Barren Jack flow (50% of Gundagai).	Reqts. for Irrign. and riparn. ints.	Excess of Gundagai flow above reqts.	Drawn from Reservoir.	Stored in Reservoir	Evapn. Losses.	Behavr. of Reservoir.	Surplus flow of River for other purposes.
Jan.	1,517	758	6,670		5,153		254	24,711	nil.
Feb.	662	331	6,670		6,008		213	18,490	nil.
Mar.	3,306	1,653	6,670		3,364		170	14,956	nil.
Apr.	8,009	4,004	6,670	1,339		1,339	98	16,197	nil.
May	10,182	5,091	870	9,312		5,091	104	21,184	4,221
June	17,838	8,919	2,320	15,518		8,919	126	29,977	6,599
July	19,678	9,839	2,320	17,358		3,573	169	33,381	13,785
Aug.	20,492	10,246	2,320	18,172		185	185	33,381	17,987
Sep.	37,252	18,626	6,670	30,582		185	185	33,381	30,397
Oct.	37,262	18,631	6,670	30,592		276	276	33,381	30,316
Nov.	11,040	5,520	6,670	4,370		276	276	33,381	4,094
Dec.	7,419	3,710	6,670	749		276	276	33,381	463
					14,525	20,120	2,332		107,862

APPENDIX D—*Continued.*

BEHAVIOUR OF BARREN JACK RESERVOIR.

Period 1903-1908.

In supplying Irrigation Requirements to Canals at Narrandera to Yanko Creek and for Riparian Interests.

Note.—All volumes in millions of cubic feet.

1907.

Month.	Gundagai Natural Flow.	Estd. Barren Jack flow (50% of Gundagai).	Reqts. for Irrign. and riparn. ints.	Excess of Gundagai flow above reqts.	Drawn from Reservoir.	Stored in Reservoir	Evapn. Losses.	Behavr. of Reservoir.	Surplus flow of River for other purposes.
Jan.	3,745	1,872	6,670		2,925		276	30,180	nil.
Feb.	2,022	1,011	6,670		4,648		260	25,272	nil.
Mar.	1,717	858	6,670		4,953		216	20,103	nil.
Apr.	1,825	912	6,670		4,845		120	15,138	nil.
May	2,354	1,177	870	1,484		1,177	99	16,216	307
June	3,788	1,894	2,320	1,468		1,468	104	17,580	nil.
July	3,955	1,977	2,320	1,635		1,635	110	19,105	nil.
Aug.	9,818	4,909	2,320	7,498		4,909	117	23,897	2,589
Sep.	8,077	4,038	6,670	1,407		1,407	139	25,165	nil.
Oct.	7,395	3,697	6,670	725		725	216	25,674	nil.
Nov.	7,039	3,519	6,670	369		369	219	25,824	nil.
Dec.	4,903	2,451	6,670		1,767		221	23,836	nil.
					19,138	11,690	2,097		2,896

1908.

Month.	Gundagai Natural Flow.	Estd. Barren Jack flow (50% of Gundagai).	Reqts. for Irrign. and riparn. ints.	Excess of Gundagai flow above reqts.	Drawn from Reservoir.	Stored in Reservoir	Evapn. Losses.	Behavr. of Reservoir.	Surplus flow of River for other purposes.
Jan.	1,717	858	6,670		4,953		207	18,676	nil.
Feb.	1,374	687	6,670		5,296		172	13,208	nil.
Mar.	905	452	6,670		5,765		134	7,309	nil.
Apr.	797	398	6,670		5,873		60	1,376	nil.
May	1,944	972	870	1,074		972	25	2,323	102
June	3,440	1,720	2,320	1,120		1,120	33	3,410	nil.
July	6,468	3,234	2,320	4,148		3,234	39	6,605	914
Aug.	7,654	3,827	2,320	5,334		3,827	56	10,376	1,507
Sep.	16,964	8,482	6,670	10,294		8,482	75	18,783	1,812
Oct.	8,982	4,491	6,670	2,312		2,312	172	20,923	nil.
Nov.	3,836	1,918	6,670		2,834		186	17,903	nil.
Dec.	1,949	974	6,670		4,721		167	13,015	nil.
					29,442	19,947	1,326		4,335

APPENDIX E.

EXTRACT FROM INSTRUCTIONS AS TO INFORMATION TO BE SUPPLIED IN CONNECTION WITH ESTIMATE OF COST AND DESIGNED DAMS PROPOSED FOR IRRIGATION PURPOSES

ACCESS TO SITE.

EXISTING AND PROPOSED ROADS.

1. Location and length of existing roads available for access to the site, with maximum gradient against the load.
2. Condition of such roads and estimated cost to put in first-class order for heavy horse or steam traffic.
3. Any deviations recommended on existing roads and estimated cost of same, to reduce gradients to 1:15 against load.
4. Any extension of the existing roads necessary to reach the site, and estimated cost for similar gradients.
5. Cost of water supplies for steam traffic.
6. Total capital expenditure estimated necessary to give access to site by means of first-class road for heavy horse or steam traffic.
7. Estimated costs of maintenance of road per ton of cement used in the work for horse or steam traffic.
8. Total length of road and estimated costs of haulage per ton per mile to the site for horse or steam traffic.

PROPOSED RAILWAY AS AN ALTERNATIVE.

1. Location and length of 2 feet gauge railway; minimum curves 1½ chain radius; maximum grade 1 in 25 against load.
2. Estimated cost of construction.
3. Estimated cost of haulage per ton per mile.

WATER CARRIAGE AS AN ALTERNATIVE.

Description and cost of proposal to afford access by dredging and locking existing waterways, either for the whole distance or in conjunction with road or railway.

MATERIALS AVAILABLE FOR CONSTRUCTION OF WALL.

1. Is material or stone in foundations and in by-washes suitable for concrete; if so, what proportion?

2. If not, the nearest suitable material such as gravel, shingle, or stone, and estimated cost per cubic yard of obtaining or quarrying quantity required.

Method proposed for conveyance to site, with details of estimated cost, and estimated cost of conveyance to site per cubic yard.

3. Is stone in foundations and in by-washes suitable for use for plum-stones; if so, what proportion and maximum weight of blocks obtainable?

4. If not, the nearest suitable stone and estimated cost of quarrying and maximum weight of blocks obtainable.

Method proposed for conveyance to site, with details of estimated cost of providing, and estimated cost of conveyance to site per cubic yard.

5. The nearest site where a sufficient quantity of suitable natural sand is available.

Distance of haulage.

Proposed method of conveyance.

Details of estimated cost, and estimated cost of conveyance per cubic yard.

6. The nearest site where suitable material for crushing rock to sand is available, if such course is recommended.

Estimated cost per cubic yard for crushing.

Distance of haulage.

Proposed method of conveyance.

Details of estimated cost per cubic yard of haulage.

7. Nearest site from which firewood would be available.

Length of haulage.

Proposed method of conveyance.

Details of estimated cost and estimated cost per cord delivered.

DIVERSION OF RIVER.

1. State how it is proposed to deal with river flow during construction.

Sketch out proposal for diversion channel or tunnel, if required for the purpose, with details of estimated cost.

2. Estimated cost, with details of diversion dams proposed.

3. Estimated cost of unwatering during construction. If foundations are deep and wet, proposals to be set out in detail.

RAILWAY OR ROAD DEVIATIONS TO AVOID STORED WATER.

1. Estimated cost and description of any necessary road deviations.

2. Estimated cost and description of renewing, removing and rebuilding large bridges or providing accommodation by punts or other methods.

3. Estimated cost and description of any necessary railway deviation.

ERECTION OF PLANT

1. Indicate proposed location of cable towers and estimated cost of the preparation of platforms by excavation and walling for their reception.

2. Estimate of cost of preparation by means of excavation and walling for the erection of other plant.

APPENDIX F.

BARREN JACK DAM.

EXPERIMENTS FOR PURPOSES OF DESIGNS OF BYWASHES.

Experiments were made with a wooden model, constructed to a scale of 10 feet to 1 inch, in order to ascertain what the effect of the water coming over the waste weir at right angles to the direction of its flow in the spillway channel would be.

The model was constructed in a wooden tank, fitted with baffles in order to keep the water free from waves and eddies. The height of surcharge was measured with a scale attached to a float. The water, after passing through the model, was run into a trench, from which it was passed through a 12 inch notch and measured.

The model was so constructed that the position of the weir wall and floor of channel could be adjusted to give different grades and width of channel. The attached table gives the results of the various experiments made.

In carrying out these experiments, it was noticed that slack water occurred at the back of the top end of the channel, forming an eddy; it was, therefore, concluded that the full width at that end was unnecessary, and this was accordingly reduced after a series of trials to 65 feet, the depth in the mean time having been increased to 20 feet.

In view of the small scale to which the model was constructed, and the consequent difficulty in accurately measuring the depth of surcharge (1/32 of an inch on this scale representing over 2,000 cusecs), it was thought advisable to construct a model to a larger scale, and one was built of brick-work and cement in the bed of the river to a scale of 3/8 inch to 1 foot, following the data obtained by experiment No. 8.

Details of the only test made with this model are given in the table in experiment No. 9.

Unfortunately, a flood occurred just after this experiment was made, resulting in the destruction of the model.

With a surcharge of 10 feet, the weir action was noticeable throughout the length of the weir wall, but with a surcharge of 11 feet, the weir action ceased, just at the top end.

In the first model, the width of spillway was measured from the crest of the weir wall, whereas in the larger model it was measured from the toe of the weir wall.

With a surcharge of 10 feet, the calculated discharge over a weir wall of this length, assuming a free fall, is 57,700 cusecs. Taken as a partially submerged weir, it is 53,500 cusecs, whilst the actual discharge of the model was 54,500 cusecs, calculated from the measurements made through a 6 feet notch with a free fall. Taking into consideration the probable roughness of the finished work as compared with the models, the total discharge may be slightly less than the above figure.

The slight discrepancy between the results obtained from the two models is probably accounted for by the difficulty in taking sufficiently accurate measurements of the height of surcharge in the smaller model.

APPENDIX F.—*Continued.*

BARREN JACK DAM.

Results of Experiments made with Model Spillways.

No. of Expmt.	Length of Weir Wall. feet.	Width of Top End.	Channel. At Dam.	Depth at Top End.	Grade, 1 in.	Surcharge. feet.	Discharge. Cusecs.	Remarks.
				MODEL No. 1—Scale, 10 feet = 1 inch.				
1	559	100	100	10	70	5	22,600	Weir action visible to 50 ft. up stream of dam, ripple to 140 ft., beyond that clear current, over 5 ft. surcharge no weir action visible till within 25 ft. of dam.
2	559	100	100	10	70	10	36,000	
3	590	100	100	10	50	10	49,500	At 7 ft. surcharge top end weir drowned, weir action visible to 150 ft. up-stream of dam.
4	559	100	100	20	32	10	56,700	At 10 ft. surcharge top end weir drowned.
5	559	100	125	20	32	10	58,500	Weir action good throughout, slack water top end channel.
6	590	100	125	20	48	10	58,000	do. do. do. do. do.
7	480	100	125	20	48	10	54,800	do. do. do. do. do.
8	550	60	110	20	50	10	57,000	Weir action good throughout, no slack water.
				MODEL No. 2—Scale, $\frac{3}{8}$ inch = 1 foot.				
9	550	65	110	20	50	10	54,500	Weir action good throughout, no slack water.

APPENDIX G.

Regarding the quality of the materials available for the construction of the Dam itself, the following tests are of importance, and show that most satisfactory results can be obtained from the use of the local stone and sand.

GRANITE FROM BARREN JACK RESERVOIR SITE.

Compression Tests.

Description of Test.	Total load.	Load pr sq. inch	Remarks.
		lbs.	
Granite—3 in. cubes,	99·5	24,755	Shattered
	100·5	25,022	,,
	94·2	23,412	,,
	77·5	19,277	,,
	74·5	18,622	,,

CONCRETE.

The stone for these 9 inch cubes was hard granite from Barren Jack, broken to 2½ inch guage and 3 inch guage. The shivers broken to pass the ¾-inch screen and caught on the ⅛-inch sieve were from the same material.

The sand also was obtained from hard granite, crushed to pass through ⅛-inch and caught on the 2,400 mesh sieve.

Cement was "Rock" brand.

Crushing

Description.	Composition.				Age.	Total Load.	Load per sq. in	Remarks.
	Cement	Sand.	Stone.	Shivers.				
	lbs.	c. ft.	c. ft.	c. ft.	days.	tons.	lbs.	
9in. cube	375	7½	9	6	30	101·5	2,810	No fracture at 100 tons
,,	375	7½	9	6	30	101·0	2,792	,, ,, ,, ,,
,,	375	10	12	8	28	97.1	2,685	Shattered, Cracked at 80 tons
,,	375	10	12	8	28	101.0	2,792	Not Broken, Cracked at 100 tons
,,	375	11½	12 3in. gau.	8	30	101.5	2,810	Cracked on outside, not broken
,,	375	11½	12	8	30	102.0	2,823	Cracked on outside, not broken

CONCRETE.

The stone and shivers used in this concrete, was obtained by breaking hard granite, while the sand used, was taken from the bed of the river, above the junction of the Gooradigbee.