	loam, weak medium and fine granular structure, slightly sticky slightly plastic firm moist slightly hard dry, common fine and medium interstitial pores, many fine and few medium roots, common worm casts, clear wavy boundary, pH 8.0
37.5/47.5 - 62.5	Red (2.5 YR.4/6) moist, light clay moderate to weak medium and fine angular and subangular blocky, slightly sticky slighty plastic firm moist slightly hard dry, common fine and medium interstitial pores, few fine roots, frequent small hard spherical dark brown iron and manganese shots, slightly calcareous, clear smooth boundary, pH 8.0
62.5 - 130	Dark red (2.5 YR.3/2) moist, clay, moderate to weak medium and fine angular and sub-angular blocky, slightly sticky slightly plastic firm moist hard dry, few fine tabular pores, frequent small hard dark brown iron-manganese nodules, slightly calcareous, pH 8.0

Range in Characteristics

a. Profile Characteristics : Deep well drained dark brown to red profile almost uniform in appearance throughout its depth, especially when moist. An Argillic B, containing large quantities of dark brown iron and manganese shots. Structure development in B is moderate to weak throughout.

b. Environmental Characteristics : This soil occurs mainly on foot slopes of hills. The dominant slopes range from 2 to 20%. The erosion hazzard is slight.

iii) Bonnygate Series

These soils are erodible soils in the dissected limestone hills. The soil depth of these soils are very shallow (0-20 cm deep). Bonnygate series comprises well to somewhat excessively drained, medium textured soils developed in precambrian formation. This soil has low moisture supplying capacity and low natural fertility. This soil occupies about 185 ha of the project area. Local number of this soil is #77. Profile description of this series is omitted due to very shallow soil depth.

Range in Characteristics

a. Profile Characteristics : Bonnygate soil has a stony loam to clay loam surface layer and bedrock at 1 to 25 cm deep.

b. Environmental Characteristics : This soil occurs mainly on summits and slopes of hills. The dominant slopes range from 35 to 70%. This soil has high erosion hazard when it is cultivated. This soil becomes droughtiness in dry season.

iv) Carron Hall Series

Carron Hall Series comprises well drained, fine textured soils developed over a flat limestone hill. These soils are slightly alkaline at the surface and increase in alkalinity with depths. These soils occupy about 688 ha of the project area including 642 ha of Carron Hall clay extremely rocky complex soils.

Description of Typical Profile

Profile No.	:	P 4
Soil Name	:	Carron Hall clay # 94 Carron Hall clay extremely rocky complex # 94V.
Location	:	Vineyard, approximately 30 meters north of the road
Topography	:	flat (slope 0 - 2%)
Vegetation and Land Use	:	Pasture and fruit farm
Drainage	:	Well drained.

Profile Description

Depth in cm	Description
0 - 20	Very dark grayish brown (10 YR.3/2) moist, clay, moderate medium and fine angular and subangular blocky breaking to fine crumb, slightly sticky slightly plastic firm moist hard dry, common medium and fine tabular pores, common fine roots, common worm casts, frequent small hard rounded black iron and manganese shots, clear smooth boundary, pH 7.0
20 - 35	Light olive brown (2.5 YR.5/4) moist, clay with steaks and coatings of dark grayish brown (10 YR.3/2), weak medium blocky structure with tendency to compound wedged shaped medium blocks formed by intersection of primary sticken sides, slightly sticky slightly plastic firm moist hard dry common medium and fine pores, few medium roots frequent small hard black iron and manganese shots, clear smooth boundary, pH 8.0
35 - 150	Yellowish brown (10 YR.5/6) moist, clay, moderate to strong medium blocky structure with many shiny ped faces and many strong intersecting coarse slicken sides, sticky plastic firm moist hard dry, few fine tabular pores, few fine roots, frequent small hard black iron and manganese shots, pH 8.0

Range in Characteristics

a. Profile Characteristics : Top soil colour ranges from dark brown to olive brown and texture is generally clayey, occasionally clay loam in some places. Subsoil colour is yellowish brown to light olive brown and texture is clay with moderate to weak angular and subangular blocky structure. Subsoil shows quite well developed slickensides and pressure faces.

b. Environmental Characteristics : This soil occurs mainly over a flat limestone hill. The type extremely rocky complex soil has a bedrock that limits root penetration at about 60 cm occasionally at about 20 to 30 cm. The dominant slopes range from 3 to 7%. The erosion hazard is slight.

v) Hodges Series

Hodges series comprises well drained coarse textured soils developed in sandy parent material. This soil is neutral to slightly acid and has low moisture supplying capacity and low natural fertility. This soil occupies approximately 158 ha of the study area.

Description of Typical Profile

Profile No.	:	P 22
Soil Name	:	Hodges sand # 150
Location	:	Luana, approximately 20 meters east of the main road towards Black River
Topography	:	Very gently undulating area
Vegetation and Land Use	:	Pasture
Drainage	:	Well drained

/

Profile Description

Depth in cm	Description
0 - 15	Brown to dark brown (10 YR.4/3) moist brown (10 YR.5/3) dry, sand, massive and single grain, soft and loose, many micro pores, common medium and fine roots, common worm casts, clear smooth boundary, pH 7.0
15 - 110	Light gray (10 YR.7/2) moist, sand, massive and single grain, soft and loose, many mirco pores, few fine roots, clear smooth boundary, pH 6.5
110 - 140	Mixed light gray (10 YR.7/2) and yellow brown (10 YR.5/8) moist, clay with few fine distinct red mottles, slightly sticky plastic firm moist hard dry, few fine tubular pores, pH 6.5

Range in Characteristics

a) Profile Characteristics : Profile is generally uniform in texture (sand) sometimes sandy clay or clay subsoil in some places, has an almost uniform light gray colour throughout occasionally with few fine distinct red mottles in subsoil Structure is single grain to massive.

b) Environmental Characteristics : This soil is developed in Alluvial sandy material occupying very gently undulating area of Alluvial plain. The dominant slopes range from 5 - 7%. The erosion hazard is slight to moderate.

vi) Cashew Series

Cashew series comprises moderately well drained fine textured soils developed in old Alluvial material. This soil is slightly acid, has high moisture supplying capacity and medium to low natural fertility. This soil occupies about 344 ha of the project area.

Description of Typical Profile

Profile No.	:	P 16
Soil Name	:	Cashew clay loam # 151
Location	:	Hatfield, about 15 meters north of the road
Topography	:	Lower part of the plain
Vegetation and Land Use	:	Pasture/acacia
Drainage	:	Moderately well.

Profile Description

Depth in cm	Description
0 - 24	Very dark grayish brown (10 YR.3/2) moist, clay, moderate to weak medium angular and subangular blocky, slightly sticky plastic firm moist hard dry, common fine tubular pores, common medium and few fine roots, common worm casts, frequent small hard rounded black iron and manganese shots, clear smooth boundary, pH 8.0
24 - 31/45	Brownish yellow (10 YR. 6/6) moist, clay with steaks and coatings of dark grayish brown (10 YR.3/2), weak to moderate medium angular and sub-angular blocky with shiny pressure faces, slightly sticky plastic firm moist hard dry, few fine tubular pores, few fine roots, frequent small hard rounded black iron and manganese shots, clear wavy boundary, pH 6.5

31/45 - 65/87	Brownish yellow (10 YR.6/6) moist, clay with common fine distinct red mottles, weak to moderate fine and medium blocky structure with moderates small intersecting slicken sides, slightly sticky plastic firm moist hard dry, few fine tubular pores, frequent small hard rounded black iron and manganese shots, clear wavy boundary, pH 5.0
65/87 - 120	Brownish yellow (10 YR.6/6) moist, clay, weak to moderate fine and medium blocky structure with many shiny red faces and few moderate to strong intersecting slicken sides, slightly sticky plastic firm moist hard dry, frequent small hard rounded black iron and manganese shots, clear smooth boundary, pH 8.0
120 +	Brownish yellow (10 YR.6/6) moist, gravelly clay, moderate medium and coarse angular blocky structure, sticky plastic firm moist hard dry, frequent small hard angular fragments of quartz and few small rounded limestone gravel (1 - 2 cm) slightly effervescent, pH 8.0

Range in Characteristics

a) Profile Characteristics : Top soil colour ranges from dark brown to grayish brown and texture is clay loam to clay. Subsoil colour ranges from brownish yellow to yellowish brown and texture is clay.

b) Environmental Characteristics : This soil occurs mainly on the lower part of the plain near the swamp. It has a water table at about one (1) meter in some places. The dominant slopes range from 3 - 7% and the erosion hazard is slight.

vii) Four Paths Series

Four Paths series comprises poorly to imperfectly drained fine textured soils developed in old Alluvial material. This series comprises with two soil types depending upon the texture of the surface soil. These soils occupy about 1.957 ha of the project area.

Description of Typical Profile

Profile No.	:	P 9
Soil Name	:	Four Paths clay # 203 and Four Paths sandy loam #204 approximately 80 meters
Location	:	North of Hatfield road and about 50 meters south of the Black River
Topography	:	Elevated part of the nearly level plain (slope 3 - 5%)
Vegetation and Land Use	:	Pasture, acacia, etc.
Drainage	:	Poorly drained.

Profile Description

Depth in cm	Description
0 - 20	Brown to dark brown (10 YR.4/3) moist, clay, weak fine and medium angular and subangular blocky, slightly sticky plastic firm moist hard dry, common fine and few medium tubular pores, common fine and medium roots, common worm casts, clear smooth boundary, pH 7.0

20 - 70	Mixed yellowish brown (10 YR.5/6) and light gray (10 YR.7/2) moist, clay with common fine distinct red mottles, massive when wet upon drying breaks to weak medium and coarse angular blocks with pressure faces, sticky plastic firm moist hard dry, common fine tubular pores, few fine roots, clear smooth boundary, pH 6.5
70 - 130	Mixed yellowish brown (10 YR.5/6), light gray (10 YR.7/2) and red (10 YR.4/8) moist, clay, weak medium and coarse angular blocky structure with many pressure faces and some slicken sides, sticky plastic firm moist hard dry, few fine tubular pores, pH 6.0

Range in Characteristics

a) Profile Characteristics : Top soil colour ranges from brown to strong brown and texture varies from clay to sandy loam occasionally sandy clay loam in some places. They have mixed gray and red mottled yellowish brown clay or sandy clay subsoil with weak to moderate angular blocky structure.

b) Environmental Characteristics : These soils occur mainly on the elevated part of nearly level plain. The dominant slopes range from 3 - 7%. The erosion hazard is slight to moderate.

viii) Anglesey Series

This series comprises well drained moderately fine textured (fine loamy) soils developed in old Alluvial material. This soil is neutral to slightly alkaline and occupies about 197 ha of the project area.

Description of Typical Profile

Profile No. : P 20

Soil Name : Anglesey clay loam # 83

Location : Baptist, approximately 100 meters east of the main road towards Black River

Topography : Gently sloping (slopes 3 -7%)

Vegetation and Land Use : Pasture

Drainage : Well drained

Profile Description

Depth in cm.	Description
0 - 10	Dark brown (7.5 YR. 3/4) moist, clay loam, weak medium and fine sub-angular blocky breaking easily to medium granular structure, slightly sticky non plastic, friable moist slightly hard dry, common fine tubular pores, many fine and common medium roots, common worm casts, common sand size quartz grains, gradual smooth boundary, pH 8.0
10 - 20	Dark reddish brown (5 YR. 3/4) moist, clay with coatings of dark brown (7.5 YR. 3/4), weak medium and fine subangular blocky to massive non sticky non plastic, friable moist slightly hard dry, common fine tubular pores, common fine roots, common fine quartz grains, arbitrary boundary, pH 8.0
20 - 140	Dark reddish brown (5 YR. 3/4) moist, clay loam, weak to moderate medium and fine subangular blocky structure,

slightly sticky slightly plastic, firm moist slightly hard dry, few fine and very fine tubular pores, common fine quartz grains, pH 8.0

Range in Characteristics

a) Profile Characteristics : The colour (dark brown) and texture (clay loam) of this soil are uniform throughout its depth. Structure is weak subangular blocky to massive.

b) Environmental Characteristics : This soil occurs mainly on the lower slopes of the undulating plain near swamp. The dominant slopes range from 3 - 7%. The erosion hazard is moderate when the soils are cultivated.

ix) Wallens Series

This series comprises imperfectly to moderately well drained very fine textured soils developed in recent Alluvial material. This soil occupies about 304 ha of the project area.

Description of Typical Profile

Profile No.	: P 2
Soil Name	: Wallens clay # 9
Location	: Holland Estate, approximately 300 meters north of the Black River
Topography	: Lower part of nearly level plain
Vegetation and Land Use:	Sugar cane
Drainage	: Moderately well.

Profile Description

Depth in cm.	Description
0 - 25	Very dark grayish brown (10 YR. 3/2) moist, crust; clay, moderate medium to fine angular and subangular blocky, very sticky plastic firm moist slightly hard dry, many fine and medium tubular and interstitial pores, many fine and common medium roots, abundant worm casts, clear smooth boundary, pH 7.0
25 - 140	Yellowish brown (10 YR. 5/6) moist, clay with common fine distinct gray mottles, weak to moderate fine and medium angular blocky, sticky plastic firm moist hard dry, common fine and medium tubular pores, few medium roots, few small hard rounded black iron and manganese nodules, common small and medium limestone gravels below 120 cm, pH 8.0

Range in Characteristics

a) Profile Characteristics : Profile represents a mollic epipedon uniform in texture with brownish black top soil and yellowish brown sub soil. Structure is moderate throughout.

b) Environmental Characteristics : This soil occurs mainly on the lower part of the nearly level alluvial plain. It has a water table at about 90 cm in some places. It is flooded about 10 to 20 cm in rainy season. The erosion hazard is slight.

x) Holland Series

This series comprises imperfect to moderately well very fine textured soil developed in recent Alluvial material. This soil is neutral to slightly Alkaline and has high moisture supplying capacity. This soil occupies about 304 ha of the project area.

Description of Typical Profile

Profile No.	:	P 15
Soil Name	:	Holland clay # 109
Location	:	Holland Estate, approximately 300 meters south of the Bamboo Avenue and 700 meters east of the ruins of Sugar Factory
Topography	:	Lower part of nearly level plain.
Vegetation & Land Use	:	Sugar cane (irrigated)
Drainage	:	Poor international drainage

Profile Description

Depth in cm.	Description
0 - 15	Brown to dark brown (10 YR.4/3) moist, clay, moderate medium angular and subangular blocky, sticky plastic firm moist hard dry, common medium and few fine tubular pores, common medium and fine roots, common worm casts, clear smooth boundary, pH 7.0
15 - 52	Dark yellowish brown (10 YR.4/6) moist, clay, moderate medium angular and subangular blocky with many shiny ped faces, sticky plastic firm moist hard dry, common medium and few fine tubular pores, common medium and fine roots, clear smooth boundary, pH 8.0

52 - 120	Dark yellowish brown (10 YR. 4/6) moist, clay with common fine to medium distinct light gray (10 YR. 7/2) mottles, strong medium angular and subangular blocky with many shiny ped faces and some small intersecting slickensides, few fine tubular pores, few fine roots, pH 8.0

Range in Characteristics

a) Profile Characteristics : This soil has brown to dark brown surface layer and dark yellowish brown subsoil. Texture is clay throughout with moderate angular and subangular blocky structure.

b) Environmental Characteristics : This soil occurs mainly on the lower slopes of nearly level Alluvial plain. It has a water table at about 1 meter in some places. The dominant slopes range from 3 - 5%. The erosion hazard is slight.

1.5.2.2 Inundated Soils

Characteristics of soil profiles in inundated area are shown in Table D-3, Fig. D-5 and Fig. D-6.

i) Black River Series (I2)

This series comprises shallow flooded water, perennially wet, very poorly drained, very fine textured soil developed in recent alluvial materials and occurs in low lying areas of the flood plain along the bank of Black River and Y.S. River.

This soil is mostly gray at the surface layer and light olive brown with mottles of high chroma in deeper layers. This soil occupies about 463 ha of the project area.

This soil is classified as Aeric Tropaquepts.

ii) Broad River Series (Hla)

This soil consists of almost completely decomposed plant remains in the subsurface tier which is wholly organic except for a thin mineral layer.

The degree of peat decomposition of these soils are more than H8 of the Post Method. This soil is usually black in colour and occurs in area where the groundwater table tend to fluctuate within the soil profile. This soil occurs both on the right and left bank of Broad River. This soil occupies about 2,064 ha of the project area.

This soil is classified as Hemic Troposaprists.

iii) Morass Series

Morass series comprises with three phases depending upon its degree of peat decomposition.

a) Morass peat - high decomposition phase (Hlb).

This soil is dominantly hemic in the subsurface tier which is wholly organic except for a thin mineral layer. This soil is usually very dary brown to black in colour and occurs mainly in the Styx River and Broad River basins. This soil occupies about 1,308 ha of the project area.

This soil is classified as Hydric Troposaprists.

b) Morass peat - low decomposition phase (Hlc)

This soil is dominantly fibric in the subsurface tier which is wholly organic except for a thin mineral layer. This soil is usually brown to dark brown in colour and occurs mainly on the left bank of Y.S. River and mangrove swamp. If the soil is drained and cultivated, subsidence due to decomposition could be rapid. This soil occupies about 903 ha of the proejct area.

This soil is classified as Hydric Tropofibrists.

c) Morass peat - sulfidic phase (Hls)

This soil is potentially acid sulphate soil that is dominantly organic. This soil is generally dark brown to very dark brown in colour and has sulfidic materials within one (1) meter of the surface. Sulfidic materials are water logged organic soil materials that contain 0.75% or more sulfur (dry weight) mostly in the form of sulfide. This soil occurs mainly in marshy area near the mouth of Broad River. This soil occupies about 1,144 ha of the project area.

This soil is classified as Typic Sulfihemists.

Total hectares of each soil unit in the project area are shown in Table D-15. Distribution area of old and recent alluvial soils are approximately 2,580 (57.8%) and 800 ha (18.1%) respectively. The area of limestone soils about 1.080 ha (24.1%).

Total hectare of mineral soils in the inundated area (I2) is 6.5% for the total inundated area. Area of high decomposed (Hla) and fibric are 28.6 and 3.8% for the total area respectively. Area of potential acid sulphate soil (Hls) is 18.1% for the total area. Area of forests scattered in the inundated is 15.8% for the total area.

1.6 Soil Characteristics in the Study Area

1.6.1 Method of soils analysis

Physical and chemical properties of soils are measured by the following methods;

1) Three phase distribution: Volumenometric method
2) pF-moisture content: Suction method
3) Bulk density of peat: Undisturbed core sample method
4) Peat composition: Water sieving method
5) pH (H_2O): Glass electric method using soil suspension of 1:2.5
6) Electric conductivity: EC meter method using soil suspension of 1:2.5
7) Organic carbon of mineral soil: Wackley and Black method
8) Organic matter of peat: Ignition loss method
9) Nitrogen: Keldarl method
10) Available phosphate (P_2O_5): Toruog method
11) Zn, Mn, Fe: Spectrometrically/atomic adsorption method
12) K_2O, Na_2O: Spectrometrically/flame emission method
13) Cation exchange capacity (CEC): Shollenberger method
14) Clay mineral identification: X-ray deffraction method

1.6.2 Identification of clay mineral composition

The X-ray diffraction data obtained are shown in Fig. D-7. A set of two reflection peaks corresponding to 7.31Å and 3.57Å, characteristic to Kaolin minerals involving Kaolinite and halloysite, occurred. The intensity of these reflection peaks increased in the following order: Black River clay (#12) > Four Path sandy loam (#204)> Four path clay (#203) > Wallens clay (#9).

In addition, in each X-ray diffraction pattern of the specimens except for Wallens clay (#9), a weak reflection peak corresponding to 14.5Å is found. From the fact that this peak neither expanded by glycerol solvation nor collapsed by saturation with K^+. This peak is referred to as "aluminum-rich vermiculite" or "dioctahedral vermiculite".

The low angle reflection peak in the X-ray diffraction pattern of the specimen from Wallens clay (#9) is an enormous one showing 16.4Å spacing under the condition, and collapsed to the 13.6Å - 10.2Å region by saturation with K^+. Thus, it is considered that this peak is to be referred to as montmorillonite.

Moreover, in each X-ray diffraction pattern of the specimens from Wallens clay and Four Path sandy loam soils, the small reflection peak at 4.84Å, characteristic of gibbsite, is observed. A little peak at 6.15Å observed for Wallens clay would be attributed to feldspars. Four Path clay soil contains about 40% of amorphous materials.

The amount of the free hydrous sesquioxides in the clay fractions are about 15%. The clay-fraction content of the soils ranges from 38 to 60%. The clay mineral composition of soils is as shown in Table D-4 and Fig. D-8.

1.6.3 Physical properties of soils

1.6.3.1 Physical properties of mineral soils

Three phase distribution of major soils are shown in Fig. D-9. Solid phase of upland soils occupies about 50% of total soil volume. Liquid phase of alluvial soils are higher than that of limestone soils, and air phase are conversely low values. It is considered that poor drainability of alluvial soils is caused by such three phase distribution. On the other hand, limestone soils has low liquid phase and relatively high air phase, so that their drainability is moderate in comparison with alluvial soils.

Water retentivity of recent alluvial soils which contains montmorillonite clay mineral, is relatively high in level compared with other soils containing Kaolin clay mineral, especially the available water content (pF 2.0 to 4.2). On the other hand, gravitation water content (pF 0 to 2.0) of recent alluvial soils is smaller than that of other soils, so that the former shows poor drainability. Water retentivity of soils is shown in Table D-5.

1.6.3.2 Composition of peat soils

Land surface in the peat area is covered by various aquatic plants which are the parent materials of peat. The root zone (0 to 20 cm) of these aquatic plants consists of the fibric materials mixed with rotten and live roots in the surface layer. In order to estimate the composition of peat, the fibric and hemic materials in the undisturbed peat soils (30 cm x 25 cm x 15 cm) are measured by the water screening method. The peat composition shown in Table D-6 is expressed based on the weight percentage.

The bulk density of surface peat is of a very low level ranging from 0.052 to 0.08 g/cc. The difference of bulk density among peat soil types cannot be found. Amount of fibric materials fractionated by more than 1 mm of water screening ranges from 32 to 56% in the surface layer.

Peat composition of the subsurface layer (20 to 60 cm) is shown in Table D-7. Hemic material less than 1 mm is larger than that of surface peat and ranges from 75 to 85%. Particularly, high-decomposed peat shows a large amount of hemic materials. On the other hand, the amount of fibric materials of subsurface peat ranges from 13 to 26%, this is a very low level in comparison with surface peat.

In the peat area, the treatment of fibric materials in the surface peat might be a very important consideration since the fibric materials in paddy is known hazard for rice culture, particularly germination and rooting of rice. The practical treatments of fibric materials are considered to be crushing, aerobic degradation and burning.

1.6.4 Chemical properties of soils

1.6.4.1 Chemical properties of mineral soils

The chemical properties of mineral soils are shown in Tables D-8 and 9. The chemical properties of each soil series are illustrated in Fig. D-10. Characteristics of each item are as follows:

pH of recent alluvial soils and limestone soils ranges from 6.0 to 8.0 of the tendency of alkalin. Also, the pH of the old alluvial soils ranges from 4.5 to 7.5, but strong acidity of pH 5.5 or less is found in some places. Since acidity of these soils increases with depth from the surface layer, the eluviation of mineral bases is considered to proceed toward the deep soil layer. Improvement of acid soils might be solved by means of the dressing of calcium carbonate.

Electrical conductivity (EC) of mineral soils is clearly low in level, so salinity hazard in the upland area does not occur.

Sulfer contents of soils are very low, so sulfidic soils which contain sulfer of 0.75% or more are not found in upland areas. Sulfer content of Wallens clay (#9) is greater than that of other soils, since sulfer in these soils was accumulated by flooding.

Organic matter contents of soils can be obtained by multiplying the organic carbon content by 1.78. Organic carbon content of limestone soils ranges from 1.0 to 3.5% corresponding to a high level. Such results might be caused by accumulation of organic matter under grazing pasture in the limestone soil area. In the sugarcane field at Holland Estate, organic matter of soils may be low due to aerobic degradation under tropical climate conditions.

Cation exchange capacity (C.E.C) of recent alluvial soils show high values of 20 meq/100g or more, since the dominant clay mineral of these soils is montmorillonite that has high surface activity. On the other hand, C.E.C. of other soils are 20 meq/100 g or less. Especially C.E.C. of Hodges sand (#150), Chudlegh clay loam (#73) and Lucky Hill clay loam (#74) are 10 meg/100 g or less, so it is necessary to decide the amount of fertilizer application taking into account the C.E.C. of soils.

Total nitrogen content is a moderate level of 0.4% (22.24 meg/ 100 g soil) or less except for some soils. Since the nitrogen content of paddy soils for high yield might be more than 20 meq/100 g soil of NH_4-N, nitrogen fertilizer application in this area is not necessary.

The large majority of phosphate contents of soils are 50 ppm or less. P_2O_5 of Anglesay clay loam ranges from 40 to 180 ppm. Assuming that extractable phosphate content of soils for high yield is 100 ppm or more, mineral soils in the study area may phosphate deficiency and so application of phosphate fertilizer is necessary.

Extractable potassium contents of soils decreases in the following order, recent alluvial soil > old alluvial soil > limestone soil. K_2O of recent alluvial soils ranges from 40 to 230 ppm, and in old alluvial soils it is 40 ppm or less. K_2O Carron Holl clay belonging to limestone soil ranges from 20 to 120 ppm. The large majority of extractable potassium is 40 ppm or less, so assuming that the optimum level of potassium is more than 150 ppm, these soils have potassium deficiency.

Exchangeable calcium content of recent alluvial soils is clearly higher than that of old alluvial soils. The latter shows strong acidity by eluviation of calcium bases. Application of calcium carbonate is necessary for improvement of soil acidity.

Variation of magnesium content shows a similar tendency with calcium. MgO of old alluvial soils is very small, so that these soils require the application of magnesium bases.

Exchangeable sodium and potassium contents of soils are relatively low level of 1.0 meq/100 g or less. Exchangeable bases of mineral soils show a generally low level, it is necessary to apply fertilizer taking into account the nutrient absorption of crops and nutrient status of soils.

Minor elements such as Zn, Mn and Fe of limestone soils are as shown in Fig. D-10. Zinc content of soils is very small, and manganese and iron contents range from 10 to 200 ppm and 10 to 60 ppm, respectively. Since these soils are generally low level, the application of minor elements is required as deficiency symptom of crops.

1.6.4.2 Chemical properties of peat soils

Chemical properties of peat soil in the inundated areas are shown in Tables D-10 and D-11. Distribution of chemical elements of each peat type are illustrated in Fig. D-11.

pH of the peat area ranges from 5.5 to 8.0. Morass peat-low decomposed phase (#H1c) shows very strong acidity of pH 4.0 to 5.0 in some places, but greater part of soils shows the tendency of alkaline and weak acidity of pH 5.5 or more.

The majority of electric conductivity in the peat area ranges from 0.2 to 1.0 ms/cm, however Morass peat-sulfidic phase (#Hls) shows relatively high E.C.

Sulfer content in the peat area is 0.1% or less. However, sulfer content of Morass peat-sulfidic phase (#Hls) is higher than that of other soils. Owing to Soil Taxonomy, sulfidic soils are defined as soil which contains sulfer of 0.75% or more. Therefore, peat soils except for sulfidic soils (#Hls) might be no problem on occuring of strong acidity by sulfer.

Organic matter content of peat soils ranges from 45 to 96% as shown in Fig. D-11. Organic matter of high-decomposed peat soils are larger than that of low-decomposed one. Organic matter content of each peat type decrease in the following order; Broad River peat (#Hla, 70 to 90%) > Morass peat - high-decomposition phase (#Hlb, 60 to 90%) > Morass peat - low decomposition phase (#Hlc, 45 to 85%).

Cation exchange capacity of peat soils ranges 60 to 200 meq/100 g. Peat soils more than H6 of decomposition classes shows high C.E.C. of 100 meq/100 g or more. On the other hand, low decomposed peats show C.E.C. of 100 meq/100 g or less. Since the nutrient retentivity of peat soils is increasing with C.E.C., fertility of high-decomposed peat soils is of a higher level in comparison with low-decomposed one.

Nigrogen content of peat soils ranges from 0.1 to 3.0%, however the larger parts of N-content are 1.0% or more. Nitrogen content of peat soils corresponds to about 10 times of mineral soils. Nitrogen type in peat is mainly organic nitrogen, so that organic nitrogen in the peat changes to inorganic nitrogen by means of aerobic degradation, and then are absorbed by plants. On the other hand, available nitrogen in peat is not always enough under the anaerobic condition of a paddy field, so application of nitrogen fertilizer must be done taking into account the nitrogen content of irrigation water and nutrient absorption of crops.

Extractable phosphate content of peat soils ranges from 10 to 80 ppm as similary mineral soils. However, bulk density of peat soils is about one tenth of mineral soils, so that phosphate content per unit volume is very low level. Therefore, application of phosphate fertilizer for peat is necessary.

Extractable potassium content of peat soils ranges from 10 to 200 ppm, but the larger majority of potassium is 100 ppm or less.

Exchangeable calcium (CaO) and magnesium (MgO) contents range 10 to 200 meq/100 g and 10 to 40 meq/100 g, respectively. Even though exchangeable bases of peat soils are about twice that of mineral soils, the bases content per unit volume are equivalent to one fifth of mineral soils. Therefore, chemical fertilizer application for peat soils is necessary in order to control such a deficiency.

And also, the other deficiency of peat soils is considered particularly to be silicate (SiO_2) being low in level in comparison with mineral soils. So the application of silicate materials might be needed for increasing rice yield.

Minor element contents such as Zn, Mn, Cu and Fe are shown in Table D-12 and Fig. D-11. Zinc contents of peat soils range from 1 to 6 ppm. The larger majority of manganese content is about 200 ppm, so manganese deficiency of peat soils might not occur. Copper content of peat soils range from 0.5 to 5 ppm. Since the amount of copper absorption by rice is very small, copper deficiency of peat could be solved by applying copper sulfate ($CuSO_4$) directly to the crops at the growing stage. Free iron oxides of peat soils are relatively high in level at 200 to 2,000 ppm, therefore, it is considered that iron deficiency of peat does not occur. Deficiency of other elements such as Boron, Seren, Cobalts and Moribden might not occur in the peat area depending on the collected data and information of the field survey.

1.6.5 Chemical deficiency of soils in the study area

1.6.5.1 Chemical deficiency of mineral soils

Chemical deficiency herein is a general name for mineral deficiency and soil reactions. Chemical deficiency of mineral soils are summarized in Table D-13. Four Path clay (#203) and Four Path clay loam (#204) belonging to old alluvial soils shows strong acidity of pH 5.5 or less, so that the application of calcium carbonate is necessary for improvement of soil acidity.

Since the organic matter content of upland fields except for pasture land are of low level, application of manure and organic materials is necessary in order to improve the physical and chemical properties of soils.

Available nitrogen, phosphate and potassium are relatively low in level, so fertilizer application for mineral soils is necessary to provide the nutritional requirement of crops.

Minor element deficiency in the project area can not be recognized according to the collected data and information of the field survey.

1.6.5.2 Chemical deficiency of peat soils

Chemical deficiency of peat soils is summarized in Table D-13. pH of existing peat soils ranges more than pH 5.5. However, peat soils after drainage might be changed to acidic soils due to the formation of organic acid by aerobic degradation of organic matter. Therefore, proper application of calcium carbonate is necessary for peat soils after land reclamation.

Since the large majority of electrical conductivity of peat soils is 2 mS/cm or less, the salinity hazard in the peat area does not occur in the paddy field. Sulfer contents of peat soils does not occur as a lack of plant nutrition. Moreover, hazard of the sulfidic acidity of peat soils is a very important problem. In order to control the formation of sulfidic soils, the accumulation of sulfer must be removed by leaching of flooding water.

Since cation exchange capacity as an index of nutrient retentivity has a very high level of 100 meq/100 g soil or more, eluviation of nutrient in peat soils can be controlled.

Nitrogen contents of peat soils is relatively high in level, however, available nitrogen under the anaerobic condition of paddy fields is not always rich, so the application of nitrogen fertilizer may be required as quality of irrigation water and nutrient requirement of crops.

Also, available phosphate and potassium content is relatively low in level in comparison with mineral soils. Therefore, these nutrients must be applied to the growing stage of crops. Copper content of peat soils is of a relatively low level of about 3 ppm or less, but the absorption amount of copper by crops is very small, so copper deficiency does not occur unless there is a remarkable lowering of oxi-reduction potential of peat soils due to fixation of copper by the lignin of peat under strong soil reduction.

Free iron oxides of peat soils are relatively high in level, so it is considered that iron deficiency of peat soils does not occur. The other deficiency of peat soils are considered with both elements of the silicate (SiO_2) and magnesium (MgO). Especially, rice plants absorb a lot of silicate for increasing rice yield, so application of calcium silicate is necessary for peat soils. Silicate plays an important role for lodging of rice and disease tolerance, so it is very important that chaff and rice straw showing high silicate contents are supplied as recycle into paddy field.

Since exchangeable bases of peat soils are generally low in level, application of chemical fertilizer for peat soils is necessary according to nutrient requirement of crops. The soil dressing for peat soils is the best way to supply mineral nutrients and strengthen bearing capacity.

1.7 Soil Mapping Unit

In the project area thirteen (13) soils series are identified and mapped separately both on series and phase levels especially in the inundated area. In upland area where soils occur in so intricate patterns that they could not be mapped separately, they are mapped as soil complexes. In the project area sixteen (16) main mapping units are described and they are further subdivided into twenty-seven (27) soil mapping units as shown in Table D-14.

Soil map in the project area is shown in Fig. D-12 using soil mapping units. Recent and old alluvial soils are mainly distributed in Holland, Luana and Slipe. Limestone soils are mainly distributed in Mountainside and Vineyard. Limestone and rock outcrops can be found in Slipe and Vineyard area.

On the other hand, high decomposed peats are distributed in the Broad River banks and Black River left bank. Low decomposed fibrous peats can be found in Middle Quarters and Y.S. River Basins. Potential sulfuric acid soils are distributed in Black River estuary.

2. LAND CAPABILITY CLASSIFICATION

2.1 Basic Consideration on Land Capability Classification

Land classification based on specifications defined by the Bureau of Reclamation, U.S. Department of Interior, 1953, and modified in 1967, is currently being done in Jamaica.

Information obtained from the soil and Land Capability Survey in the Lower Morass Development Project should be valid and available to such a national project. Therefore, the Land Capability Survey of our project is consistent with the national procedure or that of the U.S.B.R.

It is necessary to be noted however, that the specification of land capability of the U.S.B.R. is available for upland crops. It is therefore necessary to prepare the land capability specification for rice culture, especially in the low-lying areas of the project with varying soil conditions and degree of peat thickness. In order to evaluate the land capability, land use and cropping pattern must be considered.

Essential points for rice culture in the study area are identified as follows in accordance with land classification standard presented by Ministry of Agriculture, Forestry and Fishery, Japan.

(1) Effective soil depth (d): This depth, that is a distance from surface to its parent material, is a factor to be considered in the evaluation of land capability for rice culture. This depth should be at least 20 cm deep, providing adequate root and tillability of ploughing. Depth of less than 20 cm may prove difficult for mechanical ploughing due to limestone outcrops.

(2) Tillability of ploughing (P): Germination and growth of rice plants require good physical properties of soil for tillability of root zone which is affected by the texture and consistence of surface soils.

(3) Bearing capacity for workability (b): Land capability of pest area is affected by the degree of bearing capacity within one (1) meter of soil depth. Even in the case of using farm machinery in the project area, bearing capacity of 0.5 kg/cm^2 of more is at least required for its trafficability, especially on the peat soils of the inundated area.

(4) Leak of logged water (l): Logged water in paddy land is to be maintained for relatively long terms of plant growth. High percolation rate in the paddy field would result in the loss of available plant nutrients and inefficient aerobic decomposition of peat. A proper percolation rate in the paddy land might be 5 to 10 mm/day in the peat area. Percolation in the paddy field is controlled by the texture and permeability of the subsoils.

(5) Oxidation-reduction potential (r): Although paddy soils are under logged water for a long time, it is necessary to protect the plant roots from the hazard of soil reduction. The degree of oxidation-reduction potential is affected by the organic matter and free iron contents and permeability of the soils.

(6) Soil fertility (f): Fertility of paddy soils is controlled mainly by chemical properties such as pH, C.E.C., base saturation and nutrition status.

(7) Chemical hazard (c): Soils in the coastal zone of the inundated area, particularly peat soils with sulpher content of 0.75% (wt.) or more, poses severe limitation.

On the other hand, the land capability for upland crops are employed a modified format of the present system being used in Jamaica. The present land capability classification system utilizes only four broad principal limiting factors viz:-

(1) Slope and erosion hazard (e): The erodibility of soils in the project area is a product of the topographic condition of the land in complex with slope undulation. Erosion of soils in the project area is also influenced by soil physical properties and human activities, for example land clearing and ploughing.

(2) Excess water in the soil seasonally and otherwise resulting in poor drainage (W): The soils of the upland areas of the project area comprise characteristically clay under the rather high rainfall intensity. Adequate drainability of the soil is necessary in order to maintain normal plant growth.

(3) Shallow soil or soils with low moisture holding capacity (S): In order to maintain the normal growth of plant roots, the deep effective depth and adequate physical condition of root zone are essential. Upland crops that are sensitive to moisture regime in soil, are affective by the moisture holding capacity of soils evaluated by the soil texture.

(4) Climatic factor e.g. low rainfall or long dry season (c): In order to predict the soil moisture regime and soil erosion, annual rainfall and evaporation must be observed in the project area.

In order to create a better understanding of the soils and to provide a better assessment of the required management input, a modified land capability specification is developed as shown in Table D-18. This system takes into account eleven major limiting factors.

Land capability of soils in the study area are classified into I to VI classes by the following classification criteria. Capability classes of I to III are suitable for cultivation while class IV is marginally suitable and Class V to VI are not suitable. Land capability classes in the project area can be classified into some sub-classes in accordance with main limitations.

Sub-classes that found on rice culture are as follows:

Sub-classes in the class II are found on IIe (leak) IIp (ploughing) and IIpl (ploughing and leak). Sub-classes in the class III are found on IIIf (soil fertility), IIId (effective soil depth), IIIfl (Fertility and leak) and IIIpr (ploughing and reduction). Sub-classes in the class IV are found on IVdl (soil depth and leak), IVdg (soil depth and gravel), IVlf (leak and fertility) and IVbr (bearing capacity and reduction). Sub-classes in the class V are found on Vbr (bearing capacity and reduction) and Vbc (bearing capacity and chemical hazards).

Sub-class found on the project area for upland crops are as follows in accordance with the land capability specification of Jamaica.

Sub-classes in the class II are IIw (drainage), IIs (soil fertility), and IIsw (drainage and fertility). Sub-classes in the class III is only IIIw (drainage). Sub-classes in the class IV is also IVse (fertility and erosion). Sub-classes in the class V are Vse (fertility and erosion) and Vsw (fertility and drainage).

As mentioned above, Sub-classes for rice culture has many limitations in comparison with upland crops.

2.2 Criteria of Land Classification

Taking into account the soil and land condition presented in the study area and also plant physiological characteristics of paddy and upland crops, criteria and specifications for land capability classification are prepared in accordance with the land classification standard presented by Ministry of Agriculture, Forest and Fishery (MAFF), Japan and Ministry of Agriculture (MOA), Jamaica.

The criteria for the rating of soil and land limitations are shown in Table D-16. As mentioned above, rice paddy has many limitations due to prolonged logged water and consequent change of the soil environment. The specifications shown in Table D-17 except for chemical hazard and workability are attained through the aid of the Guide Book of Land Classification defined by Agriculture and Horticulture Bureau, Japan, 1979. Chemical hazard and workability are added in order to improve the accuracy of our study.

Land capability for upland crops were identified according to the standard of the Soil Department of the Ministry of Agriculture, Jamaica. Of the fifteen existing capability classes identified by the Technical Guide Sheet, only eight (8) are relevant to our study. Specification for upland crops is shown in Table D-18.

2.3 Land Capability Classification in the Study Area

Land capability evaluation in the Study Area was made through soil survey data including laboratory analysis and information on the existing land use. The differences in soil types played a significant role in the evaluation of the land capability classes.

2.3.1 Land capability of the soil groups by parent materials

Land capability classes of each soil type shown in Table D-19 shows that differences of classes between rice and upland crops cannot be almost recognised.

The classes of limestone soils in the upland area ranked into III to IV due to shallow depth, gravel and low fertility. The classes of recent and old alluvial soils are ranked relatively high into class II except for Hodges Sand. Their main limitations are leak of logged-water and tillability of plough layer due to heavy clay content of soils. Hodges Sand is poorly ranked at class IV due to leak of logged-water and low soil fertility.

Land capability classes of the inundated area are relatively low ranking into III to V due to low bearing capacity, strong soil reduction and chemical hazards. Mineral clayey soils, I2, in the inundated area have limitations such as ploughing and soil reduction. Peat soils are ranked into classes III to V due to limitations such as low bearing capacity and soil reduction as follows:

- Hemic Troposaprists H1a, is highly decomposed peat which is ranked into class III due to soil reduction. This soil is suitable for paddy after land reclamation, but is marginally suitable land for upland crops.

- Hydric Tropohemists, Hlb, is ranked into class IV due to its bearing capacity at 0.5 kg/cm^2 within 100 cm of soil depth. This soil is marginally suitable land for rice culture and upland crops.

- Hydric Tropofibrists, Hlc, is ranked into class V due to its low bearing capacity and strong soil reduction. This soil is not suitable for rice culture and upland crops.

- Typic Sulfihemists, Hls, belongs to class V due to potential Sulphuric Acid Soils that contain Sulpher of 0.75% (wt.) or more. This soil is not suitable for rice culture.

2.3.2 Land capability for rice culture

Distribution of land capability for rice culture in the upland soils is shown in Table D-20 and Fig. D-13. Holland Estate and Hatfield areas occupy all the suitable land for rice culture. Vineyard area bears the least suitable lands mainly due to limestone outcrops. Mountainside area shows a high extent of suitable lands, but actual area of suitable land might be below 40% of the project area due to complex soils (mapping units, 1a, 2a) consisting of limestone hills. Actual suitable land of Slipe area might also be below the area shown in Table D-20 due to complex soil of the sub-class IV in this area. Old Alluvial soils in the Luana area have relatively high agricultural potentiality because of the effective soil depth is deep. Total area of suitable land (classes II to III) is 3,100 ha (70% of the total upland area), except for complex soils of class IV).

On the other hand, suitable land classes in the inundated area are included class IV because of the land conditions are flat and the drainage of peat soils should be well enough with the artificial drainage system. Distribution of suitable land in the inundated area for rice culture are shown in Table D-20. Areas of suitable land for rice culture are 1,160 ha in Black River left bank, 390 ha in Y.S. River left bank, and 2,440 ha in Broad River basin. Total area of suitable land is 3,990 ha corresponding to 57.4% of entire inundated area. Forest land in the inundated area are ranked as class VII which is unsuitable for agriculture in accordance with the USDA System.

2.3.3 Land capability for upland crops

The land capability classes for upland crops in the project area are almost same except for limitations of each land class. However, the lower clasees (IV to V) for paddy are ranked one class lower due to irregular topographic conditions. Suitable lands for upland crops are defined as class I to III except for class IV because class IV lands are undulating and have limestone outcrops which would limit proper irrigation system and land reclamation.

Distribution of land suitability in the upland area are shown in Table D-20 and Fig. D-14. Area of suitable lands in Slipe and Mountain-side districts are decreased in comparison with suitable land area for rice culture. Main part of suitable lands in the upland area is distributed in Holland area. High agricultural potential area for upland crops are considered in Hatfield and Luana areas.

On the other side, suitable land in the inundated area is only class III of mineral soils along on the side of Y.S. River and Black River bank. Area of such soils is only 9.1% for whole inundated area. Peat soils are almost not suitable for upland crops because of subsidence by well drainage and aerobic decomposition under upland condition and of excess moisture injury by poor drainability.

2.3.4 Land Capability for Specific Crops

Land capability for upland crops mentioned above are made according to the present land capability classification system in Jamaica. Furthermore, land capability for specific crops are classified in accordance with the modified land capability specification shown in Table D-18 so as to provide a better assessment of the required input. Land capability for specific crops in the upland area are shown in Table D-21. Capability classes for various crops of each soil type are almost same except for few limitations, that differ depending upon the specific crops and soil types.

2.4 Demarcation of Potential Arable Land

The soils in the study area are classified into seven (7) orders, eleven (11) sub-orders, twelve (12) great groups and twelve (12) sub-groups in the higher categories of classification.

Furthermore, thirteen (13) soil series are recognized out of which 10 are in upland and 3 are in inundated areas and mapped separately both on series and phases level, especially, in the inundated area. In the upland area where soils occur in such intricate patterns that they could not be mapped separately, they are mapped as soil complexes. In the study area sixteen (16) main mapping units are described and they are further sub-divided into twenty seven (27) soil mapping units.

Taking account of the aforementioned land capability classification, the project area is demarcated based on the present land use and water for irrigation. Distribution of soil series in the project area are shown in Table D-22. Mineral soils in the Holland area occupy about 620 ha corresponding to 90% of the total area and peat soils occupy about 62 ha. On the Black River left bank, mineral and peat soils occupy about 350 ha and 750 ha, respectively. The remaining area of 100 ha is forest land consisting of mineral soils. On the Broad River right bank, peat soils occupy about 98% of the total area and the mineral soils in the forest land area the remaining 2%. Peat soils on the Broad River left bank occupy about 90% of the total area and the forest land consisting of peat soils includes about 10%.

Land capability classifications for rice culture in the Project Area are shown in Table D-23. Land capability classes in the Holland area are all suitable classes. On the Black River left bank, suitable and marginally suitable lands, are about 800 ha and 300 ha, respectively. The remainder of 106 ha is forest area consisting of mineral soils. The forest areas belong to unsuitable class VIII, however, it is considered that these forest areas can be used as arable land by means of land reclamation such as stumping and land grading. On the Board River right bank, areas of suitable land including the marginally suitable class is 98% of total area. On the other hand, the suitable land on the

Broad River left bank is 89% of the total area, the remaining 11% of the area is forest land consisting of peaty soils. It is expected that such peaty forest involves great difficulties in land reclamation.

Land capability classifications for upland crops in the Project area are shown in Table D-24. Area of the suitable classes in the project area is only about 1,000 ha corresponding to two fifth (40%) of the suitable land area for rice culture. Besides, the area of marginally suitable and unsuitable classes is remarkably high in comparison with the area for rice culture. Therefore, it is considered that rice culture in the Project area is rather an advantageous land use than upland crops.

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Table D-1 EVALUATION OF THE PEAT DECOMPOSITION BY THE POST METHOD

Classes	Characteristics of Peat
H 1	No Dy (Dy means black materials and humic colloid), undecomposition, extracted water is no colour.
H 2	No Dy, undecomposition, extracted water is yellow colour.
H 3	Little Dy, slight decomposition, extracted water is muddy.
H 4	Little or more Dy, slight decomposition, extracted water is extremely muddy.
H 5	Rich in Dy, little muddy by squeezing the peat in the hard, much paste status.
H 6	High content Dy, flow 2/3 peat material by squeezing, much paste status, 1/3 muck materials.
H 7	High humification, very high content Dy, flow 1/2 peat material by squeezing, paste status, 1/2 muck materials.
H 8	Strong humification, very high content Dy, flow 1/3 peat material by squeezing, 2/3 pasty muck.
H 9	Almost decomposition, Dy only, no plant remained.
H 10	Complete decomposition, uniformly flow out by squeezing.

Table D-2 SOIL CLASSIFICATION IN THE PROJECT AREA BY SOIL TAXONOMY

Order	Sub Order	Great Group	Sub Group	Jamaican Map Symbols	Land Condition
Oxisols	Orthox	Eutrorthox	Typic Eutrorthox	# 73, # 83	Upland
Alfisols	Ustalfs	Haplustalfs	Udic Haplustalfs	# 74	"
Entisols	Orthents	Ustorthents	Lithic Ustorthents	# 77	"
"	Psamments	Quartzipsam-ments	Typic Quartzip-samments	# 150	"
Vertisols	Uderts	Chromuderts	Typic Chromuderts	# 94, # 94v	"
"	Usterts	Chromuderts	Typic Chromuderts	# 151, # 203, # 204, # 109	"
Mollisols	Udolls	Hapludolls	Aquic Hapludolls	# 9	"
Inceptisols	Aquepts	Tropaquepts	Aeric Tropaquepts	# I2	Inundated
Histosols	Saprists	Troposaprists	Hemic Troposaprists	# H1a	"
"	Hemists	Tropohemists	Hydric Tropohemists	# H1b	"
"	Fibrists	Tropofibrits	Hydric Tropofibrists	# H1c	"
"	Hemists	Sulfihemists	Typic Sulfihemists	# H1s	"

Table D-3 LEGEND FOR THE UPLAND SOIL OF THE PROJECT AREA

PHYSIOGRAPHIC UNIT: HILLS

LIMESTONE		TEXTURE		COLOUR (Moist)					
MAP UNIT	PHYSIO-GRAFIC POSITION	TOPSOIL 0-25 cm	CONTROL SECTION 25-100cm	TOPSOIL 0-25 cm	SUBSOIL	MOTTLES DRAINAGE	DIAGNOSTIC CRITERIA	JAMAICAN NAME	PROVISIONAL USDA CLASSIFICATION
DHUDLEIGH Clay loam	SIDE SLOPE OF HILLS	Clay loam	Fine loamy	10YR 3/4 7.5YR 3/4	10YR 3/4 7.5YR 3/4	NONE-WELL DRAINED	OXIC Bs	CHUDLEIGH #73	TYPIC EUTRORTHOX
LUCKY HILL Clay loam	FOOT SLOPE OF HILLS	Clay loam	Fine	5YR 3/4 7.5YR 3/4	5YR 4/6 2.5YR 4/6	NONE-WELL DRAINED	ARGILLIC Bt	LUCKY HILL #74	UDIC HAPLUSTALFS
BONNY GATE Stony clay loam	HILLS	Stony clay loam to loam	-	7.5YR 3/4 2.5YR 3/4	-	NONE-WELL DRAINED	LITHIC 2,5cm DEEP	BONNYGATE #77	LITHIC USTORTHENTS
CARRON HALL Clay-extremely rocky complex	FLAT HILL OVER LIMESTONE	Clay	Fine	10YR 3/4 2.5Y 4/4	10YR 5/8 2.5Y 5/6	NONE-WELL DRAINED	ROCK OUTCROP LITHIC, GILGAI SLICKENSDIE	CARRON HALL #94V	TYPIC CHROMUDERTS
CARRON HALL Clay	FLAT	- do -	- do -	- do -	- do -	- do -	GILGAI, CRACKS, SLICKENSIDE	CARRON HALL #94	TYPIC CHROMUDERTS

PHYSIOGRAPHIC UNIT: ALUVIAL PLAIN

OLD ALLUVIUM		TEXTURE		COLOUR (Moist)					
MAP UNIT	PHYSIO-GRAFIC POSITION	TOPSOIL 0-25 cm	CONTROL SECTION 25-100cm	TOPSOIL 0-25 cm	SUBSOIL	MOTTLES DRAINAGE	DIAGNOSTIC CRITERIA	JAMAICAN NAME	PROVISIONAL USDA CLASSIFICATION
HODGE Sand	VERY GENTLY UNDULATING PLAIN	Sand	Sandy	10YR 5/3, 4/3	10YR 7/1, 7/2	NONE-FEW 10YR 7/6, 6/8	SANDY CONTROL SECTION	HODGES #150	TYPIC QUARTZPSAMMENTS
CASHEW Clay loam	LOWER PART OF THE PLAIN NEAR SWAMP	Clay	Fine	10YR 3/2, 3/3	10YR 6/8, 6/6, 5/8	NONE-FEW 10R 4/6, 3/6	GILGAI CRACKS 1cm WIDE AT 50cm SLICKENSIDE	CASHEW #151	TYPIC CHROMUSTERTS
FOURPATH Clay	ELEVATED PART OF NEARLY LEVEL PLAIN	Clay	Fine	10YR 4/3, 3/3 7.5YR 4/6	10YR 6/6, 5/8	COMMON RED and STRONG GRAY MIXED TYPICAL IN SUBSOIL	AS ABOVE	FOURPATH #203	TYPIC CHROMUSTERTS
FOURPATH Sandy loam	GENTLY UNDULATING PLAIN	Sandy loam	Fine	10YR 4/3, 4/4	10YR 6/6, 5/8	AS ABOVE	AS ABOVE	FOURPATH #204	TYPIC CHROMUSTERTS
ANGLESEY Clay loam	LOWER SLOPES TOWARD SWAMP	Clay loam	Fine loamy	7.5Y 3/4	7.5YR 3/4 4YR 3/4	NONE-WELL DRAINED	OXIC Bs	ANGLESEY #83	TYPIC EUTRORTHOX

PHYSIOGRAPHIC UNIT: ALLUVIAL PLAIN

RECENT ALLUVIUM		TEXTURE		COLOUR (Moist)					
MAP UNIT	PHYSIO-GRAFIC POSITION	TOPSOIL 0-25 cm	CONTROL SECTION 25-100cm	TOPSOIL 0-25 cm	SUBSOIL	MOTTLES DRAINAGE	DIAGNOSTIC CRITERIA	JAMAICAN NAME	PROVISIONAL USDA CLASSIFICATION
WALLENS Clay	LOWER PART OF NEARLY LEVEL PLAIN	Clay	Very fine clayey	10YR 3/2, 3/3	10YR 6/6, 5/6	NONE-WELL DRAINED	Mollie epipedon	WALLENS #9	AQUIC HAPLUDOLLS
HOLLAND Clay	LOWER SLOPE OF NEARLY LEVEL PLAIN	Clay	Very fine clayey	10YR 4/3, 3/3	10YR 4/6, 5/6	NONE-WELL DRAINED	Gilgai: Cracks 1 cm wide at 80cm slicken side	HOLLAND #109	TYPIC CHROMUSTERTS

PHYSIOGRAPHIC UNIT: ALLUVIAL SWAMP

BLOCK RIVER Clay (I2)	SWAMP	Clay	Very fine clayey	10YR 5/6, 3/2 2.5Y 4/4	2.5Y 5/6, 5/4	COMMON RED & GRAY	WET CAMBIC BW	N/A	AERIC TROPAQUEPTS
BROAD RIVER Peat (Hla)	SWAMP	Peat	Muck (Humic)	Black	Black	-	ORGANIC SOIL (Humic)	N/A	HEMIC TROPOSAPRISTS
MORASS Peat-high decomposi-tion phase (Hlb)	SWAMP	Peat	Peaty	Very dark brown	Very dark brown to black	-	ORGANIC SOIL (Peat)	MORAS #152	HYDRIC TROPOHEMISTS
MORAS Peat-low decomposi-tion phase (Hlc)	SWAMP	Peat	Peaty	Brown to dark brown	Brown to dark brown	-	AS ABOVE	AS ABOVE	HYDRIC TROPOFIBRISTS
MORASS Peat-sulfidic phase (hls)	SWAMP	Peat	Peaty	Dark brown to very dark brown	Dark brown to very dark brown	-	As above but UPPER HORIZON SULFIDIC	AS ABOVE	TYPIC SULFIHEMISTS

Table D-4 IDENTIFICATION OF THE CLAY MINERAL COMPOSITION

Minerals / Soils	Kaolin minerals	14Å minerals	Gibbsite	Others	Clay fraction 0.2μ>	Free R_2O_3 nH_2O
Four Path clay #203	59%	diocta.-Ver. 2%	--	amorphous materials	50.6%	14.6%
Wallens clay #9	42%	Montmorill 52%	5%	Feldspars 1%	59.1%	15.8%
Black River clay #12	98%	diocta.-Ver. 2%	--	--	47.6%	14.4%
Four Path Sandy loam #204	93%	diocta.-Ver. 3%	4%	--	38.3%	15.6%

Notes: diocta.-Ver. - dioctahedral Vermiculite, Montmorill. = Montmorillonite

Table D-5 WATER RETAINTIVITY OF UPLAND SOILS

Location	Soil Symbol	Open pit No.	Depth (cm)	Bulk Density g/c.c.	pF (vol. %) 0 1/	1.0 2/	2.0 2/	4.2 3/	Excess water 4/	Available water 5/
Vineyard	#94	P-4	10 - 15	1.67	39.6	39.4	34.3	18.6	5.3	15.7
"	"	P-5	"	1.42	48.0	42.1	36.7	19.9	11.3	16.8
Mountainside	#74	P-7	"	1.21	50.5	47.4	36.6	19.9	13.9	16.7
Arlington	#73	P-8	"	1.20	49.8	51.1	43.6	23.7	6.2	19.9
Hatfield	#203	P-9	"	1.15	55.3	47.0	37.3	20.3	18.0	17.0
Frenchman	#204	P-13	"	1.50	40.0	37.2	20.0	10.9	20.0	9.1
Holland Estate	#109	P-15	"	1.11	55.9	54.8	54.5	29.6	1.4	24.9
Hatfield	#151	P-16	"	1.31	46.9	47.3	45.8	24.9	1.1	20.9
Hope River	#83	P-18	"	0.95	6.06	57.4	49.5	26.9	11.0	22.6
Luana	#204	P-19	"	1.53	40.8	36.0	27.5	14.9	13.3	12.6
Baptist	#83	P-20	"	1.10	55.4	52.8	44.1	24.0	11.3	20.1
New Holland	#109	P-21	"	1.08	56.8	56.2	55.9	30.4	0.9	25.5
Luana	#150	P-22	"	1.58	37.8	32.0	20.2	11.0	17.6	9.2

(N.B) 1/ pF0 were measured by the volumenometric method.

2/ pF 1.0 and 2.0 were measured by the suction method.

3/ pF 4.2 are values which divided pF 2.0 - values by 1.84.

4/ pF 0 - pF 2.0

5/ pF 2.0 - pF 4.2

Table D-6 FIBRIC MATERIALS IN UNDISTURBED PEAT SOILS OF SURFACE LAYER

Location	Soil Symbol	Survey Line No.	Dist(m)	Wet wt. (g)	Air-dried wt.(g)	Wt.% Hemic materials (<1mm)	Wt.% Fibric materials (>1mm)	Bulk density g/cc
Middle Quarters River left Bank	Hlc	3	500	250	187	67.9	32.1	0.063
Black River Left Bank	Hlc	5	200	240	179	62.0	38.0	0.074
Frenchman	Hla	6	300	222	100	44.0	56.0	0.052
Cataboo	Hlb	8	300	198	146	57.8	42.2	0.063
Slipe	Hlb	9	500	278	140	58.6	41.4	0.055
Slipe	Hlb	11	100	220	166	59.7	40.3	0.078
Y.S. River Right Bank	Hla	13	300	189	132	56.8	43.2	0.055
Baptist	Hlc	14	300	283	212	68.9	31.1	0.070
Broad River Right Bank	Hla	15	300	270	210	66.7	33.3	0.081
Middle Quarters River Right Bank	Hlc	M.Q.1	Spot	135	103	66.0	34.0	0.061
Black River Left Bank	Hlc	BL.3	Spot	122	89	64.1	35.9	0.054

Table D-7 PEAT COMPOSITION OF SUB-SURFACE LAYER

Location	Soil Symbol	Survey Line	Depth (cm)	Fraction	Type of Organic matter	Air-dried wt. (g)	% Fraction (wt.)
Y.S. River	Hlc						
Left Bank		No. 14	20 - 30	< 1 mm	Hemic	22.50	76.92
		No. 14	20 - 30	> 1 mm	Fibric	6.75	23.08
Y.S. River	Hlc	No. 14	40 - 60	< 1 mm	Hemic	17.25	73.40
		No. 14	40 - 60	> 1 mm	Fibric	6.25	26.60
Scotts	Hlc	No. 5	20 - 30	< 1 mm	Hemic	33.50	85.90
Copper		No. 5	20 - 30	> 1 mm	Fibric	5.50	14.10
Broad River	Hla	No. 17	20 - 30	< 1 mm	Hemic	31.50	75.90
Left Bank		No. 17	20 - 30	> 1 mm	Fibric	10.00	24.10
Broad River	Hla	No. 17	40 - 60	< 1 mm	Hemic	44.50	87.25
Left Bank		No. 17	40 - 60	> 1 mm	Fibric	6.50	12.75

Table D-8 CHEMICAL PROPERTIES OF MINERAL SOILS COLLECTED FROM OPEN PITS

No. of Open Pit	Depth (cm)	Texture	Sand %	Silt %	Clay %	pH	E.C. ms/cm	N %	P_2O_5 ppm Available	K_2O meq/100g	CEC meq/100g	Base Sat. %	Ca Extractable Base, meq/100g	Mg	Na	K
P 9	0-20	SCL	62.4	14.7	22.9	5.3	0.07	0.34	20	86	5.2	-	6.5	1.23	0.14	0.21
	-70	SC	44.8	4.4	50.9	4.7	0.03	0.15	9	15	14.4	3.1	0.3	0.07	0.03	0.05
	-130	SC	44.8	10.4	44.9	4.5	0.04	0.11	11	15	11.2	0.4	0	0	0.01	0.03
P13	0-27	S	92.4	2.4	5.2	5.9	0.04	0.05	9	11	2.4	0.4	0	0	0.01	0.01
	-50	S	94.8	6.2	3.2	6.3	0.03	0.02	9	3	3.2	20.3	0.5	0.13	0.02	0.01
	-100	SCL	62.8	2.0	25.2	4.9	0.05	0.07	25	7	7.6	37.4	2.3	0.50	0.03	0.01
P15	0-15	SC	46.8	10.6	41.6	6.9	0.11	0.11	67	150	44.4	98.6	37.0	5.96	0.32	0.32
	-52	SC	46.8	13.6	39.6	7.7	0.09	0.17	14	95	35.4	112.8	31.8	7.33	0.45	0.45
	-100	SC	45.1	12.7	42.2	7.9	0.11	0.09	14	90	37.2	116.6	33.3	9.03	0.64	0.64
P16	0-24	SCL	63.1	6.7	30.2	6.7	0.11	0.27	13	50	17.2	98.0	15.5	0.93	0.31	0.31
	-45	SC	57.1	2.7	40.2	5.1	0.07	0.08	9	3	9.6	55.8	5.0	0.17	0.17	0.17
	-65	SCL	45.1	2.4	52.5	4.9	0.30	0.06	9	7	20.8	62.6	12.0	0.17	0.82	0.82
	-100	SCL	47.1	2.0	50.9	7.4	0.34	0.04	7	7	16.8	141.7	22.5	0.17	1.09	1.09
P18	0-27	SL	61.1	22.0	16.9	8.0	0.13	0.27	75	24	10.8	-	31.5	1.76	0.12	0.06
	-45	SCL	63.1	16.0	20.9	8.0	0.19	0.10	125	7	6.8	173.1	10.9	0.77	0.08	0.02
	-12	SCL	61.1	18.0	20.9	8.0	0.10	0.04	180	3	4.0	-	9.5	0.37	0.09	0.02
P19	0-15	S	91.1	4.0	4.9	5.3	0.14	0.12	14	7	6.0	27.2	1.0	0.17	0.44	0.02
	-37	LS	86.4	6.4	7.2	4.8	0.09	0.04	14	3	0.8	95.0	0.4	0.10	0.26	0.01
	-65	SC	52.4	0.4	47.2	4.0	0.70	0.04	7	3	12.0	41.3	1.7	0.77	2.48	0.01
	-90	SCL	60.3	4.1	35.6	4.0	0.75	0.04	8	3	10.8	52.7	1.3	0.90	3.48	0.01
P20	0-30	SCL	60.2	13.8	26.0	6.2	0.09	0.07	162	3	5.2	87.3	3.7	0.77	0.06	0.01
	-90	SCL	60.2	15.4	24.3	6.4	0.08	0.27	54	20	15.2	70.9	8.7	1.96	0.06	0.05
P21	0-10	SCL	52.2	13.4	34.3	7.8	0.22	0.32	9	68	19.2	-	73.0	1.33	0.26	0.20
	-50	C	44.2	9.4	46.3	7.7	0.38	0.18	9	45	23.2	145.6	32.1	1.17	0.36	0.15
	-100	SC	47.3	6.4	46.3	7.8	0.44	0.19	7	63	22.0	172.4	35.6	1.63	0.43	0.23
P22	0-15	S	93.7	2.0	4.3	7.1	0.07	0.08	9	11	2.0	78.0	1.4	0.13	0.03	0.02
	-100	S	91.7	4.0	4.3	7.2	0.03	0.03	9	3	0.4	112.5	0.4	0.04	0.03	0.01

Table D-9 (1/2) CHEMICAL PROPERTIES OF UPLAND SOILS

Location	Soil Symbol	Auger No.	Depth (cm)	pH (H_2O)	E.C. (ms/cm)	Sulphur (%)	Meq/100g Soil Extractable Bases Ca	Mg	PPM Available K_2O	P_2O_5	(%) N
H. Estate	#203	1	0-30	5.20	0.13	0.013	10.80	1.00	54	31	0.04
"		"	-60	5.05	0.08	0.004	5.00	0.40	33	21	0.15
"		"	-90	4.40	0.12	0.003	2.00	0.25	45	19	0.10
"	# 9	2	0-30	6.95	0.40	0.059	88.75	3.26	109	31	1.16
"		"	-60	6.65	0.60	0.148	69.50	4.86	81	37	1.09
"		"	-90	6.05	1.65	0.613	92.40	7.87	-	-	-
"	#109	3	0-30	7.75	0.17	0.014	50.00	5.26	136	21	0.17
"		"	-60	7.75	0.15	0.012	46.90	5.23	150	19	0.14
"		"	-90	7.90	0.15	0.007	60.00	6.26	127	17	0.14
"	# 9	5	0-30	6.25	0.05	0.005	35.80	6.33	127	39	0.25
"		"	-60	7.55	0.12	0.008	42.00	5.59	136	21	0.11
"		"	-90	7.85	0.18	0.016	5.50	6.49	113	19	0.06
"	#204	6	0-30	5.35	0.05	0.006	2.00	0.25	37	25	0.21
"		"	-60	5.60	0.04	0.007	4.80	0.30	11	27	0.07
"		"	-90	4.55	0.04	0.008	1.20	0.17	11	17	0.04
"	#204/150	7	0-30	4.95	0.05	0.004	3.80	0.20	28	19	0.12
"		"	-60	4.45	0.04	0.002	1.80	0.17	11	21	0.08
"		"	-90	4.35	0.04	0.003	1.00	0.16	15	17	0.03
"	#109	8	0-30	7.30	0.14	0.002	52.50	5.79	160	29	0.13
"		"	-60	7.45	0.11	-	34.80	7.33	118	27	0.08
"		"	-90	7.70	0.12	0.002	34.20	9.52	99	19	0.04
Slipe	#204	9	0-30	6.50	0.23	0.029	5.50	0.87	15	25	0.08
"		"	-60	7.80	0.09	0.002	10.80	2.73	11	17	0.04
Slipe	#203	10	0-30	6.75	0.09	0.012	8.20	1.53	20	21	0.12
"		"	-60	6.45	0.17	0.015	8.40	1.90	11	19	0.10
"		"	-90	5.25	0.65	0.035	10.20	3.13	7	19	0.05
Hatfield	#203	29	0-30	5.20	0.08	-	-	-	33	-	-
"		"	-60	5.00	0.08	0.003	-	-	15	11	-
"		"	-90	4.95	0.04	0.001	2.7	0.35	15	10	-
"	#203	32	0-30	6.45	0.13	0.081	-	-	54	23	-
"		"	-60	5.15	0.08	0.008	-	-	28	49	-
"		"	-90	5.10	0.06	0.001	-	-	37	18	-
Slipe	#151/94V	41	60-90	8.20	0.20	0.007	36.65	1.58	37	25	-
Holiday Pen	# 94V	45	0-30	6.45	0.06	0.012	-	-	59	21	-
"		"	-60	6.75	0.09	-	-	-	54	24	-
"		"	-90	-	-	-	-	-			
"	#203	46	0-30	7.15	0.18	0.006	-	-	41	23	-
Hatfield	#203	48	0-30	6.10	0.07	0.001	-	-	20	27	-
"		"	-60	5.90	0.05	0.001	12.3	1.50	11	15	-
"		"	-90	5.95	0.03	-	-	-	28	7	-
Lacovia	#204	49	0-30	6.05	0.07	0.003	-	-	11	15	-
"		"	-60	5.40	0.03	-	-	-	33	11	-
"		"	-90	6.30	0.05	0.002	-	-	3	18	-
Cuffee Pen	#151	50	0-30	-	0.09	0.002	-	-	28	15	-
"		"	-60	5.70	0.07	0.006	-	-	15	19	-
"		"	-90	4.75	0.04	0	-	-	7	11	-

Table D-9 (2/2) CHEMICAL PROPERTIES OF UPLAND SOILS

Location	Soil Symbol	Auger No.	Depth (cm)	pH (H_2O)	E.C. (ms/cm)	Sulphur (%)	Meq/100g Soil Extractable Bases: Ca	Mg	PPM Available: K_2O	P_2O_5	(%) N
Locovia Cuffie	#204	51	0-30	4.85	0.09	-	-	-	63	19	-
"		"	-60	6.65	0.05	0.003			15	43	-
Holland	#9/Hla	52	0-30	7.00	0.66	0.164	74.38	4.55	63	44	-
"		"	-60	6.80	0.83	0.277	-	-	37	43	-
"		"	-90	6.00	1.60	0.564	-	-	90	23	-
"	#9	53	0-30	7.05	0.27	0.034	-	-	237	46	-
"		"	-60	7.45	0.29	0.043	-	-	95	33	-
"		"	-90	7.45	0.45	0.086	-	-	169	29	-
"	#9	54	0-30	7.70	0.20	0.005	71.00	4.80	179	21	-
"		"	-60	8.00	0.18	0.001	53.23	3.25	90	10	-
"		"	-90	7.80	0.24	0.020	-	-	99	11	-
"	#9	55	0-30	7.10	0.10	0.005	32.13	5.92	86	21	-
"		"	-60	7.20	0.13	-	-	-	72	11	-
"		"	-90	7.65	0.30	0.014	-	-	45	13	-
"	#9	56	0-30	6.15	0.07	-	29.13	5.92	118	23	-
"		"	-60	6.50	0.09	0.009	32.1	7.26	86	17	-
"		"	-90	7.95	0.22	0.027	-	-	54	13	-
"	#203	57	0-30	6.75	0.07	-	-	-	109	48	
"		"	-60	6.80	0.11	0.011	-	-	90	30	-
"		"	-90	6.75	0.09	0.009	-	-	63	39	-

Location	Soil Symbol	Auger No.	Depth (cm)	pH (H_2O)	E.C. (ms/cm)	N (%)	K_2O ppm available	P_2O_5 ppm available	C.E.C. (me/100g)
Flour Hill	#203	194	0-30	5.60	0.05	0.09	33	25	3.6
"		"	-60	5.80	0.05	0.07	15	19	7.6
"		"	-90	5.20	0.06	0.13	15	19	6.8
Baptist	#204	191	0-30	7.1	0.12	0.27	50	19	15.2
"		"	-60	7.3	0.78	0.13	28	19	9.8
"		"	-90	7.35	0.80	0.13	15	22	10.8
Middle Quarters	# 83	192	0-30	7.6	0.17	0.27	37	44	15.6
		"	-60	7.65	0.15	0.11	20	70	9.6
"		"	-90	7.75	0.13	0.11	20	117	8.0
Slipe	#204	157	0-30	6.3	0.09	0.40	20	19	22.0
"		"	30-60	7.5	0.17	0.18	11	9	13.2
Vineyard	#94V	271	0-30	6.6	0.09	0.36	59	22	16.4

Table D-10 (1/2) CHEMICAL PROPERTIES OF PEAT SOILS ON THE BASE LINES

Soil Type	Sampling Site		Depth	pH	E.C.	Sulphur	C.E.C.	% Organic matter	PPM Available			PPM Minor	
	B.Line No.	Dist. (m)	(cm)	(H_2O)	(ms/cm)	(%)	(me/100g)		K_2O	P_2O_5	%N	Cu	Fe
Hydric-tropofibrist (Hlc)	1	300	0-30	6.5	1.09	.132	98.0	75.07	400	97	2.13	2.8	940
		"	-60	6.2	0.87	.255	84.4	71.33	179	49	2.0		
		"	-90	6.25	1.23	.350	160	78.71	72	49	1.86		
		400	0-30	6.05	1.00	.350	104.8	80.90	72	55	1.66	3.68	350
		"	-90	6.3	0.96	.307	92.8	76.36	95	45	1.84		
		"	-200	6.1	0.48	.133	92.4	73.26	104	51	1.97		
		500	0-30	6.4	0.33	.032	75.6	48.95	141	33	1.28	8.08	890
		"	-90	6.4	0.50	.058	74.0	53.48	81	27	1.37		
		"	90+	6.1	0.80	.136	72.4	62.57	76	31	1.48		
Hydric-tropo-fibrists (Hlc)	2	350	0-30	6.05	1.07	0.347	83.20	70.75	81	41	1.61	1.88	350.0
		"	-90	5.95	2.58	0.857	112.00	82.25	50	38	1.90	--	
		"	100+	6.05	1.41	0.429	115.60	77.30	45	37	2.08		
Hydric-tropo-fibrists (Hlc)	3	20	0-30	6.35	1.68	0.09	110.4	79.73	127	49	2.08		
		"	-90	6.15	1.77	0.285	105.2	77.38	109	39	2.04		
		100	0-30	7.10	2.81	0.160	156.0	79.14	81	73	2.26		
		"	-90	6.85	4.54	0.26	158.0	82.55	54	73	1.88		
		200	0-30	6.45	2.36	0.25	164.8	84.80	146	49	1.84		
		"	-90	6.43	1.77	0.18	200.4	80.50	68	42	1.59		
Typic-Sulfi-hemist (Hls)	4	100	0-30	7.1	3.01	.229	78.0	79.36	148	49	2.40	3.04	64.0
		"	100-200	7.05	2.36	.135	119.6	78.09	136	27	1.39		
		200	0-100	5.6	3.08	.675	93.2	76.76	322	67	2.20		
		"	-200	6.35	0.57	.087	14.0	9.79	109	21	0.13		
Hydric-tropo-fibrists (Hlc)	5	100	0-30	6.00	1.72	0.39	96.4	56.43	118	46	1.25		
		"	-90	5.95	2.58	0.56	116.8	72.08	95	39	1.59		
		300	0-30	6.60	2.00	0.10	86.40	78.94	150	65	2.02		
		"	-90	6.30	1.95	0.33	88.0	73.25	81	47	1.12		
Hemic-troposa-prist (Hla)	6	100	0-30	7.00	0.15	.012	38.0	24.65	20	27	0.60	3.52	400.0
		"	30-90	7.5	0.16	-	13.60	-	15	121	0.09		
		300	0-30	6.45	0.67	.140	156.80	81.47	109	24	1.50		
		"	30-90	6.2	0.47	.053	104.00	89.42	262	63	3.07	2.56	590
		500	0-30	6.15	0.60	.061	112.0	91.14	312	85	2.78		
		"	30-90	6.25	0.94	.272	128.0	80.02	28	24	1.18	2.24	950
Hydric-tropo-hemist (Hlb)	8	100	0-50	5.80	3.05	0.46	102.4	66.09	86	39	1.93		
		300	0-50	5.90	3.52	0.57	111.2	87.20	113	100	1.30		
		"	-100	6.00	2.59	0.54	172.4	82.61	72	29	0.56		
		500	0-50	6.35	2.66	0.13	139.2	84.23	150	55	2.22		
		"	-100	7.05	2.07	0.37	172.0	82.46	127	39	1.34		
Hydric-tropo-hemists (Hlb)	9	100	0-30	6.0	0.56	.065	75.20	72.38	61	37	1.97		
		"	30-90	5.95	0.47	.075	68.8	62.00	30	15	1.64	2.48	1255
		"	150+	5.5	.10	-	16.4	-	7	18	0.13		
		300	0-30	5.75	.55	.080	107.20	77.04	118	47	1.79	2.40	1535
		"	30-90	5.70	.13	-	18.00	-	11	22	0.18		
		500	0-30	6.25	.77	.055	85.60	82.47	37	28	2.49	1.84	1100
		"	30-90	6.05	17	-	13.40	-	7	15	0.07		

Table D-10 (2/2) CHEMICAL PROPERTIES OF PEAT SOILS ON THE BASE LINES

Soil Type	Sampling Site		Depth	pH	E.C.	Sulphur	C.E.C.	% Organic matter	PPM Available			PPM Minor	
	B.Line No.	Dist. (m)	(cm)	(H_2O)	(ms/cm)	(%)	(me/100g)		K_2O	P_2O_5	%N	Cu	Fe
Hydric-tropo-hemists (Hlb)	9	700	0-30	6.2	1.23	.146	116.80	78.87	37	15	0.13	1.76	1590
		"	-90	6.7	1.41	.124	100.00	87.46	68	53	2.71		
		900	0-30	6.7	2.04	0.117	118.00	88.40	146	63	2.53	1.84	318
		"	30-90	6.45	3.00	0.175	125.60	86.87	1466	35	2.20		
Hydric-tropo-hemists (Hlb)	10	100	0-50	6.60	0.57	0.04	92.8	86.96	-	35	1.48		
		"	-100	6.90	0.35	0.03	88.0	85.58	81	25	1.28		
		300	0-50	6.70	0.61	-	117.6	-	136	49	2.58		
		"	-100	6.30	0.31	0.005	116.0	83.32	82	42	1.43		
		300	0-50	7.40	0.65	0.0	88.8	82.61	-	55	2.46		
		"	-100	7.20	0.61	0.0	124.0	86.04	50	39	2.17		
Hydric-tropo-hemists (Hlb)	11	100	0-30	6.20	0.10	0.008	34.8	40.25	41	27	1.19		
		"	-90	6.70	0.23	0.002	15.6	16.19	28	17	0.36		
		300	0-50	6.85	0.34	0.012	80.4	87.06	-	35	2.87		
		"	50-100	6.80	0.21	0.01	103.6	66.59	20	20	1.41		
		500	0-50	6.30	0.30	0.02	72.8	89.13	-	29	2.71		
Hydric-tropo-fibrists (Hlc)	12	100	0-50	5.80	0.89	0.14	69.6	66.26	72	70	1.28		
		"	-100	5.70	1.33	0.205	64.0	60.72	76	27	1.28		
		300	0-50	5.88	0.58	0.08	58.4	46.05	113	32	1.12		
		"	-100	4.10	0.81	0.13	76.8	59.57	81	37	1.03		
		500	0-50	4.60	2.89	0.14	72.8	52.11	317	45	1.37		
		"	-100	5.10	2.81	0.15	-	77.68	-	65	1.46		
Hemic-tropo-saprist (Hla)	13	100	0-50	6.10	0.58	0.07	107.2	86.79	90	47	1.95		
		"	-100	6.00	0.67	0.13	94.4	82.54	37	35	2.31		
		300	0-50	6.20	0.47	0.09	106.4	85.41	-	63	2.37		
		"	-100	6.10	0.58	0.04	107.2	76.04	54	25	1.88		
		500	0-50	5.95	0.66	0.04	100	84.46	76	35	0.72		
		"	-100	6.00	0.76	0.008	108.8	86.42	68	42	2.37		
Hydric-tropo-fibrists (Hlc)	14	100	0-30	7.55	0.69	0.055	63.60	62.33	68	35	1.52	2.08	8.80
		"	30-90	7.8	0.30	0.025	75.80	51.35	15	44	0.90		
		300	0-30	6.8	0.80	0.074	116.0	81.68	45	47	1.64	2.16	366.50
		"	30-90	7.25	0.40	0.030	132.00	90.43	20	73	1.68		
Hemic-tropo-saprist (Hla)	15	100	0-50	6.90	0.34	0.42	92.8	77.38	188	27	2.17		
		"	-100	7.25	2.29	0.19	89.6	84.46	141	60	2.76		
		300	0-50	6.43	5.44	0.45	112.8	84.09	287	29	1.99		
		"	-100	7.10	3.63	0.20	70.4	87.28	198	49	2.44		
		500	0-50	7.85	0.30	00	15.2	13.68	28	24	0.20		
Hemic-tropo-saprist (Hla)	A218		0-30	6.0	2.47	-	92.40	-	198	114	2.42		
			30-60	6.20	1.31	0.331	104.30	88.41	146	99	2.31		

Table D-11 (1/2) CHEMICAL PROPERTIES OF INUNDATED SOILS

Location	Soil Symbol	Auger No.	Depth (cm)	pH (H_2O)	EC (ms/cm)	Sulphur (%)	Extractable Bases Ca (meq/100g soil)	Extractable Bases Mg (meq/100g soil)	PPM Available K_2O	PPM Available P_2O_5	PPM Available N
Holland	Hla	4	0-30	6.40	0.10	0.016	14.2	1.33	20	26	0.33
"	"	"	-60	7.25	0.16	0.015	11.2	0.78	24	21	0.10
"	"	"	-90	8.15	0.14	0.007	69.0	1.43	11	17	0.04
Luana	Hls	11	0-30	7.15	4.55	0.195	57.5	22.91	386	53	0.75
"	"	"	-60	7.15	3.49	0.148	31.4	19.33	348	58	0.48
"	"	"	-90	7.00	4.75	1.185	256.0	11.92	188	19	0.17
Middle Quarters	Hls	12	0-30	7.40	3.10	1.089	148.0	10.32	179	50	1.23
"	"	"	-60	7.35	1.70	0.503	107.5	5.53	-	25	0.78
"	"	"	-90	7.25	1.80	0.460	115.5	9.19	109	29	1.24
"	Hlc	13	0-30	7.30	1.76	0.087	-	-	-	39	-
"	"	"	-60	7.55	0.82	0.088	152.0	5.33	54	29	1.45
"	"	"	-90	7.55	1.06	0.025	-	-	-	-	-
"	Hla	14	0-30	7.50	1.60	0.100	122.0	12.32	-	50	1.90
"	"	"	-60	7.05	1.84	0.107	149.0	24.57	-	36	1.79
"	"	"	-90	6.95	2.52	0.081	112.0	19.66	198	31	-
"	"	"	-200	7.00	2.62	0.053	-	-	-	-	-
"	Hls	15	0-30	7.60	2.91	0.129	-	-	-	-	-
"	"	"	-60	7.35	3.20	0.413	141.0	33.82	-	50	1.09
"	"	"	-90	7.15	3.59	0.835	145.0	38.32	-	-	-
"	Hlc	16	0-30	7.60	1.10	0.072	143.0	7.60	-	102	1.14
"	"	"	-60	7.45	0.73	0.013	136.0	6.73	54	53	0.97
"	"	"	-90	7.45	0.60	-	127.8	6.43	-	42	1.97
"	Hlc	17	0-30	7.30	1.25	0.104	-	-	-	-	-
"	"	"	-60	7.20	1.14	0.079	-	-	-	39	-
"	"	"	-90	7.15	0.97	0.058	125.6	13.65	24	35	0.94
Y.S. River	Hlc	18	0-30	6.80	0.97	0.243	-	-	-	-	-
"	"	"	-60	6.15	0.87	0.203	81.0	7.06	-	-	-
"	"	"	-90	6.45	0.60	0.126	-	-	-	-	-
Holiday Pen	Hla	19	0-30	7.45	0.61	0.009	115.0	9.32	212	-	0.83
"	"	"	-60	6.85	1.34	0.104	-	-	-	-	-
"	"	"	-90	6.75	1.33	0.192	113.0	14.39	90	-	1.34
Frenchman	Hlb	20	0-30	7.05	0.55	0.084	-	-	218	11	-
"	"	"	-60	7.55	0.50	0.071	-	-	127	11	-
"	"	"	-90	7.45	0.22	0.005	-	-	81	17	-
"	"	21	0-30	7.30	0.30	-	-	-	109	15	-
"	"	"	-60	7.45	0.26	-	-	-	104	73	-
"	"	"	200	6.65	0.51	0.097	-	-	45	39	-
Holland	Hla	22	0-30	6.20	0.22	0.034	-	-	24	46	-
"	"	"	-90	6.85	0.19	0.022	-	-	86	19	-
"	"	23	0-30	6.65	1.10	0.299	-	-	68	41	-
"	"	"	-90	-	-	-	-	-	-	-	-
"	"	24	0-30	7.15	0.27	0.010	-	-	28	27	-
"	"	"	-90	7.30	0.24	0.007	38.1	32.59	20	27	-
Hatfield	I2	25	0-30	7.20	0.14	-	-	-	54	-	-
"	"	"	-60	7.85	0.23	0.009	-	-	24	-	-
"	"	26	-	8.15	0.22	0.025					
"	Hlb	27	0-30	7.05	0.33	-	-	-	59	-	-
"	"	"	-60	8.05	0.21	0.001	57.88	2.70	50	33	-
"	"	"	-90	8.20	0.18	0.005	-	-	54	9	-
"	"	28	0-30	7.10	0.16	0.015	-	-	37	65	-
"	"	"	-60	7.90	0.25	0.014	78.75	1.02	28	15	-
"	"	"	-90	8.00	0.21	0.017	-	-	28	7	-

Table D-11 (2/2) CHEMICAL PROPERTIES OF INUNDATED SOILS

Location	Soil Symbol	Auger No.	Depth (cm)	pH (H_2O)	EC (ms/cm)	Sulphur (%)	Extractable Bases (meq/100g soil)		PPM Available		
							Ca	Mg	K_2O	P_2O_5	N
Hatfield	I2	30	0-30	7.80	0.23	0.021	-	-	99	24	-
"	"	"	-60	8.25	0.28	0.031	-	-	63	18	-
"	"	"	-90	7.95	0.31	0.046	-	-	72	21	-
"	"	31	0-30	5.15	0.07	0.003	-	-	33	26	-
"	"	"	-60	5.10	0.06	0.032	-	-	20	23	-
"	"	"	-90	4.90	0.06	0.036	-	-	15	13	-
Cashoo	H1b	33	0-30	7.45	0.06	-	-	-	11	9	-
"	"	"	-60	7.60	0.14	-	-	-	11	15	-
"	"	"	-90	8.20	0.16	-	59.63	6.67	11	40	-
Frenchman	H1a	34	0-30	6.40	0.36	0.026	-	-	99	50	-
"	"	"	-60	6.85	0.26	0.040	-	-	28	21	-
"	"	"	-90	6.75	0.22	0.007	87.5	9.72	33	30	-
"	I2	35	0-30	6.75	0.31	0.007	-	-	118	17	-
"	"	"	-60	7.45	0.17	-	23.7	1.60	24	10	-
"	"	"	-90	7.45	0.17	0.003	-	-	28	15	-
"	H1b	36	0-30	6.55	0.08	-	-	-	24	23	-
"	"	"	-60	6.40	0.09	0.002	-	-	20	23	-
"	"	37	0-30	6.65	0.16	0.016	8.13	3.17	15	38	-
"	"	"	-60	7.85	0.13	0.007	10.0	0.57	3	23	-
"	"	"	-90	7.90	0.14	-	19.4	1.04	11	17	-
Little Cashew	H1a	38	0-30	6.45	0.13	0.002	21.7	4.12	50	27	-
"	"	"	-60	7.30	0.10	0.003	-	-	11	36	-
"	"	"	-90	8.25	0.17	-	-	-	7	10	-
Cataboo	H1b	39	0-30	6.85	0.23	0.001	-	-	68	24	-
"	"	"	-60	6.45	0.19	0.014	-	-	37	17	-
"	"	"	-90	6.55	0.21	0.054	-	-	15	24	-
Slipe	"	40	0-30	-	-	-	-	-	-	-	-
"	"	"	-60	7.85	0.20	0.014	-	-	15	13	-
"	"	"	-90	7.65	0.24	0.007	-	-	11	13	-
Holiday Pen	H1c	42	0-30	6.03	0.32	0.005	-	-	45	27	-
"	"	"	-60	6.85	0.29	0.017	-	-	20	21	-
"	"	"	-90	7.55	0.31	0.010	-	-	33	7	-
"	H1a	43	0-30	6.35	0.23	0.024	-	-	81	39	-
"	"	"	-60	7.05	0.21	0.033	-	-	11	18	-
"	"	"	-90	7.25	0.25	0.037	-	-	11	39	-
"	"	44	0-30	6.95	1.07	0.244	-	-	-	-	-
"	"	"	-60	6.85	1.86	0.528	-	-	-	-	-
"	"	"	-90	-	-	-	-	-	-	-	-
Cataboo	H1c	47	0-30	6.16	2.64	0.172	-	-	193	69	-
"	"	"	-60	7.15	1.12	0.042	-	-	118	23	-
"	"	"	-90	8.10	0.95	0.016	-	-	113	29	-
Holland Y.S., River	I2	69	0-30	7.60	0.32	0.016	-	-	146	16	-
"	"	"	-60	7.10	0.36	0.011	-	-	174	9	-
"	"	"	-90	7.35	0.34	0.036	-	-	188	11	-
"	"	70	0-30	7.35	0.34	0.012	-	-	164	9	-
"	"	"	-60	6.80	0.53	0.082	-	-	146	13	-
"	"	"	-90	6.45	0.30	0.017	-	-	37	32	-

Table D-12 MINOR ELEMENTS AND BASES OF PEAT SOILS

Soil Types	Sampling Sites	Distance (m)	Depth (cm)	ppm Extractable				Meq/100g Soil	
				Zn	Mn	Cu	Fe	CaO	MgO
Hemic-tropo-saprist (Hla)	BL 2	Spot	0-30	1.68	100.0	0.60	728	-	-
Hydric-tropo-fibrist (Hlc)	B. Line No. 3	20	"	1.58	60.0	0.50	94	-	-
	"	200	"	3.20	135.5	0.68	830	-	-
"	B. Line No. 5	100	"	6.40	171.3	1.20	940	-	-
	"	300	"	4.00	54.8	0.48	610	-	-
Hydric-tropo-hemist (Hlb)	B. Line No. 11	100	0-50	3.76	482.5	0.76	1,095	-	-
	"	300	"	2.84	89.0	0.40	1,100	-	-
	"	500	"	1.20	26.0	0.32	115	-	-
Hydric-tropo fibrist (Hlc)	B. Line No. 12	100	"	4.20	160.0	1.92	1,680	-	-
	"	300	"	4.08	475.0	4.64	2,380	-	-
	"	500	"	4.24	30.0	2.00	1,220	-	-
Hydric-tropo-hemist (Hlb)	B. Line No. 8	100	"	-	-	-	-	196.9	20.00
"	B. Line No. 10	200	0-50	-	-	-	-	86.1	8.75
	"	"	-100	-	-	-	-	88.2	6.95
"	B. Line No. 18	100	0-50	-	-	-	-	157.5	10.97
	"	"	-100	-	-	-	-	178.5	12.77
"	B. Line No. 9	100	0-50	-	-	-	-	167.8	6.67
	"	"	-100	-	-	-	-	143.5	11.10

Table D-13 CHEMICAL DEFICIENCY OF SOILS IN THE PROJECT AREA

1. Mineral Soils	Optimum Level	Deficiency	Practices
Acidity (pH)	5.5 - 6.5	Non*	Application of $CaCO_3$
E.C. (mS/cm)	Less than 2	Non	Leaching
Sulpher (wt.%)	Less than 0.75	Non	
Organic matter (%)	More than 1	Care*	Manure application
C.E.C. (me/100g)	More than 20	Non	
Base Sat. (%)	More than 20	Non	
Nitrogen (%)	More than 0.2	Non	Fertilizer application
P_2O_5 (Extractable) (ppm)	More than 100	Care*	"
K_2O (Extractable) (ppm)	More than 150	Care*	"
CaO (mg/100g)	More than 200	Non	"
MgO (mg/100g)	More than 25	Non	"
2. Peat Soils	Optimum Level	Deficiency	Practices
Acidity (pH)	5.5 - 6.5	Non*	Application of $CaCO_3$
E.C. (mS/cm)	Less than 2	Non	Leaching
Sulpher (wt.%)	Less than 0.75	Care*	Application of $CaCO_3$
C.E.C. (me/100g)	More than 100	Non	
P_2O_5 (Extractable) (ppm)	More than 500	Care*	Fertilizer application
K_2O (Extractable) (ppm)	More than 750	Care*	"
Cu (ppm)	More than 3	Care*	"
Fe (ppm)	More than 100	Non	
SiO_2 (mg/100g)	More than 75	Care*	"
MgO (mg/100g)	More than 100	Care*	"
CaO (mg/100g)	More than 1,000	Care*	"

* Noticible deficiency

Source: Guide Book of Land Classification, Agriculture, Forest and Fishery Ministry, Japan (1979)

Table D-14 CORRELATION OF MAP UNIT ON SOIL MAP AND JAMAICAN MAP SYMBOL

UPLAND SOIL

		Map Symbols
A. HILLS		
I. Limestone Soil		
1.	Chudleigh clay loam	# 73
1a	Chudleigh clay loam - Bonnygate st. clay loam complex	# 73/77
2.	Lucky Hill clay loam	# 74
2a	Lucky Hill clay loam - Bonnygate st. clay loam complex	# 74/77
3.	Bonnygate st. clay loam	# 77
3a	Bonnygate st. clay loam - Chudleigh clay loam complex	# 77/73
4v	Carron Hall clay loam - Extremely rocky complex	# 94v
4.	Carron Hall clay	# 94
B. ALLUVIAL PLAIN		
II. Old Alluvium Soil		
5.	Hodges sand	# 150
5a	Hodges sand - Fourpath sandy loam complex	# 150/204
6.	Cashew clay loam	# 151
6a	Cashew clay loam - Fourpath clay complex	# 151/203
7.	Fourpath clay	# 203
7a	Fourpath clay - Cashew clay loam complex	# 203/151
8.	Fourpath sandy loam	# 204
8a	Fourpath sandy loam - Hodgessand complex	# 204/150
9.	Anglesey clay loam	# 83
III. Recent Alluvium Soil		
10.	Wallen clay	# 9
10a	Wallen clay - Broad River Peat complex	# 9/H1a
11.	Holland clay	# 109
C. ALLUVIAL PLAIN/FLAT HILLS		
IV. Old Alluvium/Limestone Soil		
12.	Cashew clay loam - Carron Hall clay extremely rocky complex	# 151/94v
13.	Fourpath - Carron Hall clay extremely rocky complex	# 203/94v

INUNDATED SOIL

		New Symbol
D. ALLUVIAL SWAMP		
V. Recent Alluvium Soil		
14.	Black River clay	# I2
15.	Broad River peat	# H1a
16.	Morass Peat - High decomposition phase	# H1b
16a	Morass Peat - Low decomposition phase	# H1c
16b	Morass Peat - Sulfidic phase	# H1s

Table D-15 TOTAL HECTARE OF EACH MAP UNIT

UPLAND AREA

Mapping Unit	Map Symbol	Name of Sub-segment							Parent Materials Subtotal Area
		Holland E Lacovia	Slipe Cataboo	Vineyard	Luana Baptist	Mountain-side	Hatfield	Total	
1.	73	-	-	-	-	23	-	23	Limestone
1a	73/77	-	-	-	-	331	-	331	1,075 ha
2.	74	-	-	-	-	36	-	36	(24.1%)
2a	74/77	-	-	-	-	82	-	82	
3.	77	-	-	-	-	35	-	35	
3a	77/73	-	-	-	-	18	-	18	
4.	94	-	-	-	46	-	-	46	
4v	94v	-	142.0	362	-	-	-	504	
5.	150	-	-	-	49	-	-	49	Old alluvium
5a	150/204	-	-	-	99	-	-	99	2,579 ha
6.	151	17	59	96	-	-	15	187	(57.8%)
6a	151/203	-	-	62	-	-	-	62	
7.	203	723	157	21	18	113	261	1,293	
7a	203/151	-	8	16	-	-	-	24	
8.	204	90	210	-	209	-	28	537	
8a	204/150	58	48	-	24	-	-	130	
9.	83	-	-	-	77	120	-	197	
10.	9	304	-	-	-	-	-	304	Recent Alluvium
10a	9/H1a	86	-	-	-	-	-	86	809 ha
11.	109	304	-	-	-	-	-	304	(18.1%)
12.	151/94v	-	48	-	-	-	-	48	
13.	203/94v	-	67	-	-	-	-	67	
Total		1,582	739	557	522	758	304	4,462	

INUNDATED AREA

Mapping Unit	Map Symbol	Name of Sub-segment								Total
		Frenchman Holiday Pen	Y.S. River lt. bank	Y.S. River rt. bank	M.Q. River rt. bank	Styx River bank	Br. River rt. bank	Br. River lt. bank	Bl. River estuary	
14.	I2	295	168	-	-	-	-	-	-	463
15.	H1a	463	111	-	-	-	891	570	-	2,035
16.	H1b	-	108	-	-	404	374	602	-	1,488
16a	H1c	-	110	276	367	-	-	-	150	903
16b	H1s	-	-	-	227	-	-	-	917	1,144
Forest		106	140	50	70	7	22	132	388	915
Total		864	637	326	664	411	1,287	1,304	1,455	6,948
									All Total	11,410

Remarks: Figure in parenthesis shows area of forest of Hotfield.

Table D-16 CRITERIA FOR RATING OF LAND FACTORS

1. Soil Condition

1.1 Soil Texture Qualities

	Surface Soils	Sub Soils
s0:	Coarse loamy to fine loam	Fine loamy to fine clay
s1:	Fine loamy to fine clay	Coarse loamy to fine clay
s2:	Coarse loamy and/or very fine clayey	Coarse loamy and/or very fine clayey
s3:	Sandy and/or histic soils	Sandy and/or histic soils

1.2 Effective Soil Depth

		For Paddy Rice	For Upland Crops
K0:	Very deep	- More than 100 cm	- More than 120 cm
K1:	Deep	- 50 to 100 cm	- 90 to 120 cm
K2:	Moderate	- 20 to 50 cm	- 40 to 90 cm
K3:	Shallow	- 15 to 20 cm	- 20 to 40 cm

1.3 Soil Reaction (pH)

		For Paddy Rice	For Upland Crops
a0:	Adequate reaction	- 5.5 to 6.5	- 5.3 to 7.5
a1:	Moderately reaction	- 5.0 to 7.0	- 5.0 to 8.0
a2:	Strong	- 4.5 to 8.5	- 4.5 to 8.5
a3:	Very strong reaction	- 4.5 to 8.5	- 4.5 to 8.5

2. Topography

2.1 Relief Conditions

r0: Flat to nearly flat

r1: Gently slopped land

r2: Undulating

r3: Rolling

2.2 Sloping Conditions

t0: 0 to 2%

t1: 2 to 5% in single slope

t2: 5 to 8% in single slope

t3: 8 to 15%

t4: More than 15%

3. Drainage Condition

3.1 Soil Drainability

d0: Well drainable

d1: Moderately drainable

d2: Somewhat poorly drainable

d3: Poorly drainable

d4: Very poorly drainable

4. Workability

4.1 Bearing Capacity of 0.5 kg/cm^2

b1: Within 20 cm soil depth

b2: Within 50 cm soil depth

b3: Within 100 cm soil depth

b4: Below 100 cm soil depth