ANNEX

B. LAND CAPABILITY CLASSIFICATION

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B. LAND CAPABILITY CLASSIFICATION

1. Introduction

The Project Area may as well be classified of its land capability at three stages of: (i) pre-reclamation; (ii) post-drainage, and (iii) post-construction. First stage represents the existing land conditions in which a great majority of the Area is under the lake-water of the Manzala and the remaining dryland is agriculturally unproductive except 4% of the total which has been so far put under plow. Second stage envisages the land conditions which may be obtainable in the Project area immediately after the lakewater will have been drained by use of pumps. Under such circumstances, the land would remain agriculturally unproductive because of an excessive salinity, poor permeability and hydraulic conductivity and inadequate aeration of soils. Third stage is put in such a situation as that appropriate drainage facilities should have been provided and desalinization could have been carried out through leaching combined with soil permeability improvement. The land capability classification in this report will be made on the assumption of the conditions obtainable in the above-said Third Stage.

2. Criteria of Land Capability Classification

Capability of the Project land in the "post-construction" stage has been classified by 7 specifications of (i) soil texture; (ii) depth to hard pan or to barrier layer; (iii) salinity (EC); (iv) alkalinity (PH and ESP); (v) slope; (vi) drainage hydraulic conductivity, and (vii) ground-water table, in general pursuance of the style adopted by the USBR.

3. Definitions of Respective Classes

The Project land at the stage where construction work will have been completed has been classified into the following 5 classes from irrigation agriculture point-of-view:

Class 1 (Highly suitable) : Lands that are highly suitable for irrigation farming, being capable of producing high yields of a wide range of climatically adaptable crops, under appropriate soil management;

Class 2 (Moderately suitable) : This class comprises lands of moderate suitability for irrigation farming where normal yields are expected with most of the crops cultivable in Class 1 lands, if appropriate soil management and improvement practices are adhered to in order to overcome some detrimental factors which are lacking in Class 1 lands;

Class 3 (Narrowly suitable) : Landsthat are suitable for irrigation farming of a restricted range of crops and their yields may not be as high compared with those expectable from Class 2 lands, if proper soil improvement and management practices should be ignored;

Class 4 (Barely suitable) : Lands that are approaching marginality for irrigation farming, being unable to bring about normal crop-yields through ordinary soil improvement and management practices due to extreme dificiencies in the soil, topographic, or drainage characteristics;

Class 5 (Least suitable) : Lands that are unsuitable for crop cultivation under irrigation and their productivity will remain extremely low even after making costly enginnering investments. Possibly useful as pasture or forest lands.

Table B-3-1 shows the specification of land capability classification for the Project Area.

Table B-3-1 Specifications of Land Capability Classification

Land Characteristics	Class I	Class II	Class III	Class IV	Class V
Soil					
Texture	Sil, SCL, L	CL, L, SiCL, Sil	Sic, C, SiCL	C	C
Depth to hard pan or to barrier layer	> 2.0	2.0 - 1.5 m	1.5 - 1.0 m	1.0 m >	1.0 m >
Salinity (EC) (1)	0 - 4 mmhos/cm	4 - 8 mmhos/cm	8 - 15 mmhos/cm	15mmhos/cm	
Alkalinity (EPS)	0 - 5	5 - 10	10 - 15	15 - 20	20 <
" (PH)	< 8%	< 8%	< 8.5%	< 8.5%	
Topography (2)					
Slope	< 3°	3° - 8°	8° - 15°	15° - 25°	> 25°
Drainage					
Hydraulic conductivity	moderately well	moderate	moderate	moderately poor	poor
Groundwater table	> 2.0 m	2.0 - 1.5 m	1.5 - 1.0 m	< 1.0 m	

(1) Salinity (EC) is presumed to be lowered to the value which is not detrimental for growth of the recommended crops after the primary leaching. At places, however, EC may rise again through percolation of groundwater, if not properly controlled from desalinization viewpoint.

(2) Soil erosion, disadvantageousness of location and exchangeable cation of Ca and Mg may also be listed as detrimental factors but will be ignored since their influences are not as decisive in the Project area.

4. Results of Analyses

The Survey Team's findings with each specification are summarized as follows:

i) Soil Texture

Soil classification and the representative soil textures of each soil class are shown in Table B-4-1.

Table B-4-1 Distribution of Representative Soil Texture

Soil Classification	Surface (0-30cm)	Subsoil (30-60cm)
JAC-awl	C, SCL	C, CL
" aw2	SL	L
" aw3	L	SiC
" aw5	SiCL, SiC, SCL	CL, SiCL
Others	Sic, SiCL	SiC, C

Soil texture is closely related with water permeability, water holding capacity, salinity, alkalinity and humus content of the soil concerned. Generally speaking, SCL, CL, L, etc., stand for suitable textures for crops as against C, SiC, etc., which are less favorable for crop production. JAC-awl and Others (dryland) are areas which require careful soil structure improvement because of their rich content of clayey soils.

ii) Depth to Hard Pan or to Barrier Layer

Depth to hard pan is related with soil's drainage hydraulic conductivity; if it should be spreading within 1.0 m depth, it would need to be broken to improve the soils' water permeability. Hard pan exists in shallow depth in JAC-awl area at the central part of North Hussinia section, covering an extent of some 42,500 feddan. In this specific area, hard pan can be reached at approx. 80 cm from the ground surface where it lies at the

southwest. The area with shallow pan and large salinity content will be ranked comparatively lower in land capability classification.

iii) Salinity (EC)

As shown in Fig. B-4-1, B-4-2 EC distribution in the Project area may be broadly classified as follows :

Most of submerged area ..... 4 - 16 mmhos/cm

Central part of South Port Said Section and Swampy area bordering on its dryland ..... 16 - 32 mmhos/cm

Dryland (parts) ..... 32 - mmhos/cm

Area-wise distribution of EC is shown in Table B-4-2 which implies that our Project area largely consists of saline soils :

Table B-4-2 Distribution of EC

EC	Surface (0-30cm)			Subsoil (30-60cm)		
	North Hussinia	South Port Said	Total	North Hussinia	South Port Said	Total
4 - 8 (medium saline)	9,110	2,020	11,130	14,450	2,940	17,390
8 -16 (highly saline)	48,660	16,730	65,390	36,010	19,630	55,640
16-32 (strongly saline)	10,710	21,240	31,950	17,470	17,760	35,230
32-64	520	1,010	1,530	1,070	670	1,740
Total	69,000	41,000	110,000	69,000	41,000	110,000

iv) Alkalinity

U.S. Salinity Laboratory classifies saline soils and alkaline soils as per Table B-4-3.

Table B-4-3 Classification of Saline/Alkaline Soils

	Saline Soil	Saline-Alkali Soil	Alkaline Soil
EC ($mmhos/cm^2$)	> 4	> 4	< 4
ESP (%)	< 15	> 15	> 15
PH	< 8.5	< 8.5	8.5 - 10

Fig. B-4-1 EC Distribution Map of Surface Soil (0 - 30 cm)

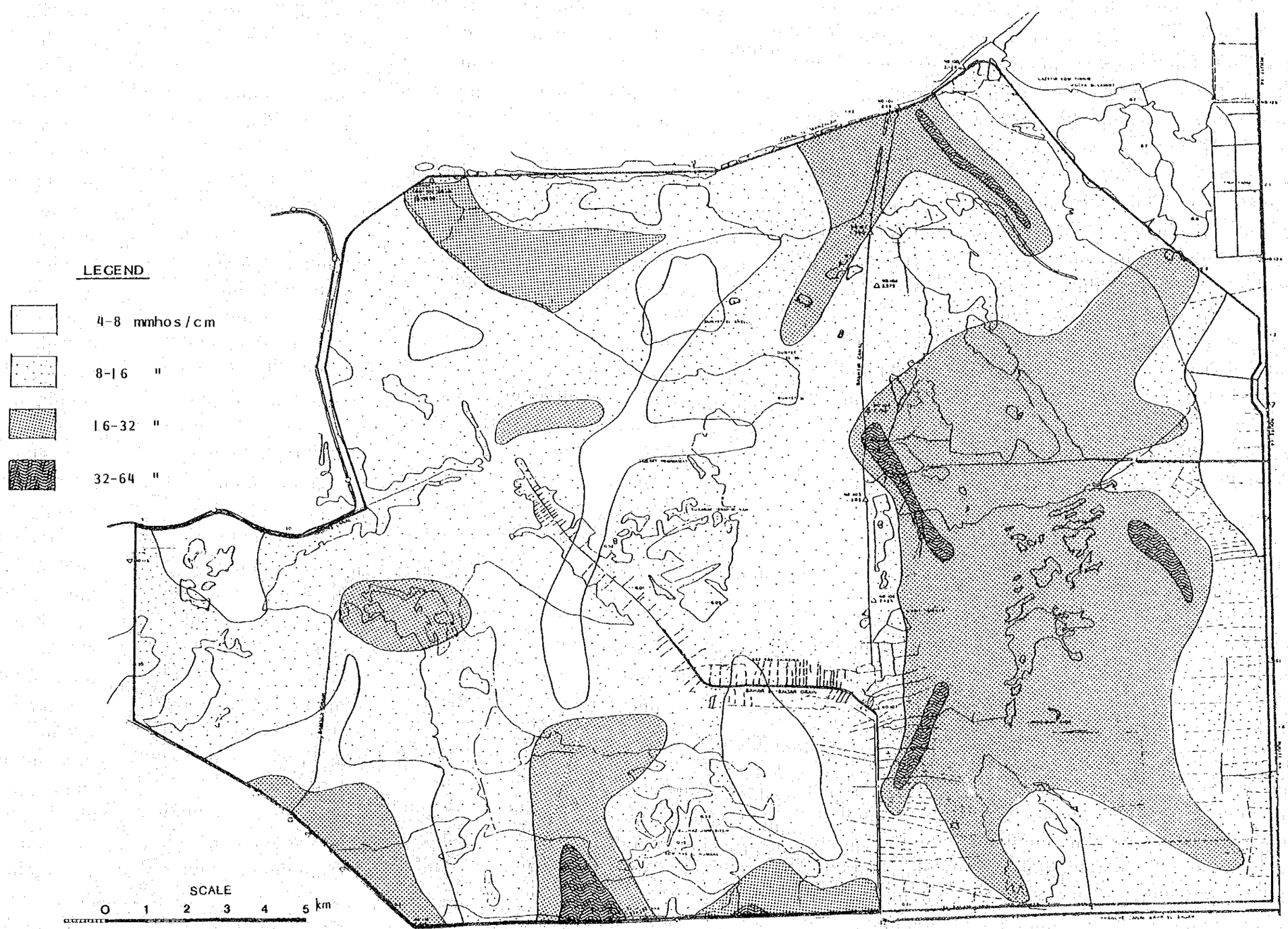
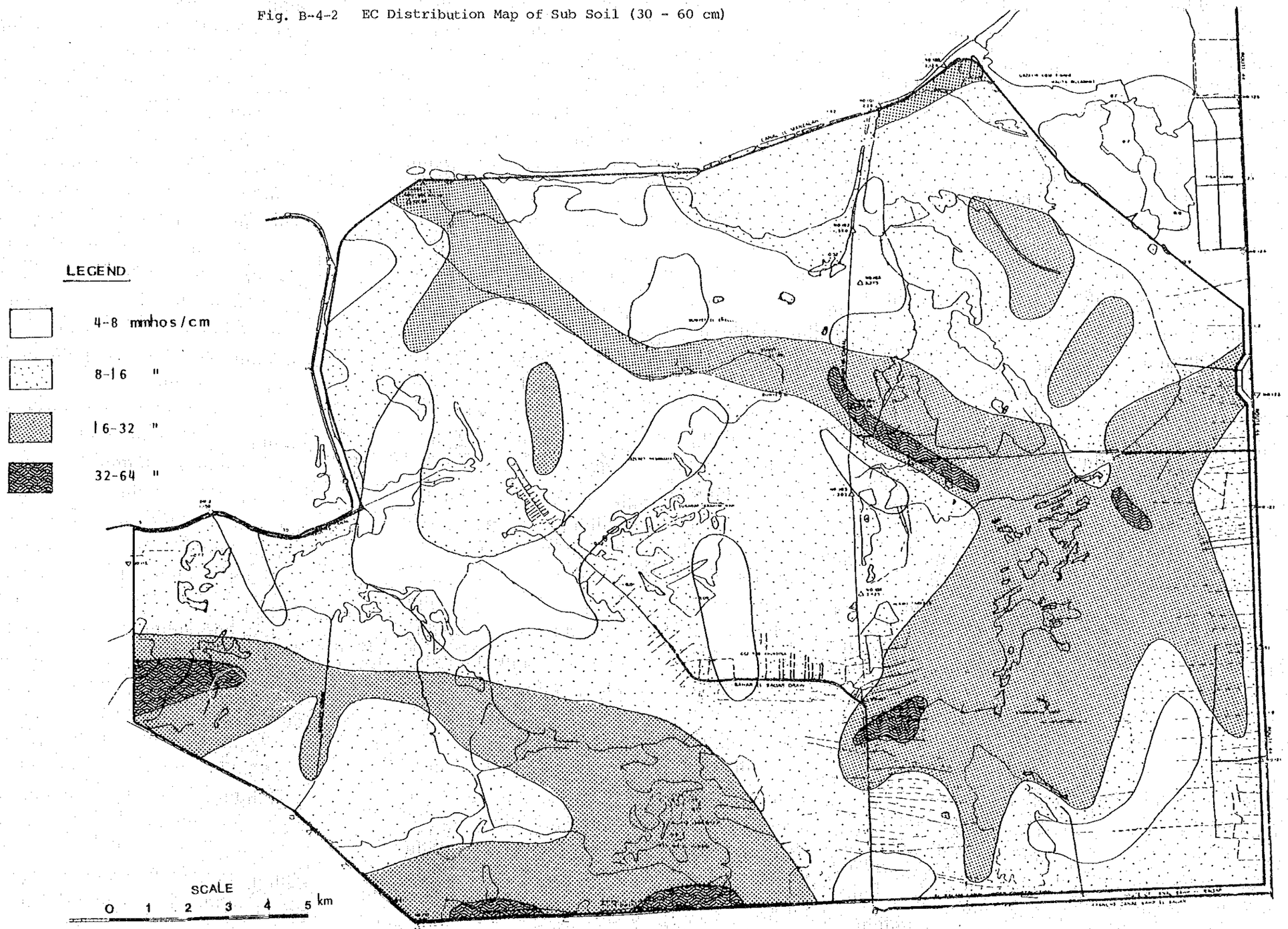


Fig. B-4-2 EC Distribution Map of Sub Soil (30 - 60 cm)



ESP is expressed in terms of Na percentage to exchangeable cations; 15% is the marginal value of ESP for crop production and plants mostly die out when ESP is 25-30%. Poor drainage is often the case with saline-alkali and alkaline soils containing more than 15% of ESP.

As will be seen from Fig. B-4-3 which shows ESP distribution in the Project area, ESP generally remains between 5 - 15% all over the Project area except in many parts of dryland as well as some parts of submerged and swampy areas where ESP is over 15%. The dryland part which is poorly ranked in the existing conditions will lower its ESP value through application of gypsum.

As regards PH, its value remains at 7.2 - 7.8 all over the Project area, implying that it is primarily comprised of light basic soils. (See Fig. B-4-4)

v) Topography

An entire Project area is commanded by a flat terrain with a mild gradient between 1/10,000 and 1/40,000, giving no harm at all for agricultural activities, except some 300 feddan dotted by historical remains and relics with over 3° slope. This specific area will be appropriated for either tourism or housing site, preserving relics where they are.

vi) Hydraulic Conductivity

As is shown in Fig. B-4-5, hydraulic conductivity is generally better in the northern side than in the southern side but, at any rate, hydraulic conductivity of this order is not believed to provide any serious constraint on crop production and soil amelioration.

vii) Groundwater Table

In the dryland area, groundwater table lies at 1.0 - 1.3 m depth at present, but it is assumed to be lowered to such a depth as non-harmful for plants' growth by providing drainage canals and, therefore, does not stand as serious minus factor in land capability classification.

Legend

5—10 ..... ■
10—15 ..... ●
15—20 ..... ▲
20— X

Fig. B-4-3 ESP. Distribution Map

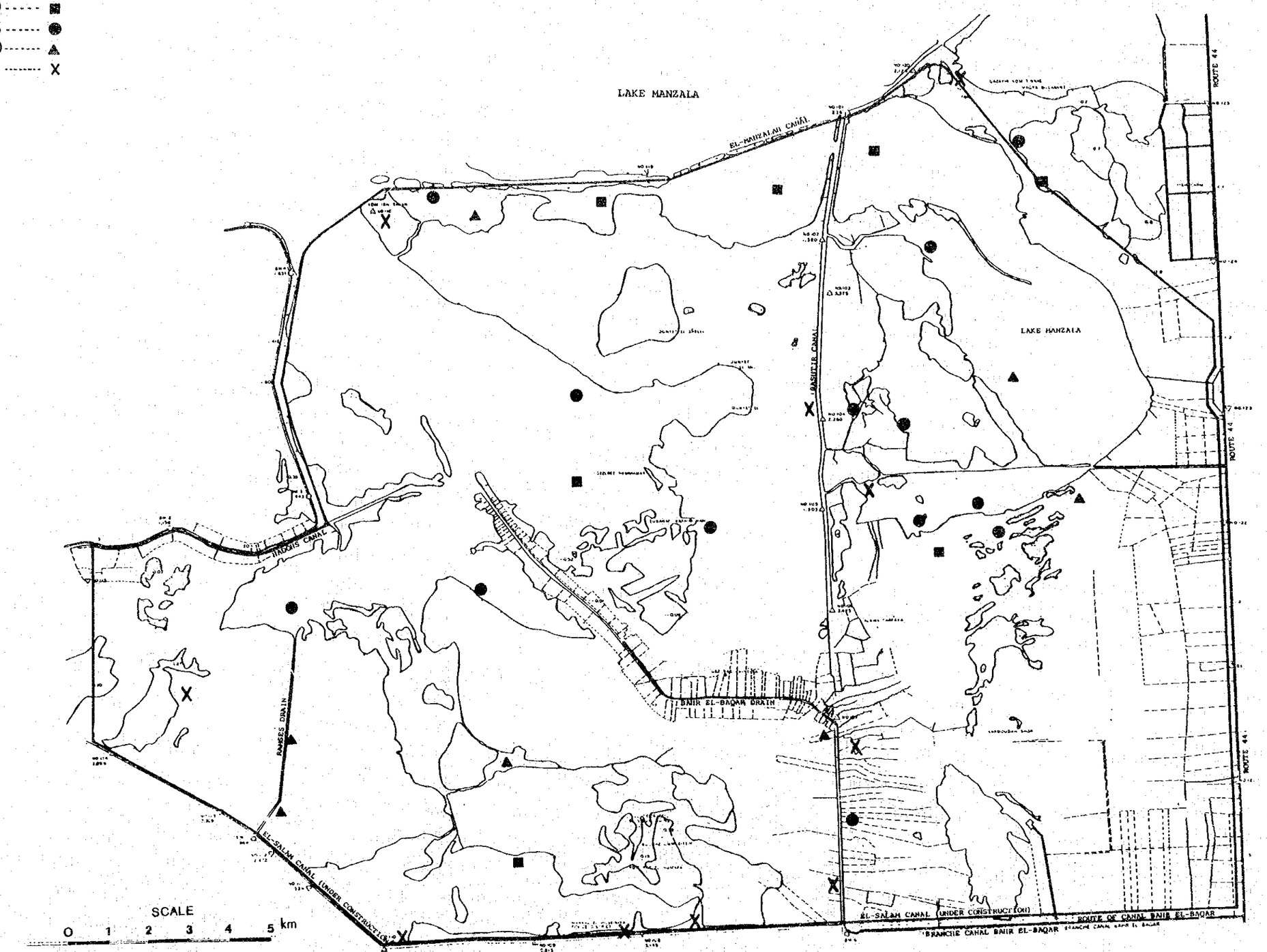


Fig. B-4-4 PH Distribution Map

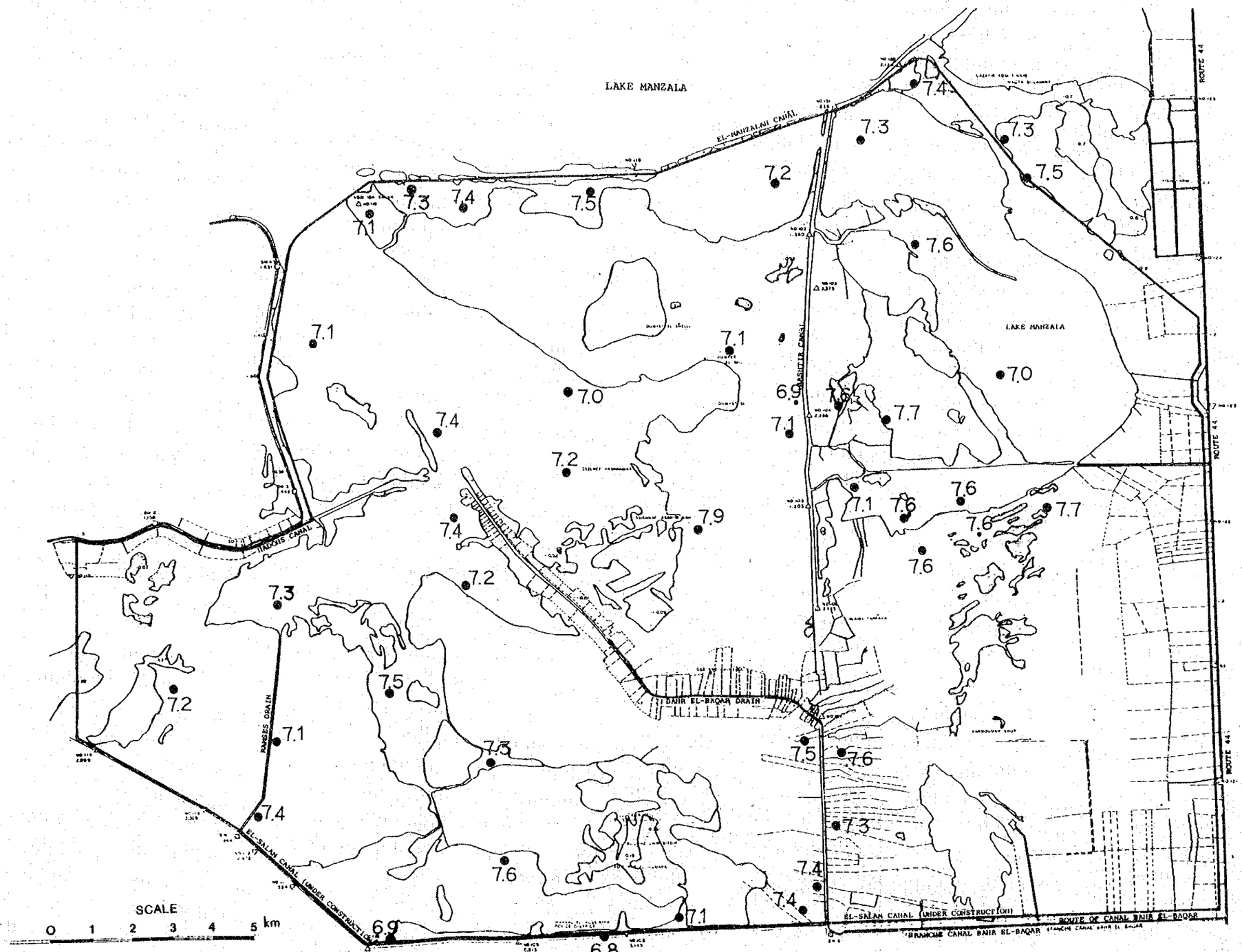
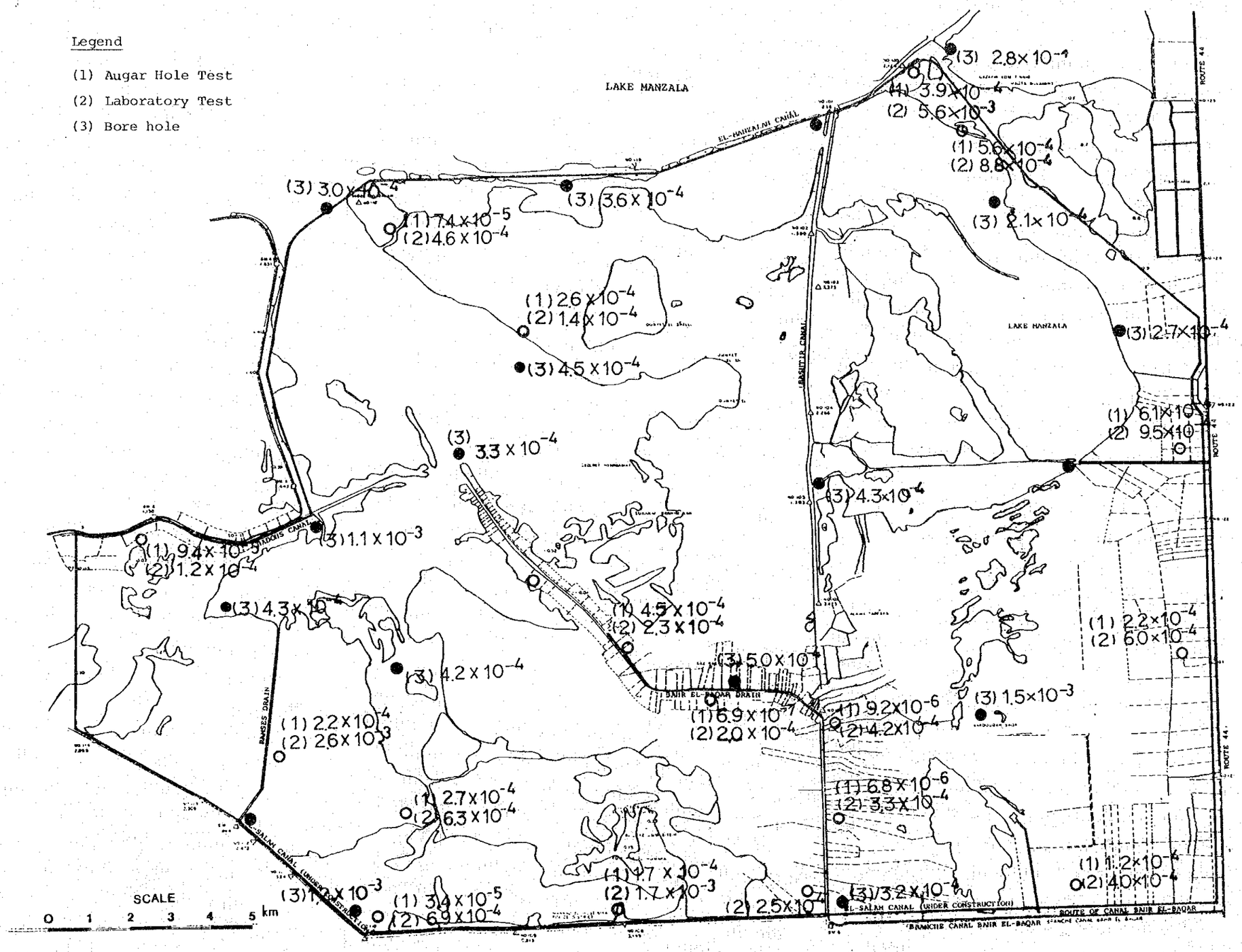


Fig. B-4-5 Hydraulic Conductivity Distribution Map



5. Land Capability Classification and Project Implementation

Out of 7 factors so far analyzed for land capability calssification of the Project area, two - topography (slope) and groundwater table - have been found to cause no serious problem. Among the other 5, soil texture and depth to hard pan or to barrier layer which have direct influences upon crop production would require a long-range effort for their improvement hand in hand with leaching and amelioration of the soils's drainage capacity to facilitate leaching itself. As regards the remaining 3: salinity, alkalinity and drainage conductivity, they are assumed to be put in more favorable conditions through land reclamation work and primary soil amelioration effort which will be undertaken in the initial stage of the project implementation; nevertheless, salinity problem particularly in southwestern side of the Project area where EC value is over 32 mmhos/cm would necessitate doubled efforts in soil management. The above observations are being reflected on Fig. B-5-1. Analytical results given in the above would be summarized as follows:

Characteristics of Two Major Land Classes

1. In reference to the class-distinction into 1 to 5 major classes under (3) above, the Project area predominantly consists of Classes 2 and 3 which can be further sub-divided into 2-a, 2-b as well as 3-a and 3-b with respective characteristics as shown in the below.
2. The Project area can be almost entirely used for agricultural production, but stable output is conditional to careful soil management all through crop cultivation, particularly in the problematic areas which are distinguished by suffix of R in the below.

2-a: Relatively stable agricultural production is expected through improvement of drainage capacity by execution of the primary soil amelioration work; however, careful drainage management is required where deep-root crops are to be introduced since this area is spreading on low elevation nearby the Lake Manzala.

1-b: Equally stable production as in 2 -a is expectable by controlling the supply of irrigation water to avoid excessive soil moisture content because this area is spreading on clayey subsoil.

2-bR: High salt content is detected (32 mmhos/cm) since it is spreading on clayey subsoils.

2-a: Poor drainage capacity inherent to this area needs to be improved through amelioration of its soil texture by means of additional supply of humus which would also facilitate smooth plowing operations. The range of suitable crops will be somewhat restricted.

3-aR: Having similar characteristics as 3-a above, but its salt content is very much more than 3-a.

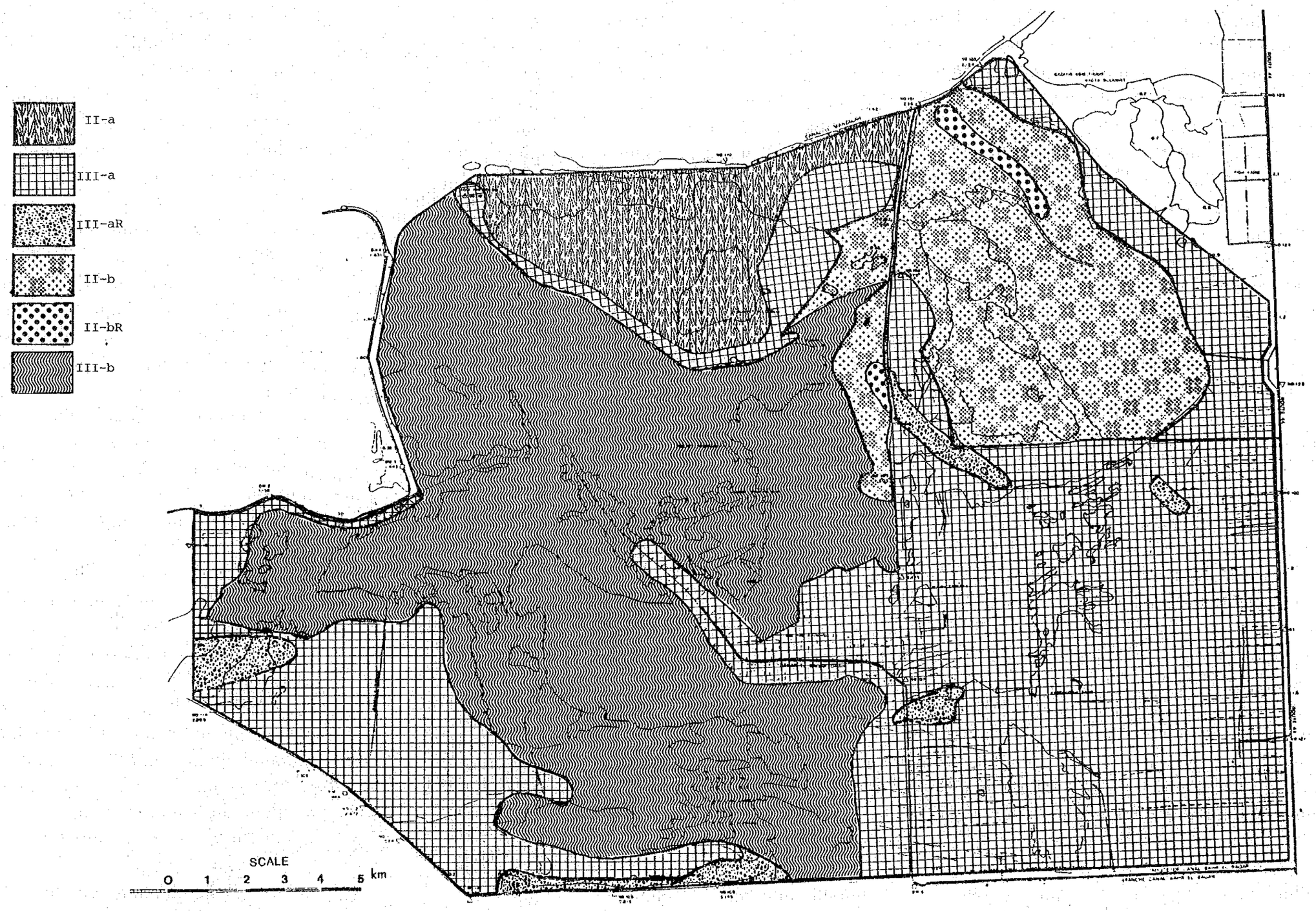
3-b: Additional efforts to those for 3-a are required in avoidance of an excessive soil moisture including breaking of hard clay layer if it is spreading at shallow depth, otherwise the same crops as in 3-a cannot be introduced.

The area falling into each class of land will be as follows:

Table B-5-1 Area Falling Into Each Class of Land (feddan)

Classification	North Hussinia	South Port Said	Total
2-a	7,240	-	7,240
2-b	2,090	11,050	13,140
2-bR	100	400	500
3-a	16,880	29,030	45,910
3-aR	1,320	520	1,840
3-b	41,370	-	41,370
Total	69,000	41,000	110,000

Fig. B-5-1 LAND CAPABILITY CLASSIFICATION PLAN



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