A.6. Supporting Data

A.6.1. Results of Soil Profile Investigation

Descriptions of the representative soil profiles are summarized here in the order as follow;

Typic Salorthid (a) P-10, 17, 25, 27, 37
(b) P-2, 5, 6, 12, 18, 28, 31
(c) P-8, 11, 20, 24, 34
Typic Gypsiorthids P-1, 7, 13, 30, 33
Typic Torriothents P-14, 16, 35

The descriptions were made mainly in accordance with the FAO's guidelines. Soil colors were named according to the Munsell's color chart except for gley colors. Soil hardness indexes determined by Yamanaka's tester were classified into five categories as below;

Hardness Index		(kg/cm^2)
Soft	< 8	(0.98)
Slighly hard	8 - 12	(1.93)
Hard	12 - 17	(4.04)
Very hard	17 - 23	(10.0)
Extremely hard	> 23	(10.0)

And the columner sections of all soil profiles are shown in Figures A-20, following to the descriptions.

Information on the Site

Profile No.:	P-10
Soil Name:	Typic Salorthids,
Date of Investigation:	November 3, 1983
Location:	Mohamad Mahoch, about 2.5 km southeast of the conjunction of Bahr Saft and Hadous drains
Elevation:	0.2 m
Landform and Slope:	Nearly flat
Vegetation and Land Use:	Rice cultivation

General Information on the Soil

Parent Material: Fluvio-lacustrine deposits

Drainage: Poor

Depth of Groundwater Table: 40 cm below surface

Presence of Stones, Shells etc.: None

Evidence of Erosion: None

Surface Features: No cracking

Profile Description

0 - 25 cm	Very dark brown (10YR 2/3) clay, moist, weak subangular blocky, sticky and plastic, common fine salt crystals, compacted, very hard (20.0), gradual merging boundary to;
25 - 72 cm	Very dark brown (10YR 2/3) clay, wet, weak subangular blocky, sticky and plastic, few fine roots, few fine pores, compacted, very hard (18.0), clear smooth boundary to;
72 - 200 cm	Olive gray *(2.5GY 5/1) clay, wet, very sticky and structureless, compacted hard (14.4) common pores, few fine roots, few manganese concretions, many iron mottling, many shell fragments (bivalves) at 120 - 140 cm, seepage from pores, coming up water rapidly.

Information on the Site

Profile No.:	P-17
Soil Name:	Typic Salorthids
Date of Investigation:	November 22, 1983
Location:	About 1 km south of Ramsis canal and 5 km northeast of Tell Sanhur
Elevation:	0.5 m
Landform and Slope:	Flat
Vegetation and Land Use:	No vegetation

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	50 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	Weak Salt Crust

Profile Description

0 - 8 cm	Weak salt crusts (1 mm thick), dark brown (10YR 3/3) clay, water saturated below the crusts, no structure, sticky and plastic, many large salt crystals, abrupt smooth boundary to;
8 - 15 cm	Dark brown (10YR 3/3) silty clay, water saturated, no structure, slightly sticky and plastic, common gypsum flakes, slightly hard (10.6), abrupt smooth boundary to;
15 - 45 cm	Dark brown (10YR 3/3) silty clay loam, wet, no structure, slightly sticky and slightly plastic, soft (3.6), fe reddish brown motting, abrupt smooth boundary to;
45 - 150 cm	Very dark brown (10YR 2/3) silty clay, moist, dark greenish gray *(10GY 3/1) on the crack surface, coarse angular blocky sticky and plastic, few manganese mottling, compacted, very hard (19.0), water spring up from pores, gradual merging boundary to;
150 - 220 cm	Very dark brown (10YR 2/3) light clay, coarse angular blocky, sticky and very plastic, wet, compacted.

Information on the Site

Profile No.:	P-27
Soil Name:	Typic Salorthids
Date of Investigation:	November 20, 1983
Location:	Wahedan Korba, about 3 km south of Skadel Azam
Elevation:	0.3 m
Landform and Slope:	Gently slope towards south
Vegetation and Land Use:	Salicornia, Paddy rice surrounded by fish ponds

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Restricted
Depth of Groundwater Table:	30 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	

The lands along the Bahr El Baqar drain have been cultivated for 50 years.

Profile Description

0 - 20 cm	Dark grayish brown (10YR 4/2) light clay, wet, medium subangular blocky, slicky and plastic, hard (15.8), few pores, wide cracks up to 5 cm deep, clear smooth boundary to;
20 - 60 cm	Dark brown (10YR 3/3) clay loam, wet, weak subangular blocky, sticky and plastic, few pores, soft (4.6), clear smooth boundary to;
60 - 90 cm	Dark brown (10YR 3/3) clay, wet, weak fine platy structure, sticky and plastic, soft (4.2), abrupt smooth boundary to;
90 - 110 cm	Very dark brown (10YR 2/3) sand, wet, structureless non-sticky and non plastic, common large pores, permeable, few gypsum crystals, abrupt smooth boundary to;
110 - 200 cm	Greenish black *(5G 2/1) light clay, wet, massive, sticky and plastic, few pores.

Information on the Site

Profile No.:	P-37
Soil Name:	Typic Salorthids
Date of Investigation:	November 24, 1983
Location:	About 2 km northeast of San El Hagar, between Ramsis drain and swamp
Elevation	0.5 m
Landform and Slope:	Almost flat
Vegetation and Land Use:	Paddy rice

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	80 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	Wide Cracks

Profile Description

0 - 25 cm	Very dark grayish brown (10YR 3/2) clay, dry, coarse angular blocky, wide cracks up to 10 cm deep, hexagonal clods, few organic matter, hard (14.4), abrupt smooth boundary to;
25 - 55 cm	Dark brown (10YR 3/3) light clay, slightly wet, coarse angular blocky, common wide cracks, few gypsum crystals, hard (15.4), clear smooth boundary to;
55 - 110 cm	Very dark grayish brown (10YR 3/2) clay, wet, massive, very sticky and plastic, gradual smooth boundary to;
110 - 150 cm	Very dark grayish brown (10YR 3/2) silty clay, wet, massive, sticky and plastic, clear smooth bandary to;
150 - 200 cm	Very dark gray (N 3/0) mixed with very dark brown (10YR/2/3) clay, wet, massive, very sticky and plastic, diffuse boundary to;
200 - 260 cm	Very dark brown (10YR 2/2) clay, wet, massive, very sticky and very plastic

Information on the Site

Profile No.:	P-2
Soil Name:	Typic Salorthids
Date of Investigation:	October 30, 1983
Location:	About 5.5 km north of Bahr El Baqar drain
Elevation:	1.0 m
Landform and Slope:	Almost flat
Vegetation and Land Use:	No vegetation

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	1.0 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosion
Surface Features:	Thin wind blown silt on the salt crust (5mm thick)

Profile Description

0 - 35 cm	Very dark grayish brown (10YR 3/2) silty clay loam, moist, massive, slightly sticky and plastic, few pores, few gypsum crystals,
35 - 55 cm	Dark brown (7.5YR 3/3) silty clay, wet, massive, sticky and plastic, few small pores, gradual smooth boundary to;
55 - 95 cm	Very dark brown (10YR 2/2) silty clay, wet, medium subangular blocky, few pores, few manganese concretions, clear smooth boundary to;
95 - 150 cm	Dark brown (7.5YR 3/3) silty clay loam with stratified fine sand layers, compacted few brown nodule and black manganese mottling, clear smooth boundary to;
150 - 170 cm	Brown (10YR 4/3) fine sand mixed with clay, wet, structureless, few manganese concretions, gradual smooth boundary to;
170 - 200 cm	Similar to the above layer except mottlings and concretions increase with depth.

Information on the Site

Profile No.:	P-6
Soil Name:	Typic Salorthids
Date of Investigation:	November 2, 1983
Location:	About 25 km southeast of Tell Sanhur, near Taimoor
Elevation:	1.0 m
Landform and Slope:	Flat
Vegetation and Land Use:	Cultivated lands, some Salicornia and Tamarix

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	1.2 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	Very thin wind blown silt, many salt crystals on the surface

Profile Description

0 - 5 cm	Very dark brown (10YR 2/3) clay, dry, weak platy, firm, hard (17.2), many fine salt crystals, clear smooth boundary to;
5 - 60 cm	Dark yellowish brown (10YR 3/4) silty clay, moist, structureless, friable, hard (15.5) few lime nodules, common gypsum crystals, very few reddish brown spotty mottling, clear smooth boundary to;
60 - 90 cm	Dark brown (10YR 3/3) silty clay loam, wet, structureless, many lime nodules, slightly hard (10.6), clear smooth boundary to;
90 - 160 cm	Very dark grayish brown (10YR 3/2) clay, moist, strong coarse angular blocky, compacted, very hard (21.6), few fine pores, common manganese concretions (3mm diameter), gradual smooth boundary to;
160 - 200 cm	Brown (10YR 4/3) silty clay, wet, massive, compacted, few manganese concretions,

Information on the Site

Profile No.:	P-12
Soil Name:	Typic Salorthids
Date of Investigation:	November 5, 1983
Location:	Along the Bahr El Baqar drain, about 6 km north east of the Hanon Project
Elevation:	0.1 m
Landform and Slope:	Flat
Vegetation and Land Use:	Fish pond, no vegetation

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	25 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	Surface cracks (1.5 cm wide, 3 cm deep) makes hexagonal clods

Profile Description

0 - 5 cm	Very dark brown* (7.5YR 2/3), light clay, dry, moderate medium subangular blocky, common white veins, clear smooth boundary to;
5 - 40 cm	Dark brown (7.5YR 4/3) silty clay, wet, weak subangular blocky, sticky and plastic, soft common gypsum flakes, gradual smooth boundary to;
40 - 100 cm	Dark brown (7.5YR 4/3) light clay, and silty clay, wet, porous sticky and plastic, soft, gradual smooth boundary to;
100 - 130 cm	Dark brown (7.5YR 3/3) light clay with pockets of coarse sand, gradual smooth boundary to;
130 - 150 cm	Very dark brown *(7.5YR 2/2) sandy clay, wet;
150 - 200 cm	Very dark brown * (7.5YR 2/2) light clay, wet, structureless, very sticky and plastic

Information on the Site

Profile No.:	P-18
Soil Name:	Typic Salorthids
Date of Investigation:	November 22, 1983
Location:	About 500 m north of Tanis Project
Elevation:	0.75 m
Landform and Slope:	Gentle slope with hummocky relief
Vegetation and Land Use:	Tamarix, non cultivated but levelled

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	Deeper than 2 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	Pluffy surface, few coarse sand on the surface

Profile Description

0 - 15 cm	Yellowish brown (10YR 5/4) silty clay, dry, loose, common fine salt crystals, abrupt smooth boundary to;
15 - 35 cm	Dark yellowish brown (10YR 3/4) silty clay loam with a few stratified fine sand layer, moist, granular structure, slightly sticky and plastic, very hard (22.2), few manganese mottling, abrupt wavy boundary to;
35 - 43 cm	Light gray (10YR 7/2) sand, moist, structureless, hard (16.6), abrupt wavy boundary to;
43 - 60 cm	Brown (10YR 4/3) coarse sand mixed with silty clay, moist, compacted, very hard (19.6), gradual wavy boundary to;
60 - 150 cm	Dark brown (10YR 3/3) clay, moist, strong coarse angular blocky, very sticky and plastic, compacted, very hard (22.2), few salt spot, common manganese concretions, gradual smooth boundary to;
150 - 200 cm	Black (10YR 2/1) clay, slightly wet, friable, structureless, compacted, very hard (22.6), gradual smooth boundary to;
200 - 250 cm	Dark grayish brown (2.5Y 4/1) clay, moist compacted, extremely hard.

Information on the Site

Profile No.:	P-28
Soil Name:	Typic Salorthids
Date of Investigation:	November 21, 1983
Location:	Tell El Ginn, about 5 km northeast of Bahr El Baqar drain
Elevation:	1.5 m
Landform and Slope:	Gentle slope
Vegetation and land Use:	Dwarf shrub of Salicornia, paddy rice

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Restricted
Depth of Groundwater Table:	52 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosion
Surface Features:	Salt crust and brownish black (7.5YR 2/2) wind blown silt loam

Profile Description

0 - 20 cm	Very dark brown (7.5YR 2/2) silt loam, moist, friable, slightly hard (8.2), clear smooth boundary to;
20 - 70 cm	Dark brown (7.5YR 3/2) silty clay, moist, friable, few gypsum crystals, soft (3.5), gradual smooth boundary to;
70 - 90 cm	Very dark brown (7.5YR 2/1) silty clay, wet, massive, slightly hard (8.5), sticky and plastic, clear smooth boundary to;
90 - 200 cm	Dark brown (7.5YR 3/2) clay, wet, massive, very sticky and plastic, slightly hard (8.4), few manganese concretions, permeable layer between 100 and 115 cm.

Information on the Site

Profile No.:	P-31
Soil Name:	Typic Salorthids
Date of Investigation:	November 21, 1983
Location:	About 4 km southeast from El Slam Canal
Elevation:	0.2 m
Landform and Slope:	Flat
Vegetation and Land Use:	Scattered Salicornia

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	70 cm (170 cm at the initial then coming up)
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosion
Surface Features:	Tin wind blown silt and salt crust

Profile Descriptions

0 - 10 cm	Very dark grayish brown (10YR 3/2) clay, moist, friable, slightly hard (10.0), clear smooth boundary to;
10 - 40 cm	Very dark brown (10YR 2/3) silty clay, moist, many fine salt crystals, structureless, hard (14.2), clear smooth boundary to;
40 - 70 cm	Very dark brown (10YR 2/3) silty clay loam, moist, moderate subangular blocky, very fine salt crystals, very hard (21.2) slightly sticky and plastic, gradual smooth boundary to;
70 - 130 cm	As above layer except for common manganese concretions, gradual smooth boundary to;
130 - 200 cm	Very dark brown (10YR 2/2) clay, wet, subangular blocky, very sticky and plastic, very hard (20.0) few manganese concretions, black pylites (FeS)

Information on the Site

Profile No.:	P-8
Soil Name:	Typic Salorthids
Date of Investigation:	November 2, 1983
Location:	About 4 km east of Tell San El Hagar, about 2 km south of Ramsis drain
Elevation:	0.5 m
Landform and Slope:	Almost flat
Vegetation and Land Use:	Paddy rice

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Moderate
Depth of Groundwater Table:	1.1 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	

Profile Description

0 - 5 cm	Dark brown (7.5YR 3/2) silty clay, moist, fluffy, few pores, few shell and gypsum, gradual smooth boundary to;
5 - 45 cm	Dark brown (7.5YR 3/2) silty clay loam, moist, medium subangualr blocky, friable, few organic matter, slightly hard (10.4), gradual smooth boundary to;
45 - 80 cm	Very dark brown (7.5YR 2/2) clay, moist, medium subangular blocky, very sticky and plastic, hard (17.6), clear smooth boundary to;
80 - 130 cm	Very dark brown (10YR 2/2) silty clay loam, wet, medium subangular blocky, hard (15.0), few manganese convertions, gradual smooth boundary to;
130 - 200 cm	Very dark brown (10YR 2/2) silty clay, wet several stratified sand layers between 130 and 160 cm, few manganese concretions.

Information on the Site

Profile No.:	P-11
Soil Name:	Typic Salorthids
Date of Investigation:	November 5, 1983
Location:	Tell El Ginn, about 5 km north of Bahr El Baqar drain
Elevation:	1.5 m
Landform and Slope:	Flat
Vegetation and Land Use:	Reclaimed but abandoned sparse Tamarix

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Moderately poor
Depth of Groundwater Table:	Deeper than 2 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	Many gypsum flakes, no salt crust

Profile Description

0 - 8 cm	Yellowish brown (10YR 5/4) silty clay loam, dry, loose, many fine salt crystals, clear smooth boundary to;
8 - 40 cm	Dark brown (7.5YR 4/3) silty clay loam, slightly moist, moderate coarse angular blocky, friable, very hard (21.6), few gypsum flakes, few salt crystals, few fine pores, fine cracks (1 mm wide) up to 40 cm deep, clear smooth boundary to;
40 - 60 cm	Dark brown(7.5YR 4/4) silty clay loam, moist, weak subangular blocky, friable, few fine pores, extremely hard (24.2), common lime concretions and veins, few fine manganese concretions, abrupt smooth boundary to;
60 - 140 cm	Very dark grayish brown (10YR 3/2) silty clay, moist, moderate medium subangular blocky, friable, very sticky and plastic, very hard (22.0), few fine pores, common spotty lime, few gypsum flakes, few manganese concretions, plant roots at 95 cm below the surface, clear smooth boundary to;
140 - 160 cm	Very dark brown (10YR 2/3) clay, wet, medium coarse angular blocky, very sticky and very plastic, compacted, very hard (22.6);
160 - 200 cm	Dark gray (N 4/0) clay mixed with brownish black spots (10YR 2/3) wet, compacted, few large manganese concretions (2 mm diameter).

Information on the Site

Profile No.:	P-24
Soil Name:	Typic Salorthids
Date of Investigation:	November 24, 1983
Location:	Ezeba Farag, near El Khalfi drain
Elevation:	0.75 m
Landform and Slope:	Flat
Vegetation and Land Use:	Berseem field

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposit
Drainage:	Moderately well
Depth of Groundwater Table:	30 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	No cracks

Profile Description

0 - 15 cm	Dark grayish brown (2.5Y 4/2) silty clay, moist, firm, slightly hard (12.4), very few pores, many fine roots and organic matter) many brown cloudy mottling, gradual smooth boundary to;
15 - 65 cm	Dark brown (10YR 3/3) clay, moist, medium subangular blocky, firm, hard (14.0), very sticky and plastic, many fine roots, few brown cloudy mottling, gradual smooth boundary to;
65 - 80 cm	Brown (10YR 4/3) clay coated with yellowish gray (2.5Y 4/1) fine sand, few pocket of sand (0.5 - 1.0 cm thick), moist, coarse angular blocky, firm, hard (13.8), many pores, gradual smooth boundary to;
80 - 100 cm	Dark grayish brown (7.5Y 4/1) clay with many pocket of fine sand (Brown 10YR 4/3), wet, strong prismatic, few pores and holes, slightly hard (11.4), water coming from pores, gradual smooth boundary to;
100 - 120 cm	Dark greenish gray *(7.5GY 4/1) silty loam, wet, slightly hard (10.4), gradual smooth boundary to;
120 - 200 cm	Dark greenish gray *(10GY 3/1) silty clay with some stratified fine sand layer, sticky and plastic, compacted, common yellowish brown cloudy mottling.

Information on the Site

Profile No.:	P-34
Soil Name:	Typic Salorthids
Date of Investigation:	November 23, 1983
Location:	About 2.5 km south of Tell El Gabha, in the Hanon Project
Elevation:	1.5 m
Landform and Slope:	Artificially levelled
Vegetation and Land Use:	Upland crops, berseem

General Information on the Soil

Parent material:	Fluvio - lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	1.1 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosian
Surface Features:	Cracking

Profile Description

0 - 35 cm	Dark brown (10YR 3/3) silty clay loam, dry, strong coarse subangular blocky, cracks make hexaganal clods, very hard (22.8), few roots, abrupt smooth boundary to;
35 - 55 cm	Dark brown (10YR 3/3) silty loam, moist, massive slightly plastic, hard (17.4), few roots, clear smooth boundary to;
55 - 95 cm	Very dark brown (10YR 2/2) sandy loam, moist, massive, very hard (21.9), non-sticky and nonplastic, clear smooth boundary to;
95 - 150 cm	Very dark brown (10YR 2/2) silty loam, wet, platy structure very hard (22.6), clear smooth boundary to;
150 - 190 cm	Very dark brown (10YR 2/2) clay, wet, massive
190 - 220 cm	Very dark gray (N 3/0) clay wet, massive
220 - 230 cm	Similar to the above layer except for the color dark greenish gray * (10G 3/2)

Information on the Site

Profile No.:	P-1
Soil Name:	Typic Gypsiorthids
Date of Investigation:	October 31, 1983
Location:	About 5.5 km northeast from Bahr El Baqar drain
Elevation:	1.0 m
Landform and Slope	Scattering clay dunes, almost flat, gently slope to west
Vegetation and Land Use:	No natural vegetation

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	Deeper than 2 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosion

Profile Description

0 - 15 cm	Brown (7.5YR 5/2) silty clay, dry, friable, porous, loose, soft (6.0), few organic matter, abrupt smooth boundary to;
15 - 40 cm	Brown (7.5YR 5/2) clay, moist, medium subangular blocky, friable, sticky and plastic when wet, few pores, few gypsum flakes, few white salt veins, common manganese concretions, hard (15.2), gradual smooth boundary to;
40 - 65 cm	Very dark brown (10YR 2/3) clay, moist, medium subangular blocky, firm, sticky and plastic when wet, compacted, extremely hard (23.8), common salt efflorescence, few manganese concretions, gradual smooth boundary to;
65 - 125 cm	Very dark brown (10YR 2/3) clay, most, firm massive, sticky and plastic, common white salt veins, compacted, extremely hard (24.0), gradual smooth boundary to;
125 - 200 cm	Very dark brown (10YR 2/2) clay, wet, massive, very sticky and very plastic, compacted, very hard (18.4).

Information on the Site

Profile No.:	P-7
Soil Name:	Typic Gypsiorthids
Date of Investigation:	November 1, 1983
Location:	About 1 km north of Tanis Project and 4 km south of Ramsis drain
Elevation:	0.5 m
Landform and Slope:	Almost flat
Vegetation and Land Use:	Cultivated land

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	85 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosion
Surface Features:	No cracks

Profile Description

0 - 5 cm	Very dark brown (7.5YR 2/2) clay, moist, friable, few fine roots, few pores, few white salt veins, clear smooth boundary to;
5 - 105 cm	Very dark brown (7.5YR 2/2) silty clay, moist, medium subangular blocky, firm, few fine roots, few pores, common gypsum flakes, soft (4.6), gradual smooth boundary to;
105 - 130 cm	Very dark brown (7.5YR 2/2) clay, wet, coarse subangular blocky, very sticky and plastic, slightly hard (10.8), clear smooth boundary to;
130 - 140 cm	Similar to the above layer except the texture is silty clay, gradual smooth boundary to;
140 - 200 cm	Very dark grayish brown (10YR 3/2) silty clay loam, wet, coarse subangular blocky, slightly sticky and plastic, few manganese concretions ;

Information on the Site

Profile No.:	P-30
Soil Name:	Typic Gypsiorthids
Date of Investigation:	November 21, 1983
Location:	Near Tell Khaiwanet (about 1.5 km southwest)
Elevation:	0.5 m
Landform and Slope:	Scattering clay dunes, nearly flat
Vegetation and Land Use:	None

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	80 cm below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosion
Surface Features:	

Profile Description

0 - 10 cm	Very dark grayish brown (10YR 3/2) silty clay, dry friable, porous, many gypsum flakes, hard (13.8), clear smooth boundary to;
10 - 30 cm	Dark brown (10YR 3/3) silty clay, moist, friable, many pores, few gypsum flakes, hard (17.0), clear smooth boundary to;
30 - 60 cm	Dark brown (10YR 3/3) silty clay loam, moist, friable, hard (17.8), salt efflorescence between 40-90 cm, few gypsum, common pores, clear smooth boundary to;
60 - 90 cm	Very dark brown (10YR 2/3), silty clay loam, wet, massive, few fine pores, sticky and plastic, compacted, very hard (19.2), few manganese concretions, gradual/smooth boundary to;
90 - 170 cm	Very dark grayish brown (10YR 3/2) silty clay loam, wet, porous, massive, hard (16.6), few manganese concretions, gradual smooth boundary to;
170 - 230 cm	Black (10YR 2/1) clay, wet, massive, compacted, very hard (20.2), very sticky and plastic, few yellowish brown mottling (170 - 180 cm) and rich mottling (180 cm below);
230 - 300 cm	Black (N 2/0) clay, wet, massive, compacted, very hard.

Information on the Site

Profile No.:	P-33
Soil Name:	Typic Gypsiorthids
Date of Investigation:	November 23, 1983
Location:	About 1 km north from Bahr El Baqar drain
Elevation:	0.2 m
Landform and Slope:	Flat, somewhat depressed land
Vegetation and Land Use:	Salicornia, uncultivated, near swamp

General Information on the Soil

Parent Material:	Fluvio-lacustrine deposits
Drainage:	Poor
Depth of Groundwater Table:	1.1 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	None
Surface Features:	No cracking

Profile Description

0 - 15 cm	Very dark brown (10YR 2/3) silt loam, dry, friable, clear smooth boundary to;
15 - 70 cm	Dark brown (10YR 3/3) silty clay loam, moist, friable, medium subangular blocky, hard (15.3), common gypsum flakes, clear smooth boundary to;
70 - 150 cm	Very dark grayish brown (10YR 3/2) silt loam, wet, non-sticky and nonplastic, hard (14.7);
150 - 200 cm	Very dark grayish brown (10YR 3/2) clay, wet massive, very sticky and very plastic, compacted, very hard (19.2), few manganese concretions.

Information on the Site

Profile No.:	P-14
Soil Name:	Typic Torriorthents
Date of Investigation:	November 21, 1983
Location:	Foothill portion of Tee Swid hill, about 1 km northwest of the summit
Elevation:	3.0 m
Landform and Slope:	Clay hummocky, undulating
Vegetation and Land Use:	Tamarix

General Information on the Soil

Parent Material:	Wind blown deposits
Drainage:	Well
Depth of Groundwater Table:	1.75 m below surface
Presence of Stones, Shells etc.:	None
Evidence of Erosion:	Susceptible to wind erosion
Surface Features:	Wind blown (10YR 4/3) silty

Profile Description

0 - 5 cm	Very dark brown (10YR 2/3) clay, dry, loose, fluffy structure, sticky and plastic when wet, common gypsum flakes and fine salt crystals, clear smooth boundary to;
5 - 25 cm	Dark brown (10YR 3/3) silty clay, moist, structureless, slightly sticky and plastic, many gypsum flakes, hard (15.0), abrupt wavy boundary to;
25 - 110 cm	Dark brown (10YR 3/3) Silty clay, moist, friable, structureless, sticky and plastic, hard (14.2), gradual smooth boundary to;
110 - 200 cm	Very dark brown (10YR 2/3) light clay, slightly wet, very weak subangular blocky, sticky and plastic, slightly compacted, extremely hard (29.2), few manganese concretions.

Information on the Site

Profile No.:	P-35
Soil Name:	Typic Torriothents
Date of Investigation:	November 24, 1983
Location:	Foothill of Tell San El Hagar
Elevation:	2.0 m
Landform and Slope:	Flat
Vegetation and Land Use:	Newly reclaimed farm, vegetables and fodders cropping

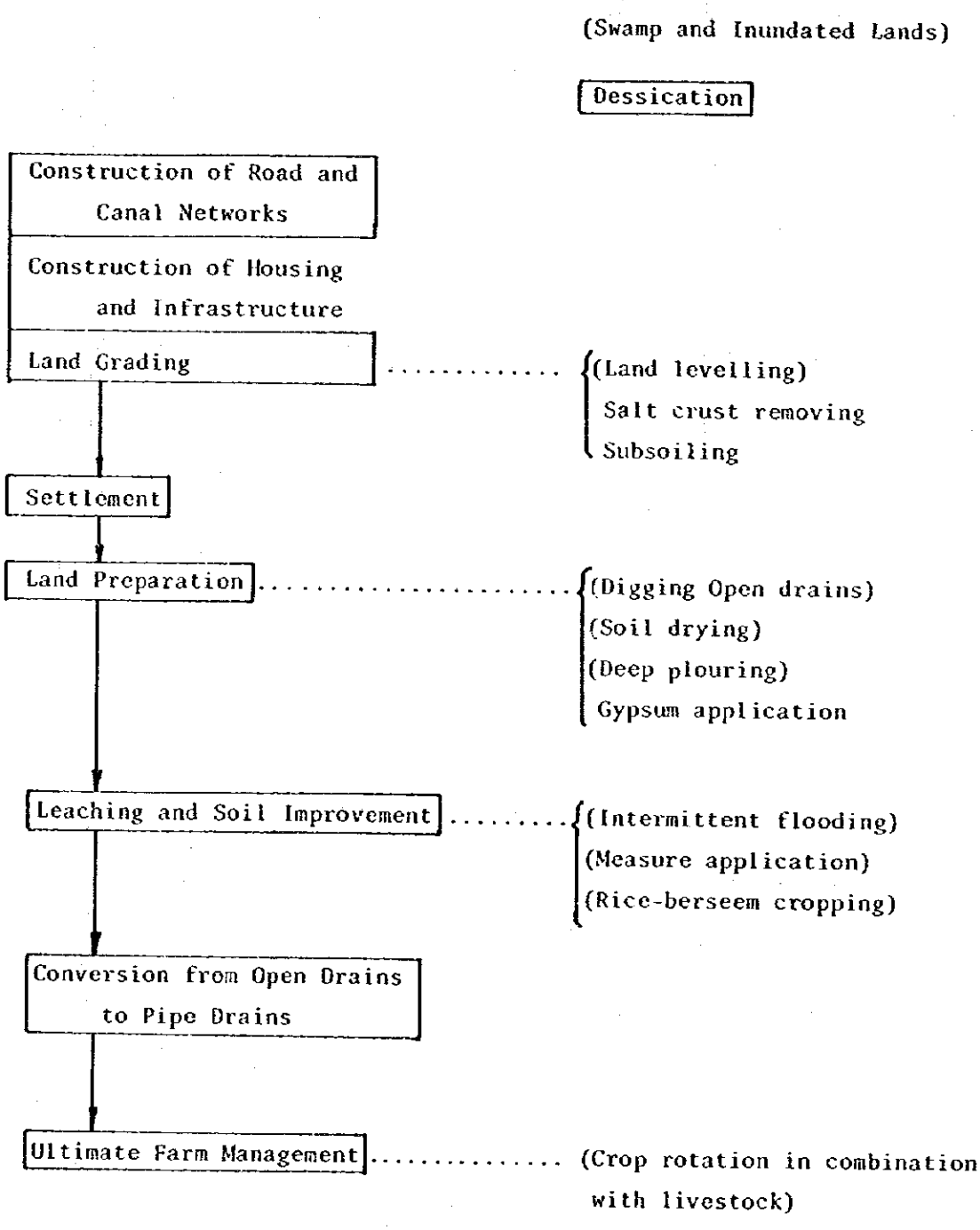
General Information on the Soil

Parent Material:	Fluvio - lacustrine deposits
Drainage:	Well
Depth of Groundwater Table:	80 cm below surface
Presence of Stones, Shells etc.:	Scattering ancient ceramics
Evidence of Erosion:	Susceptible to wind erosion

Profile Description

0 - 70 cm	Very dark grayish brown (10YR 3/2) silty clay loam, dry, friable, ancient ceramics, weak medium subangular blocky, slightly sticky and plastic, diffuse irregular boundary to;
70 - 120 cm	Very dark brown (10YR 2/2) silty clay, wet, structureless, sticky and plastic, clear smooth boundary to;
120 - 200 cm	Very dark gray (N 3/0) clay, wet, structureless, compacted.

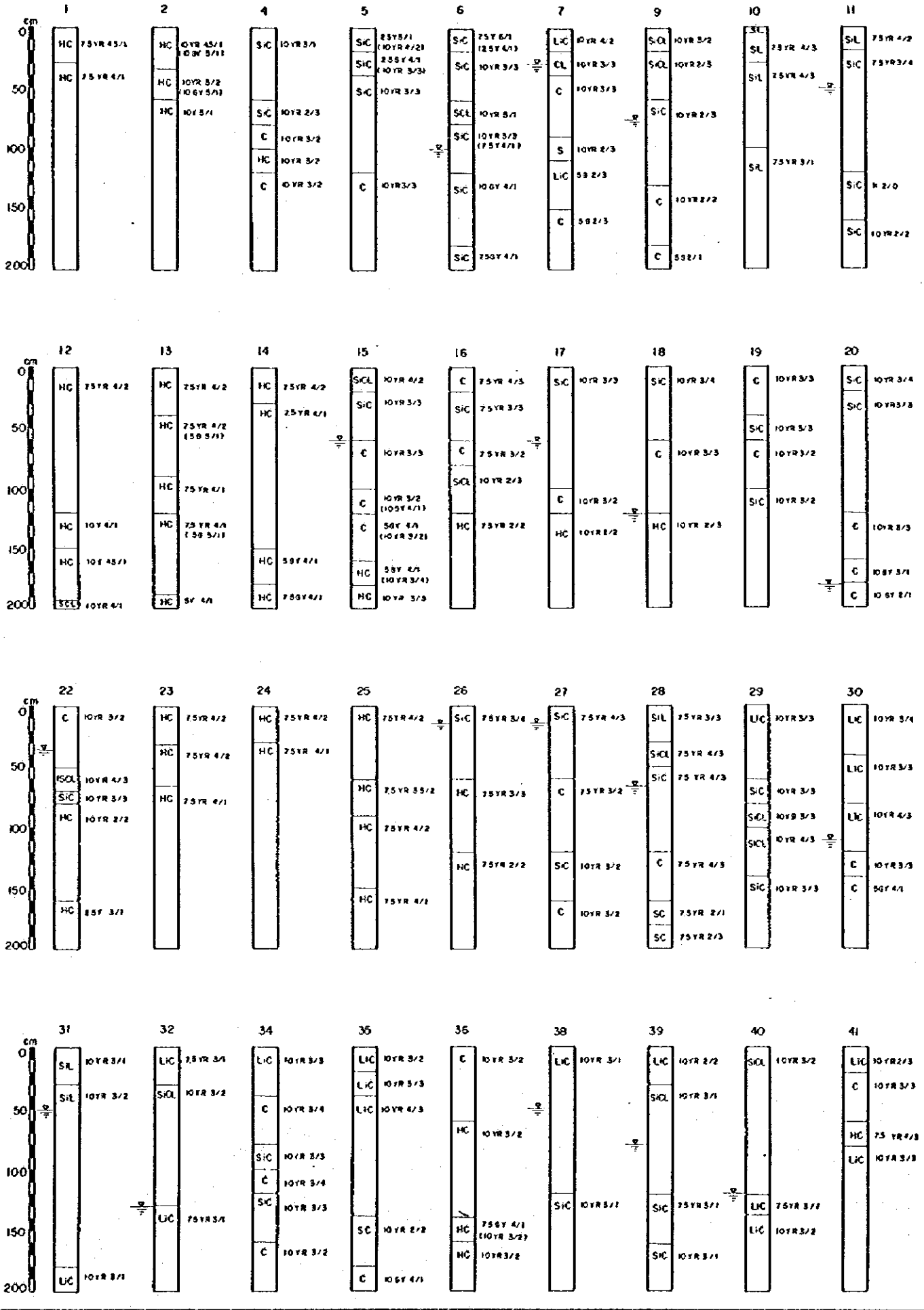
Figure A-19 Work Programme of Land Reclamation



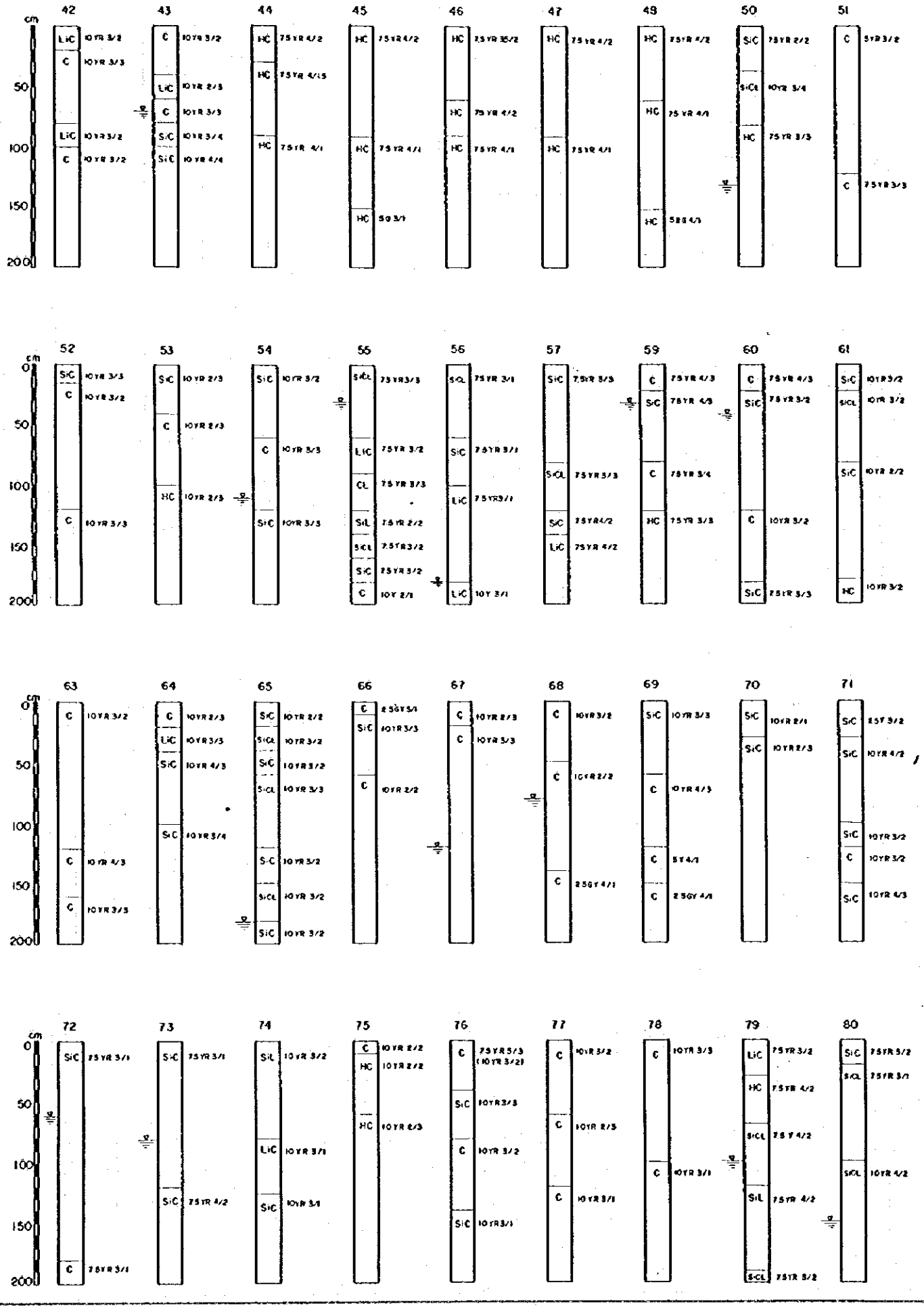
( ) main works

{ } works depending on the local condition

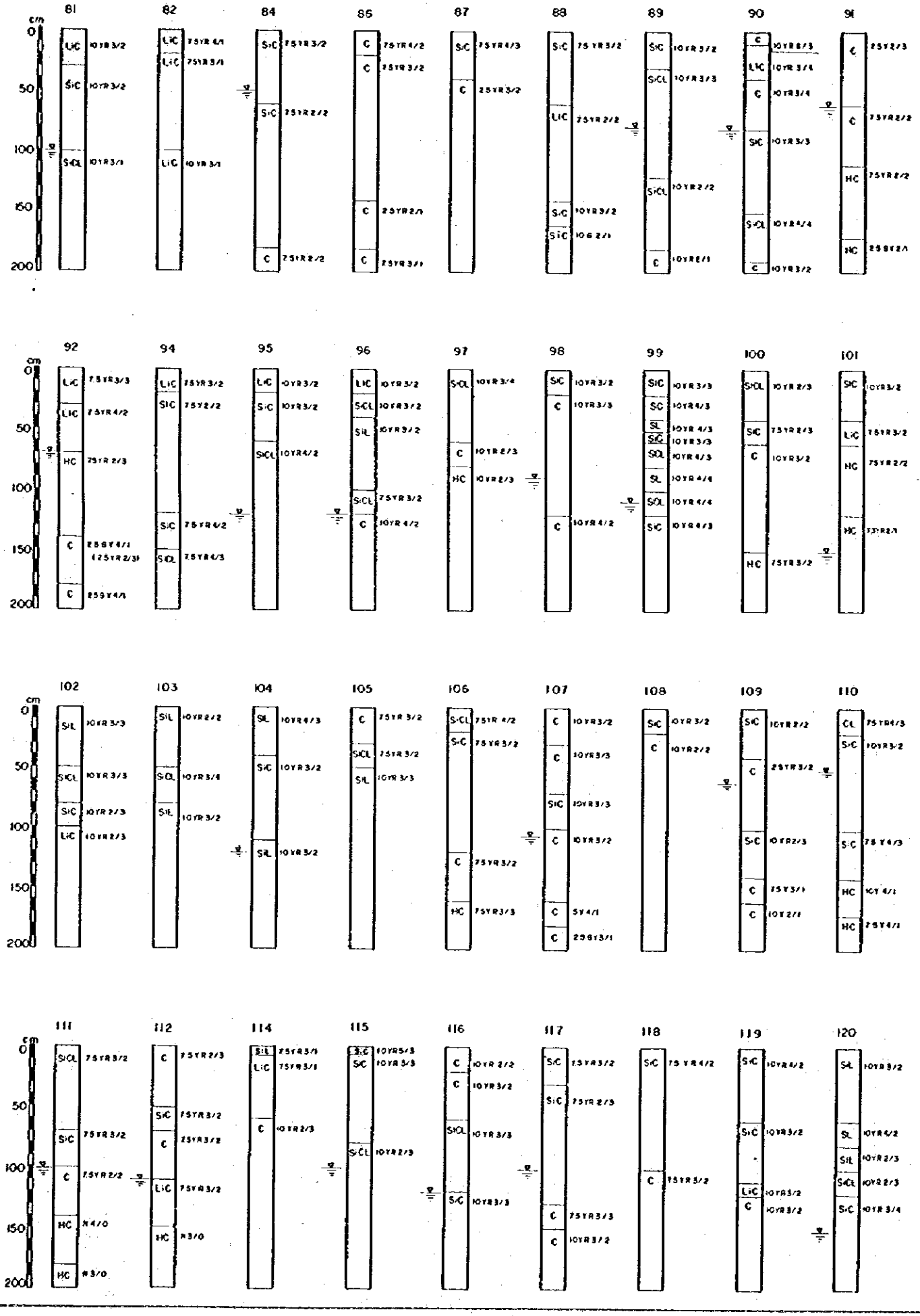
Figure A-20 COLUMNAR SECTIONS OF SOIL PROFILES (I)



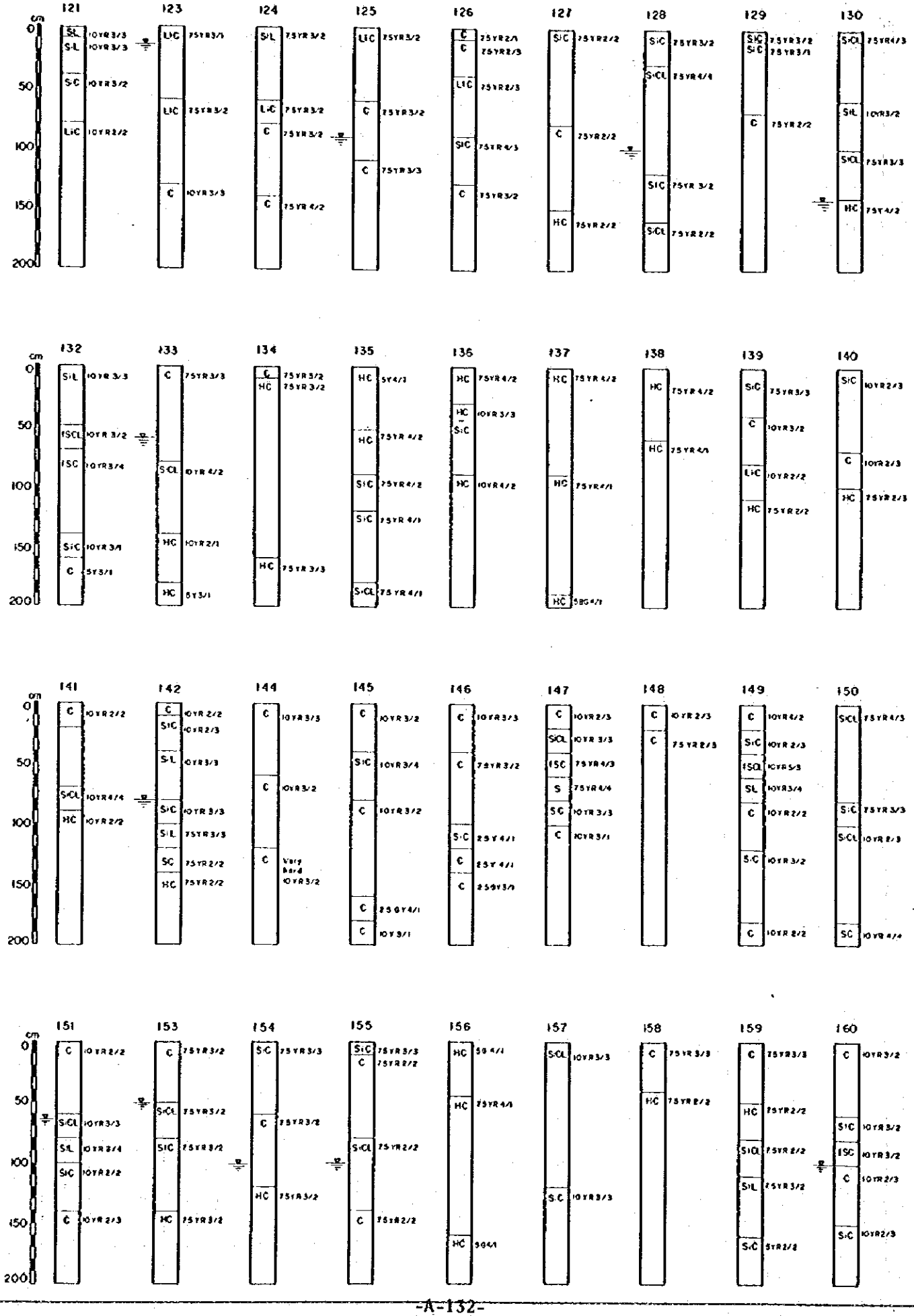
COLUMNAR SECTIONS OF SOIL PROFILES (2)



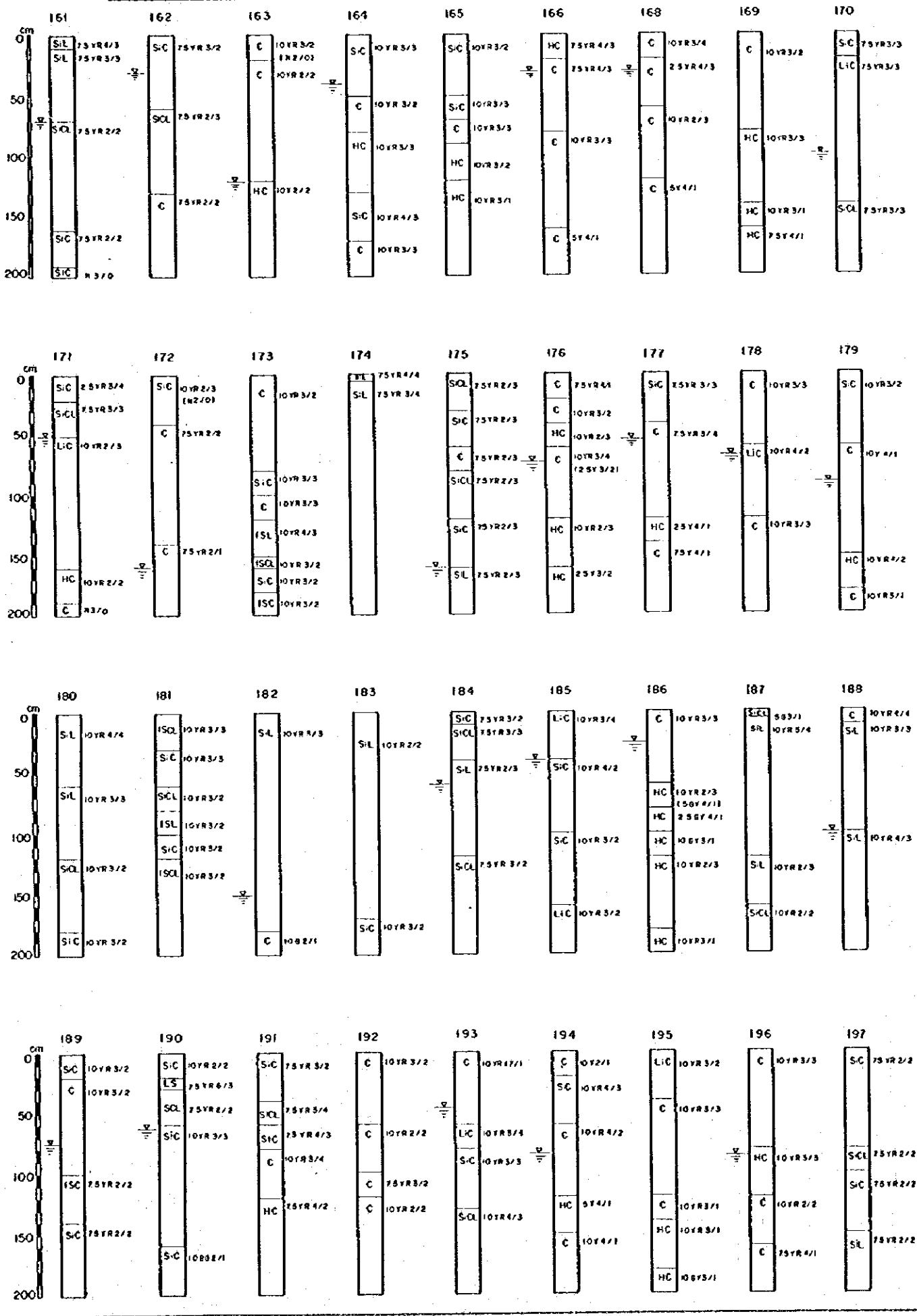
COLUMNAR SECTIONS OF SOIL PROFILES (3)



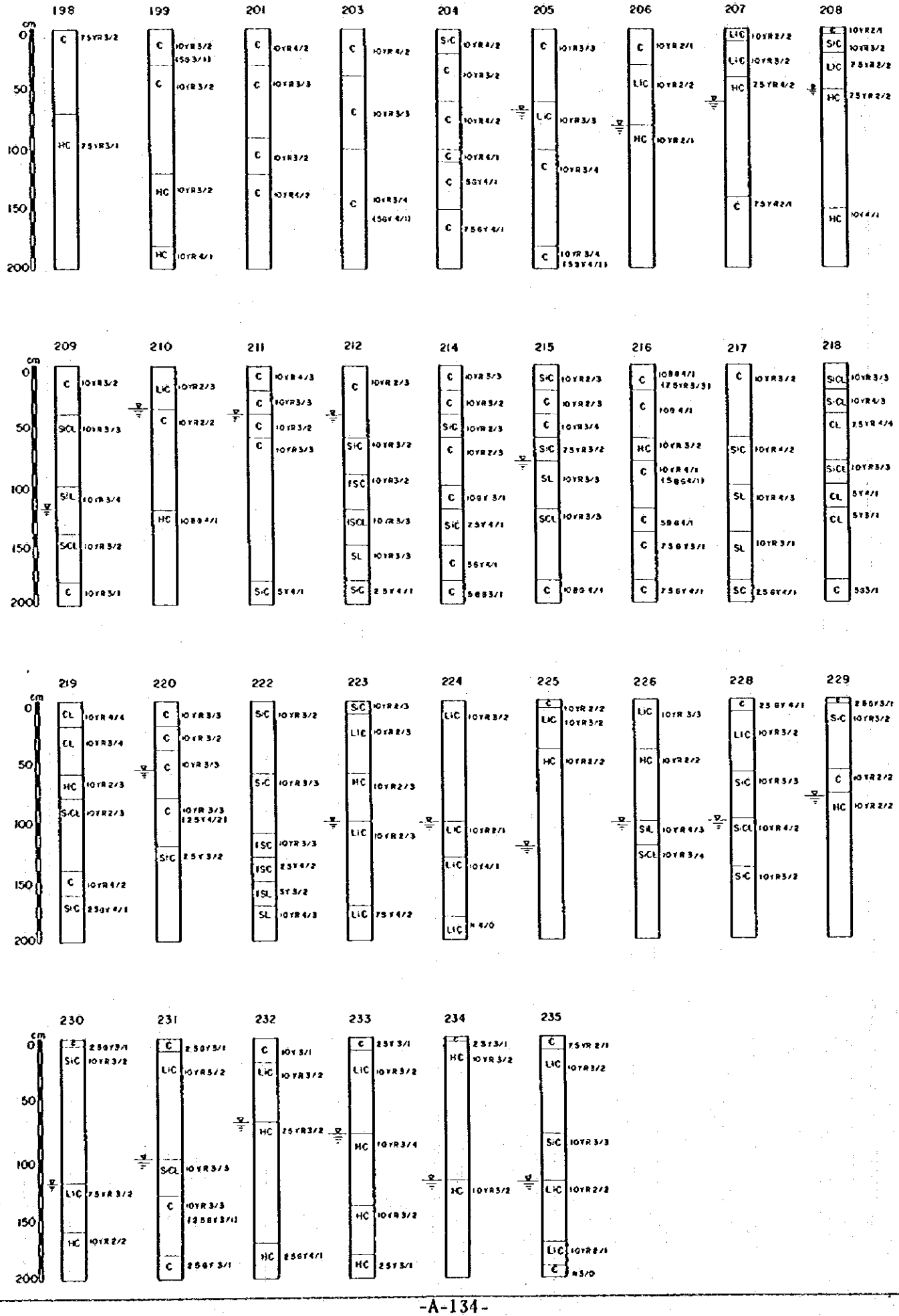
COLUMNAR SECTIONS OF SOIL PROFILES (4)



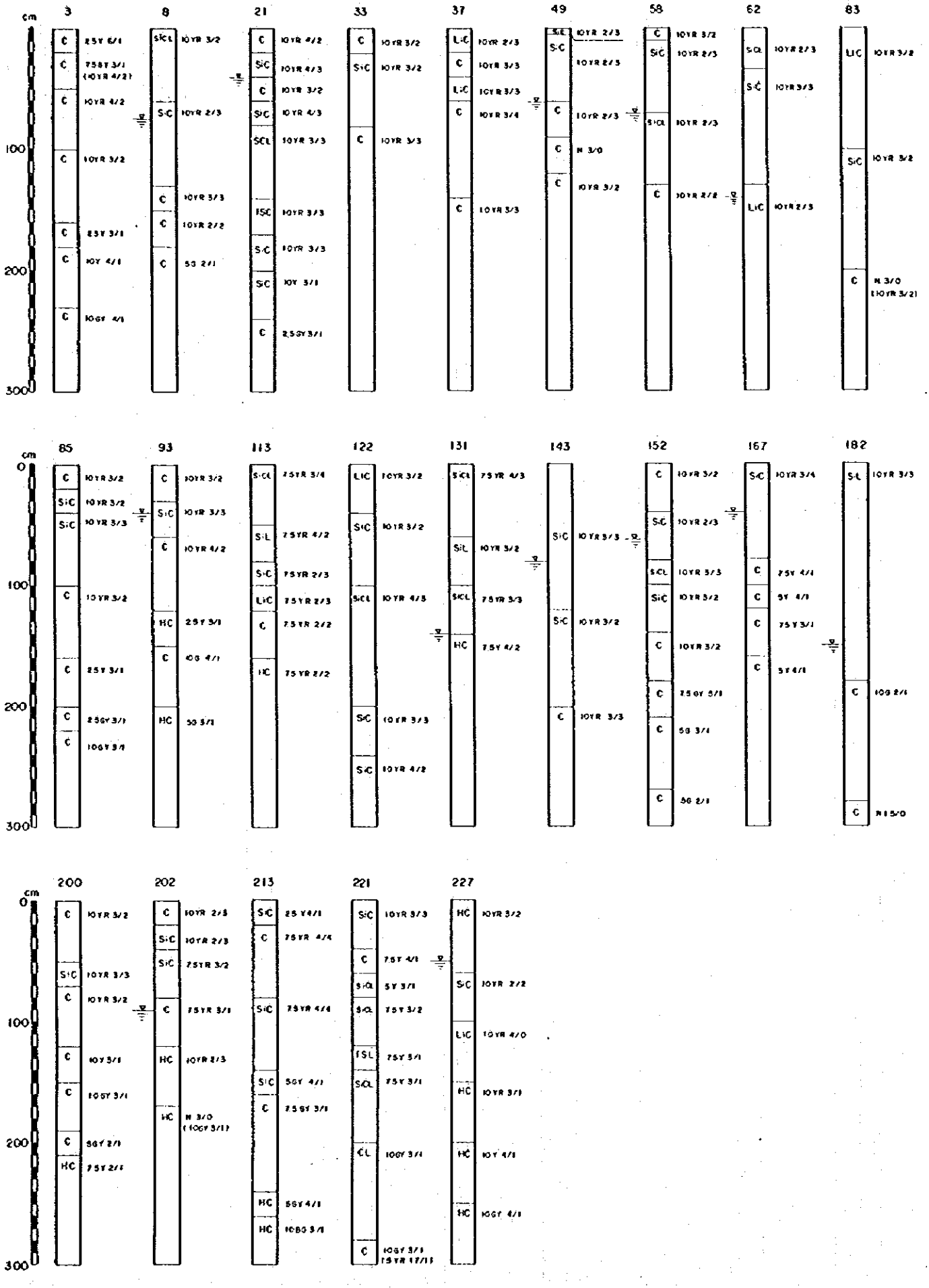
COLUMNAR SECTIONS OF SOIL PROFILES (5)



COLUMNAR SECTIONS OF SOIL PROFILES (6)



COLUMNAR SECTIONS OF SOIL PROFILES (7)



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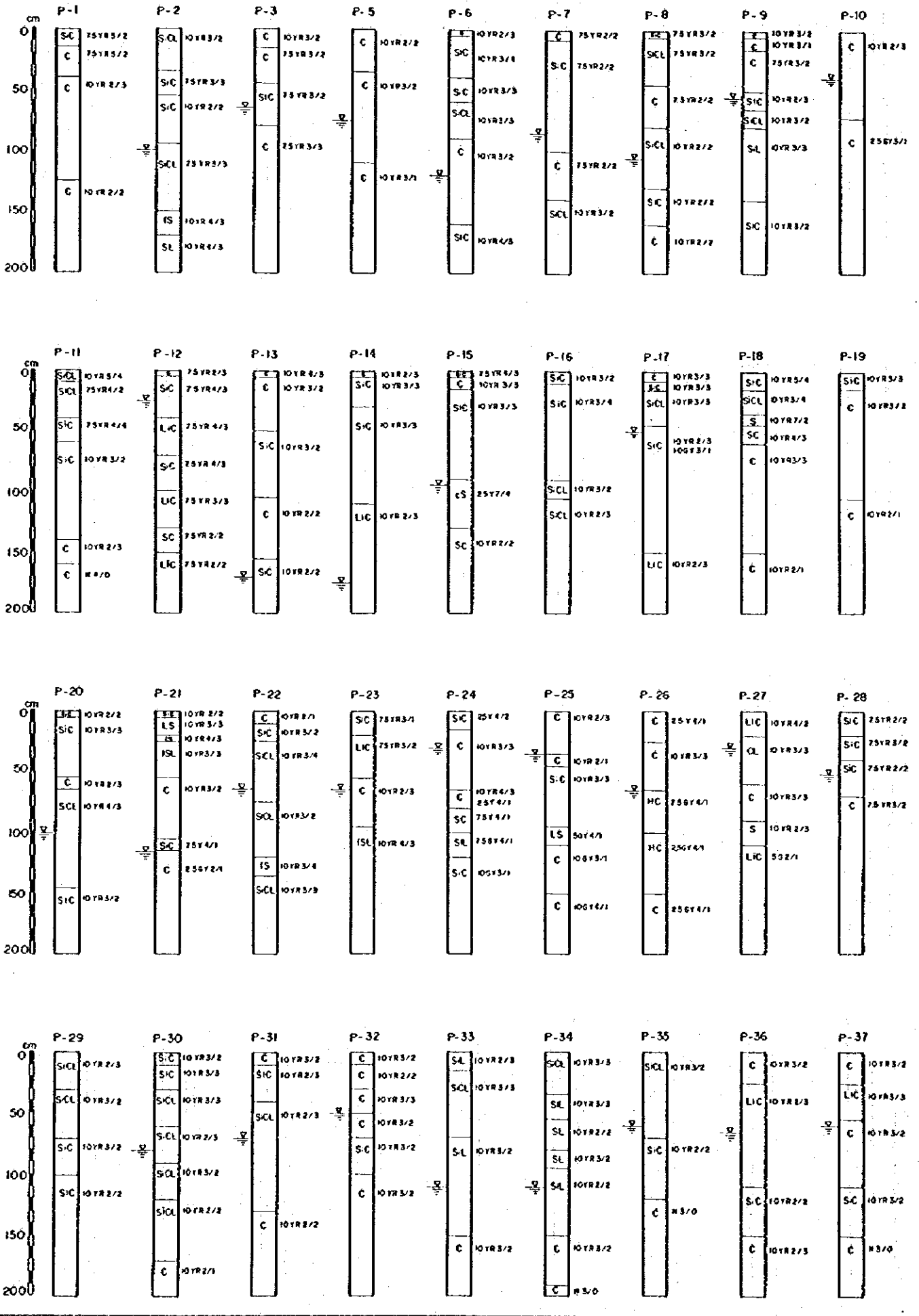
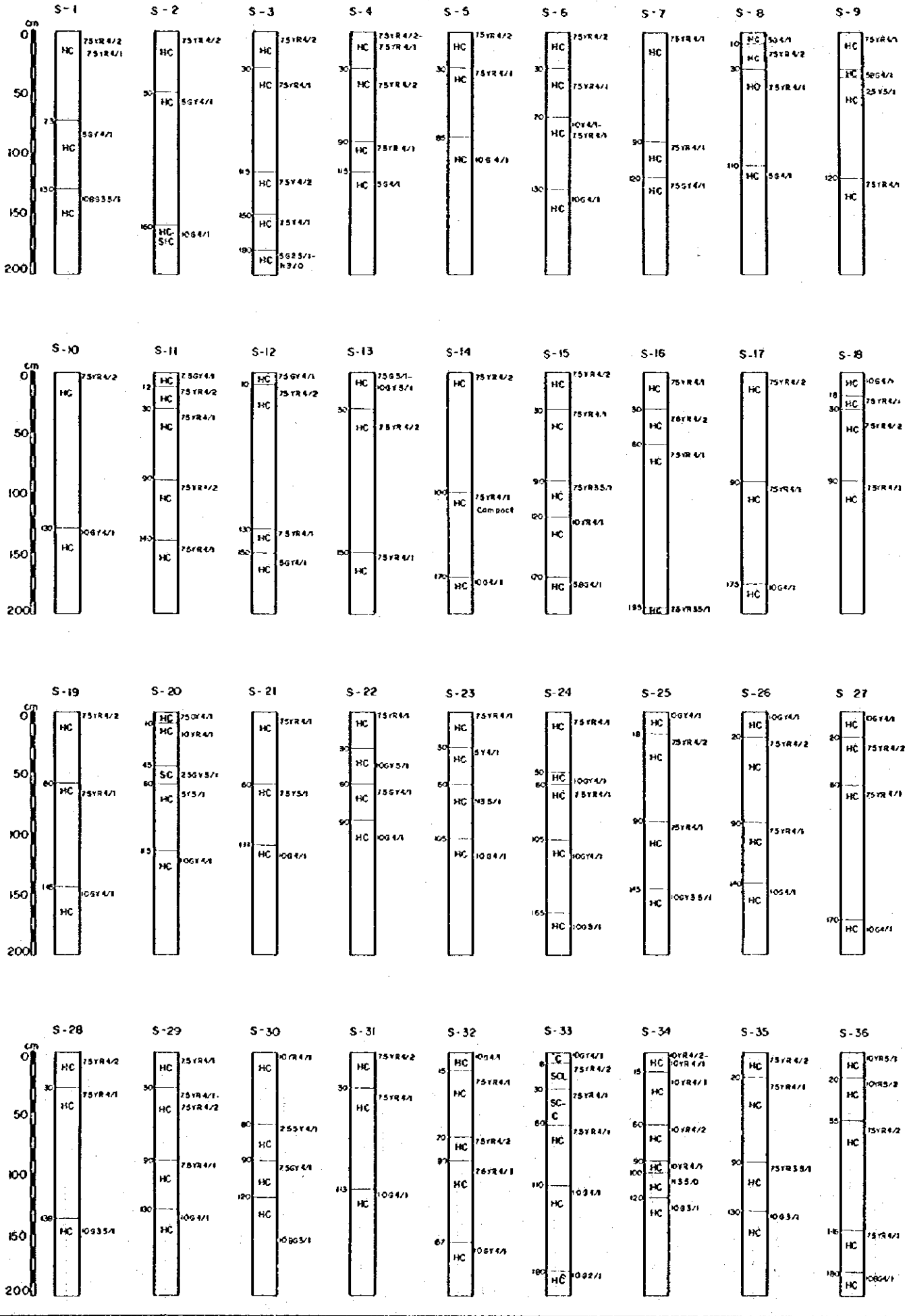
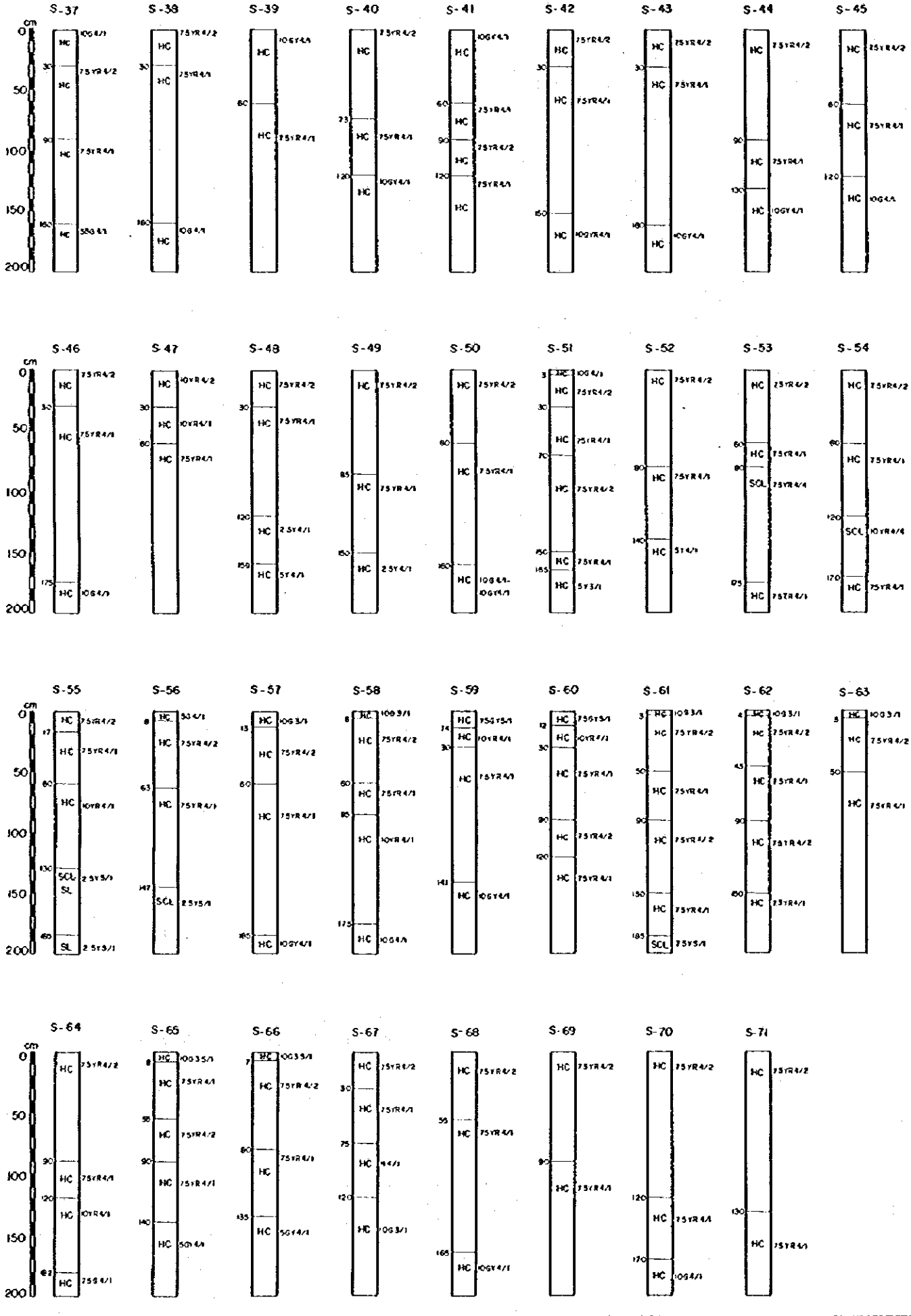


COLUMNAR SECTIONS OF SOIL PROFILES (9)



COLUMNAR SECTIONS OF SOIL PROFILES (10)



A.6.2. Results of Soil Analysis

The results of complete analysis are shown in Table A-9, and those of ECe and pH measurement in Table A-10. In addition, the results of soil analysis conducted during the Phase I Study are summarized in Table A-11. As regards soil physical properties, the results of three phase distribution and soil moisture content are shown in Figure A-21, Table A-12, and Table A-13, respectively.

In general, these results can be summarized as below;

pH : Most soils show neutral or slightly alkaline reaction having the pH values within a range from 7.0 to 8.0.

ECe : Most soils fall into a category of highly salinized soils, that is, the EC values of saturation extract are more than 16 mS/cm.

Soluble Ions:
The predominant cation and anion are sodium and chloride, respectively.

CEC : Every soil shows high CEC value, more than 20 meq/100g soil. The highest value is about 40 meq/100g soil.

ESP : The ESP values were calculated from the exchangeable sodium as a percentage of the CEC. Some soils fall into a category of alkali soils, that is, the ESP values exceed 15%.

Mechanical Analysis:
The textural class of all soils belongs to clayey. The percentages of clay fraction range from 44 to 76%.

CaCO3: The $CaCO_3$ content ranges from 0.8 to 5.6%

Gypsum: The gypsum content varies widely from 0.2 to 8.6% with an exception of extremely high value (13.5%) of surface layer.

Total-N: Total nitrogen contents are low. The highest value is still less then 0.1%.

Available-P:
Available phosphorus contents are moderately low; that is, 6 to 30 ppm P_2O_5.

Organic Matter : Most soils contain scarce organic matter, that is, less than one percent. The values are ranging from 0.4 to 2.0%.

Bulk Density:

Average values of the bulk density range from 1.2 to 1.4 g/cm^3.

Soil Moisture:

Moisture contents at saturation range from 55 to 75% and those at field capacity range from 30 to 40% in most dryland soils.

Most soils have large proportions of solid and liquid phases, that is, 40 - 50% and 30 - 40%, respectively. Vapor phase occupies only 10 - 20% in the surface layer (0 - 40 cm below the surface).

Table A-9 Results of Complete Analysis (1)

No.	Depth (cm)	S.P. (%)	pH	EC (mS/cm)	Mechanical Analysis				CaCO3 (%)	Gypsum (%)	Soluble Anions and Cations							Exchangeable Cations			CEC meq/100g	ESP (%)	T-N (%)	Av-P (ppm)	Org.M. (%)
					Clay (%)	Silt (%)	Sand (%)	Texture			HCO3	Cl (meq/litter)	SO4	Ca	Mg	Na	K	Na (meq/100g soil)	K	Ca+Mg					
P-1	0- 15	100	7.8	22.5	68	20	12	C	5.2	4.9	2.5	249	42.4	78.0	6.6	208	1.2	5.0	0.3	27.7	33.0	16.6	0.099	14	2.00
	15- 40	75	7.6	25.2	64	24	12	C	1.4	1.8	2.3	184	140.9	41.6	33.6	250	2.0	6.0	0.3	26.7	33.0	18.2	0.030	6.5	0.57
	40- 56	65	7.3	52.5	44	36	20	C	1.6	2.7	2.8	537	208.0	135.2	109.2	500	3.8	2.3	0.55	23.55	26.4	8.7	0.031	10	0.60
	56-125	62	7.2	87.1	56	32	12	C	0.8	0.4	1.3	1,056	191.5	208.0	233.8	800	5.0	2.0	0.25	27.75	30.0	6.7	0.038	16.5	0.76
	125-200	70	7.55	68.0	48	32	20	C	2.0	1.2	1.7	739	239.0	124.8	119.6	730	5.2	2.3	0.35	24.35	27.0	8.5	0.038	22.5	0.77
P-2	0- 35	65	7.45	68.0	52	32	16	C	1.2	1.1	1.1	768	219.0	124.8	148.6	710	4.9	2.45	0.4	20.9	23.4	10.5	0.025	8	0.50
	35- 55	70	7.55	69.5	52	32	16	C	1.2	2.8	1.7	672	335.0	93.6	132.0	780	3.8	2.4	0.2	26.2	28.8	8.3	0.024	28	0.50
	55- 95	75	7.3	49.3	56	32	12	C	1.2	1.3	2.1	624	75.1	114.4	148.8	435	3.0	2.8	0.15	25.85	28.8	9.7	0.050	10.5	0.96
	95-150	80	7.35	84.0	52	32	16	C	0.8	1.3	0.8	1,018	215.8	124.8	180.6	920	9.2	4.4	0.25	25.35	30.0	14.6	0.036	12	0.72
	150-200	65	7.5	45.7	48	36	16	C	2.4	1.9	1.3	480	161.7	93.6	56.8	490	2.5	8.35	0.45	18.1	27.0	30.9	0.052	15.5	1.04
P-3	0- 15	67	7.6	38.8	48	40	12	C	2.0	5.6	1.1	384	154.3	82.3	53.1	400	3.2	10.4	0.35	16.25	27.0	28.5	0.0475	8	0.95
	15- 45	75	7.6	42.9	52	28	20	C	0.8	2.1	1.1	384	214.9	98.8	9.2	490	2.0	2.65	0.25	22.9	25.8	10.2	0.023	13.5	0.45
	45- 80	70	7.35	26.0	48	32	20	C	0.8	0.5	1.1	228	116.4	83.2	10.8	250	1.5	3.5	0.15	21.55	25.2	13.9	0.019	15	0.38
	80-200	70	7.6	45.0	48	32	20	C	1.2	0.8	1.3	480	151.6	104.0	69.9	455	4.0	1.75	0.2	23.85	25.8	6.8	0.021	9	0.45
P-4	0- 25	75	7.45	47.0	48	32	20	C	1.2	4.5	1.3	442	219.5	72.8	87.0	500	3.0	2.9	0.3	22.60	25.8	11.2	0.022	8	0.50
	25- 72	70	7.5	49.2	44	36	20	C	1.6	0.5	1.1	538	161.5	124.8	72.6	500	3.3	2.4	0.15	26.25	28.8	8.3	0.024	30	0.48
	72-140	67	7.3	72.9	56	28	16	C	1.6	0.2	1.7	787	278.3	104.0	248.0	710	5.0	3.4	0.4	21.40	25.2	13.6	0.035	30	0.72
P-5	0- 20	70	7.45	54.0	64	24	12	C	0.8	1.2	2.1	624	139.5	119.6	153.0	490	3.0	2.35	0.25	33.4	36.0	6.5	0.039	14.5	0.77
	20- 35	70	7.35	47.4	60	24	16	C	0.8	1.2	1.1	509	158.9	114.4	120.6	430	4.0	2.9	0.2	23.9	27.0	10.7	0.033	12.5	0.66
	35- 70	62	7.15	88.2	48	32	20	C	1.2	1.6	1.3	1,084	256.5	187.6	288.1	860	6.5	2.6	0.35	24.05	27.0	9.6	0.037	24.5	0.76
	70-110	55	7.2	92.3	52	28	20	C	1.0	1.5	1.7	1,286	223.3	171.6	157.4	1,275	7.0	2.7	0.45	23.25	26.4	10.2	0.050	30	1.02
	110-200	75	7.4	45.0	60	28	12	C	1.2	0.2	1.5	432	296.1	135.2	90.4	400	4.0	2.4	0.5	26.5	29.4	8.2	0.030	29	0.66
P-6	0- 40	71	7.25	32.2	60	28	12	C	1.2	0.4	0.78	400	24.1	78.1	96.6	220	1.2	5.4	0.15	25.5	31.0	17.35	0.037	30	0.76
	40- 60	80	7.65	35.2	76	8	16	C	2.0	0.4	0.59	420	24.1	23.9	79.8	340	2.0	3.6	0.2	29.8	33.6	10.7	0.044	30	0.89
	60- 90	54	7.0	82.1	48	32	20	C	2.6	1.7	0.59	1,700	70.5	315.7	628.9	825	1.5	2.25	0.15	20.40	22.8	9.9	0.069	24	1.37
	90-130	62	7.35	43.0	52	12	36	C	2.0	1.5	0.59	675	6.5	92.2	138.2	450	1.7	2.7	0.3	21.00	24.0	11.25	0.064	22	1.285
	130-150	55	7.15	42.8	44	20	36	C	0.6	1.9	0.98	560	49.6	91.1	147.0	370	2.5	2.65	0.35	18.60	21.6	12.3	0.039	30	0.78
P-7	0- 5	55	7.2	57.5	52	22	26	C	1.2	13.5	0.39	805	110.5	119.4	193.5	600	3.0	3.4	0.1	22.9	26.4	12.9	0.050	29.5	0.99
	5- 55	55	7.05	54.9	52	24	24	C	1.8	1.7	0.98	460	45.2	50.8	83.2	360	2.2	1.8	0.15	20.05	24.0	7.5	0.060	15	1.23
	55-100	65	7.25	21.6	60	20	20	C	0.8	0.9	0.98	250	29.1	49.8	78.8	150	1.5	3.1	0.2	35.3	38.6	8.3	0.060	27	0.745
	100-130	60	7.15	38.1	60	20	20	C	1.2	2.2	0.59	535	62.3	86.8	188.6	340	2.5	5.4	0.1	30.3	35.8	15.1	0.060	23.5	1.285
P-8	0- 5	55	7.05	53.3	52	32	16	C	0.8	8.6	0.98	750	115.3	162.8	202.0	500	1.5	3.5	0.1	28.0	31.6	14.5	0.040	21.5	0.79
	5- 45	65	7.55	23.9	64	22	14	C	0.8	0.5	0.78	280	28.5	28.2	60.1	220	1.0	2.8	0.15	26.45	29.4	9.5	0.027	30	0.56
	45- 80	55	7.25	48.6	52	32	16	C	1.2	0.4	0.59	730	79.5	86.8	151.3	570	2.0	4.65	0.1	26.85	31.6	14.7	0.037	18.5	0.73
	80-130	55	7.0	45.4	44	32	24	C	1.6	1.7	0.98	710	25.1	156.2	189.4	390	0.5	3.15	0.2	23.45	26.8	11.7	0.036	10	0.92

Results of Complete Analysis (2)

No.	Depth	S.P.	pH	EC	Mechanical Analysis				$CaCO_3$	Gypsum	Soluble Anions and Cations							Exchangeable Cations			CEC	ESP	T-N	Av-P	Org.M.
					Clay	Silt	Sand	Texture			HCO_3	Cl	SO_4	Ca	Mg	Na	K	Na	K	Ca+Mg					
P-9	0- 15	60	7.25	34.0	44	36	20	C	1.2	1.4	0.75	275	131.8	59.7	116.9	230	1.0	3.2	0.2	23.6	27.0	11.85	0.040	26.5	0.79
	15- 50	55	7.0	67.2	48	32	20	C	0.8	4.3	0.59	1,075	70.0	206.2	331.4	600	3.0	2.6	0.1	20.1	22.8	11.2	0.060	30	1.22
	50- 80	55	7.0	57.6	48	36	16	C	1.2	4.4	1.17	890	27.3	238.7	277.8	400	2.0	4.0	0.25	20.95	25.2	15.8	0.060	25	1.24
	80-140	60	7.2	22.0	64	20	16	C	1.0	1.0	0.59	305	26.0	32.6	108.0	200	1.0	4.0	0.25	26.95	31.2	12.8	0.050	20.5	1.01
P-10	0- 25	87	7.5	41.2	68	16	16	C	2.8	3.6	0.78	509	75.1	54.3	128.1	400	2.5	3.0	0.15	28.25	31.4	9.5	0.057	23.5	1.15
	25- 72	59	7.45	31.2	44	40	16	C	0.4	0.1	0.48	405	19.3	22.8	90.5	310	2.0	3.4	0.35	22.65	26.4	13.0	0.020	22.5	0.42
	72-140	65	7.35	47.6	60	24	16	C	1.2	1.2	0.59	710	22.3	82.5	147.9	500	2.5	3.0	0.35	26.45	29.8	10.1	0.030	15	0.64
P-11	0- 8	67	7.3	30.6	48	32	20	C	1.2	8.6	0.59	390	13.3	64.1	93.3	245	1.5	5.8	0.2	21.8	27.8	20.8	0.020	20	0.45
	8- 40	64	7.35	33.8	56	30	14	C	1.3	0.8	1.17	490	9.8	81.5	133.5	285	1.0	5.2	0.2	20.4	25.8	20.3	0.028	19.5	0.56
	40- 60	61	7.2	26.5	52	32	16	C	1.8	3.1	0.78	320	49.6	52.1	82.3	235	1.0	3.7	0.2	21.9	25.8	14.3	0.026	7	0.53
	60-140	58	7.65	33.7	48	40	16	C	0.8	0.3	0.59	400	43.6	58.5	43.2	340	1.5	3.1	0.25	22.45	25.8	12.0	0.019	12.5	0.38
	140-200	71	7.4	21.5	52	28	20	C	0.8	1.3	0.78	255	38.3	28.2	125.4	140	0.5	3.2	0.1	22.5	25.8	12.4	0.050	7	0.99
P-12	0- 40	59	7.25	34.2	52	32	16	C	1.2	1.3	0.78	460	27.9	78.1	119.6	290	1.0	2.6	0.15	23.05	25.8	10.1	0.022	10.5	0.45
	40- 70	71	7.1	36.6	48	34	18	C	1.5	3.6	0.98	500	25.8	64.1	60.7	400	2.0	3.0	0.2	22.6	25.8	11.8	0.020	10.5	0.42
	70-100	59	7.35	25.5	64	22	14	C	1.8	1.7	1.4	340	48.9	56.4	152.9	180	1.0	3.1	0.25	25.85	29.2	10.6	0.028	14	0.57
	100-130	56	7.15	130.1	40	36	24	C	2.0	0.7	1.17	425	17.3	76.0	116.0	250	1.5	3.8	0.1	21.9	25.8	14.7	0.035	11.5	0.70
	130-200	61	7.5	22.3	52	28	20	C	0.8	0.3	1.17	265	10.4	47.7	57.9	170	1.0	2.8	0.2	21.0	24.0	11.6	0.022	18	0.44
S-4	0 - 30	75	7.6	32.4	56	24	20	C	2.4	1.0	1.9	380	59.0	72.8	82.2	284	2.0	4.3	0.15	21.35	25.8	16.6	0.060	11	1.20
	30 --60	95	7.7	20.7	64	16	20	C	0.8	2.9	1.3	230	37.7	52.0	37.3	178	1.7	4.5	0.15	25.35	29.0	15.5	0.600	15	1.14
	60 - 90	100	7.7	45.7	64	12	24	C	4.0	0.7	2.0	476	162.4	114.0	83.4	430	4.0	4.0	0.2	25.6	29.8	13.4	0.073	14.5	1.45
S-6	0 - 30	75	7.65	35.0	60	16	24	C	2.8	1.6	1.7	322	151.5	90.5	102.2	280	2.5	4.25	0.2	24.05	28.4	15.0	0.062	18	1.24
	30 - 60	100	7.95	34.5	64	16	20	C	5.6	0.4	1.7	354	113.4	62.4	73.9	330	2.8	4.2	0.15	25.75	30.0	14.0	0.070	20	1.40
	60 - 90	90	7.75	37.0	56	20	24	C	2.4	0.4	2.3	400	105.2	83.2	71.9	350	2.4	2.6	0.15	23.05	25.8	10.1	0.050	16	1.02
S-27	0 - 30	110	7.75	36.2	64	16	20	C	3.2	2.0	2.5	351	142.5	57.2	121.4	315	2.4	3.75	0.3	27.75	31.8	11.8	0.064	12	1.30
	30 - 60	120	7.85	23.0	60	20	20	C	5.6	1.0	1.7	248	46.0	26.0	68.0	200	2.0	4.6	0.3	24.1	29.0	15.8	0.060	11.5	1.30
	60 - 90	110	7.9	28.6	60	20	20	C	3.6	0.6	1.5	300	77.5	31.2	80.8	265	2.0	3.65	0.35	25.4	29.4	12.4	0.058	7	1.16
S-28	0 - 30	85	7.55	49.1	59	16	32	C	1.6	3.0	1.7	572	128.0	46.8	151.0	500	4.0	2.7	0.2	22.9	25.8	10.4	0.070	9	1.40
	30 - 60	120	7.7	38.8	68	16	16	C	2.0	0.7	1.2	395	141.3	52.0	112.5	370	3.0	5.1	0.35	32.15	37.6	13.6	0.055	18	1.10
	60 - 90	110	7.7	36.0	64	16	20	C	2.0	1.9	1.7	360	132.3	52.0	89.0	350	3.0	4.3	0.35	31.8	36.4	11.8	0.059	22	1.20
S-35	0 - 30	12.5	7.7	33.5	64	16	20	C	2.0	0.8	2.1	332	119.0	72.8	77.6	300	2.5	3.55	0.45	37.1	33.1	10.7	0.048	8	0.965
	30 - 60	120	7.6	42.4	64	16	20	C	1.6	1.3	1.3	438	148.1	62.4	120.9	400	3.7	5.5	0.45	23.95	29.9	18.4	0.054	12	1.075
	60 - 90	112.5	8.0	26.5	60	20	20	C	3.6	0.2	1.5	276	71.0	26.0	77.4	245	2.1	3.4	0.4	24.2	28.0	12.1	0.050	14	1.03
S-44	0 - 30	90	7.65	32.6	60	20	20	C	2.4	1.1	1.5	300	135.5	78.0	86.5	270	2.3	4.2	0.3	22.9	27.4	15.3	0.048	6	0.95
	30 - 60	125	8.0	30.1	68	16	16	C	4.8	2.0	2.3	305	87.7	67.7	54.6	270	2.8	3.75	0.3	28.35	32.4	11.6	0.070	7.5	1.32
	60 - 90	90	7.8	45.9	64	16	20	C	2.4	0.2	2.5	464	180.8	83.2	100.0	460	4.1	2.8	0.45	28.15	31.4	8.9	0.056	8	1.12

Table A-10 PH and Salinity

No.	Depth (cm)	SP (%)	PH	EC (mS/cm)
1	0-30	70	7.3	25.4
	30-60	74	7.25	26.2
2	0-30	67	7.3	25.5
	30-60	64	7.2	51.2
4	0-30	55	7.3	83.9
	30-60	50	7.1	77.3
5	30-60	65	7.3	23.5
6	0-30	80	7.1	19.6
	30-60	75	7.2	21.1
15	0-30	75	7.7	61.5
	30-60	50	7.9	68.3
16	0-30	53	7.05	44.7
	30-60	58	7.1	50.3
17	0-30	63	7.05	28.6
	30-60	70	7.1	34.4
18	0-30	53	7.05	65.2
	30-60	80	7.15	53.0
19	0-30	66	7.05	44.3
	30-60	66	7.1	38.0
20	0-30	81	7.4	17.0
	30-60	75	7.15	14.8
22	0-30	73	7.6	44.5
	30-60	68	7.15	28.8
24	0-30	70	7.4	53.5
	30-60	72	7.3	45.1
25	0-30	100	7.25	49.5
	30-60	74	7.5	32.5
26	0-30	62	7.15	60.0
	30-60	66	7.35	51.0
27	0-30	63	7.2	62.8
	30-60	70	7.15	74.0
28	0-30	50	7.2	54.0
	30-60	54	7.1	56.9
29	0-30	62	7.0	40.3
	30-60	62	6.85	63.3
30	0-30	85	8.0	22.9
	30-60	75	8.0	16.7
31	0-30	75	7.1	75.3
	30-60	65	7.4	31.8
32	0-30	90	7.4	30.8
	30-60	70	7.8	53.1
33	0-30	52	7.0	100.0
	30-60	63	7.25	88.0
34	0-30	100	8.0	30.6
	30-60	80	7.8	35.9
35	0-30	65	8.1	33.1
	30-60	70	8.1	30.3
36	0-30	75	8.2	30.6
	30-60	71	8.1	18.5
37	0-30	57	7.25	11.8
	30-60	97	7.4	7.6
38	0-30	70	7.4	62.6
	30-60	65	7.4	34.0
39	0-30	62.5	7.4	23.3
	30-60	90	7.7	23.3
40	0-30	62.5	7.7	59.4
	30-60	70	7.2	34.0
41	0-30	65	7.85	58.0
	30-60	50	7.6	69.5
42	0-30	50	7.6	45.8
	30-60	77	7.35	37.2
43	0-30	60	7.65	64.9
	30-60	60	7.8	42.3
44	0-30	67	7.35	40.7
	30-60	70	7.4	43.8
45	0-30	86	7.4	19.1
	30-60	87	7.4	38.3
46	0-30	84	7.55	25.4
	30-60	72	7.05	44.8
47	0-30	74	7.15	32.5
	30-60	94	7.4	30.6
50	0-30	63	7.05	23.0
	30-60	66	7.7	22.0
51	0-30	58	7.2	39.0
	30-60	54	7.0	53.8
52	0-30	42	7.0	87.5
	30-60	70	7.4	35.3
53	0-30	87.5	7.6	46.4
	30-60	77	7.35	21.4
54	0-30	50	7.8	22.9
	30-60	74	7.3	21.2
55	0-30	77.5	7.9	46.0
	30-60	58	8.0	50.2
56	0-30	80	8.0	36.9
	30-60	70	7.25	14.4
57	0-30	90	7.9	22.6
	30-60	57.5	7.5	70.7
59	0-30	62	7.1	40.7
	30-60	60	7.15	41.3
60	0-30	62	7.25	39.0
	30-60	58	7.2	54.6
61	0-30	52	7.1	54.0
	30-60	56	7.0	74.5
63	0-30	92	7.6	27.2
	30-60	60	7.05	76.3
64	0-30	65	7.5	41.9
	30-60	75	7.2	19.0
65	0-30	80	7.7	27.2
	30-60	51	7.05	13.9
66	0-30	60	7.8	47.1
	30-60	77	7.55	21.3
67	0-30	60	7.8	47.1
	30-60	80	7.6	30.9
68	0-30	50	7.7	62.1
	30-60	55	7.9	50.4
69	0-30	51	7.25	31.6
	30-60	52	7.15	50.4
72	0-30	75	7.6	26.5
	30-60	70	7.4	37.1
73	0-30	55	7.1	29.7
	30-60	70	7.4	18.0
74	0-30	59.5	7.1	32.9
	30-60	70	7.5	72.1
75	0-30	84	7.35	25.3
	30-60	40	7.0	104.5
76	0-30	50	7.8	95.6
	30-60	40	7.9	67.7
77	0-30	50	7.6	36.2
	30-60	55	7.2	51.8
78	0-30	75	7.35	7.2
	30-60	67	7.5	11.9
79	0-30	67.5	7.9	48.0
	30-60	56	7.45	29.0
80	0-30	70	7.2	21.2
	30-60	55	7.1	29.7
81	0-30	60	7.1	44.6
	30-60	57.5	7.1	31.8
82	0-30	70	7.3	21.2
	30-60	70	7.1	48.8
84	0-30	58	7.05	40.1
	30-60	40	7.0	75.1
86	0-30	36	7.4	111.0
	30-60	68	7.35	36.3
87	0-30	59	7.15	49.1
	30-60	48	7.0	84.5
88	0-30	66	7.2	38.3
	30-60	63	7.05	52.4
90	0-30	87.5	7.8	45.8
	30-60	65	7.55	10.4
91	0-30	60	7.35	16.1
	30-60	61	7.45	25.7

PH and Salinity (2)

No.	Depth (cm)	SP (%)	PH	EC (mS/cm)	No.	Depth (cm)	SP (%)	PH	EC (mS/cm)	No.	Depth (cm)	SP (%)	PH	EC (mS/cm)	No.	Depth (cm)	SP (%)	PH	EC (mS/cm)
92	0-30	77.5	7.8	26.2	111	0-30	67	7.2	39.4	131	0-30	77	7.3	82.8	151	0-30	83	7.6	9.4
	30-60	65	7.9	38.5		30-60	62	7.3	30.0		30-60	58.5	7.2	61.8		30-60	65	7.4	14.7
93	0-30	65	7.1	46.6	113	0-30	70	7.15	14.8	133	0-30	57	7.2	18.5	152	0-30	50	7.15	31.0
	30-60	65	7.35	20.0		30-60	55	7.2	6.6		30-60	50	7.1	55.7		30-60	70	7.3	14.3
94	0-30	70	7.1	74.3	115	0-30	70	8.0	9.7	134	0-30	63	7.3	44.6	153	0-30	46	7.5	62.9
	30-60	80	7.1	63.7		30-60	85	7.15	14.7		30-60	58	7.2	54.0		30-60	54	7.7	21.0
95	0-30	62.5	7.0	69.0	116	0-30	60	7.0	52.9	135	0-30	68	7.0	51.9	154	0-30	61	7.6	35.6
	30-60	65	7.1	78.5		30-60	66	7.2	35.2		30-60	69	7.5	26.0		30-60	55	7.4	22.0
96	0-30	67.5	7.2	95.5	117	0-30	77.5	7.6	29.7	136	0-30	88	7.3	39.1	155	0-30	60	7.6	57.0
	30-60	70	7.1	42.4		30-60	57	7.3	36.1		30-60	74	7.35	57.4		30-60	46	7.8	69.4
97	0-30	65	7.2	31.8	118	0-30	60	7.3	76.4	137	0-30	84	7.35	54.1	157	0-30	66	7.4	20.5
	30-60	65	7.1	42.4		30-60	80	7.5	40.3		30-60	78	7.25	52.5		30-60	62	7.6	24.8
98	0-30	66	8.1	44.2	119	0-30	80	7.7	30.8	138	0-30	74	7.25	28.2	158	0-30	63	7.4	26.3
	30-60	67	8.0	36.4		30-60	75	7.6	42.4		30-60	86	7.4	34.6		30-60	61	7.2	60.4
99	0-30	60	7.35	37.2	120	0-30	50	7.2	20.0	139	0-30	72	7.2	18.1	159	0-30	68	7.3	38.6
	30-60	61	7.45	25.0		30-60	90	7.0	34.4		30-60	55	7.4	31.2		30-60	54	7.2	51.8
100	0-30	70	7.5	37.1	121	0-30	75	7.0	31.3	140	0-30	62	7.3	17.9	160	0-30	80	7.7	30.5
	30-60	62.5	7.2	42.4		30-60	62.5	7.6	65.5		30-60	79	7.3	51.7		30-60	75	7.35	13.4
101	0-30	70	7.4	22.3	122	0-30	65	7.1	38.4	141	0-30	45	7.2	73.6	161	0-30	50	8.0	37.7
	30-60	75	7.1	53.1		30-60	49	7.35	40.6		30-60	40	7.1	80.2		30-60	45	7.5	44.7
102	0-30	65	7.5	65.5	123	0-30	55	7.1	34.0	142	0-30	55	7.0	49.3	162	0-30	95	8.1	12.2
	30-60	75	7.15	16.4		30-60	70	7.6	31.8		30-60	64	7.1	39.0		30-60	85	7.2	23.8
103	0-30	55	7.6	54.7	124	0-30	70	7.4	31.8	144	0-30	80	7.8	19.5	163	0-30	47.5	7.2	25.7
	30-60	71	7.3	19.8		30-60	70	7.3	41.4		30-60	85	7.6	59.7		30-60	77	7.3	62.2
104	0-30	70	7.05	11.9	125	0-30	70	7.6	23.3	145	0-30	49	7.0	99.7	164	0-30	75	7.5	82.2
	30-60	70	7.0	10.7		30-60	65	7.2	29.7		30-60	41	7.05	42.9		30-60	72	7.7	31.2
105	0-30	75	7.4	36.1	126	0-30	75	7.0	16.1	146	0-30	56	7.35	35.2	165	0-30	60	7.8	24.1
	30-60	65	7.3	40.3		30-60	67	7.05	26.4		30-60	72	7.0	19.4		30-60	57	7.05	60.3
106	0-30	45	7.0	74.5	127	0-30	90	7.7	24.1	147	0-30	85	7.1	14.9	166	0-30	66	7.2	30.4
	30-60	76	7.25	36.5		30-60	80	7.6	34.1		30-60	88	7.45	19.5		30-60	53	7.1	37.4
108	0-30	66	7.1	87.6	128	0-30	67	7.1	22.6	148	0-30	46	7.2	56.4	167	0-30	53	7.0	61.1
	30-60	60	7.0	68.5		30-60	51	7.25	21.6		30-60	80	7.4	31.5		30-60	66	7.15	35.3
109	0-30	66	7.0	39.5	129	0-30	65	7.3	34.4	149	0-30	75	7.25	26.8	168	0-30	60	7.0	40.6
	30-60	63	7.0	67.7		30-60	70	7.35	29.6		30-60	83	7.0	16.4		30-60	66	7.25	38.6
110	0-30	56	7.4	54.7	130	0-30	54	7.3	98.0	150	0-30	70	7.4	9.5	169	0-30	65	8.0	12.9
	30-60	67	7.1	57.0		30-60	59	7.4	66.0		30-60	55	7.6	35.8		30-60	63	7.3	22.2

PH and Salinity (3)

No.	Depth (cm)	SP (%)	PH	EC (mS/cm)
170	0-30	70	8.1	8.3
	30-60	67	7.9	16.4
171	0-30	80	7.8	38.2
	30-60	45	7.6	61.1
172	0-30	66	7.5	19.8
	30-60	50	7.3	70.3
173	0-30	67	8.1	15.6
	30-60	57	7.6	55.7
174	0-30	45	7.1	35.4
	30-60	57	7.7	44.1
175	0-30	54	7.1	53.9
	30-60	59	7.3	103.6
176	0-30	66	7.0	36.2
	30-60	54	7.1	68.5
177	0-30	66	7.05	64.3
	30-60	46	7.0	90.1
178	0-30	55	8.4	59.6
	30-60	62	7.0	59.7
179	0-30	67	7.7	36.3
	30-60	60	7.15	34.6
180	0-30	37.5	7.5	79.9
	30-60	76	7.45	12.9
181	0-30	85	7.9	33.9
	30-60	67	7.25	10.3
182	0-30	50	7.7	107.2
	30-60	86	7.35	15.3
183	0-30	77	7.4	16.5
	30-60	63	7.3	26.9
184	0-30	59	7.1	48.8
	30-60	50	7.3	24.0
185	0-30	75	7.2	39.7
	30-60	65	7.25	30.5
186	0-30	65	8.0	36.6
	30-60	70	7.15	11.7
187	0-30	63	7.6	9.1
	30-60	60	7.6	106.2
188	0-30	52.5	7.9	26.1
	30-60	60	7.45	19.2
189	0-30	40	7.25	31.4
	30-60	63	7.1	42.0
190	0-30	63	7.3	55.5
	30-60	53	7.25	49.4
191	0-30	76	7.25	37.9
	30-60	53	7.85	45.9
192	0-30	80	7.65	8.4
	30-60	66	7.65	24.6
193	0-30	80	7.45	16.1
	30-60	93	7.5	11.9
194	0-30	65	7.8	12.2
	30-60	70	7.8	19.0
195	0-30	83	7.45	13.1
	30-60	77.5	7.9	45.5
196	0-30	71	8.2	34.6
	30-60	66	8.2	27.5
197	0-30	53	7.5	16.4
	30-60	55	7.4	69.0
198	0-30	53	7.3	36.8
	30-60	54	7.4	81.8
199	0-30	80	7.9	17.9
	30-60	100	7.9	27.4
200	0-30	53	7.2	2.7
	30-60	82	7.6	28.6
201	0-30	57	7.2	28.9
	30-60	60	7.25	23.6
202	0-30	80	7.5	48.2
	30-60	65	7.25	16.9
203	0-30	62	7.3	20.5
	30-60	81	7.3	23.4
204	0-30	75	7.7	20.3
	30-60	70	7.8	23.7
205	0-30	75	7.25	26.8
	30-60	65	7.35	15.7
206	0-30	85	7.9	22.5
	30-60	70	7.25	26.2
207	0-30	65	7.35	37.8
	30-60	72	7.15	19.4
208	0-30	72	7.45	33.5
	30-60	72	7.4	29.8
209	0-30	67	7.15	18.2
	30-60	92	8.0	25.5
210	0-30	60	7.05	48.4
	30-60	75	7.45	37.4
211	0-30	65	7.0	27.7
	30-60	75	7.5	44.3
212	0-30	85	7.5	40.8
	30-60	70	7.6	60.9
213	0-30	90	7.05	9.3
	30-60	84	7.1	21.5
214	0-30	70	7.0	24.8
	30-60	65	7.1	14.8
216	0-30	64	7.0	17.0
	30-60	73	7.05	14.6
217	0-30	65	7.6	19.8
	30-60	70	7.35	22.2
218	0-30	63	7.0	22.0
	30-60	80	7.25	24.9
219	0-30	62	7.05	31.7
	30-60	81	7.25	16.8
220	0-30	65	7.2	21.6
	30-60	83	7.45	14.1
221	0-30	75	7.3	12.6
	30-60	83	7.4	15.8
222	0-30	75	7.6	32.0
	30-60	90	7.8	35.2
223	0-30	70	7.15	14.8
	30-60	55	7.2	6.6
224	0-30	80	7.45	4.6
	30-60	88	7.6	3.2
225	0-30	70	7.7	32.0
	30-60	75	7.35	7.9
226	0-30	75	7.3	24.8
	30-60	60	7.35	8.4
227	0-30	72	7.35	8.25
	30-60	73	7.45	16.0
228	0-30	75	7.45	21.2
	30-60	62	7.15	42.1
229	0-30	90	7.9	24.9
	30-60	70	7.7	44.0
230	0-30	75	7.4	25.2
	30-60	62	7.15	46.2
231	0-30	65	7.2	49.5
	30-60	60	7.25	23.2
232	0-30	80	7.35	11.4
	30-60	65	7.25	13.4
233	0-30	60	7.25	56.9
	30-60	67	7.35	19.1
234	0-30	57	7.2	65.5
	30-60	75	7.4	17.3
235	0-30	60	7.15	33.0
	30-60	75	7.3	23.5

PH and Salinity (4)

No.	Depth (cm)	SP (%)	PH	EC (mS/cm)
S-1	0-30	100	8.0	12.9
	30-60	100	7.9	14.3
S-2	0-30	72	7.4	15.1
	30-60	55	7.3	19.5
S-3	0-30	90	8.3	50.9
	30-60	82	8.2	28.7
S-5	0-30	93	8.3	12.4
S-7	0-30	75	7.3	14.0
	30-60	80	7.9	32.1
S-8	0-30	75	7.2	12.9
	30-60	75	7.15	13.0
S-9	0-30	72	7.15	41.7
	30-60	63	7.25	34.1
S-10	0-30	75	7.9	27.5
	30-60	50	8.0	6.8
S-11	0-30	80	7.25	5.3
	30-60	85	7.15	16.5
S-12	0-30	90	8.2	35.9
	30-60	71	8.3	15.0
S-13	0-30	60	7.3	32.6
	30-60	70	7.25	19.3
S-14	0-30	80	7.15	6.6
	30-60	65	7.9	42.1
S-15	0-30	80	7.25	13.5
	30-60	66.5	8.2	20.4
S-16	0-30	80	7.3	12.8
	30-60	75	7.3	10.1
S-17	0-30	63.5	8.0	41.9
	30-60	75	7.2	10.0
S-18	0-30	68	7.05	43.0
	30-60	113	7.2	18.2
S-20	0-30	85	7.9	30.9
	30-60	85	7.7	39.2
S-21	0-30	90	7.8	64.8
	30-60	70	7.9	43.7
S-22	0-30	80	7.15	21.5
	30-60	100	8.1	15.2
S-23	0-30	93	8.0	20.4
	30-60	93	8.1	18.2
S-24	0-30	91	8.3	20.6
	30-60	87	8.0	31.9
S-25	0-30	87.5	8.0	38.1
	30-60	65	7.9	27.4
S-26	0-30	72	7.25	11.8
	30-60	57	7.8	55.5
S-29	0-30	85	8.1	26.9
	30-60	72.5	8.0	24.9
S-30	0-30	83	8.2	20.4
	30-60	82	7.35	11.3
S-32	0-30	60	8.0	19.3
	30-60	50	7.9	26.5
S-33	0-30	50	7.9	39.9
	30-60	70	7.15	6.8
S-34	0-30	92	8.0	21.7
	30-60	80	8.0	28.0
S-36	0-30	56	7.05	55.5
	30-60	66	7.25	43.5
S-37	0-30	88	7.55	26.4
	30-60	97	7.2	48.7
S-39	0-30	72	7.25	38.5
	30-60	76	7.15	27.1
S-41	0-30	66	7.15	46.8
	30-60	60	7.15	24.5
S-42	0-30	44	7.55	25.5
	30-60	66	7.2	57.8
S-47	0-30	88	7.15	32.9
	30-60	66	7.15	30.0
S-48	0-30	80	8.1	24.0
	30-60	90	7.8	9.0
S-49	0-30	65	6.85	28.2
	30-60	80	7.55	63.4
S-50	0-30	90	7.9	33.3
	30-60	75	7.6	11.5
S-65	0-30	80	7.2	10.0
	30-60	68	8.2	31.6
S-66	0-30	65	7.8	61.5
	30-60	65	7.8	22.5
S-69	0-30	80	7.9	34.4
	30-60	70	8.0	23.7
S-70	0-30	75	7.9	30.1
	30-60	60	7.7	29.9
S-71	0-30	60	8.0	15.5
	30-60	65	8.0	41.0

Table A-11 Summary of Soil Analysis(Phase I Study) (1)

No.	Depth (cm)	S.P. (%)	pH	EC (mS/cm)	Mechanical Analysis: Clay (%)	Silt (%)	Sand (%)	Texture	$CaCO_3$ (%)	Gypsum (%)	Soluble Anions and Cations (meq/litter): HCO_3	Cl	SO_4	Ca	Mg	Na	K	Exchangeable Cations (meq/100g soil): Na	K	Ca+Mg	CEC meq/100g	ESP (%)	Sol-N (ppm)	Sol-P (ppm)	Org.M. (%)
34	0- 15	60	8.1	81.4	50	35	15	C	2.5	0.4	1.3	1,290	334	134	450	1,040	1.4				19.5		33.8	4.5	
	15- 36	84	8.3	19.2	65	30	5	C	1.0	4.7	1.8	230	139	75	165	130	0.6				21.5		41.2	5.5	
	36- 80	81	8.2	28.7	70	25	5	C	0.4	10.8	1.8	381	193	85	200	290	0.6				-		-	-	
31	0- 5	40	8.4	146.6	25	70	5	SiL	0.7	8.7	0.9	2,210	622	583	920	1,328	2.2				-		-	-	
	5- 15	35	8.4	87.9	35	60	5	SiL	2.5	6.8	0.8	1,140	516	265	665	725	1.3				28.5		77.9	7.5	
	15- 35	70	8.0	63.5	65	30	5	C	1.6	1.4	0.9	930	337	180	424	662	1.2				42.0		27.9	6.0	
	35- 50	83	8.0	28.6	75	20	5	C	1.8	7.1	2.6	388	180	74	121	375	0.6				-		-	-	
36	0- 12	64	7.7	28.7	45	40	15	SiC	0.7	4.1	2.4	350	218	60	230	280	0.6				19.0		52.9	7.5	
	12- 40	62	8.0	24.9	45	50	5	SiC	0.8	1.2	3.3	365	127	37	83	375	0.5				-		-	-	
	40- 57	82	8.0	31.6	65	20	15	C	2.5	-	2.0	490	139	92	196	342	0.6				-		-	-	
	57- 90	83	8.1	21.1	60	25	15	C	6.9	-	2.4	220	200	83	147	192	0.4				-		-	-	
37	0- 10	77	7.2	95.8	50	35	15	C	1.4	1.4	1.5	1,499	414	192	356	1,365	1.1				18.5		70.6	7.5	
	10- 19	64	7.8	69.9	55	30	15	C	1.5	0.7	1.5	1,078	320	114	192	1,092	0.9				19.5		64.7	7.0	
28	0- 8	80	7.9	27.3	50	30	20	C	3.9	2.8	3.3	392	151	85	110	350	0.5				-		-	-	
	8- 17	75	7.9	36.7	35	25	40	CL	0.6	2.8	2.2	588	144	95	155	483	0.6				26.5		42.7	6.5	
	17- 37	78	7.8	56.6	50	15	35	C	1.8	0.7	2.2	790	340	368	202	561	0.8				-		-	-	
	37- 78	74	7.8	70.5	30	45	25	CL	0.3		3.3	1,065	342	425	245	739	1.0				-		-	-	
30	8- 25	86	8.2	14.7	60	25	15	C	3.1	0.7	3.2	148	62	17	56	140	0.4				31.0		44.1	6.0	
	25- 40	91	8.2	35.2	65	20	15	C	3.8	-	2.6	490	210	31	201	470	0.6				42.0		35.3	4.5	
	40- 55	93	8.2	7.3	65	20	15	C	2.3	0.5	3.2	42	28	15	32	26	0.2				40.0		30.9	4.5	
	55- 80	91	8.2	7.3	55	30	15	C	2.4	0.9	2.6	44	27	10	24	40	0.2				-		-	-	
35	0- 10	85	7.7	50.8	75	20	5	C	7.5	-	3.3	687	326	185	335	495	0.9				38.5		57.4	5.5	
	10- 45	72	7.3	15.3	75	20	5	C	1.1	8.1	3.0	137	80	18	72	130	0.3				-		-	-	
	60- 85	81	7.8	16.3	75	20	5	C	0.5	2.1	3.2	183	81	23	84	160	0.3				-		-	-	
	85-100	60	7.8	22.0	50	45	5	SiC	0.3	0.2	3.0	321	120	18	112	310	0.4				-		-	-	
42	1- 18	87	7.9	24.9	85	10	5	C	1.9	-	1.3	294	163	74	187	197	0.5				18.5		44.1	4.5	
	18- 44	84	8.4	8.6	80	15	5	C	1.4	1.5	2.2	50	33	12	36	37	0.3				-		-	-	
	44- 78	84	8.3	6.7	75	20	5	C	1.3	0.8	2.2	39	26	10	29	28	0.3				-		-	-	
	78-110	93	8.3	6.7	80	15	5	C	1.4	18.6	1.3	42	24	17	20	30	0.3				-		-	-	
5	0- 8	57	7.2	147.0	80	10	10	C	0.4	10.0	2.4	2,361	589	905	745	1,300	2.2				17.0		52.9	2.5	
	8- 42	67	7.4	85.5	60	30	10	C	0.8	10.4	2.2	1,364	345	373	627	710	1.2				-		-	-	
	42- 65	74	7.7	80.8	49	34	7	C	0.2	4.2	1.5	1,217	393	263	348	1,000	1.0				-		-	-	
	65-100	67	7.8	66.5	55	38	7	C	1.5	1.9	1.0	1,079	431	201	379	930	0.7				-		-	-	

Summary of Soil Analysis (Phase I Study) (2)

No.	Depth (cm)	S.P. (%)	pH	EC (mS/cm)	Mechanical Analysis: Clay (%)	Silt (%)	Sand (%)	Texture	$CaCO_3$ (%)	Gypsum (%)	Soluble Anions and Cations: HCO_3	Cl	SO_4	Ca	Mg	Na	K	Exchangeable Cations: Na	K	Ca+Mg	CEC meq/100g	ESP (%)	Sol-N (ppm)	Sol-P (ppm)	Org.M. (%)
											(meq/litter)							(meq/100g soil)							
16	0- 6	55	7.3	128.0	48	30	22	C	0.4	2.2	1.8	2,470	690	563	797	1,800	2.2				-		-	-	
	6- 25	35	7.4	111.6	20	52	28	SiL	0.6	15.4	2.4	2,055	456	514	572	1,425	2.0				17.5		47.1	4.0	
	25- 40	49	7.6	69.6	14	62	24	SiL	0.5	12.3	2.2	1,170	229	109	391	900	0.9				-		-	-	
	40- 55	41	7.6	69.7	12	62	26	SiL	2.0	1.2	1.9	1,015	371	120	339	928	0.9				-		-	-	
1	1- 4	67	7.2	144.4	60	33	7	C	0.3	9.6	3.3	1,964	814	403	761	1,774	2.4				-		-	-	
	4- 25	68	7.4	85.5	59	28	13	C	0.2	5.5	2.4	1,274	429	185	438	1,080	1.7				16.5		22.1	4.5	
	25- 65	62	7.6	66.5	52	38	10	C	0.9	10.7	2.2	1,078	215	196	74	1,025	1.1				16.0		32.4	7.5	
	65-110	61	8.1	62.8	52	18	8	SiC	0.4	6.9	2.9	990	263	142	306	825	1.0				-		-	-	
3	1- 5	73	7.3	78.9	59	34	7	C	0.8	9.7	2.6	1,160	403	251	394	920	1.4				-		-	-	
	5- 18	77	7.8	55.1	76	22	2	C	0.5	3.6	3.0	833	269	218	406	480	1.0				-		-	-	
	18- 80	69	7.5	76.0	69	23	8	C	1.2	2.1	3.1	1,225	392	296	323	1,000	1.1				23.0		28.0	2.5	
6	1- 18	56	7.4	55.1	51	41	8	SiC	0.5	15.7	2.2	880	229	142	288	680	0.6				13.0		63.2	3.0	
	18- 43	56	7.2	150.0	43	48	9	SiC	0.4	13.0	1.8	2,518	459	318	500	2,160	1.2				-		-	-	
	43- 70	46	7.4	124.8	27	62	11	SiL	0.5	7.7	1.5	1,940	555	558	662	1,275	2.1				-		-	-	
	70-100	48	7.4	120.5	15	73	12	SiL	0.5	6.3	1.6	2,191	223	627	632	1,155	2.2				-		-	-	
17	2- 7	43	7.1	98.5	18	48	34	L	0.1	7.1	2.4	1,413	567	368	632	980	1.5				-		-	-	
	7- 19	28	7.2	140.7	48	40	12	SiC	0.6	6.2	2.8	1,920	894	480	834	1,500	2.5				14.5		52.9	7.0	
	19- 47	67	7.4	51.6	12	70	18	SiL	0.1	1.9	2.6	686	347	135	450	450	0.9				28.5		29.4	4.0	
	47- 80	59	7.6	46.9	10	66	24	SiL	0.6	1.0	1.9	637	299	153	274	510	0.8				-		-	-	
	80-120	65	7.8	44.6	18	72	10	SiL	0.6	0.7	1.7	588	304	152	261	480	0.8				-		-	-	
20	1- 7	51	7.2	56.4	41	41	18	SiC	0.9	9.4	1.5	920	209	270	270	590	1.0				-		-	-	
	7- 17	51	7.2	70.5	34	52	14	SiCL	1.3	5.1	2.0	1,176	232	233	371	805	1.2				32.5		77.9	4.5	
	17- 40	46	7.4	38.2	30	56	14	SiCL	2.0	2.4	1.3	470	292	106	306	350	0.7				-		-	-	
	40- 60	50	7.8	25.7	30	52	18	SiCL	1.3	2.0	1.3	321	192	95	128	290	0.5				-		-	-	
	60- 85	48	7.7	22.6	30	58	12	SiCL	1.3	0.8	2.2	290	163	85	120	250	0.4				-		-	-	
4	2- 6	80	7.4	22.2	66	30	4	C	1.6	2.5	3.0	245	194	71	86	284	0.7				-		-	-	
	6- 27	80	7.7	66.5	51	41	8	SiC	2.2	4.8	1.8	980	349	126	196	1,008	1.0				19.0		38.2	4.5	
	27- 45	83	8.2	40.4	61	27	12	C	1.0	1.8	2.2	383	405	154	226	409	0.8				-		-	-	
	45-140	73	8.1	14.4	63	27	10	C	4.0	0.5	2.2	155	47	55	29	120	0.3				-		-	-	
21	1- 7	42	7.7	150.4	41	34	25	C	0.9	8.1	2.2	2,410	599	583	626	1,800	2.4				21.5		60.3	2.5	
	7- 37	30	8.2	103.4	52	36	12	C	0.2	3.1	2.2	1,520	546	318	664	1,084	2.0				23.5		38.2	7.5	
	37- 55	30	8.0	61.1	51	33	16	C	0.4	3.7	1.6	960	259	313	477	430	1.2				24.0		97.0	4.5	
	55-100	29	8.1	89.3	14	16	60	SL	0.3	0.3	1.5	1,215	568	307	716	760	1.7				-		-	-	
	100-120	25	8.2	79.9	10	33	57	SL	0.5	-	2.0	1,120	475	212	439	945	1.2				-		-	-	

Summary of Soil Analysis (Phase I Study) (3)

No.	Depth (cm)	S.P. (%)	pH	EC (mS/cm)	Mechanical Analysis: Clay (%)	Silt (%)	Sand (%)	Texture	$CaCO_3$ (%)	Gypsum (%)	Soluble Anions and Cations (meq/litter): HCO_3	Cl	SO_4	Ca	Mg	Na	K	Exchangeable Cations (meq/100g soil): Na	K	Ca+Mg	CEC meq/100g	ESP (%)	Sol-N (ppm)	Sol-P (ppm)	Org.M. (%)
14	4- 15	73	7.3	55.8	87	3	10	C	0.8	4.5	3.3	925	193	218	202	700	1.5				24.0		36.8	3.5	
	15- 28	83	7.2	65.0	79	3	19	C	0.4	3.6	2.4	926	374	250	250	800	1.5				20.5		16.2	2.5	
	28- 63	58	7.6	55.8	74	11	15	C	1.6	1.2	2.4	735	376	150	152	810	1.4				21.5		23.5	2.5	
	63-100	61	7.3	93.0	43	33	24	C	0.6	0.5	1.3	1,290	571	374	561	925	1.9				-		-	-	
18	0- 9	49	7.6	119.6	30	56	14	SiCL	0.6	1.9	2.6	1,579	803	229	1,071	1,080	2.0				32.5		20.6	3.0	
	9- 20	65	7.6	50.6	64	22	14	C	0.8	2.2	1.3	731	281	109	413	490	1.0				-		-	-	
	20- 45	61	7.6	64.4	52	32	16	C	1.1	1.8	1.5	927	362	218	292	780	1.2				-		-	-	
	45- 80	54	7.6	27.6	46	38	16	C	1.7	0.7	1.7	400	152	56	141	355	0.6				-		-	-	
	80-110	70	7.7	50.6	58	30	12	C	2.4	1.5	2.2	729	280	109	161	740	1.0				-		-	-	
22	0.5- 11	50	6.9	36.9	57	33	10	C	0.4	12.4	2.0	520	216	169	261	307	0.6				-		-	-	
	11- 35	65	7.7	56.4	45	39	16	C	1.7	0.4	2.2	880	245	191	460	475	1.2				35.5		52.9	7.5	
	35- 60	60	7.8	32.3	48	35	17	C	1.5	0.8	2.2	633	211	159	246	440	0.8				-		-	-	
	60- 90	64	7.7	51.7	58	26	16	C	1.1	-	2.6	880	292	272	346	555	1.7				-		-	-	
27	2- 15	45	7.6	131.6	35	50	15	SiCL	0.5	-	1.9	2,050	576	495	551	1,580	2.1				-		-	-	
	15- 34	48	7.6	117.5	30	40	30	CL	1.0	-	1.2	1,944	405	590	473	1,285	2.0				30.5		61.8	4.0	
	34- 63	68	7.6	61.1	35	50	15	SiCL	1.1	13.8	1.1	878	339	130	317	770	0.8				-		-	-	
	63-100	59	7.7	33.0	35	50	15	SiCL	0.8	2.7	1.2	509	151	115	145	400	0.5				-		-	-	
29	0- 4	36	7.4	131.6	35	10	55	SiL	4.0	7.0	2.3	1,980	651	845	295	1,491	2.0				-		-	-	
	4- 21	84	7.9	47.0	50	25	25	C	5.0	-	2.3	675	263	275	155	509	0.6				34.5		48.5	8.0	
	21- 34	82	7.9	56.6	70	5	25	C	0.4	1.3	2.2	780	349	480	240	410	1.0				-		-	-	
	34- 72	75	7.7	53.7	55	25	20	C	0.5	-	1.8	831	238	154	306	610	0.9				-		-	-	
43	0- 15	65	7.2	54.6	55	10	35	C	0.8	-	1.3	792	298	193	397	500	1.0				11.5		77.9	2.0	
	15- 50	75	7.6	27.8	75	20	5	C	1.8	-	2.6	378	177	98	169	290	0.6				20.5		52.9	2.5	
	50- 75	80	7.6	19.2	80	15	5	C	3.8	0.9	2.1	210	158	82	117	170	0.5				24.0		58.8	4.0	
2	2- 16	71	7.6	37.5	73	18	9	C	0.7	4.3	3.1	490	257	174	65	510	0.9				-		-	-	
	16- 46	75	7.6	135.9	64	27	9	C	0.5	5.5	3.5	2,332	396	390	330	2,011	1.2				18.5		29.4	4.0	
	46- 80	70	7.4	80.8	70	22	8	C	0.4	8.6	2.6	1,300	318	212	207	1,200	1.5				-		-	-	
11	2- 10	61	7.7	85.5	44	15	41	C	0.6	6.8	3.3	1,492	211	242	182	1,280	1.7				16.0		30.9	3.0	
	10- 24	73	8.0	60.8	60	15	25	C	2.7	1.7	2.4	1,029	190	87	173	959	1.5				-		-	-	
	24- 50	65	8.0	26.8	57	25	18	C	3.5	1.7	2.2	410	114	65	110	350	0.9				-		-	-	
	50- 95	75	8.1	27.0	84	6	10	C	0.9	1.1	4.0	441	91	92	73	370	0.9				-		-	-	
12	10- 25	60	7.9	85.5	25	67	8	SiL	0.5	12.4	3.4	1,281	425	254	353	1,100	1.5				6.5		10.3	3.5	
	25- 45	67	7.8	95.0	41	21	38	C	0.3	2.0	3.8	1,517	380	376	373	1,150	1.8				18.0		25.0	4.0	
	45- 60	59	7.7	121.6	42	34	24	C	0.2	0.7	3.4	1,950	469	398	322	1,700	1.9				-		-	-	
	60-100	60	7.7	76.0	44	30	26	C	0.6	0.3	3.2	1,110	414	254	256	1,015	1.9				-		-	-	

Summary of Soil Analysis (Phase I) (4)

No.	Depth (cm)	S.P. (%)	pH	EC (mS/cm)	Mechanical Analysis: Clay (%)	Silt (%)	Sand (%)	Texture	$CaCO_3$ (%)	Gypsum (%)	Soluble Anions and Cations (meq/litter): HCO_3	Cl	SO_4	Ca	Mg	Na	K	Exchangeable Cations (meq/100g soil): Na	K	Ca+Mg	CEC meq/100g	ESP (%)	Sol-N (ppm)	Sol-P (ppm)	Org.M. (%)
13	4- 20	61	7.7	57.0	65	18	17	C	1.6	6.8	2.8	929	156	134	92	860	2.2				20.0		26.5	2.0	
	20- 40	61	7.7	99.8	73	15	12	C	2.5	6.3	3.2	1,517	478	109	97	1,790	2.0				-		-	-	
	40- 60	67	7.6	93.0	84	16	10	C	1.6	1.1	2.3	1,456	404	272	228	1,360	1.9				-		-	-	
	60-100	58	7.8	93.0	83	6	11	C	1.0	0.3	3.3	1,699	162	221	286	1,355	1.9				-		-	-	
19	2- 18	40	7.3	110.4	38	50	12	SiCL	0.5	10.8	2.2	1,600	606	232	776	1,198	2.1				28.5		64.7	4.5	
	18- 35	57	7.7	90.1	26	60	14	SiL	0.9	6.8	3.2	1,360	447	272	216	1,320	1.7				-		-	-	
	35- 67	75	7.8	64.4	56	32	12	C	1.6	2.4	2.2	960	325	170	118	998	1.2				-		-	-	
	67- 85	74	7.9	55.2	59	31	10	C	2.5	0.8	2.0	880	221	112	178	812	1.2				-		-	-	
25	0.5- 4	60	7.3	141.9	56	26	18	C	1.3	17.3	2.2	2,330	508	159	399	2,280	2.1				11.0		62.2	4.5	
	4- 13	50	7.4	23.5	40	38	22	C	1.6	6.3	1.5	380	87	117	138	214	0.4				19.5		70.0	3.5	
	13- 30	55	8.0	41.4	48	39	13	C	1.0	0.1	2.0	537	289	153	282	392	0.7				27.0		26.5	4.0	
	30- 55	78	8.0	12.8	41	45	14	SiC	1.7	1.4	3.3	125	36	17	51	96	0.4				-		-	-	
	55-100	86	7.9	29.1	73	15	12	C	1.6	0.2	3.5	420	158	64	122	395	0.5				-		-	-	
26	1- 44	56	7.2	75.2	24	60	16	SiL	0.5	-	2.4	1,070	432	191	627	685	1.1				29.0		41.2	4.0	
	14- 38	54	7.7	50.7	30	58	12	SiCL	0.5	8.6	1.7	780	230	138	373	500	0.9				-		-	-	
	38- 60	65	7.4	42.3	55	30	15	C	0.8	2.4	3.2	620	223	159	196	490	1.0				-		-	-	
	60- 85	67	7.7	51.7	55	30	15	C	0.7	-	1.9	735	295	227	424	380	1.0				-		-	-	
32	0- 20	64	7.2	69.0	55	20	25	C	0.5	-	1.8	962	417	216	704	460	1.2				34.0		91.2	11.0	
	20- 50	70	7.5	34.5	75	20	5	C	1.0	13.7	2.0	420	269	105	260	325	0.7				-		-	-	
	50- 68	75	7.9	27.6	85	10	5	C	1.9	4.9	2.6	419	128	95	109	345	0.6				-		-	-	
	68-100	77	8.1	20.7	75	20	5	C	0.5	5.7	1.8	343	68	74	39	300	0.4				-		-	-	
33	0- 10	78	7.2	59.1	65	20	15	C	-	2.3	2.2	811	368	116	564	500	0.8				-		-	-	
	10- 23	86	7.5	36.4	75	10	15	C	0.2	0.8	1.5	472	255	105	312	310	0.6				27.5		48.5	5.5	
	23- 70	84	7.8	22.7	75	20	5	C	1.8	9.7	1.8	315	136	98	155	200	0.4				-		-	-	
	70-120	85	7.7	52.7	85	10	5	C	2.5	12.0	1.1	790	262	125	415	512	1.1				-		-	-	
8	2.5- 15	62	8.0	74.4	39	53	8	SiCL	0.3	1.3	2.0	1,121	365	120	452	915	1.2				17.5		32.4	3.0	
	15- 38	60	8.0	36.3	31	58	11	SiCL	0.5	2.3	1.5	500	224	94	181	450	0.7				15.0		19.1	7.0	
	38- 55	55	8.0	45.7	16	74	10	SiL	0.5	0.4	1.3	640	278	84	174	660	0.8				-		-	-	
	55- 80	50	8.0	55.8	7	72	21	SiL	1.1	-	1.9	980	134	174	336	605	0.8				-		-	-	
15	0- 10	33	7.1	144.0	14	71	15	SiL	0.3	9.1	1.5	2,361	411	307	563	1,902	2.0				-		-	-	
	10- 37	83	7.2	93.0	57	25	18	C	0.6	9.4	1.8	1,300	560	231	409	1,220	1.9				21.5		77.9	3.0	
	37- 60	62	7.3	79.1	50	18	12	C	0.5	14.6	1.8	1,121	449	231	339	1,000	1.0				-		-	-	
	60- 85	68	7.6	74.4	77	6	17	C	0.8	4.5	1.8	1,266	214	120	239	1,122	0.9				-		-	-	
	85-110	74	7.5	83.7	84	6	10	C	1.4	2.5	2.2	1,260	414	176	274	1,225	1.0				-		-	-	

Summary of Soil Analysis (Phase I) (5)

No.	Depth (cm)	S.P. (%)	pH	EC (mS/cm)	Mechanical Analysis				CaCO3 (%)	Gypsum (%)	Soluble Anions and Cations (meq/litter)							Exchangeable Cations (meq/100g soil)			CEC meq/100g	ESP (%)	Sol-N (ppm)	Sol-P (ppm)	Org.M. (%)
					Clay (%)	Silt (%)	Sand (%)	Texture			HCO3	Cl	SO4	Ca	Mg	Na	K	Na	K	Ca+Mg					
23	4- 13	64	7.5	145.7	54	28	18	C	1.6	4.7	2.2	2,350	562	414	1,145	1,353	2.0				22.0		79.4	7.5	
	13- 30	64	7.5	84.6	58	26	16	C	1.3	-	1.7	931	758	386	573	730	1.5				23.5		48.5	11.0	
	30- 46	68	7.7	74.3	59	25	16	C	1.3	-	1.1	1,020	465	230	330	925	1.3				-		-	-	
	46- 62	70	7.8	61.1	60	24	16	C	2.5	-	1.5	784	435	270	320	630	1.2				-		-	-	
	62- 90	70	8.0	45.0	58	26	16	C	1.2	-	1.5	730	169	106	144	650	1.1				-		-	-	
24	0- 10	64	7.3	103.0	59	23	18	C	0.4	3.1	1.7	1,575	485	402	458	1,200	2.0				-		-	-	
	10- 16	64	7.5	75.2	58	24	18	C	0.5	2.2	1.8	1,211	288	285	275	940	1.1				-		-	-	
	16- 35	41	7.5	32.9	42	42	16	SiC	0.2	0.5	1.3	343	311	106	173	375	0.5				9.5		26.5	5.0	
	35- 60	61	7.5	22.5	50	26	14	C	0.5	1.1	2.2	280	168	95	115	240	0.4				-		-	-	
	60- 90	61	7.5	42.3	50	22	18	C	1.0	0.4	1.5	637	207	127	152	566	0.6				-		-	-	
10	8- 16	54	7.4	20.2	9	79	2	SiL	1.4	7.2	2.1	301	101	140	254	210	0.3				19.0		38.2	4.5	
	16- 27	66	7.7	19.0	31	64	5	SiCL	1.3	1.3	3.1	250	109	119	53	190	0.3				21.5		17.7	7.5	
	27- 55	68	8.2	116.3	35	62	3	SiCL	2.5	0.5	3.3	2,000	377	205	313	1,860	2.1				22.0		14.7	4.0	
	55- 85	53	8.2	46.5	27	68	5	SiL	1.6	-	2.6	684	246	164	148	620	0.9				-		-	-	

Figure A-21 Three Phases Distribution of Soil

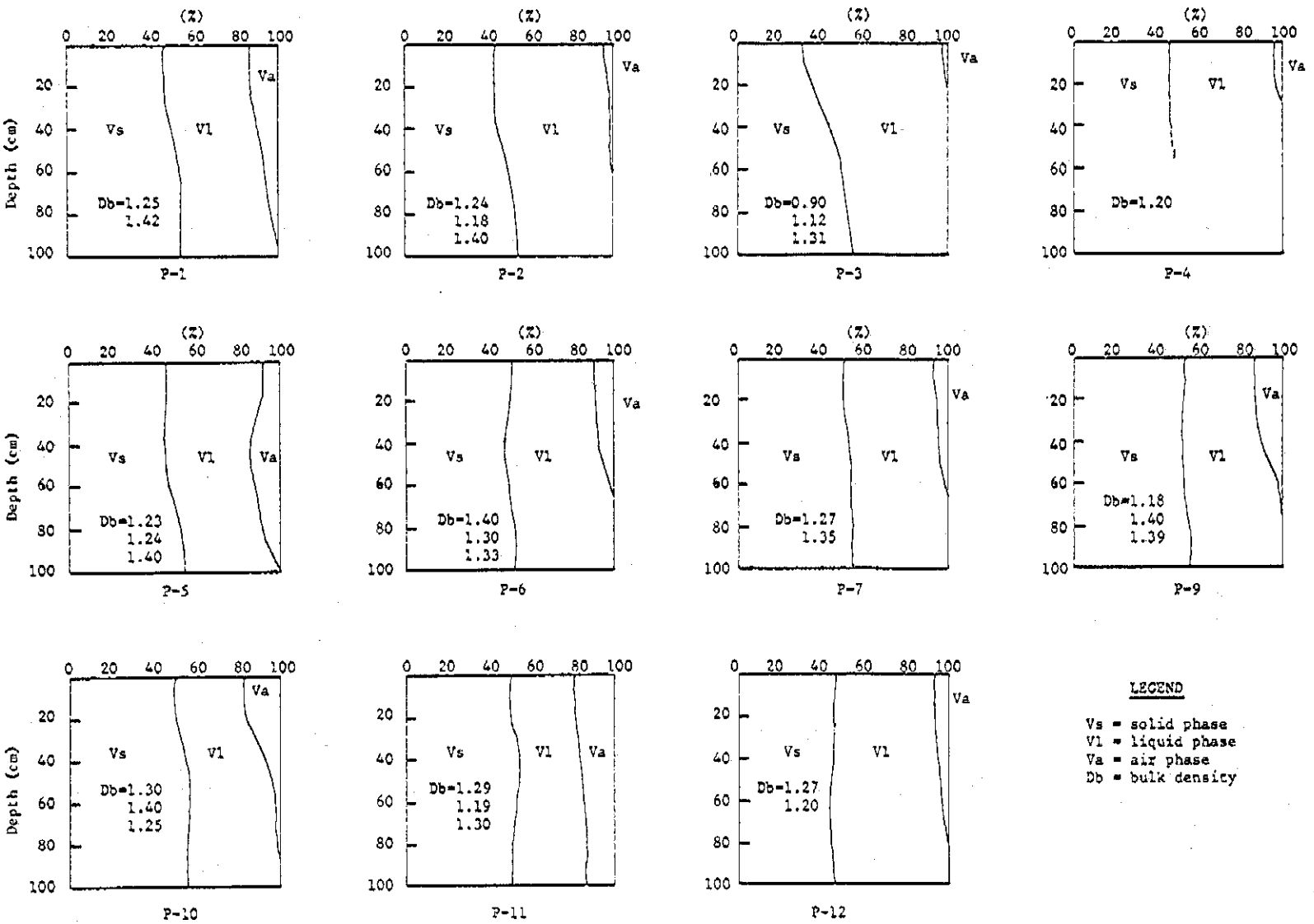


Table A-12 Results of Soil Physical Test

Pit No.	Depth	Three Phases of Soil			Void Ratio	Bulk Density	Moisture Ratio
		Solid	Liquid	Vapor			
	cm	%	%	%	%		%
P-1	15- 40	47.3	42.8	9.9	52.7	1.3	32.9
	56-125	52.9	39.3	7.8	47.1	1.4	28.1
P-2	0- 35	44.6	51.0	4.4	55.4	1.2	42.5
	35- 55	40.9	57.2	2.3	59.1	1.1	52.0
	55- 95	51.5	46.2	2.4	48.5	1.4	33.0
P-3	0- 15	34.0	64.6	1.9	66.0	0.9	71.8
	15- 45	42.5	59.0	0	57.5	1.1	53.6
	45- 80	47.9	53.6	0	52.1	1.2	44.7
P-4	25- 72	45.2	54.9	1.7	54.8	1.2	45.8
P-5	0- 20	41.9	34.9	23.2	58.2	1.1	31.7
	20- 35	46.7	35.5	17.8	53.3	1.2	29.6
	35- 70	52.4	32.7	14.9	47.6	1.4	23.4
P-6	0- 40	51.2	38.5	10.3	48.8	1.6	24.1
	40- 60	47.6	44.2	8.3	52.4	1.3	34.0
	60- 90	50.3	50.9	0	49.1	1.3	39.2
P-7	5- 55	50.6	41.9	7.5	49.4	1.4	29.9
	55-100	50.6	46.4	3.1	49.4	1.3	35.7
P-9	15- 50	54.6	29.1	26.4	45.5	1.4	20.8
	50- 80	52.3	42.0	5.7	47.7	1.4	28.0
	80-140	55.4	44.1	1.6	44.5	1.5	29.4
P-10	0- 25	49.4	28.9	21.7	50.6	1.3	22.2
	25- 72	53.0	42.5	4.6	47.0	1.4	30.4
	72-140	54.5	34.3	11.3	45.6	1.3	26.4
P-11	8- 40	50.9	28.3	20.9	49.1	1.3	21.8
	40- 60	53.9	7.5	38.6	46.1	1.2	6.3
	60-140	49.1	31.6	19.4	50.9	1.3	24.3
P-12	0- 40	47.6	46.6	5.8	52.4	1.3	35.8
	70-100	45.2	51.4	3.4	54.8	1.2	42.8

Table A-13 Soil Moisture Content

Pit No.	Depth (cm)	Moisture Content (%) S.P.	F.C.	Pit No.	Depth (cm)	Moisture Content (%) S.P.	F.C.
P-1	0- 15	100	39	P- 7	0- 5	55	27
	15- 40	75	35		5- 55	55	29
	40- 56	65	34		55-100	65	33
	56-125	62	31		100-130	60	31
	125-200	70	37				
P-2	0- 35	65	32	P- 8	0- 5	55	28
	35- 55	70	37		5- 45	65	27
	55- 95	75	37		45- 80	55	27
	95-150	80	39		80-130	55	27
	150-200	65	32				
P-3	0- 15	67	33	P- 9	0- 15	60	32
	15- 45	75	36		15- 50	55	27
	45- 80	70	36		50- 80	55	28
	80-200	70	34		80-140	60	32
P-4	0- 25	75	36	P-10	0- 25	87	39
	25- 72	70	36		25- 72	59	29
	72-140	67	34		72-140	65	32
P-5	0- 20	70	36	P-11	0- 8	67	34
	20- 35	70	35		8- 40	64	31
	35- 70	62	33		40- 60	61	32
	70-110	55	28		60-140	58	28
	110-200	75	34		140-200	71	36
P-6	0- 40	71	36	P-12	0- 40	59	30
	40- 60	80	39		40- 70	71	36
	60- 90	54	28		70-100	59	29
	90-130	62	33		100-130	56	28
	130-160	55	27		130-200	61	32

A.6.3. Results of Hydraulic Conductivity Measurements

The hydraulic conductivities of soils in the dryland and swamp areas was measured by the auger-hole method, and the results are shown in Table A-14, on the other hard, those in the inundated area was measured by the laboratory method and the results are shown in Table A-15.

Most soils in the dryland and swamp area have low hydraulic conductivity ranging from the order of 10^{-4} to 10^{-5} cm/sec with a few exception of the order of 10^{-3} cm/sec. According to the present measurement, it is not clear the hydraulic conductivity in the inundated area, but it can be supposed to be very low.

Table A-16 show the result of vertical and horizontal hydraulic conductivity of dry land soils measured by the Desert Institutes' laboratory.

Table A-14 Hydraulic Conductivity of Dry Land and Swamp Soil (1)

Site No.	Hole No.	Measurement No.	Depth of Zone Tested (m)	Hydraulic Conductivity (cm/sec)	Conductivity (m/day)
15	1-1	1-1-1	0.5 - 1.1	2.2×10^{-4}	0.190
	1-1	1-1-2	0.6 - 1.5	5.3×10^{-5}	0.046
	1-2	1-2-1	0.5 - 0.9	1.4×10^{-4}	0.121
	1-2	1-2-2	0.5 - 1.8	4.6×10^{-5}	0.040
93	2-1	2-1-1	0.5 - 1.0	2.2×10^{-4}	0.190
	2-1	2-1-2	0.6 - 1.4	3.0×10^{-4}	0.259
	2-2	2-2-1	0.5 - 1.0	1.6×10^{-4}	0.138
	2-2	2-2-2	0.5 - 1.8	1.9×10^{-4}	0.164
144	3-1	3-1-1	0.7 - 1.3	5.6×10^{-5}	0.048
	3-1	3-1-2	0.7 - 1.8	4.9×10^{-5}	0.042
	3-2	3-2-1	0.6 - 1.2	4.3×10^{-5}	0.037
	3-2	3-2-2	0.6 - 2.0	3.8×10^{-5}	0.033
152	4-1	4-1-1	0.4 - 1.1	8.6×10^{-4}	0.743
	4-1	4-1-2	0.5 - 1.6	4.3×10^{-4}	0.372
	4-2	4-2-1	0.6 - 1.0	1.8×10^{-3}	1.555
	4-2	4-2-2	0.6 - 1.3	4.0×10^{-4}	0.346
160	5-1	5-1-1	0.6 - 1.1	4.7×10^{-4}	0.406
	5-1	5-1-2	0.6 - 1.5	3.6×10^{-4}	0.311
	5-2	5-2-1	0.7 - 1.2	5.1×10^{-4}	0.441
	5-2	5-2-2	0.8 - 1.5	4.9×10^{-4}	0.423
20	6-1	6-1-1	1.0 - 1.8	2.0×10^{-4}	0.173
	6-1	6-1-2	1.1 - 2.1	1.8×10^{-4}	0.156
	6-2	6-2-1	1.0 - 1.5	1.9×10^{-4}	0.164
	6-2	6-2-2	1.0 - 2.0	1.6×10^{-4}	0.138
29	7-1	7-1-1	1.5 - 1.9	5.7×10^{-4}	0.492
	7-1	7-1-2	1.6 - 2.2	5.4×10^{-4}	0.467
	7-2	7-2-1	1.3 - 1.8	5.6×10^{-4}	0.484
	7-2	7-2-2	1.6 - 2.2	4.7×10^{-4}	0.406
117	8-1	8-1-1	0.2 - 0.9	3.1×10^{-4}	0.268
	8-1	8-1-2	0.2 - 1.5	2.2×10^{-4}	0.190
	8-2	8-2-1	0.4 - 1.1	6.7×10^{-4}	0.579
	8-2	8-2-2	0.4 - 0.5	5.0×10^{-4}	0.432
122	9-1	9-1-1	0.8 - 1.5	9.9×10^{-5}	0.086
	9-1	9-1-2	0.8 - 1.5	1.1×10^{-4}	0.095
	9-2	9-2-1	0.8 - 1.0	1.6×10^{-4}	0.138
	9-2	9-2-2	0.8 - 1.5	1.0×10^{-4}	0.086
99	10-1	10-1-1	0.7 - 1.4	4.3×10^{-4}	0.372
	10-1	10-1-2	0.7 - 1.4	4.5×10^{-4}	0.389
	10-2	10-2-1	0.7 - 1.0	3.8×10^{-4}	0.328
	10-2	10-2-2	0.7 - 1.5	3.9×10^{-4}	0.337
98	11-1	11-1-1	0.4 - 1.6	3.9×10^{-4}	0.337
	11-1	11-1-2	0.4 - 1.6	6.4×10^{-4}	0.553
	11-2	11-2-1	0.4 - 1.0	4.8×10^{-4}	0.415
	11-2	11-2-2	0.4 - 1.6	4.0×10^{-4}	0.346
203	12-1	12-1-1	1.8 - 2.4	6.0×10^{-5}	0.052
	12-1	12-1-2	0.6 - 2.4	1.8×10^{-5}	0.016
	12-2	12-2-1	0.5 - 2.0	5.3×10^{-5}	0.046
	12-2	12-2-2	0.5 - 2.5	1.2×10^{-5}	0.010
200	13-1	13-1-1	0.6 - 2.1	1.0×10^{-5}	0.009
	13-1	13-1-2	1.4 - 2.2	2.8×10^{-5}	0.024
	13-2	13-2-1	0.5 - 1.2	2.3×10^{-5}	0.020
	13-2	13-2-2	0.5 - 2.2	1.8×10^{-5}	0.016
199	14-1	14-1-1	0.4 - 2.2	1.3×10^{-5}	0.011
	14-1	14-1-2	1.7 - 2.2	7.0×10^{-5}	0.060
	14-2	14-2-1	0.5 - 1.3	3.2×10^{-5}	0.028
	14-2	14-2-2	0.5 - 2.2	2.0×10^{-5}	0.017

Hydraulic Conductivity of Dry Land and Swamp Soils (2)

Site No.	Hole No.	Measurement No.	Depth of Zone Tested (m)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/day)
202	15-1	15-1-1	0.6 - 1.7	5.8×10^{-4}	0.501
	15-1	15-1-2	0.6 - 1.7	7.1×10^{-4}	0.613
	15-2	15-2-1	0.6 - 1.2	6.3×10^{-4}	0.544
	15-2	15-2-2	0.6 - 1.8	4.9×10^{-4}	0.423
164	16-1	16-1-1	0.2 - 1.7	2.2×10^{-4}	0.190
	16-1	16-1-2	0.3 - 1.7	3.2×10^{-4}	0.276
	16-2	16-2-1	0.3 - 1.2	4.1×10^{-4}	0.354
	16-2	16-2-2	0.3 - 2.0	2.3×10^{-4}	0.199
173	17-1	17-1-1	0.6 - 1.6	3.2×10^{-4}	0.276
	17-1	17-1-2	0.6 - 2.1	2.9×10^{-4}	0.251
	17-2	17-2-1	0.5 - 1.2	3.8×10^{-4}	0.328
	17-2	17-2-2	0.5 - 2.2	2.2×10^{-4}	0.190
212	18-1	18-1-1	0.4 - 1.9	2.4×10^{-4}	0.207
	18-1	18-1-2	0.4 - 1.9	3.4×10^{-4}	0.294
	18-2	18-2-1	0.4 - 1.2	3.9×10^{-4}	0.337
	18-2	18-2-2	0.4 - 2.1	3.0×10^{-4}	0.259
222	19-1	19-1-1	0.7 - 1.8	6.2×10^{-4}	0.536
	19-1	19-1-2	0.7 - 1.8	5.2×10^{-4}	0.449
	19-2	19-2-1	0.6 - 1.1	6.6×10^{-4}	0.570
	19-2	19-2-2	0.6 - 2.0	5.1×10^{-4}	0.441
181	20-1	20-1-1	0.2 - 2.0	3.9×10^{-4}	0.337
	20-1	20-1-2	0.2 - 2.0	3.8×10^{-4}	0.328
	20-2	20-2-1	0.3 - 1.2	4.3×10^{-4}	0.372
	20-2	20-2-2	0.3 - 2.1	4.0×10^{-4}	0.346
3	21-1	21-1-1	2.1 - 2.4	2.6×10^{-4}	0.225
	21-1	21-1-2	2.1 - 2.5	2.5×10^{-4}	0.216
	21-2	21-2-1	1.9 - 2.2	3.0×10^{-4}	0.259
	21-2	21-2-2	1.9 - 2.5	2.1×10^{-4}	0.181
71	22-1	22-1-1	0.7 - 2.0	1.5×10^{-3}	1.296
	22-1	22-1-2	0.7 - 2.0	8.5×10^{-5}	0.073
	22-2	22-2-1	0.7 - 2.0	1.7×10^{-4}	0.147
	22-2	22-2-2	0.7 - 1.5	2.2×10^{-4}	0.190
85	23-1	23-1-1	0.7 - 3.4	3.1×10^{-4}	0.268
	23-1	23-1-2	0.7 - 3.4	2.3×10^{-4}	0.199
	23-2	23-2-1	0.6 - 2.1	4.0×10^{-4}	0.346
	23-2	23-2-2	0.6 - 3.0	2.9×10^{-4}	0.251
107	24-1	24-1-1	1.1 - 2.0	6.8×10^{-4}	0.588
	24-1	24-1-2	1.1 - 2.0	5.2×10^{-4}	0.449
	24-2	24-2-1	0.8 - 1.5	7.1×10^{-4}	0.613
	24-2	24-2-2	0.8 - 2.0	6.1×10^{-4}	0.527
132	25-1	25-1-1	0.6 - 2.0	1.7×10^{-4}	0.147
	25-1	25-1-2	1.1 - 2.0	2.7×10^{-4}	0.233
	25-2	25-2-1	0.5 - 1.2	3.1×10^{-4}	0.268
	25-2	25-2-2	0.5 - 2.0	2.6×10^{-4}	0.225

Table A-15 Hydraulic Conductivity of Inundated Land Soils By Laboratory Test

Site No.	Core No.	Hydraulic Conductivity (m/day)
S - 4	A - 1	Not dropped
	2	"
	3	"
	4	"
S - 6	A - 16	"
	17	"
	18	"
	19	"
S - 27	A - 26	"
	27	"
	28	"
	29	"
S - 28	K - 1	"
	2	"
	3	"
	4	"
S - 35	A - 11	"
	12	"
	13	"
	14	"
S - 44	K - 21	"
	22	"
	23	"
	24	"

Table A-16 Vertical and Horizontal Hydraulic Conductivity of Dry Land Soils

Sample No.	Hydraulic Conductivity (cm/hr)	Class
P-13-H (1)	-	IMPERMEABLE
P-13-H (2)	-	"
P-13-V (3)	-	"
P-13-V (4)	0.03384	VERY SLOW
P-15-H (5)	0.1018	"
P-15-H (6)	0.0334	"
P-15-V (7)	0.0680	"
P-15-V (8)	0.03384	"
P-17-H (9)	0.01692	"
P-17-H (10)	0.01692	"
P-17-V (11)	0.0126	"
P-17-V (12)	0.0162	"
P-20-H (13)	0.0324	"
P-20-H (14)	0.0162	"
P-20-V (15)	0.1018	"
P-20-V (16)	0.1191	"
P-23-H (17)	0.1018	"
P-23-H (18)	0.4050	SLOW
P-23-V (19)	0.4050	"
P-23-V (20)	0.60768	MODERATELY SLOW

A.6.4. Results of Water Analysis

The results of water quality analysis (pH and EC) for groundwater and surface water are shown in Table A-17. In addition, the results of groundwater analysis carried out during the Phase I Study are shown in Table A-18.

These data proved a high groundwater salinity except for some shallow groundwater having connection with stagnant water in the inundation area.

Table A-17 Results of Water Quality Analysis

(1) Groundwater Quality

Sampling No.	pH	EC at 25°C mS/cm	Total salts ppm
p-2	7.5	128	82,000
p-3	6.7	201	118,400
p-5	7.0	63	40,300
p-9	7.2	44	28,200
p-10	6.8	160	102,400
p-12	7.4	165	105,000
p-13	7.3	63	40,300
p-15	7.1	235	150,400
p-20	7.1	156	99,800
p-21	6.7	214	137,000
p-22	7.0	240	153,600
p-23	7.5	7	4,500
p-24	7.3	6	3,800
p-25	7.5	33	21,100
p-26	7.1	38	24,300

(2) Canal and Surface Water Quality

Sampling Place	pH	EC at 25°C mS/cm	Total salts ppm
1. Lake Manzala	7.5	2.8	1,900
2. Lake Manzala	8.5	3.1	2,000
3. Bahr Baqar at Shadel Azam	7.4	2.0	1,300
4. Bahr Baqar at Bridge	7.9	3.2	2,000
5. Bahr Hadus drain	7.7	2.0	1,300
6. Bahr Hadus drain	7.8	2.4	1,300
7. Bahr Saft drain	7.8	2.9	1,900
8. Ramses drain	7.4	13.0	8,300
9. Khalig el Safla drain	7.6	2.8	1,800
10. Inundation near El Salam	8.3	58.5	37,400
11. Inundation near Bahr Baqar	8.3	58.0	37,100
12. Fish pond near Bahr Baqar	7.5	7.8	5,000
13. Inundation near P-13	7.9	18.0	11,500
14. Inundation near P-11	7.7	46.0	29,400
15. Inundation near P-19	6.9	245.0	156,800
16. Inundation near P-20	8.1	70.0	44,800
17. Inundation near P-20	8.1	87.0	55,700
18. Inundation near Ramses drain	7.4	18.0	11,500
19. Inundation near P-10	7.6	15.0	9,600

Table A-18 Groundwater Analysis

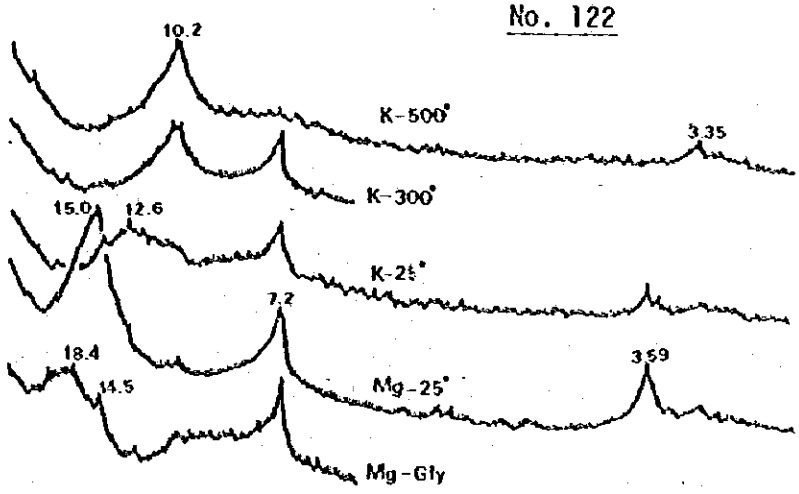
Pit No.	Depth cm	pH	EC mS/cm	Anions			Cations			
				HCO_3^-	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+
				meq/l						
34	36	7.2	82.7	5.9	1,270	378	122	639	892	1.0
31	55	7.1	103.7	2.2	1,617	449	143	503	1,420	2.0
47	58	6.7	160.0	4.4	2,630	556	153	1,075	1,965	2.5
28	78	7.0	139.1	4.4	2,290	488	98	1,004	1,678	2.2
30	60	7.2	35.7	5.3	441	268	119	192	402	0.8
42	78	7.3	32.0	5.2	343	292	131	98	410	0.7
5	83	6.7	137.0	3.3	2,101	636	403	824	1,510	1.5
14	95	7.1	74.3	4.0	1,012	467	272	320	900	1.0
18	85	6.8	126.0	4.8	2,154	365	287	361	1,894	1.7
22	82	6.7	103.5	3.9	1,797	270	240	539	1,290	1.5
27	85	6.9	73.3	3.7	1,029	433	165	335	965	1.3
29	85	7.0	137.2	5.5	1,960	778	176	658	1,908	2.4
2	85	6.9	165.0	4.4	2,675	625	349	1,003	1,950	2.0
11	80	7.3	57.0	4.4	980	198	87	294	800	1.0
19	87	7.2	57.0	4.6	970	169	87	296	760	1.0
26	85	6.9	92.1	3.1	1,372	467	186	542	1,112	1.5
32	82	7.5	55.5	6.2	836	268	99	235	775	1.2
33	85	6.7	134.4	4.4	2,103	581	219	822	1,645	2.2
39	86	7.1	95.9	4.2	1,470	444	164	450	1,300	1.5
16	90	7.0	134.0	4.4	2,000	659	283	528	1,850	1.5
46	90	7.2	75.2	3.3	1,225	276	122	400	980	1.5
20	100	6.5	190.0	2.1	2,863	939	566	785	2,450	2.5

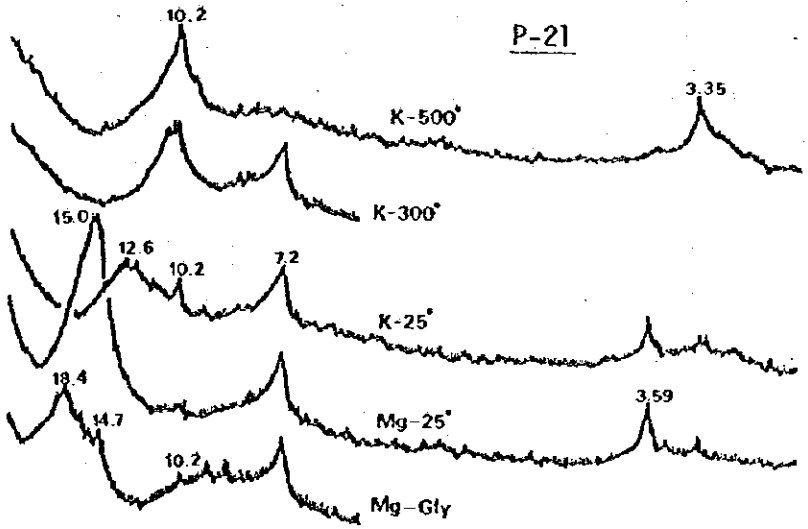
A.6.5. Result of Clay Mineral Identification

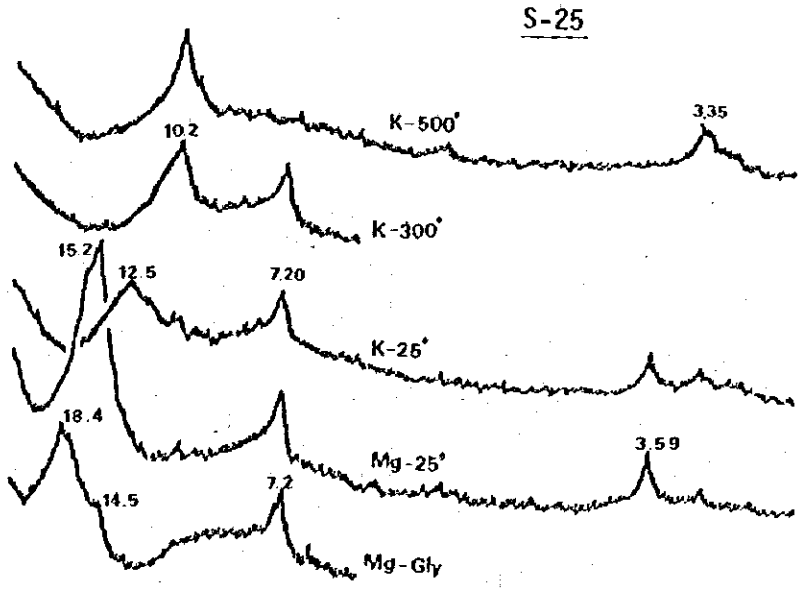
The results of clay mineral identification by a diffractometer are shown in Figure A-22. As shown in this figure, there is no significant difference in clay minerals composition among three samples. A considerable amount of montmorillonite is contained. Montmorillonite shows a marked peak at the wave-length of 18.4Å under the condition of Mg-glycerol and the peak is shifted to at 15Å, 12Å, and 10Å under the conditions of Mg-air dry, K-air dry, and K-300°C, respectively. Vermiculite and halloysite are also contained in some degree, but there is little fact to corroborate the evidence of illite. In the coarser fraction, quartz and feldspar are dominant.

Figure A-22

Clay Mineral Identification by Diffractometer







A.6.6. Results of Laboratory Leaching Experiments

The laboratory leaching experiments were started on December 3, 1983 and terminated on January 9, 1984 when all eC values of the leachate reached below 4 mS/cm.

The leaching curves were made as shown previously, based on the results obtained from the large scale and the small scale leaching apparatus(Table A-19).

The leaching process is referred to as the miscible displacement. Theoretically, the plots of the outflowing solution's solute content versus time or versus cumulative discharge show a so-called breakthrough curves as shown below;

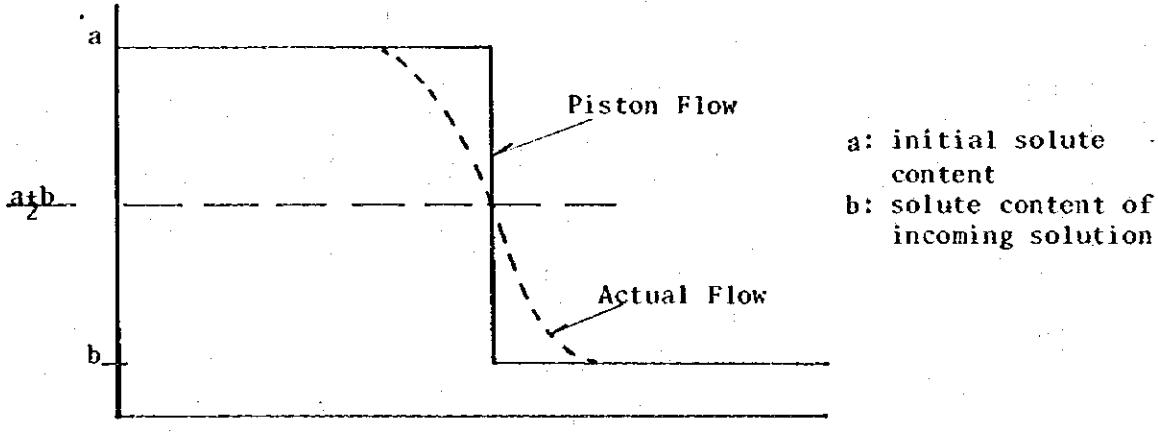


Table A-19 Results of Laboratory Leaching Tests

No. of Days	Large-Scale Equipment (P-11)				Small-Scale Equipment (P-6)				Small-Scale Equipment (P-12)				Small-Scale Equipment (P-5)				Small-Scale Equipment (P-7)				Small-Scale Equipment (P-10)			
	DW	DW accumulated	EC	pH	DW	DW accumulated	EC	pH	DW	DW accumulated	EC	pH	DW	DW accumulated	EC	pH	DW	DW accumulated	EC	pH	DW	DW accumulated	EC	pH
	ml/day	ml	mS/cm		ml/day	ml	mS/cm		ml/day	ml	mS/cm		ml/day	ml	mS/cm		ml/day	ml	mS/cm		ml/day	ml	mS/cm	
1	530	530	155	6.2	12	12	165	6.5	12	12	150	6.4	13	13	110	6.5	11	11	165	6.7	15	15	185	6.6
2	490	980	130	6.9	8	20	142	6.7	8	20	135	6.8	11	24	132	6.6	13	24	141	6.9	12.5	27.5	140	6.8
3	530	1510	142	7.1	10	30	124	6.7	9.5	29.5	141	6.1	10	34	135	6.7	8	32	119	6.9	7.5	35	106	6.9
4	600	2110	149	7.3	9	39	149	7.0	12.5	42	142	7.1	8.5	42.5	141	6.9	8.5	40.5	152	7.15	9.5	44.5	142	6.9
5	585	2695	141	7.1	10.5	49.5	110	7.1	8.5	50.5	116	7.0	10	52.5	119	7.0	8	48.5	128	7.2	10	54.5	120	7.15
6	500	3195	155	7.15	11.5	61	129	7.0	12.5	63	129	6.95	10	62.5	133	6.8	8	56.5	136	7.1	10	64.5	128	7.0
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	540	3735	155	7.05	7.5	68.5	141	7.05	6	69	141	7.1	8	70.5	143	6.9	7.5	64	143	7.0	9	73.5	139	6.95
9	520	4255	94	7.05	9	77.5	62	7.1	10	79	80	7.15	9.5	80	77	7.15	8	72	60	6.85	8.5	82	59	6.8
10	520	4755	144	6.9	9	86.5	111	7.05	10	89	108	7.0	10	90	124	7.0	8	80	111	6.95	8.5	90.5	116	6.95
11	480	5255	111	6.95	9.5	96	98	7.1	7.5	96.5	100	6.9	8	98	85	7.0	7	87	84	6.95	7.5	98	85	7.1
12	480	5735	96	6.9	8.5	104.5	82	6.95	9	105.5	90	6.7	9	107	92	6.9	7.5	94.5	78	6.85	7.5	105.5	83	6.85
13	470	6205	90	7.1	7	111.5	80	7.15	8.5	114	87	7.1	7.5	114.5	91	7.1	9	103.5	84	7.0	7.5	113	81	7.1
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	470	6675	155	7.1	8	119.5	84	7.2	7.5	121.5	100	7.05	6	120.5	97	7.0	5	108.5	72	6.95	7.5	120.5	80	7.0
16	600	7275	155	7.15	10	129.5	96	7.15	12	133.5	98	7.1	10	130.5	94	7.15	10	118.5	67	7.1	9.5	130	73	7.1
17	490	7765	135	6.85	8	137.5	81	6.85	9	142.5	103	6.8	8.5	139	133	6.8	8.5	127	67	6.9	8	138	76	6.85
18	470	8235	123	7.05	8	145.5	102	7.0	7.5	150	89	6.95	7.5	146.5	114	6.85	7.5	134.5	54	6.95	8	146	60	7.05
19	480	8715	148	6.9	8	153.5	114	7.0	8	158	96	6.9	8	154.5	135	6.95	7.5	142	47	6.85	8	154	53	6.9
20	570	9285	123	7.0	8.5	162	85	7.0	8.5	166.5	70	7.1	8.5	163	107	6.9	8.5	150.5	52	6.9	8.5	162.5	47	6.95
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	520	9805	39	7.1	10	172	69	7.0	8	174.5	65	7.0	8	171	100	6.9	8.5	159	46	7.0	8	170.5	39	6.95
23	500	10305	19	6.95	9	181	61	7.1	8.5	183	52	7.0	8	179	88	7.0	7	166	38	6.9	7.5	178	36	7.0
24	520	10825	16	7.0	10	191	49	7.1	10	193	44	7.0	8.5	187.5	73	6.9	7.5	173.5	32	7.0	8	186	29	6.9
25	500	11325	8	6.9	9	200	21	7.15	8.5	201.5	30	7.05	8	195.5	33	7.15	7.5	181	21	6.9	8	194	20	7.0
26	520	11845	17	7.0	9	209	41	7.5	8.5	210	37	7.1	10.5	206	69	7.2	7.5	188.5	26	7.0	8	202	22	6.95
27	490	12335	-	-	7.5	216.5	30	-	9	219	28	-	8	214	54	-	7.5	196	21	-	8	210	20	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	490	12825	15	7.1	8	224.5	29	7.5	8	227	27	7.1	8	222	48	7.1	7.5	203.5	23	6.9	8	218	20	6.95
30	480	13305	15	7.0	8	232.5	23	7.5	8	235	23	7.1	8	230	39	7.1	7.5	211	14	6.9	8	226	18	6.95
31	490	13795	13	7.0	10	242.5	19	7.5	10	245	19	7.0	9	239	31	7.0	10	221	19	7.1	8.5	234.5	16	7.0
32	480	14275	12	6.95	9	251.5	21	6.95	9	254	19	6.95	9	248	30	7.05	8	229	17	6.95	8	242.5	16	6.95
33	500	14775	14	-	9	260.5	18	6.9	9	263	17	6.95	9	257	25	7.0	7.5	236.5	15	6.95	9	251.5	15	6.95
34	500	15275	13	-	9	269.5	17	6.9	9	272	16	6.95	9	266	23	7.0	7.5	244	15	6.95	9	260.5	14	6.95
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	500	15775	9	6.95	9	278.5	11	6.95	9	281	6	6.95	9	275	17	7.05	7.5	251.5	9	6.95	9	269.5	9	6.95
37	500	16275	3	6.95	10	288.5	7	6.95	10	291	6	6.95	10	285	7	7.05	8	259.5	5	6.95	10	279.5	7	6.95
38	500	16775	-	-	10	298.5	4	6.95	10	301	4	6.95	10	295	4	7.05	9	268.5	3	6.95	10	289.5	2	6.95

A.6.7. Plan of Approach for Small Scale Field Leaching Experiment

Introduction

The small scale field leaching experiment has been proposed in the Minutes of Meeting dated August 27, 1983 in order to improve the practicability of the result of the laboratory leaching experiment. As for the initial leaching practices, the ponding will be used and the leaching water of 100 mm to 200 mm per treatment will be applied to the test plots. The water will be added to test plots in successive increments until the total amount for leaching is attained.

Test Plot and Water Supply

Leaching experiment on different treatment will be conducted at least in duplicate plots. Dimensions of the plot are 40 m by 20 m (See Figure A-23). After the levelling work to eliminate the surface irregularity, the plots will be ploughed. A vinyl sheet shall be laid vertically at the boundary between the plots to prevent the water from horizontal movement. A low dike shall be constructed around the plots to control water application, which permits impounding the water leaching and estimating the infiltration rate.

A minimum allowable depth of groundwater table in the test plots should be maintained in order to permit adequate leaching and prevent the root zone from salt accumulation accompanied with capillary movement of water. For this purpose, a subsurface drainage system shall be provided in the test plots. Depth of drains depends on the full consideration of such factors as the depth to poorly permeable barrier, the hydraulic conductivity of the soil, the required depth of soil aeration for plant growth, and the effects of irrigation practice on deep percolation etc. A pump shall be used at an outlet of the

subsurface drainage system because the drain effuluent should be lifted up to dispose it into the gravity outlet.

For water supply to the test plots, a pump will be required to lift water from the anticipated source of water. A low pressure pipeline for the leaching water distribution shall be used. This system allows the accurate control and the measurement of water inflow. the pumping rate is determined not only by the leaching requirement but also by the operational decisions such as water distribution hours per day and days per week.

Observation

Change in Soil Properties: Soil samples will be taken to measure ECe and pH at the different depths; 10, 20, 40 and 60 cm, before and during the leaching process. Bulk density should be measured.

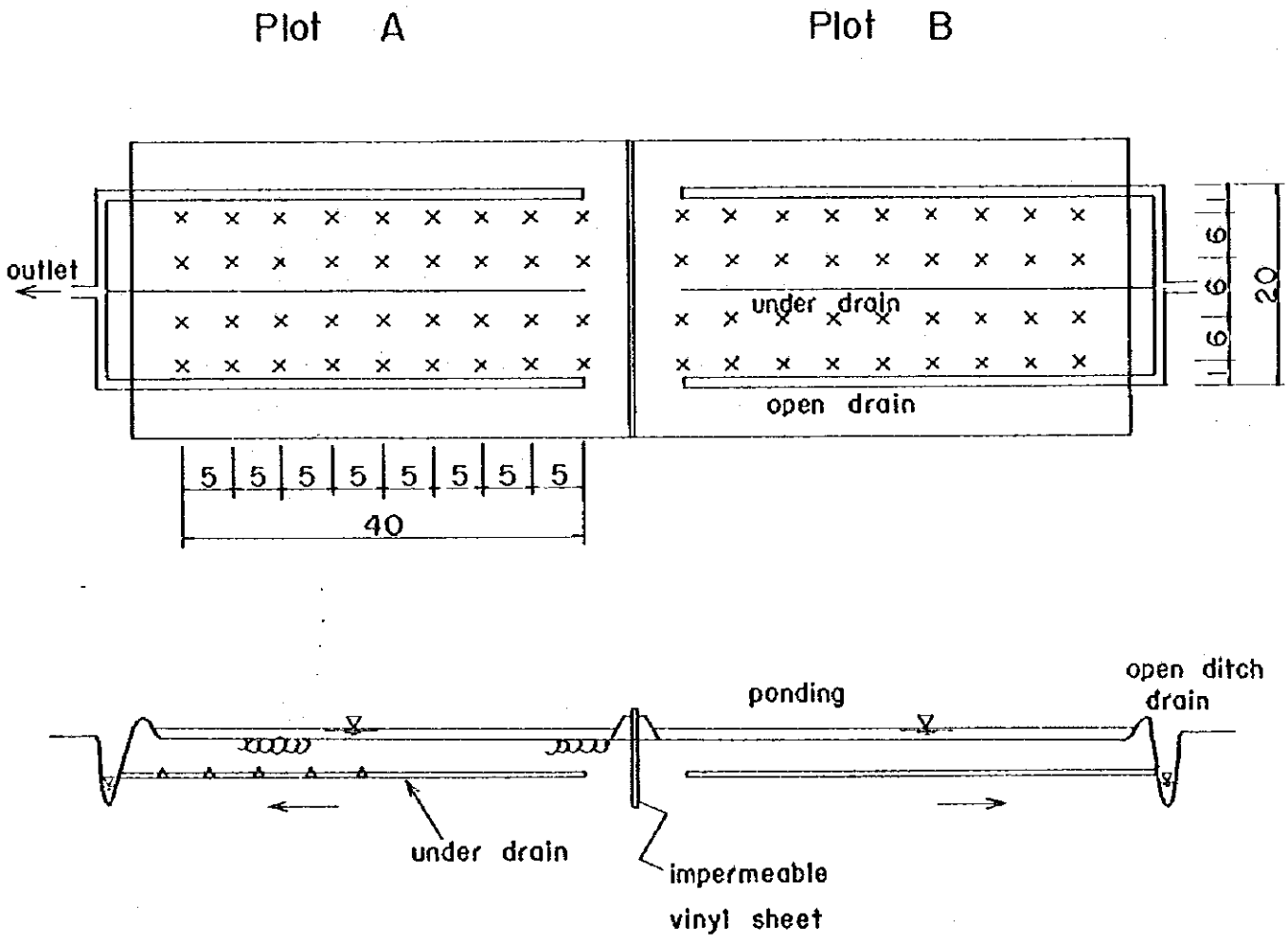
Groundwater Table: depth of groundwater table will be observed before and during the leaching process at two sites; one is 2 m from the drain and another is midway between drains.

Hydraulic Conductivity: by auger-hole method, hydraulic conductivity will be performed at two sites per plots and two measurement at different depths per site.

Water Quantity and Quality: amount of the water applied to the plots should be recorded and EC and pH of the water shall be measured periodically during the experiment. Also, amount of the drain flow should be measured. Samples of the water flowing out of the drains will be collected to make the chemical analysis.

Figure A-23 Layout of Field Leaching Experiment Plot

(Unit : meter)



X soil sampling for ECe and pH measurements
(sampling soil layer is 0 - 30 cm)

A.6.8. Results of Geotechnical Investigation (Deep Boring)

Drilling logs and the results of standard penetration test and permeability test as well as ECe and pH measurements are summarized in the data sheets as shown in Figures A-24 and the columnar sections of substrata profiles are shown in Figure A-25. The columnar section show the fact that various types of sedimentation process had took the place.

Clay and silty clay layers occupy the predominant profiles. In some boreholes, stratified sandy layer has been deposited in the substratuns. Boreholes 2 and 9 contain the shell-rich layer at 5 or 7 meters below the surface. The groundwater tables appeared at 2 to 5 meters below the surface at the time of drilling, but they ascended up to shallow depth less than 1.5 meter from the surface. The results of permeability test ranges from the order of 10^{-4} to 10^{-3} cm/sec, and of standard penetration tests (N-values) ranges from 15 to 35.

The substrata at 9 - 10 meters deep show the high salinity, that is, all ECe values exceed 20 mS/cm. The result agrees with the fact of high groundwater salinity in the Project Area.

Figure A-24 Data Sheet of Geotechnical Investigation

Bore Hole No. 1 — Project: South Hussinia — Project No. 109/SH/JT/1983 — Date: 19/11/1983 — Client: Jica Team

Description	depth (m)	Samples	Legend	Strata Change	N / Q_u	No of Blows (N) (S.P.T) Depths
Light gray to brown silty clay some organic matter, little of fine sand.	1.0	A			17	1
		SS		1.50		
Light brown clay trace of silt.	2.0	A		2.00		17
		UT			11	2
Dark gray silty clay.	3.0	A		3.00		11
		SS		3.50	6	3
Brown silty clay some organic matter. Gray to brown medium stiff silty clay.	4.0	A				4
		A				
	5.0	SS			5	5
		A		5.50		
Dark gray soft clay, trace of silt.	6.0	A				6
		UT			17	7
Dark gray silty clay.	7.0			7.00		17
	8.0	SS		8.00	24	8
Dark gray soft clay.		A				24
	9.0	SS			6	9
	10.0	A		10.00		10

Ground Water: At 3.10 m After Zero Hour; At 1.60 m After 24 Hour — Ground Level: ms

Permeability: At 2.3 – 3.8 m 1.1×10^{-3} cm/sec 0.950 m/day; 2.2 – 4.8 2.3×10^{-4} 0.199; 1.8 – 6.0 1.0×10^{-4} 0.086

Bore Hole No. 2 — Project: South Hussinia — Project No. 109/SH/JT/1983 — Date: — Client: Jica Team

Description	depth (m)	Samples	Legend	Strata Change	N / Q_u	No of Blows (N) (S.P.T) Depths
Brown medium clay, trace of silt.	1.0	A				1
		A				
Brown to gray soft silty clay some organic matter.	2.0	SS		2.0	7	2
Dark gray to brown soft clay and organic matter.		A		2.50		
Layers of yellow sand and dark gray soft clay.	3.0			2.80		3
		A		3.70		
Dark gray soft clay trace of silt.	4.0	SS			5	4
		A				
	5.0					5
Dark gray soft clay some broken shells.	6.0	UT		5.50	18	6
		A				
	7.0			7.00		7
Dark gray soft clay.	8.0	SS			3	8
		A				
	9.0	A				9
		A				
	10.0	SS		10.00	1	10

Ground Water: At 3.00 m After Zero Hour; At 1.65 m After 24 Hour — Ground Level: ms

Permeability: At 2.0 – 3.0 m 7.5×10^{-4} cm/sec 0.648 m/day; 1.7 – 3.9 2.1×10^{-4} 0.181; 3.2 – 9.0 1.8×10^{-4} 0.156

pH & Salinity: At 0.0 – 1.0m pH 7.7 ECe 42.2 mS/cm; 3.2 – 4.0 7.5 47.5; 9.0 – 9.5 7.6 63.7

Bore Hole No. 3 — Project: South Hussinia — Project No. 109/SH/JT/1983 — Date: 23/11/1983 — Client: Jica Team

Description	depth (m)	Samples	Legend	Strata Change	N / Q_u	No of Blows (N) (S.P.T) Depths
Light brown silty clay.	1.0	A		1.00		1
Brown stiff clay, trace of silt some pieces of cemented clay.		A				
	2.0	SS		2.50	16	2
Brown stiff clay.						16
Dark brown silty clay some organic matter.	3.0	UT		3.00	20	3
	4.0			4.00		4
Dark gray to brown soft clay, trace of silt.		A				20
	5.0	SS			2	5
Dark gray soft silty clay.				5.80		
Dark gray silty clay and sand.	7.0	SS		6.50	5	7
Gray graded sand, little of silt, trace of clay.		A		7.20		
	8.0	SS			6	8
				8.50		
Light gray to white graded sand.	9.0	A				9
		A				
	10.0	SS		10.00	7	10

Ground Water: At 2.80 m After Zero Hour; At 0.80 m After 24 Hour — Ground Level: ms

Permeability: At 1.8 – 2.3 m 7.9×10^{-4} cm/sec 0.683 m/day; 1.6 – 3.4 1.9×10^{-4} 0.164; 0.0 – 9.0 4.3×10^{-3} 3.715

pH & Salinity: At 0.0 – 1.0m pH 7.8 ECe 34.9 mS/cm; 4.0 – 5.0 7.6 21.9; 9.1 – 9.56 8.2 40.5

Bore Hole No. 4 | Project South Hussinio
Date 22/11/1983 | Project No. 109/SH/JT/1983
Client Jica Team

Description	depth (m)	Samples	Legend	Strata Change	N / Q_u	No. of Blows (N) (S.P.T) Depth m
Brown medium silty clay, trace of silt.	1.0	A		1.00	19	1
Brown stiff clay.		A				2
Brown medium stiff clay.	2.0	SS				19
Dark gray to brown stiff clay, small pieces of cemented clay.	3.0	A				3
Light brown clayey silt.	4.0	UT		3.70	24	4
Dark gray clay and silt.		A		4.50		24
	5.0	A		5.20		5
Dark gray soft clay some silt.	6.0	SS A			3	6
	7.0	A		7.00		7
Dark gray very soft clay, trace of silt.		SS			2	8
	8.0	A				9
	9.0	SS			1	10
	10.0	A				

Ground Water: At 5.00 m After Zero Hour; At 2.40 m After 24 Hour | Ground Level: m.s

Permeability At: 2.7 ~ 4.0 m — 3.7×10^{-4} cm/sec — 0.492 m/day
4.6 ~ 5.8 — 1.2×10^{-4} — 0.104
2.8 ~ 8.7 — 1.7×10^{-4} — 0.147

Bore Hole No. 5 | Project South Hussinio
Date 21/12/1983 | Project No. 109/SH/JT/1983
Client Jica Team

Description	depth (m)	Samples	Legend	Strata Change	N / Q_u	No. of Blows (N) (S.P.T) Depth m
Brown silty stiff clay.	1.0	A				1
	2.0	SS		2.00	7	2
Brown medium stiff clay.	3.0	A				3
		UT			18	18
Brown medium stiff silty clay.	4.0	A		4.00		4
	5.0	SS		5.00	11	11
Dark gray stiff silty clay.		A				5
	6.0	UT			36	36
	7.0	SS			18	7
Dark gray soft clay, little of silt.				7.50		18
Light brown to gray coarse sand.	8.0	A		8.00		8
	9.0	SS		8.80	3	9
Dark gray soft clay.		A				
	10.0					10

Ground Water: At 3.60 m After Zero Hour; At 1.60 m After 24 Hour | Ground Level: m.s

Permeability At: 3.8 ~ 4.0 m — 5.7×10^{-4} cm/sec — 0.492 m/day
3.3 ~ 6.0 — 4.2×10^{-4} — 0.363
2.7 ~ 8.0 — 2.2×10^{-4} — 0.190

pH & Salinity At: 0.0 ~ 1.0m — pH 8.2 — ECe 21.1 mS/cm
4.0 ~ 5.0 — 7.7 — 48.0
9.1 ~ 10.0 — 8.0 — 43.4

Bore Hole No. 6 | Project South Hussinio
Date 26/11/1983 | Project No. 109/SH/JT/1983
Client Jica Team

Description	depth (m)	Samples	Legend	Strata Change	N / Q_u	No. of Blows (N) (S.P.T) Depth m
Brown medium agriculture clay, trace of silt.	1.0	A			10	1
	2.0	SS		2.00	19	2
Gray clayey sandy silt.		UT				10
	3.0	A				3
	4.0	SS		4.50	19	4
Gray fine to medium sand.		A				19
	5.0	SS			5	5
	6.0	A		7.00		6
Gray medium sand, trace of fine gravel.	7.0	SS		8.50	7	7
	8.0	SS			9	8
Dark gray silty clay.	9.0			9.50		9
Gray medium sand.	10.0	A		10.00		10

Ground Water: At 2.10 m After Zero Hour; At 1.00 m After 24 Hour | Ground Level: m.s

Permeability At: 2.0 ~ 3.2 m — 5.0×10^{-4} cm/sec — 0.432 m/day
1.7 ~ 4.2 — 7.3×10^{-4} — 0.631
1.9 ~ 8.1 — 5.8×10^{-4} — 0.501

pH & Salinity At: 0.0 ~ 1.0m — pH 8.0 — ECe 44.9 mS/cm
4.5 ~ 6.0 — 7.8 — 37.5
9.5 ~ 10.0 — 8.2 — 40.0

Bore Hole No. 7
Date 25/11/1983
Project South Hussinia
Project No. 109/SH/JT/1983
Client Jica team

Description	depth (m)	Samples	Legend	Stratum Change	N / Q_u	No of Blows (N) (S.P.T) Dep m
Brown agriculture silty clay.	1.0	A		1.50		1
Gray to brown medium stiff clay.	2.0	UT				2
		A		2.50		
Dark gray medium stiff clay, trace of silt.	3.0	SS			10	3
	4.0	UT		4.00	11	4
		A				
Dark gray silty clay.	5.0	SS			8	5
	6.0			6.00		6
Dark gray soft clay.				6.50		
	7.0	A				7
Dark gray silty clay.		SS			4	
	8.0	A				8
				8.50		
Gray sandy clay.	9.0	SS			3	9
				9.50		
Gray silty sandy clay.	10.0	A		10.00		10

Ground Water At 1.70 m After Zero Hour
At 0.80 m After 24 Hour
Ground Level m.s

Permeability At 1.6 – 3.2 m 6.4×10^{-4} cm/sec 0.363 m/day
1.6 – 4.3 1.5×10^{-4} 0.130
1.3 – 8.6 1.2×10^{-4} 0.104

pH & Salinity At 0.0 – 1.0 m pH 8.3 ECe 38.9 mS/cm

Bore Hole No. 8
Date 23/11/1983
Project South Hussinia
Project No. 109/SH/JT/1983
Client Jica Team

Description	depth (m)	Samples	Legend	Stratum Change	N / Q_u	No of Blows (N) (S.P.T) Dep m
Brown to gray clay.	1.0	A		1.50		1
Gray silty clay, trace of fine sand.	2.0	SS			6	2
		A		2.50		
Brown silty clay.	3.0	SS		3.00	5	3
Gray medium sand, trace of fine gravel.	4.0			4.00		4
Dark gray to brown stiff clay, trace of silt.		A				
	5.0	SS			6	5
	6.0	A		6.00		6
Dark gray soft clay.		UT			15	
	7.0	A		7.00		7
Dark gray silty clay.		SS			6	
	8.0	A				8
		A				
	9.0	SS			5	9
				9.50		
Gray to brown soft clay.	10.0	A		10.00		10

Ground Water At 2.10 m After Zero Hour
At 0.90 m After 24 Hour
Ground Level m.s

Permeability At 1.6 – 3.0 m 1.2×10^{-3} cm/sec 0.137 m/day
1.6 – 4.3 1.8×10^{-4} 0.166
2.0 – 7.9 1.6×10^{-4} 0.691

pH & Salinity At 0.0 – 1.0 m pH 8.1 ECe 46.9 mS/cm
4.0 – 5.0 8.1 18.8
6.5 – 7.0 8.1 37.5
9.5 – 10.0 7.7 21.8

Bore Hole No 9
Date 24/11/1983
Project South Hussinia
Project No. 109/SH/JT/1983
Client Jica Team

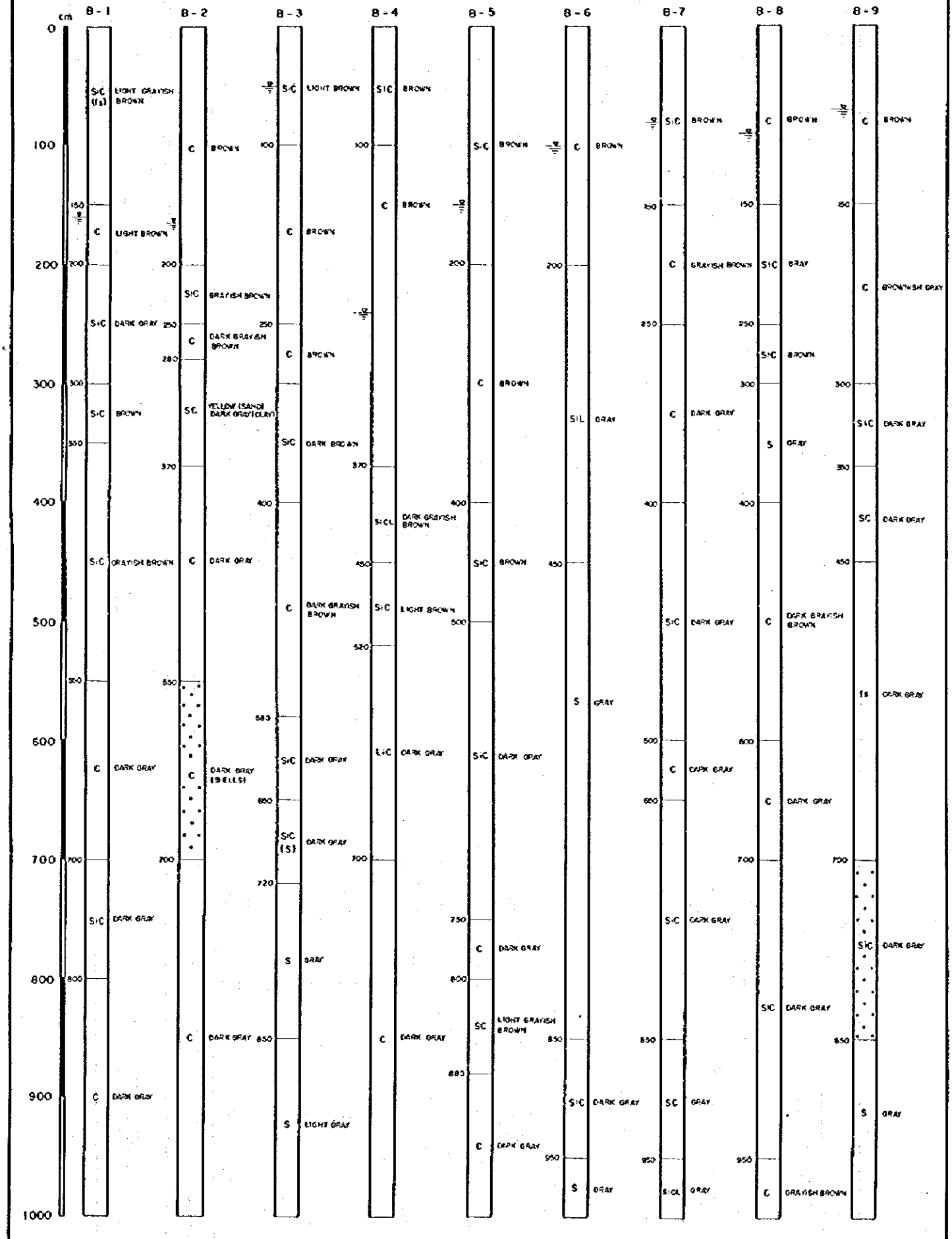
Description	depth (m)	Samples	Legend	Stratum Change	N / Q_u	No of Blows (N) (S.P.T) Dep m
Brown to gray clay	1.0	A		1.50		1
Brown to gray stiff clay, trace of silt.	2.0	UT			19	2
		A		3.00		
Dark gray silty clay some organic matter.	3.0	SS		3.70	5	3
Dark gray sandy clay.	4.0	A				4
		A		4.50		
Dark gray fine sand, little of silt.	5.0	SS			4	5
	6.0	A				6
		SS			3	
	7.0	A		7.00		7
Dark gray silty clay some brown shells	8.0	A				8
		SS		8.50	5	
Gray fine to medium sand, trace of silt.	9.0	A				9
	10.0	SS		10.00	11	10

Ground Water At 1.90 m After Zero Hour
At 0.70 m After 24 Hour
Ground Level m.s

Permeability At 1.6 – 3.4 m 4.2×10^{-4} cm/sec 0.363 m/day
1.6 – 4.6 4.3×10^{-4} 0.372
1.6 – 7.8 2.0×10^{-3} 1.726

pH & Salinity At 0.0 – 1.0 m pH 8.2 ECe 29.1 mS/cm
3.5 – 4.0 8.3 19.8
8.5 – 9.5 8.3 28.5

Figure A-25 Columnar Sections of Substrata



A.6.9. Diagnostic Horizons for Soil Classification

Salic Horizon

A salic horizon is a horizon 15 cm thick or more that contains a secondary enrichment of salts more soluble in cold water than gypsum. It contains at least 2 percent salt, and the product of its thickness in centimeters and salt percentage by weight is 60 or more.

Natric Horizon

The natric horizon (NL. natrium, sodium; implying presence of sodium) is a special kind of argillic horizon. It has, in addition to the properties of the argillic horizon:

1. Either

    a. Prisms or, more commonly, columns in some part, usually the upper part, that may or may not break to blocks; or

    b. Rarely, blocky structure and tongues of an eluvial horizon, in which there are uncoated silt or sand grains, extending more than 2.5 cm into the horizon; and

2. Either

    a. The SAR is $\geq$ 13 (or 15 percent or more saturation with exchangeable sodium) in some subhorizon with 40 cm of the upper boundary; or

    b. More exchangeable magnesium plus sodium than calcium plus exchange acidity (at pH 8.2) in some subhorizon within 40 cm of the upper boundary if the SAR is $\geq$ 13 (or ESP $\geq$ 15) in some horizon within 2 m of the surface.

Subhorizons in the upper 40 cm of the natric horizon may have calcium as the dominant exchangeable cation if the lower subhorizons in the upper 40 cm have the necessary SAR or sodium. Or, some subhorizons of the upper 40 cm may have more exchange acidity and calcium than magnesium and sodium if (a) the lower subhorizons in the upper 40 cm have a dominance of magnesium and sodium and (b) some horizon within 2 meters of the surface has an SAR $\geq$ 13 (or ESP $\geq$ 15).

The effect of sodium on dispersion of clay and on formation of a B horizon of illuvial clay has long been recognized. the importance of special recognition of an illuvial horizon that is strongly affected by sodium has not been seriously questioned.

The effect of magnesium ions on dispersion of clay is still disputed. Laboratory studies seem to show only slight difference between the effects of magnesium and of calcium. Yet it is common to find poor physical condition in a clay that has a large amount of exchangeable magnesium. The reasons for the poor physical condition are uncertain. Magnesium is considered in the definition of the natric horizon because, as sodium is removed, magnesium follows in the leaching sequence if chlorides are low and sulfates high. If leaching continues, the magnesium is eventually replaced. When replacement reaches the point that the amount of exchangeable sodium is $<$ 15 percent and the amount of magnesium and sodium is less than that of calcium and exchange acidity in upper subhorizons that have a total thickness of 40 cm or more, the horizon is no longer considered natric. One sees remains of such former natric horizons in which the columnar form is clearly evident but all other properties have been altered because of a greatly changed environment or continued leaching.

Gypsic Horizon

The gypsic horizon is a noncemented or weakly cemented horizon of enrichment with secondary sulfates that is 15 cm or more thick, it has at least 5 percent more gypsum than the C horizon or the underlying stratum, and is one in which the product of the thickness in centimeters and the percentage of gypsum is ≥ 150.

Gypsum may accumulate uniformly throughout a matrix of sand and finer textured material or as nests of crystals. In gravel or in stony material it may accumulate in pendants below the pebbles or stones.

Sulfuric Horizon

The sulfuric (L. sulfur) horizon is composed either of mineral or organic soil material that has both a pH 3.5 (1:1 in water) and jarosite mottles (the color of fresh straw that has a hue of 2.5Y or yellower and a chroma of 6 or more).

A sulfuric horizon forms as a result of artificial drainage and oxidation of slufide-rich mineral or organic materials. Such a horizon is highly toxic to plants and virtually free of living roots.

Sulfidic Materials

Sulfidic materials are waterlogged mineral or organic soil materials that contain 0.75 percent or more sulfur (dry weight), mostly in the form of sulfides and that have less than three times as much carbonate ($CaCO_3$ equivalent) as sulfur. Sulfidic materials accumulate in a soil that is permanently saturated, generally with brackish water. The sulfates in the water are biologically reduced to sulfides as the soil materials accumulate. Sulfidic materials

are most common in coastal marshes near the mouths of rivers that carry noncalcareous sediments, but they may occur in fresh-water marshes if there is sulfur in the water. If the soil is drained, the sulfides oxidize and form sulfuric acid. The pH, which normally is nearly neutral before drainage, may drop below 2. The acid reacts with the soil to form iron and aluminum sulfates. The iron sulfate, jarosite, segregates and forms the bright-yellow mottles that characterize a sulfuric horizon. The transition from sulfidic materials to a sulfudic horizon normally only requires a few years. A sample of sulfidic materials, if air dried slowly in shade for about 2 months with occasional remoistening, becomes extremely acid.

A.6.10. Determination of Gypsum Requirement (By USDA Handbook 60)

When a soil containing an excess of Na is shaken with a gypsum solution, Na is exchanged for Ca. The gypsum requirement of the soil is calculated in function of this exchange.

Weight 5 g of air-dried soil into a 150 ml bottle. Add 100 ml of saturated gypsum solution and shake for 30 minutes. Filter part of suspension and determine the Ca + Mg concentration of a suitable volume of the clear filtrate using EDTA (Versanate) method by titration.

Gypsum requirement (meq/100g) = [Ca conc. of added gypsum solution (meq/lit.) - (Ca + Mg) conc. of filtrate (meq/lit.)] x 2

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