

S561/DLN/vdP - January 1979

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DETAILED SOIL SURVEY OF THE PROPOSED EXTENSIONS OF THE
HEWANI IRRIGATION SCHEME

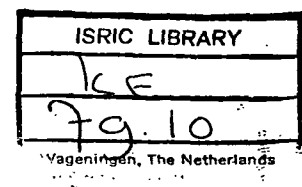
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ADDENDUM TO DETAILED SOIL SURVEY REPORT No. D8
January 1979

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INTRODUCTION

Report No. D8 on the detailed soil survey of Wema and Hewani irrigation schemes was published by Kenya Soil Survey in October 1977. Following a request of the Small Scale Irrigation Unit of the Land & Farm Management Division of the Ministry of Agriculture, an additional detailed soil survey was carried out in the proposed extensions of the Hewani irrigation scheme. The fieldwork was carried out in the first half of October, 1978, and comprised 14 soil augerings (nos. 1 to 14 on attached soil map) and 10 detailed soil profile descriptions (nos. 179/1-79 to 179/1-88 on attached soil map).

The result of this additional field-work is presented as a soil map at scale 1:5,000 which also includes the existing scheme surveyed in 1977 (see attached soil map, appendix 3). Some minor corrections were made in the 1977 soil map, Therefore the attached soil map supersedes the 1977 soil map of Hewani irrigation scheme. Furthermore the description of some soil mapping units was modified. Changes and additional information are given below.

DESCRIPTION OF THE SOIL MAPPING UNITS

Mapping unit Fbcl (cf. page 8 of report D8)

Extent: 16.0 ha

Soils: The soils of this unit north of Hewani village do not have the uniform clay texture which is typical for this unit. North of Hewani village the soils usually have a silty clay texture between 10 and 50 cm depth. Since the other soil characteristics do not show any significant changes, the area north of Hewani village was included in this unit.

Mapping unit Fbc2 (cf. page 8 of report D8)

Extent: 9.4 ha

Soils: As described in report D8

Mapping unit Fbsal (not included in report D8)

Extent: 14.6 ha

Soils: This unit comprises the easternmost part of the eastern extension. The soils are poorly drained and extremely deep. Mottling starts usually directly below the A-horizon (top soil). The soils consist of dark brown (7.5YR 3/2) to very dark brown (10YR 3/2), firm clay with 10-20 cm topsoil of friable to firm clay. The colour of the topsoil ranges from dark reddish brown (5YR 3/2) to very dark grey (10YR 3/1).

The structure of the topsoil is weak to moderate, fine to medium, subangular blocky. The structure of the subsoil is weak to moderate, medium to coarse, angular blocky. The upper part of the subsoil may show a weak prismatic character. The soils are non-calcareous throughout and slightly or moderately saline and slightly sodic from about 90 cm. The Sodium Adsorption Ratios (SAR - Values) of the deeper subsoil range from 8 to 15, showing a slight increase with depth. The pH measured in the saturation extract, is about 8.0.

The soils have a moderately slow infiltration rate. The description of a representative profile and its analytical data are given in appendix 1 (prof. no. 179/1-86)

Mapping unit Fbsa2 (cf. unit Fbsa on page 8 of report D8)

Extent: 33.6 ha

Soils: This unit comprises the major part of the eastern extension. It includes the area indicated as Fbsa on the 1977 soil map.

The soils are similar to those of unit Fbsa1 except for their pH and salt content. The pH, measured in the saturation extract, ranges from 7.0 to 7.7. The soils are slightly or moderately saline from about 50 cm depth. The description of a representative profile and its analytical data are given in appendix 2 (profile no. 179/1-80).

Mapping unit Fls1 (cf. page 9 of report D8)

Extent: 16.9 ha

Soils: No change.

Mapping unit Fls2 (cf. page 10 of report D8)

Extent: 3.0 ha

Soils: No change.

LAND SUITABILITY CLASSIFICATION FOR IRRIGATION

The land suitability classification for the area covered by the attached detailed soil map is essentially the same as described in chapter 5.3 of report D8. The attached soil map shows only minor changes in the tables for the land suitability classification. These changes comprise the inclusion of the units Fbsa1 and Fbsa2 and the revised areas (in ha) of each mapping unit.

SOIL ANALYTICAL DATA

Field ref: 179/1-86, unit Flsa1

Lab. no. /78	11706	11707	11708	11709	11710
Depth (in cm)	0-10	10-35	35-63	63-96	96-138
Texture class	clay	clay	clay	clay	clay
Sand %	10	32	14	12	10
Silt %	24	16	16	14	20
Clay %	66	52	70	74	70
pH-H ₂ O 1:2½ susp.	5.7	6.6	7.7	7.9	7.7
pH-KCl "	4.9	5.7	6.5	6.9	6.8
EC (mmhos/cm)"	0.25	0.26	0.35	0.95	1.95
<u>Saturation extract</u>					
% water				-	96.2
E _{Ce} (mmho/cm)				1.50	4.50
pH				8.0	8.0
Ca (me/l)				-	5.0
Mg "				-	7.4
K "				-	0.2
Na "				-	28.3
Cl "				-	20.6
SO ₄ "				-	1.4
CO ₃ "				-	-
HCO ₃ "				-	3.8
SAR				-	11
Qualitative CaCO ₃	0	0	0	0	0

Appendix 1

Mapping unit Fbsa1 Profile No. 179/1-86

Geological formation : Quaternary alluvial sediments
Physiography : Floodplain (river basin land)
Relief, macro : Flat to very gently undulating
meso, micro : Nil
Vegetation/land use : Grassland/extensive grazing
Erosion : Nil
Rock outcrops : Nil
Flooding/ponding : Twice a year
Surface stoniness : Nil
Slope gradient : 0.5%
Effective soil depth : 138 cm.
Drainage class : Poorly drained

A 0-10 cm Very dark grey (10YR 3/1 dry and moist); clay; moderate, medium, subangular blocky structure; very hard when dry; friable when moist; sticky and plastic when wet;

AB 10-35 cm Very dark grey (10YR 3/1 moist); clay; moderate, fine, angular blocky structure; common pressure faces; firm when moist, very sticky and very plastic when wet;

B21 35-63 cm Very dark grey (10YR 3/1 moist); clay; weak, medium angular blocky structure; many, moderate slickensides; friable when moist, sticky and plastic when wet;

B22 63-96 cm Very dark greyish brown (10YR 3/2 moist); clay; weak, medium, angular blocky structure; many strong slickensides; friable when moist, sticky and plastic when wet;

B23 96-138 cm Dark brown (10YR 3/3 moist); clay; weak, medium angular blocky structure; many strong slickensides; friable when moist, sticky and plastic when wet.

Other remarks: (a) soil very moist from 10 cm
(b) weak structure development due to very moist soil from 10 cm
(c) about 0.5% Fe concretions, about 2 mm in size, from 10 cm depth
(d) slightly saline and slightly sodic from about 96 cm depth

SOIL ANALYTICAL DATA

Field ref: 179/1-80, unit Flsa2

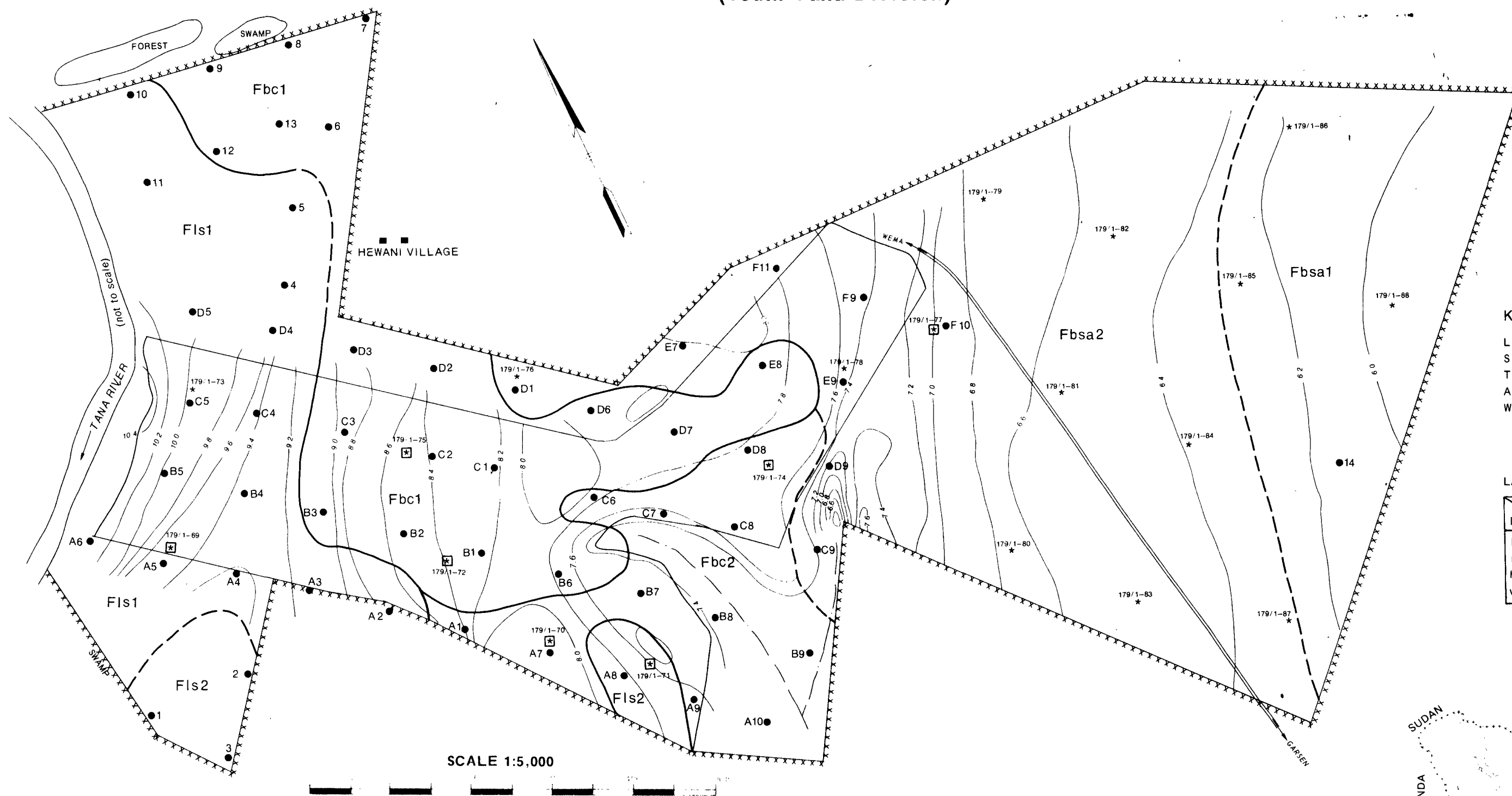
Lab. no./78	11678	11679	11680	11681	11682
Depth (in cm)	0-19	19-54	54-90	90-140	140-220
Texture class	clay	clay	clay	clay	clay
Sand %	14	14	10	14	32
Silt %	20	18	20	20	16
Clay %	66	68	70	66	52
pH-H ₂ O 1:2½ susp.	6.2	7.2	7.4	6.8	7.1
pH-KCl "	5.0	5.5	6.2	6.2	6.0
EC (mmho/cm) "	0.29	0.35	1.70	5.50	3.50
<u>Saturation extract</u>					
% water			92.2	86.4	82.5
ECe (mmho/cm)			4.50	11.50	10.00
pH			7.0	6.8	7.2
Ca (me/l)			6.2	29.2	24.8
Mg "			7.8	29.2	24.8
K "			0.2	0.3	0.3
Na "			28.3	82.6	71.7
Cl "			34.0	75.6	55.6
SO ₄ "			0.7	6.3	6.3
CO ₃ "			-	-	-
HCO ₃ "			3.6	5.0	4.0
SAR			11	15	14
Qualitative CaCO ₃	0	0	0	0	0

Appendix 2

Mapping unit Fbsa2 Profile No. 179/1-80

Geological formation	:	Quaternary alluvial sediments
Physiography	:	Floodplain (river basin land)
Relief, macro	:	Flat to very gently undulating
meso, micro	:	Nil
Vegetation/land use	:	Grassland/extensive grazing
Erosion	:	Nil
Rock outcrops	:	None
Slope gradient	:	0.5%
Salinity/sodicity	:	Slightly saline and slightly sodic from 54 cm; moderately saline and slightly sodic from 90 cm
Effective soil depth	:	140 cm +
Drainage class	:	Poorly drained
A	0-19 cm	Dark reddish brown (5YR 2.5/2 dry and moist); clay; moderate very fine to fine subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few fine pores; few fine, faint mottles;
B1	19-54 cm	Dark brown (7.5YR 3/1 moist); clay; weak, coarse prismatic structure breaking into moderate, medium angular blocky structure; few, weak slickensides; firm when moist, very sticky and very plastic when wet; few, very fine pores; few, fine, faint mottles;
B21	54-90 cm	Dark brown (7.5YR 3/2 moist); clay; moderate, medium angular blocky structure; abundant, strong slickensides; firm when moist, very sticky and very plastic when wet; few, very fine pores; common, fine, distinct mottles;
B23	90-140 cm	Dark brown (7.5YR 3/2 moist); clay; moderate, medium, angular blocky structure; abundant strong slickensides; friable when moist, sticky and plastic when wet; few very fine pores; many, medium distinct mottles; salt crystals.
Other remarks:	(a)	about 1% Fe concretions, 1-3 mm in size, throughout the profile
	(b)	moist from 19 cm, increasing with depth
	(c)	0-19 cm: very many very fine to fine roots; 19-54 cm: common, very fine roots; deeper than 54 cm: few, very fine roots.

DETAILED SOIL MAP OF HEWANI IRRIGATION SCHEME AND THE PROPOSED EXTENSIONS⁺ (South Tana Division)



KEY TO LAND SUITABILITY CLASSIFICATION FOR SURFACE IRRIGATION

LIMITATIONS	SUITABILITY CLASSES
S Soil	I highly suitable
T Topography and/or erosion	II moderately suitable
A Salinity and/or alkalinity	III marginally suitable
W Drainage	IV unsuitable

LAND IMPROVEMENT REQUIREMENTS

type level	artificial drainage	initial leaching and/or soil amendments
low	(d)	(I)
moderate	d	I
high	D	L
very high	<u>D</u>	<u>L</u>

KEY TO INFILTRATION CLASSES*

rate in cm/hour	descriptive term
< 0.1	very slow
0.1-0.5	slow
0.5-2.0	moderately slow
2.0-6.5	moderate
6.5-12.5	moderately rapid
12.5-25.5	rapid
> 25.5	very rapid

*according to U.S. Soil Conservation Service

SCALE 1:5,000

LEGEND

CLAY SOILS

Fbc1 imperfectly drained, extremely deep, dark brown to very dark greyish brown, mottled firm clay, with 10-25cm very dark greyish brown topsoil; strongly calcareous from about 120cm; moderate infiltration

Fbc2 like Fbc1, but underlain by silty clay or sandy clay from 120-180cm depth; micaceous from about 170cm; non calcareous; moderate to moderately rapid infiltration

CLAY SOILS WITH SALINE SUBSOIL

Fbsa1 poorly drained, extremely deep, dark brown to very dark greyish brown, mottled, very firm clay; slightly to moderately saline and slightly sodic from about 90cm; moderately slow infiltration

Fbsa2 like Fbsa1, but slightly to moderately saline from about 50cm

STRATIFIED SOILS

Fis1 moderately well drained to imperfectly drained, extremely deep soils with 20-45cm very dark greyish brown, mottled, friable clay, overstratified, friable to firm, sandy clay loam, silty clay and clay; micaceous; moderate infiltration

Fis2 like Fis1, but with about 70cm dark greyish brown to very dark grey, friable clay over a stratified subsoil

*extremely deep = more than 180cm

LAND SUITABILITY CLASSIFICATION AND LAND IMPROVEMENT REQUIREMENTS

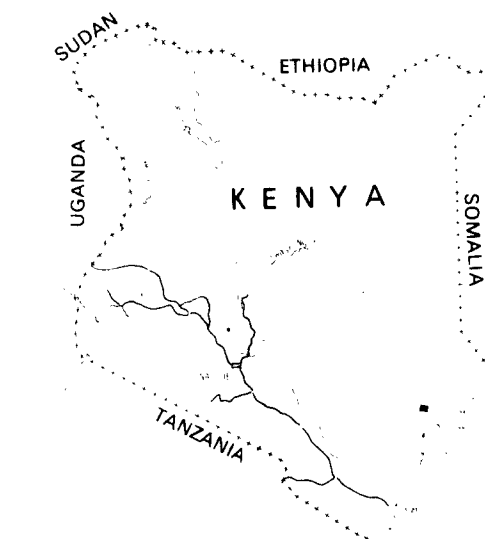
a) Surface Irrigation

mapping unit	land suitability (without improvements)	land improvement requirements*	potential land suitability (with major improvements)	ha
Fbc1	IIIWS (A)	D	IIS	16.0
Fbc2	IIIWS	D	IIS	9.4
Fbsa1	IIIWSA	(I) - D	IIS	14.6
Fbsa2	IIIWSA	I - D	IIS	33.6
Fis1	IIIWS (A)	D	IIS	16.9
Fis2	IIW	d	I	3.0

*clearing, levelling/grading and flooding hazard(occurrence, intensity) have not been taken into account as insufficient data are available

b) Basin Irrigation (paddy rice)

mapping unit	potential land suitability	ha
Fbc1	I	16.0
Fbc2	I	9.4
Fbsa1	I	14.6
Fbsa2	I	33.6
Fis1	I-II	16.9
Fis2	I-II	3.0



■ Location of surveyed area

KEY

- boundary of present irrigation scheme
- xxxxxx boundary of soil survey
- 6.2 contours V, I 0.2m
- soil boundary
- - - soil boundary (uncertain)
- Fbc1 soil mapping symbol
- A9 augerhole with ref. number
- ★ 179/1-88 profile pit with sampling, with ref. number
- ⊠ 179/1-74 profile pit with sampling and infiltration measurement, with ref. number

1cm² 0.25ha

+ Note: This soil map supersedes the detailed soil map of Hewani Irrigation Scheme (Appendix 7 to Detailed Soil Survey Report No. D8, 1977)