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Technical Paper No. 56

# Land Drainage in the Deccan Canal Areas

BY

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WITH

Prefatory Note by

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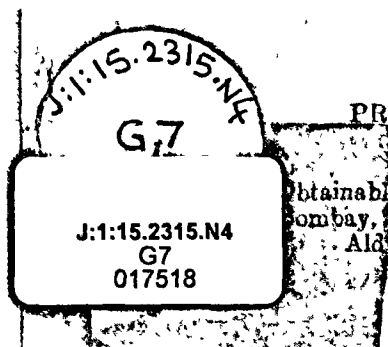
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PREFATORY NOTE BY C. C. INGLIS, SUPERINTENDING ENGINEER,  
DECCAN IRRIGATION CIRCLE, ON "LAND DRAINAGE" BY W. A.  
EVERSHED, EXECUTIVE ENGINEER, IRRIGATION RESEARCH  
DIVISION.

This Technical Paper is meant mainly for reference ; but for those who can only spare a little time I append a short summary of important points connected with land drainage :—

(1) Deccan rock is generally impervious vertically, but is fissured horizontally, and so transmits water under pressure. In general, all strata in the Deccan are much more porous horizontally than vertically, due to horizontal stratification ; and even in the case of colluvial deposition, the porosity is much higher horizontally than vertically, due to the material having been laid down in alternating layers of coarse and fine materials.

(2) Water reaches the low land—

(a) by percolating down the slope from the ridge, which may stretch for miles, or

(b) by spreading from the noses of ridges.

Where it is possible to tap the spring at the nose of a ridge the result is exceedingly successful over a wide area.

Where this is not possible, relief drains located in porous sub-strata have to be adopted.

(3) Drains are divided into—

(i) pipe lines and (ii) open drains.

The former act as—

(a) relief drains.

The latter act as either—

(a) relief or (b) carrier drains.

The former remove water from porous sub-strata, the latter carry it away.

(4) Relief drains are most effective where constructed down the slope. Where relief drains are constructed across the slope they drain the upstream side but do not act as intercepting drains ; because pressure is transmitted through fissures or porous strata underlying the drain, and the sub-soil water level downstream of a drain may be little affected by the drain.

(5) Where porosity ( $K/A$ ) is less than 0.7, a drain acts only to a small extent as a relief drain ; and may be looked on as a carrier drain ; however  $K/A$  values may be moderate (1.0) and yet drainage excellent—as in Shenya Murum which contains isolated fissures.

(6) Carrier drains are fed by drains from subsidiary ridge noses, relief drains down the slope, and drains located in subsidiary valleys.

(7) Where the sub-stratum in a valley is at a depth of more than 8 feet below ground level it is generally rock or impervious material and the drain then becomes merely a carrier drain, except where it cuts the nose of a subsidiary ridge or is diverted to act as a valley-side drain.

Deep valleys frequently contain liquid mud (clay dispersed due to alkalinity) which makes the construction of drains exceedingly difficult and expensive.

(8) A drain in sand or mān lowers the water level over a large area—water conditions in these materials being analogous to conditions in a lake. In other strata the effect is much more uneven and local, as in the case of drainage into a river.



(9) In general the sub-soil water level is some 2 feet higher than in the drains, and so a drain should in general be at least 6 feet deep—to keep the water level down to 4 feet below ground level.

(10) A short length of deep drain cutting into highly porous strata is in general much more effective than a long length of drain at a higher level in less porous material. Sub-artesian bores are rarely satisfactory, but trenches cut down to porous material filled with stones, gravel and finally sand—i.e. a reversed filter—give satisfactory results.

(11) *Murum* may be hard, yet it may be fissured and therefore suitable for drainage and a *murum* that is hard to excavate may disintegrate quickly thereafter especially if exposed to the air.

(12) Intercepting drains do not intercept; and though valley-side drains may be useful, yet in general, it is better to tap the nose of the ridge or to drain down the slope; but the great secret of land drainage is to find the points where there is a highly porous stratum ( $K/A > 2$ ) and tap them.

(13) Work connected with sub-soil surveys and land drainage cannot be reduced to fixed rules, because the data is generally conflicting. Thus: though certain trees and weeds normally indicate a particular soil condition—yet trees and weeds which normally indicate shallow soils are not infrequently found in deep soils and *vice versa*.

(14) Each drain should justify its cost.

(15) Pipe lines should be constructed where practicable and open drains where that is not practicable. It should however be remembered that pipe lines cannot be enlarged or deepened except at great cost. They should therefore be generally constructed larger and deeper than seems necessary, i.e., for 50 per cent. more flow than estimated and a foot deeper than necessary.

(16) A day in the field is worth six in the office.

(17) No single indication is a reliable guide. Experience, judgment and a natural gift for diagnosis are essential.

**LAND DRAINAGE**  
in the  
**DECCAN CANAL AREAS**  
by

W. A. EVERSHED, B.Sc., M.Inst.C.E., Executive Engineer, Irrigation Research Division.

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LIST OF ABBREVIATIONS.

	Abbreviation
(1) Murum isobath .. .. .	.. M. I. B.
(2) 8 foot murum isobath .. .. .	.. 8' M. I. B.
(3) Hydro-isobath .. .. .	.. H. I. B.
(4) 4 foot hydro-isobath .. .. .	.. 4' H. I. B.
(5) First strong flow .. .. .	.. F. S. F.
(6) Final water level .. .. .	.. F. W. L.
(7) Sub-soil water level .. .. .	.. S. S. W. L.
(8) Well observation (of water level) .. .. .	.. W. O.
(9) Open trench .. .. .	.. O. T.
(10) Pipe line .. .. .	.. P. L.
(11) Rubble drain .. .. .	.. R. D.
(12) Standing wave flume .. .. .	.. S. W. F.
(13) Manhole .. .. .	.. M. H.
(14) Hard murum .. .. .	.. H. M.
(15) Soft murum .. .. .	.. S. M.
(16) Lime kankar .. .. .	.. L. K.
(17) Not properly commanded .. .. .	.. N. P. C.
(18) Ground level .. .. .	.. G. L.
(19) Formation level .. .. .	.. F. L.
(20) Chainage .. .. .	.. Ch.
(21) Longitudinal section .. .. .	.. L. S.
(22) Cross section .. .. .	.. C. S.
(23) Centre line .. .. .	.. C. L.
(24) Baramati Experimental Salt Area .. .. .	.. B. E. S. A.
(25) Technical Paper .. .. .	.. T. P.

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No. 1

Typical salt affected land at the Baramati Experimental Salt Area when first acquired. There is an encrustation of salt at the surface due to efflorescence.



No. 2

Salt in sugarcane plots at Baramati.



No. 3

Salt efflorescence at the Baramati Experimental Salt Area on clumps of 'mol' grass (*Pennisetum Alopecuros*). Note the size of the match box in the foreground.

The object of acquiring this area was research—first to drain the land and then to reclaim it, i.e. restore its physical condition to that required for the cultivation of crops, particularly sugarcane.





No. 4

Land partially reclaimed, but still in bad physical condition as seen by the **stagnant water** between the furrows, showing that it will not drain naturally.



No. 5

Similar to the above, but improvement noticeable. It is seen that **Pundia cane in the foreground** has not done well, but that an 'arrowing' variety in the **background** has succeeded indicating the suitability of the variety for soils in **bad physical condition**.



No. 6

**Example of fully reclaimed land at Baramati Experimental Salt Area which produced over 80 tons of *Pundia* cane per acre.**



No. 7

**Planting cane sets at the Baramati Experimental Salt Area. This particular plot was originally so bad that it was left as a babul plantation for some ten years. It has already produced a moderate crop of cane, the soil having improved vastly except in one or two small patches. The planting now done was for the second crop. Note the crop in the distance (P. O. J. 2878)—plots which were reclaimed comparatively quickly.**

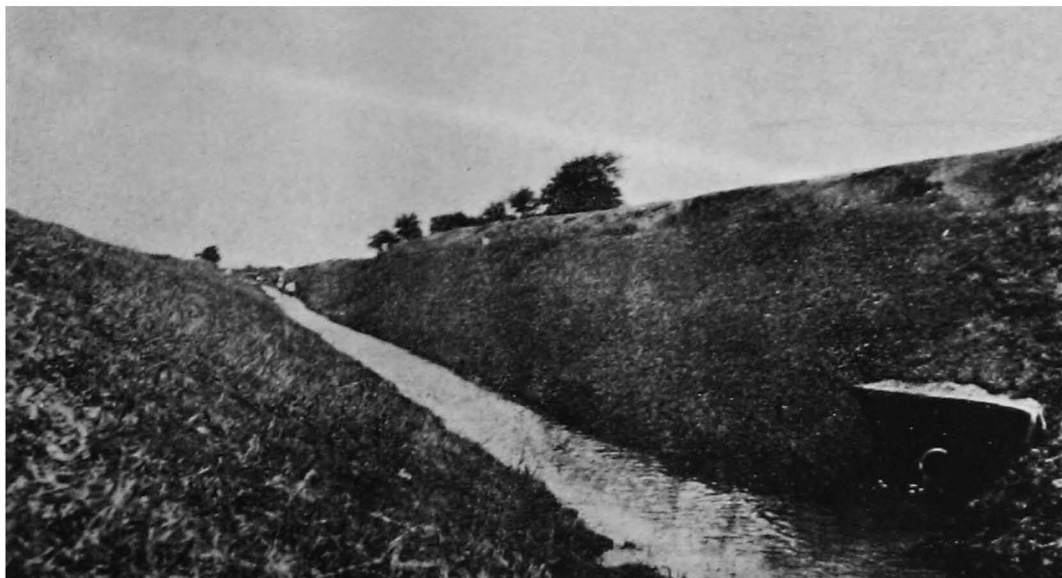
*No. 8*

**Maujri Drainage Scheme.** While excavating the main O. T. a spring was met discharging more than 0.5 cusecs. The waterway shown in the photograph is about 18 inches wide at the water surface, and the spring is immediately below the head of the dog. The result of releasing this subsoil water was to dry out about 30 acres above in less than three months.

*No. 9*

**Manjri Drainage Scheme.** No. 9 is typical of the area drained, which had been badly waterlogged for some 40 years. In many parts, quaking bogs occurred, due, it is thought, to the formation of liquid mud beneath the grass. This grass is 'mol' and the root system had formed a mattress of fibre about 8 inches thick. Drainage effected rapid drying out, and reclamation required special ploughing by tractor and complete overturning of this mattress in order to kill the roots by exposure to the sun—thereafter ordinary ploughing and cultivation sufficed to produce the cane crop shown in No. 10, the outturn of which was about 30 tons (the first crop taken).

*No. 10*

*No. 11**No. 12**No. 13*

Hol, Murum, Karanja Drainage Scheme—Main Open Trench just above the Baramati-Indapur Road. No. 11 shows grassing of the sideslopes, which were formed of layers of soil and sand alternately, just after completion of the work. No. 12 shows the same length of O. T. 5 years after, indicating the excellent protection afforded by well established grass. No. 13 shows grass laid above a subsoil layer of mán a little further up the O. T. than Nos. 11 and 12.

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