



Government of Bombay
Public Works Department

Technical Paper No. 58

Summary of the Annual Note on Experiments
carried out by the Irrigation Research Division
during 1936-37 at Lake Fife Hydrodynamic
Research Station near Poona

BY

C. C. INGLIS, O.L.E., B.A., B.A.I., M.INST.C.E., I.S.E.

Director, Central Irrigation and Hydrodynamic Research

A. R. THOMAS, B.Sc., I.S.E.

Executive Engineer

and

RAO SAHIB D. V. JOGLEKAR, B.E., B.S.E.

Off. Executive Engineer

FIRST EDITION

26.231,9N3:1

D26.231,9N3:1
G7
017519

BOMBAY

PRINTED AT THE GOVERNMENT CENTRAL PRESS

1938

Available from the Superintendent, Government Printing and Stationery,
through the High Commissioner for India, India House,
London, W.C.2, or through any recognized Bookseller

[Price—Annas 11 or 1s. 2d.]

List of Bombay Public Works Department Technical Papers.

Paper No.	Subject.	Price.	Year of publication.	Number of copies in stock (January 1938).
		Rs. a. p.		
1	Reinforced Concrete Flooring in the Hostel for the High School at Satara (Bombay Presidency), by W. L. C. Trench, B.A.I., A.M.I.C.E., Executive Engineer, and T. S. Mirchandani, B.Sc. (Edin.), Assistant Engineer.	....	1913	Out of stock.
2	Famine Relief Road Works carried out in the Banda District, United Provinces, in the Famine of 1913-14, by D. R. H. Browne, A.K.C., Executive Engineer.	....	1915	Do.
3	Note on the Lower Ganges Bridge Works at Sara, Bengal, by D. R. H. Browne, A.K.C., Executive Engineer.	....	1915	Do.
4	Report on Experiments on Concrete Flooring carried out at Poona (Bombay Presidency), by Conductor T. H. Naughton, Sub-Engineer.	....	1917	Do.
5	Reinforced Concrete Work in the Bombay Presidency, by J. C. Gammon, B.Sc., A.C.G.I., late Assistant Engineer, Bombay Public Works Department.	....	1917	Do.
6	Reinforced Concrete Roof Construction for use with ceiling tiles, by J. M. Mackay, A.M.I.C.E., Executive Engineer.	....	1917	Do.
7	Report on the Felling of the Masonry Chimney at Dapuri (Bombay Presidency), by H. W. Oddin Taylor, A.C.G.I., B.Sc., Executive Engineer.	....	1920	Do.
8	Note on the Tests carried out with Reinforced Concrete Brick Walling Loaded as a Beam, by Khan Sahab J. D. Dubash, Assistant Engineer.	....	1920	Do.
9	Note on the Manufacture of Hydraulic Lime in the Nasik and Ahmednagar Districts of the Bombay Presidency, 1920, by Rao Sahab V. K. Chaphekar, Temporary Engineer.	....	1921	Do.
10	Glossary of Irrigation Terms applicable to the Deccan Canals.	....	1921	Do.
11	Report on the Malir River Boring Investigations for the Karachi Water Supply, by W. C. Dooris, Executive Engineer, Boring Works, Bombay Presidency, with a note by H. O. B. Shoubridge, M.Inst.C.E., Chief Engineer for Irrigation.	....	1925	Do.
12	A Note on the Design, Application and Construction of Masonry Semi-Modules as used on the Jamrao Canal, by W. Kirkpatrick, Executive Engineer. (2nd Edition.)	....	1925	Do.
13	Soil and Sub-Soil Surveys in the Deccan Canal areas, by C. C. Inglis, Executive Engineer, and V. K. Gokhale, Deputy Soil Physicist. (2nd Edition.)	....	1929	Do.
14	A short Note on the Improvement of Damaged Lands in the Canal Irrigated Tracts of the Bombay Deccan, by C. C. Inglis, Executive Engineer.	....	1927	Do.
15	Notes on Standing Wave Flumes and Flume Meter Falls, by C. C. Inglis, Executive Engineer, Special Irrigation Division.	....	1928	Do.
16	Note on Irrigation on the Block System in the Deccan Canal Tracts, by C. C. Inglis, I.S.E., Executive Engineer, Special Irrigation Division.	....	1927	Do.
17	Note on the Effluent Farm near Poona (1918-19 to 1925-26) by C. C. Inglis, B.A., B.A.I., M.Inst. C.E., Executive Engineer, Special Irrigation Division.	....	1927	Do.
18	Note on the Use of Hydro-Electric Power by Small Industries in Switzerland, Norway and Sweden, by F. O. J. Roose, M.I.M.E., M.I.E.E., F.C.S., Electrical Engineer to Government.	1 14 0	1928	100
19	Note on the Design of Distributaries and their Outlets in the Bombay Deccan, by C. C. Inglis, B.A.I., A.M.Inst.C.E., Executive Engineer, Special Irrigation Division.	....	1928	Out of stock.
20	Note dated November 1927 on "Model experiments to ascertain the effect of Partial Lining of the Malegaon Cut" in miles 38 and 39 of the Nira Left Bank Canal, by C. C. Inglis, B.A.I., M.Inst.C.E., Executive Engineer, Special Irrigation Division, and D. V. Joglekar, B.E., Assistant Engineer.	1 0 0	1928	107

Paper No.	Subject.	Price.	Year of publication.	Number of copies in stock (January 1938).
		Rs. a. p.		
21	Note on the Outturn and Profit from Sugarcane Crops grown in the Deccan Canal Tracts, by C. C. Inglis, B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, and V. K. Gokhale, B.Ag., Deputy Soil Physicist.	1 3 0	1928	9
22	Note on Experiments carried out at the Hydraulic Testing Station at Distributary No. 5, Mutha Right Bank Canal, near Poona, with a Lindley Type Standing Wave Flume, by C. C. Inglis, B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, Bombay, with the Assistance of D. V. Joglekar, B.E., Assistant Engineer.	0 10 0	1928	2
23	A Note on Standing Wave Pipe Outlets, by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, Bombay.	....	1928	Out of stock.
24	Report on Land Drainage Experiments at Baramati, by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, with V. K. Gokhale, B.Ag., Deputy Soil Physicist, and the staff of Baramati Development Sub-Division.	2 1 0	1928	44
25	Moduling Operations on Distributary No. 8, Nira Left Bank Canal, and application of the Results to other Distributaries, by C. C. Inglis, B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, with D. V. Joglekar, Assistant Engineer.	0 12 0	1928	14
26	Report on Tests made on a Model of the Group of Regulators at Oderolal at mile 169 approximately of the Rohri Main Canal, Sind, by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., A.M.Inst.C.E., Executive Engineer, Central Designs Division, Karachi, and C. C. Inglis, B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, Poona.	1 11 0	1928	23
27	Report on Experiments on Model Culverts made with Hume Pipes, by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., A.M.Inst.C.E., Executive Engineer, Central Designs Division, and H. S. Kahai, Assistant Engineer, with Appendix containing a Note on the use of Hume Pipes for Irrigation purposes, based on Notes by C. C. Inglis, B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle.	1 3 0	1929	38
28	Note on "Research Work done by the Special Irrigation Division since its formation in June 1916" by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle.	0 8 0	1929	63
29	Note on "Experiments carried out with various designs of piers and sills in connection with the Lloyd Barrage at Sukkur," by C. C. Inglis, B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, and C. G. Hawes, M.C., B.Sc., A.M.Inst.C.E., Executive Engineer, Central Designs Division, with J. S. Reid, B.Sc., Assistant Executive Engineer, D. V. Joglekar, B.E., Assistant Engineer, and H. V. Katakhar, B.E., Temporary Engineer.	2 10 0	1929	50
30	A note on "A Critical study of Run off and floods of catchments of the Bombay Presidency with a short note on losses from lakes by evaporation," by C. C. Inglis, B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, with A. J. DeSouza, B.E., Assistant Engineer.	4 7 0	1930	40
31	Report on Experiments carried out at the Karachi Model Testing Station on a Model of a Flumed Regulator, by C. G. Hawes, M.C., B.Sc. (Lond.), A.M.Inst.C.E., Executive Engineer, Central Designs Division, and H. S. Kahai, Assistant Engineer, with a note by W. A. Evershed, B.Sc. (Lond.), A.M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle.	0 7 0	1929	33
32	Note on experiment on a model of the Bifurcation on the North-Western Perennial Canal at the head of the Warah Branch, by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., A.M.Inst.C.E., Executive Engineer, Central Designs Division, and H. S. Kahai, Assistant Engineer.	0 12 0	1929	71

Paper No.	Subject.	Price.	Year of publication.	Number of copies in stock (January 1938).
		Rs. a. p.		
33	Report on experiments carried out in the Central Designs Division, Lloyd Barrage and Canals Construction, in the Karachi Testing Station on a model of syphon proposed to be constructed on the North-Western Railway, by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., A.M.Inst.C.E., Executive Engineer, Central Designs Division, and H. S. Kahai, Assistant Engineer.	0 12 0	1930	56
34	Report on experiments carried out on a model of the Makhi Right Distributary of Mithrao Canal, Eastern Nara Division (Sind), by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., A.M.Inst.C.E., Executive Engineer, Central Designs Division, and H. S. Kahai, Assistant Engineer.	3 2 0	1930	25
35	Report on the installation and testing of various types of radial gates on the 84th mile Jamrao Canal by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., M.Inst.C.E., Executive Engineer, Central Designs Division.	1 6 0	1931	68
36	Note on road construction in the Nili Bar Colony, Punjab, by H. B. Parikh, L.C.E., M.I.E. (Ind.), Executive Engineer on Special Duty, Sind Roads, including summaries of important details.	0 3 0	1931	50
37	Standard Type Buildings for the Forest Department, Bombay Presidency—Abstract estimates, block plans, specifications, etc., by T. S. Pipe, B.Sc., M.Inst.C.E., Executive Engineer, Poona Division (formerly Superintending Engineer, Forest Department, Bombay Presidency).	1 8 0	1932	181
38	Standard Forest Roads—Cross Sections and Earthwork Tables by T. S. Pipe, B.Sc., M.Inst.C.E., Executive Engineer, Poona Division (formerly Superintending Engineer, Forest Department, Bombay Presidency).	0 11 0	1931	34
39	Note on the resurfacing of the Nasik Station Road with various asphalts, cement macadam and cement concrete by L. E. Greening, A.M.Inst.C.E., M.Inst.Struct.E., Executive Engineer, Nasik Division.	1 9 0	1931	85
40	Note on cement concrete roads in the United Provinces and on the financial aspects of cement concrete and asphalt surfaces by T. C. Kantawala, L.C.E., M.R.San.I., Special Officer, Road Development Schemes.	0 4 0	1931	84
41	Note on boring operations in the Bombay Presidency by A. P. Maddocks, B.Sc., M.Inst.C.E., Superintending Engineer, Public Health, Bombay.	0 5 0	1931	114
42	Notes on (1) Flumed Aqueducts, (2) Remodelling an existing Canal or Distributary to pass an increased discharge, (3) Afflux caused by heading up water at regulators of a Canal and the extent of backwater and (4) Distribution of velocities in channels, by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle.	0 4 0	1932	Out of stock.
43	Concise Report on the Punjab Irrigation Works by M. T. Gibling, B.A. (Cantab.), I.S.E., Executive Engineer, Northern Dadu Division.	0 14 0	1932	4
44	The dissipation of Energy below Falls, by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Irrigation Development and Research Circle, and D. V. Joglekar, B.E., Assistant Engineer.	5 5 0	1933	35
45	Note of May 1931 on Silt Exclusion from Canals "Still Pond" versus "Open Flow," Part I, by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., I.S.E., Superintending Engineer, Irrigation Development and Research Circle.	0 15 0	1933	70
46	Note on Silt Exclusion from Canals, Part II—First report on experiments with the full width model of the Sukkur Barrage at Khadakvaala with Appendices on the design of dynamically similar models in accordance with Lacey's formulas, by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., I.S.E., Superintending Engineer, Irrigation Development and Research Circle, and D. V. Joglekar, B.E., Assistant Engineer.	2 1 0	1933	60
47	Report on experiments carried out on Models of Standard Vertical Screw Gates adopted in the Lloyd Barrage and Canals Scheme, by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., M.Inst.C.E., I.S.E., Executive Engineer, Development and Research Division.	0 15 0	1933	52

Paper No.	Subject.	Price.	Year of publication.	Number of copies in stock (January 1938).
		Rs. a. p.		
48	Report on reclamation and drainage of alkali lands in Hungary by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., M.Inst.C.E., I.S.E., Executive Engineer, Development and Research Division.	0 7 0	1933	53
49	Development of Irrigation in the Deccan Canal areas by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Deccan Irrigation Circle, and V. K. Gokhale, B.Ag., Deputy Soil Physicist, Irrigation Research Division.	1 13 0	1934	12
50	Bridge over Krishna River at Udgaon on the Kolhapur-Miraj Road by A. Bhattacharya, L.C.E., I.S.E., Executive Engineer, Belgaum Division.	1 6 0	1934	37
51	Note on experiments carried out with a short-crested weir model by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Deccan Irrigation Circle, Poona and D. V. Joglekar, B.E., Assistant Engineer.	0 14 0	1934	17
52	Factors affecting exclusion of bed silt from Canals taking off from alluvial Rivers by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Deccan Irrigation Circle, and D. V. Joglekar, B.E., Assistant Engineer.	2 3 0	1935	Out of stock.
53	Note on the results of silt Analysis carried out in the Development and Research Division by C. G. Hawes, M.C., B.Sc. (Lond.), A.C.G.I., M.Inst.C.E., I.S.E., Executive Engineer, Development and Research Division.	0 10 0	1935	19
54	Note on experiments with a model of the Head sluices of the Nira Left Bank Canal by C. C. Inglis, B.A., B.A.I., M.Inst.C.E., Superintending Engineer, Deccan Irrigation Circle, and D. V. Joglekar, B.E., Assistant Engineer.	0 5 0	1935	Out of stock.
55	Report on experiments carried out with Models in connection with the protection of the Hardinge Bridge, on the Eastern Bengal Railway, by C. C. Inglis, B.A., B.A.I., M.Inst.C., Superintending Engineer, Deccan Irrigation Circle, Poona.	For official use only.	1936	
56	Land Drainage in the Deccan Canal Areas by W. A. Evershed, B.Sc., M.Inst.C.E., Executive Engineer.	3 5 0	1937	100
57	Disposal of Poona Sewage Effluent, Part I, Note on effluent distribution by C. C. Inglis, C.I.E., B.A., B.A.I. (Dub.), M.Inst.C.E., I.S.E., Superintending Engineer, and D. V. Joglekar, B.E., B.S.E., Assistant Engineer.	....	1938	

Copies obtainable from the Superintendent, Government Printing and Stationery, Bombay, or through the High Commissioner for India, India House, Aldwych, London, W.C.-2 or through any recognised bookseller.

**Summary of the Annual Note on experiments carried out during 1936-37
at Lake Fife Hydrodynamic Research Station at Khadakvasla near Poona.**

CONTENTS.

PHOTOS.

1. EXPERIMENTS WITH A MODEL OF THE SINA RIVER AND CAUSEWAY AT MILE 5 OF THE AHMEDNAGAR-MANMAD ROAD (DISTRICT AHMEDNAGAR, BOMBAY PRESIDENCY).
2. PART I.—RIVER TRAINING EXPERIMENTS WITH A MODEL OF THE MULA RIVER AT RAHURI (DISTRICT AHMEDNAGAR, BOMBAY PRESIDENCY) TO DETERMINE HOW BEST TO ERADICATE HIGH VELOCITY FLOW ABOVE THE CAUSEWAY, WHICH INTERFERES WITH THE WORKING OF THE FERRY.

PART II.—EXPERIMENTS WITH A DEFLECTOR ON THE DOWNSTREAM GLACIS OF THE MULA RIVER CAUSEWAY TO PREVENT THE PAVEMENT BEING UNDERMINED.
3. EXPERIMENTS WITH A MODEL OF THE SLUICES OF THE BHIMGODA WEIR CONSTRUCTED ACROSS THE GANGES AT HARDWAR (UNITED PROVINCES) TO ASCERTAIN HOW BEST TO PREVENT JETTING AND ABRASION OF THE DOWNSTREAM PAVEMENT.
4. EXPERIMENTS WITH A MODEL OF A WEIR TO BE CONSTRUCTED TO STORE WATER FOR THE ALANDI WATER SUPPLY PROJECT (DISTRICT POONA) TO ASCERTAIN AFFLUX CAUSED THEREBY AND THE BEST DESIGN TO REDUCE AFFLUX.
5. DESIGN AND CALIBRATION OF A TRAPEZOIDAL STANDING WAVE FLUME FOR THE POONA DRAINAGE OUTFALL SEWER AT BAHIROBA PUMPING STATION.
6. INVESTIGATIONS TO DETERMINE THE WEIR SECTION WHICH, WHILE DESIGNED TO PASS A MAXIMUM FLOOD, WILL STORE THE MAXIMUM POSSIBLE SUPPLY AT LAKE ARTHUR HILL (WILSON DAM) AT BHANDARDARA (BOMBAY PRESIDENCY).
7. EXPERIMENTS WITH A MODEL OF THE HEAD SLUICES OF THE NIRA LEFT BANK CANAL TO DETERMINE LOSSES AT ENTRANCE, IN BARREL, IN EXPANSION AND AT EXIT, IN ORDER TO WORK OUT A GENERAL FORMULA FOR LOSSES OF HEAD.
8. TRAINING OF THE RIVER SARDA ABOVE THE BARRAGE AT BANBASSA—UNITED PROVINCES.
9. EXPERIMENTS WITH LARGE SCALE MODEL OF THE GANGES AT THE HARDINGE BRIDGE (HORIZONTAL SCALE RATIO = 1/500) ON EFFECT OF LENGTH OF GUIDE BANKS ON FLOW (FOR THE RAILWAY BOARD).
10. EXPERIMENTS WITH (a) GUIDE BANKS AND (b) FALLING APRONS (FOR THE RAILWAY BOARD).
11. EXPERIMENTS TO ASCERTAIN THE BEST DESIGNS FOR DISSIPATING ENERGY DOWN-STREAM OF FALLS.
12. EXPERIMENTS WITH SILT ABRADER.
13. FLOOD RUN-OFF FROM CATCHMENTS.
14. BED SILT OF CANALS.

In this Note—

Q = total discharge.

q = discharge per foot run.

\equiv = equivalent to.

Thus $Q = 6$ cusecs $\equiv 480$ cusecs means discharge in model was 6 cusecs equivalent to 480 cusecs in the prototype.

Sina River and Causeway at mile 5 of Nagar-Manmad Road.



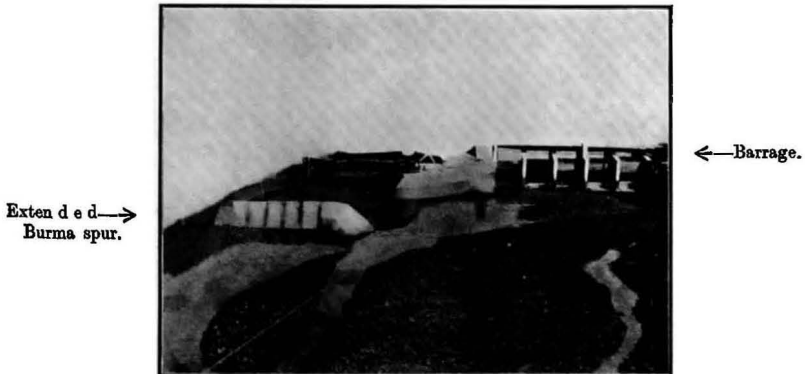
1399.—*Model of junction of the Sina River and Shendi Nala in experiments 8 and 9. Looking upstream.*

Mula River at Rahuri, district Ahmednagar.



1401.—*Experiment 9 with old groyne lengthened on left bank and 5 groynes round the convex right bank. Looking downstream.*

Model of the Sarda River and Barrage (U. P.).
(1/300 Horizontal scale).



1436.—*Experiment 4. Burma spur extended by equivalent of 1020 feet at an angle of 20° d/s of the present alignment. Looking downstream.*