STATUTORY INSTRUMENTS

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STATUTORY INSTRUMENTS SUPPLEMENT

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STATUTORY INSTRUMENTS

2001 No. 59.

THE NATIONAL ENVIRONMENT (MINIMUM STANDARDS FOR MANAGEMENT OF SOIL QUALITY) REGULATIONS, 2001.

ARRANGEMENT OF REGULATIONS

Regulation.

SCHEDULES.

SIXTH SCHEDULE—IMPROVEMENT NOTICE

STATUTORY INSTRUMENTS.

2001 No. 59.

The National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001.

(Under sections 31 and 108 of the National Environment Statute, 1995, Statute No. 4 of 1995)

IN EXERCISE of the powers conferred on the Minister by sections 31 and 108 of the National Environment Statute, 1995 and on the recommendation of the Board and the Policy Committee on the Environment, these Regulations are made this 4th day of April, 2001.

1. These Regulations may be cited as the National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001.

2. In these Regulations, unless the context otherwise requires—

"Authority" means the National Environment Management Authority established under section 5 of the Statute;

"conservation measures" means activities which will prevent degradation and maintain or enhance the quality of a particular soil or the environment;

"Executive Director" means the Executive Director of the National Environment Management Authority appointed under the Statute and includes, for the purposes of these Regulations, any person who has been authorised by the Executive Director to act on his or her behalf;

"responsible person" means the owner of the land or person residing on, or using the land;

"Statute" means the National Environment Statute, 1995.

3. (1) The purpose of these Regulations is—

(a) to establish and prescribe minimum soil quality standards to maintain, restore and enhance the inherent productivity of the soil in the long term;

(b) to establish minimum standards for the management of the quality of soil for specified agricultural practices;

(c) to establish criteria and procedures for the measurement and determination of soil quality; and

(d) to issue measures and guidelines for soil management.

4. The soil class specified in column IV of Parts 1, 2, 3 and 4 of the First Schedule is the minimum standard of soil required for the agricultural practice specified in that respective Part.

5. For the purposes of rain-fed agriculture, the soil quality parameters specified in column I of Part 1 of the First Schedule are classified according to the soil classes specified in columns II, III, IV, V and VI of that Part.

6. (1) For the purposes of irrigated agriculture, the soil quality parameters specified in column I of Part 2 of the First Schedule are classified according to the soil classes specified in columns II, III, IV, V and VI of that Part.

(2) For the avoidance of doubt, subregulation (1) does not apply to drip irrigation.

7. For the purposes of wetland rice systems under natural flooding, the soil quality parameters specified in column I of Part 3 of the First Schedule are classified according to the soil classes specified in columns II, III, IV, V and VI of that Part.

8. For the purposes of wetland rice under irrigated systems, the soil quality parameters specified in column I of Part 4 of the First Schedule are classified according to the soil classes specified in columns II, III, IV, V and VI of that Part.

9. (1) The soil classes specified in columns V and VI of Parts 1, 2, 3 and 4 of the First Schedule shall not be used for the specified type of agricultural practice unless the responsible person has undertaken conservation measures.

(2) The conservation measures referred to in subregulation (1) shall take into account the results obtained from tests carried out with respect to diagnostic field characteristics of potentially acid sulphate soils, or other limitations, as specified in the Second Schedule.

(3) A person who fails to comply with subregulation (1) commits an offence and is liable, on conviction, to a fine of not less than one hundred and eighty thousand shillings and not more than eighteen million shillings or to imprisonment not exceeding eighteen months, or both.

10. The soil parameters and methods of determination of soil quality under these Regulations are as specified in the Third Schedule.

11. (1) No person shall use land in contravention of the soil quality parameters established under these Regulations.

12. (1) Every responsible person shall comply with the measures and guidelines for soil conservation for the particular topography, drainage and farming systems prescribed in the Fourth Schedule.

(2) A person who contravenes subregulation (1) commits an offence and is liable, on conviction, to a fine of not less than one hundred and eighty thousand shillings and not more than eighteen million shillings or to imprisonment not exceeding eighteen months, or both.

13. An Environmental Inspector shall—

(a) ensure that the measures and guidelines in the Fourth Schedule are observed;

(b) ensure that the guidelines for the frequency of monitoring soil quality parameters in the Fifth Schedule are observed;

(c) carry out investigations and other measures to determine the quality of soil as specified in these Regulations; and

(d) ensure that the soil quality parameters established under the First Schedule are observed.

(2) In exercise of the functions under subregulation (1), an Environmental Inspector may issue an improvement notice in the form set out in the Sixth Schedule, requiring the responsible person to restore the quality of the soil and to ensure compliance with these Regulations.

(3) An Environmental Inspector may, at all reasonable times, enter any land to ensure compliance with the requirements of these Regulations.

(4) A person who fails to comply with a notice issued under subregulation (2) commits an offence and is liable, on conviction, to a fine of not less than one hundred and twenty thousand shillings and not exceeding twelve million shillings, or to imprisonment for a term not exceeding twelve months or both.

FIRST SCHEDULE Regulations 4, 5 and 9

SOIL QUALITY PARAMETERS

PART 1

Soil quality parameters and classes for rain- fed agriculture.

Column I Column II Column III Column IV Column V Column VI

SOIL QUALITY Class I Class II Class III Class IV Class V

PARAMETER PRIME GOOD MEDIUM MARGINAL
UNSUITABLE

1. Bulk density 1.25 1.3 1.5 1.65 or

(upper limit) of / cm3 1.25 (wetlands) High

2. Porosity53 51 43 38 or

(Vol. %) 53 (wetlands) Low

3. WHC >150 130 -150 100- 130 <100 Low

(mm of H2O/m soil)

4. Infiltration Rate 60-100 40-6040-10<10 Low

(mm/hr)

5. Permeability 50-8040-5040-10<10 Low

(mm/hr)

6. Slope (%) 0 — 3 3 — 8 8 — 13 13 - 20 >20

7. Stoniness (vol%) <0.1 0.1 <1 1-3 >15% of the

(>30 m apart) (10-30 m) (10-30 m) (10-30 m apart) surface covered

8. Soil depth (cm) >100 75-100 75-20 <20 cm Very shallow

9. Flooding and duration N.L. N.L. Slight to moderate Moderate to severe Very severe (>4)

(months/year) >1-2 2-4

10. Depth to water table N.L. N.L. Slight limit. Shallow Shallow

(cm) >150 100 - 150 50 - 100 25 - 50 0 - 25

N.L. Not Limiting. WHC Water Holding Capacity.

Note: 1. Prime agricultural land, which is high value land with least management problems apart from nutrients management. 2.Good agricultural land. 3.Medium agricultural land. 4.Marginal/fragile agricultural land. 5. Low value/unsuitable agricultural land.

FIRST SCHEDULE Regulations 4, 6 and 9

PART 2

Soil quality parameters and classes for irrigated agriculture.

Column I Column II Column III Column IV Column V Column VI

SOIL QUALITY Class IClass II Class III Class IV Class V

PARAMETER SUITABLE MODERATELY MARGINALLY POTENTIALLY UNSUITABLE

SUITABLE SUITABLE SUITABLE

1. Slope (%) <2 2-5 5-8 8-12 > 12

2. Wetness

- flooding N.F Slight or less - - -

- internal drainage Mod. Mod. Rapid Slow to very rapid Slow to very rapid Very slow to

- natural drainage Good Good Mod. Imperfect Very poor

3. Physical

- top soil texture (0-25 cm) SL-CLLS-C S-C S-C CM to S

- sub-soil texture (25-100 cm) SL-CLLS-C LS-C S-C CM to S

- surface stoniness (vol%) <0.01 0.01 - 0.1 0.1- 3.0 3-15 >15

- subsurface coarse fragments 0-5 5-15 15-50 20-25 >25

(vol%)

4. Salinity /alkalinity

(0-100 cm)					
- Ec mmhos/cm	<1	1-4	4-8	8-15	>15
- ESP (0-100 cm)	<4	4-10	10-20	20-25	>25

NF: No Flooding. Mod: Moderate. SL: Sandy Loam. LS: Loamy Sand. CL: Clay Loam. C: Clay

Cm: Massive Clay. S: Sand. ESP: Exchangeable Sodium Percentage. EC: Electrical Conductivity.

Note: Internal drainage means soil conditions where there is internal impediment of water flow.

Natural drainage means downward movement of water within the soil horizons by gravity.

FIRST SCHEDULE Regulations 4, 7 and 9

PART 3

Soil quality parameters and classes for wetland rice systems under natural flooding.

Column I	Column II	Column III	Column IV	Column V	Column VI
SOIL QUALITY PARAMETER	Class I SUITABLE POTENTIALLY	Class II MODERATELY SUITABLE	Class III UNSUITABLE SUITABLE	Class IV MARGINALLY SUITABLE	Class V
1. Slope (%)	N.L.	<2	<4	<6	<8
2. Wetness					
- Flooding	3-4 months	3-4 months	<2 months	<1 months	Too short to operate
- Drainage	Poor V. Poor	Poor to imperfect	moderate	V.Poor to	V. Poor
3. Physical					
- surface text/structure	CM to SiCs	CM to SCL	CM to Sf	CM to Sf	CM to Sc

- subsurface text	CM to LSf	CM to Sc	--	--	--
4. Salinity /alkalinity					
- Ec mmhos/cm	<1	<4	<6	<6	<6
- ESP (%)	<4	<10	<20	<25	<25

Note: CM: Massive Clay. SiCs: Silty Clay Blocky. SCL: Sandy Clay Loam. Sf: Fine Sand Sc : Coarse Sand. LSf: Loamy Fine Sand. N.L: Not Limiting. V .P: Very Poor. MO: Months.

FIRST SCHEDULE Regulations 4, 8 and 9

PART 4

Soil quality parameters and classes for wetland rice under irrigated systems.

Column I	Column II	Column III	Column IV	Column V	Column VI
SOIL QUALITY PARAMETER	Class I SUITABLE	Class II MODERATELY SUITABLE	Class III POTENTIALLY SUITABLE	Class IV MARGINALLY SUITABLE	Class V UNSUITABLE
1. Slope (%)	<1	<2	<3	<4	<5
2. Wetness					
- Flooding	N.L.	N.L.	3-4 months	3-4 months	Too short or too long
- Drainage	Mod. to IP	Good to Poor	Good to V.P	--	--
3. Physical					
- surface text/structure	CM to SiCs	CM to SCL	CM to Sf	CM to Sf	CM to SC
- subsurface texture/structure		CM to LSf	CM to SC	--	-- --
4. Salinity /alkalinity					
- Ec mmhos/cm	<2	<4	<6	<6	<6
- ESP (%)	<5	<10	<20	<35	<35

CM: Massive Clay. SiCs: Silty Clay blocky. SCL: Sandy Clay Loam. Sf: Fine Sand. SC: Coarse Sand LSf: Loamy Fine Sand. N.L: Not Limiting. LSf: Loamy Fine Sand. N.L: Not Limiting. V.P: Very Poor I.P: Impermeable.

SECOND SCHEDULE Regulation 9 (2)

GUIDELINES FOR MANAGEMENT OF FRAGILE OR PECULIAR SOILS

PART I

A. Acid sulphate soils (Sulfaquents)

Acid sulphate soils form when the quantity of sulphuric acid, formed by oxidation of reduced sulphur compounds, exceeds the acid neutralizing capacity of absorbed bases and easily weatherable minerals to the extent that the pH drops below 4. Potential acid sulphate soils become acidic as a result of drainage because the reduced sulphur compound (pyrite) is very stable under anaerobic condition.

Pyritic papyrus peats are common in Uganda (e.g. Kabale swamps). Accumulation of ferrous monosulfide (FeS) and ferrous disulphide or pyrite (FeS_2) occur in a highly reducing environment (anoxic). This process is especially prominent in the presence of mobile iron and abundance of organic matter, and under conditions of a ready supply of sulphur.

On drainage (improved aeration) atmospheric and microbiological oxidation convert the iron sulphide into ferric oxide and sulphuric acid, resulting in an extremely acid soil reaction, with pH well below 3-5, and occasionally as low as 1.0.

B Diagnostic field characteristics of (potentially) acid sulphate soils.

The following tests shall be conducted before drainage of any wetland—

1. Potentially non-acid sulphate soils are those that contain sizeable quantities of neutralizing cations, mainly Ca. The presence of Ca (and Mg) carbonate is tested using diluted HCl; the CO_2 given off will cause effervescence.
2. The diluted HCl test may give rise to the characteristic odour of hydrogen sulphide, indicating the presence of sulphide in the soil.
3. Bluish-black colours of fresh mineral soil may point to the presence of pyrite.
4. Acid - tolerant vegetation may be indicative.
5. Treatment of potentially acid sulphate soils with hydrogen peroxide causes a prominent drop in pH of the soil. This decrease may well be 1-2 units lower than that which develops under natural oxidation.
6. Slow oxidation by the regular exposure (drying) of the moistened soil samples (air drying) over a period of several weeks gives a fair simulation of the natural process and the resulting soil reaction (pH).

C Reclamation of acid sulphate soils.

Reclamation by chemical improvement of acid sulphate soils requires 20-30 tons of lime per hectare. The cost of purchasing, transporting and application of such large quantities of lime for the reclamation exercise is high and can be justifiable only in few cases. Moreover, large quantities of lime create problems of potash and trace element deficiencies. Leaching is a better solution but no land should be flooded with the drained-off water. Additional measures to be taken include: regular applications of small amounts of lime, together with basic fertilizers (not containing sulphates) and ashes; cultivation of acid-tolerant, shallow rooting crops; mounding of land in the case of more deeply rooting crops and good water table management.

D Irrigation

The soil suitability for irrigation purposes is considered based on the following qualities—

1. topography (slope);
2. wetness - flooding and drainage characteristics;
3. soil chemical characteristics;
4. physical soil characteristics:
    (a) texture (includes surface and subsurface),
    (b) soil depth,
    (c) salinity and alkalinity,
    (d) infiltration.

The qualities mainly relate to irrigation of crops normally grown under rain fed-conditions and give particular attention to soil-water plant relationship. These qualities are not applicable to drip irrigation. The soil chemical qualities are, per earlier recommendation, on the general threshold values for fertility management.

Five classes shall apply: suitable moderately suitable, marginally suitable, potentially suitable, and not suitable for irrigation.

It is important to note that some of the recommended parameters are normally assessed in the field i.e. some parameters have no quantitative values e.g. drainage classes, soil structure etc.

Since most water sources in Uganda are not salt affected, it is assumed that the irrigation water will also be free of salts. Salt content of irrigation water is expressed in one of the parts per million (ppm); milligrammes of salt per litre (mg/l); or as electrical capacity expressed as micro Ohms per centimetre ($Ec.x10^{-6}$). High calcium carbonate and gypsum levels occur in very localised areas in Uganda and hence no values are included in the parameters specified in the First Schedule.

Class I — Suitable
Class II — Moderately suitable
Class III — Marginally suitable
Class IV — Potentially suitable
Class V — Unsuitable

PART II Wetlands Rice

Systems

The wetlands rice systems have been grouped into two broad categories:

1. Rice cultivation under natural flooding or waterlogged areas; and
2. Irrigated rice systems.

The natural flooding or waterlogged system represents the small-scale rice producers in periodically flooded alluvial plains and valleys. These systems depend on flooding from rain events. The irrigated system represents the large-scale systems where irrigation waters are "fairly" well regulated. These rice production systems are adapted to specific hydrologic conditions and specific soil qualities.

The first category is very widespread in eastern Uganda and it is the main cultivation pattern in wetlands.

The following are suitability classifications of soils for natural waterlogged rice production system based on landform, flooding and physical soil properties—

Class I — Suitable
Class II — Moderately suitable
Class III — Marginally suitable
Class IV — Potentially suitable
Class V — Unsuitable

THIRD SCHEDULE.

Regulation 10

PARAMETERS AND METHODS OF DETERMINATION OF SOIL QUALITY.

There are a variety of soil parameters used for the management of soils:

Chemical parameters

Soil Acidity (pH)

The parameter generally denotes soil reaction which expresses the degree of acidity or alkalinity The pH value equals the negative logarithm of the H+ ion concentration (CH+). Conventionally, the soil pH is measured in a soil - water suspension 1:2.5 (10 g soil in 25 ml water) and is designated pH (water). It could also be determined in suspensions of 1:1 or 1:5.

For the measurement of exchange (reserve or potential) acidity of an acid soil a 1:2.5 suspension should be used to which a neutral salt (KCl) has been added, in order to bring exchangeable H-ions into solution. It is designated pH (KCl). The pH value of soil is most accurately measured with a pH meter in the laboratory method.

Organic matter

Organic matter, because of its colloidal nature, contributes to the cation exchange capacity, CEC, and therefore the nutrient retention capability of the soil. Organic matter improves the physical characteristics of the soil through its enhancement of water permeability and retention. Soil organic matter is high in organic carbon and serves as a source of energy for soil micro-organisms.

Organic carbon should be determined by the modified Walkley and Black method (Nelson, D.W. & Sommers, L.E.)

Sodicity (ESP)

Normal soils usually have an exchange complex that is dominated by Ca and Mg and has only minor amounts of K and Na. When excess soluble salts accumulate in such soils, Na frequently becomes the dominant cation in the soil solution, a part of the original Ca and Mg is replaced by the cation. In general, physical properties become increasingly unfavourable with increasing levels of exchangeable Na.
The commonly determined parameter, the exchangeable sodium percentage (ESP) shall be used.

$$ESP = \frac{\text{Exchangeable Na (meq/100g soil) x100}}{\text{Cation Exchange capacity (meq/100g soil)}}$$

Salinity (Ec)

Saline soils contain soluble salts in concentrations that impair crop growth. Although weathering of primary minerals is the source of nearly all soluble salts, accumulation of these on the spot are seldom concentrated enough to form a saline soil. Invariably, strong salinity is found under semi-arid climatic conditions in soils where salts from other locations have accumulated through the inflow and subsequent concentrations of salt-bearing waters. Most saline soils are characterised by low humus content, no differentiation into horizons and very little structure.

The generally accepted parameter of salinity, the electrical conductivity (Ec) at 25EC shall be used. The Ec can be determined according to the saturated paste extract method and measured with a conductivity bridge.

Cation Exchange Capacity (CEC)

The CEC of a soil often indicates its natural fertility and its ability to supply Ca, Mg, and K for plant growth. It is also a measure of the ability of the soil to store added nutrients (fertilizers).

Soils which have a low CEC cannot store large amounts of plant nutrients and must be replenished more regularly.

In the inorganic part of the soil complex only clay particles play a decisive role, since the active total internal surface of silt and sand particles in comparison to that of clay is very small. The CEC of clay depends on the type of clay mineral. The organic matter complex (the humus colloids) has a much higher CEC than clay.

The CEC of a soil shall be determined in the laboratory, either in an exchange medium with pH = 8.2 or in exchange medium with pH = 7.0. The expression T value may be used instead of CEC value.

Exchangeable Bases

This is restricted to the cations Ca, Mg, K, and Na. The total quantity of these four exchangeable cations (S value) can be related to the CEC value and expressed as the base saturation percentage (BSP). The individual values for exchangeable Ca, Mg, and K give certain indicators of the fertility status of the soil (Macro-nutrients). The exchangeable Na percentage (ESP) is an important criterion for sodic conditions.

Exchangeable cations shall be determined in the laboratory by flame photometry for K and Na, and by atomic absorption spectrophotometry (AAS) for Ca and Mg using Anderson and Ingram, 1993).

Phosphorous (P)

Compounds of P (ADP & ATP) act as energy currency in plants. Energy from photosynthesis and metabolism of carbohydrates is stored in these compounds for subsequent use in growth and reproductive processes. The role of P as a structural component of a wide variety of biochemical and seed formations are also important.

The following commonly used methods shall be applied: the calorimetric method (Anderson and Ingram, 1993); the Olsen for extractable P, and Bray II method for available P.

Calcium carbonate

The presence of CaCO3 affects both the physical and chemical characteristics of a soil. High lime concentrations may not severely restrict water movement but may prevent root penetration. A high CaCO3 concentration particularly in the very fine fractions brings risks of lime-induced chlorosis for many crops. The physical characteristics of calcareous soils change when they are irrigated. It is therefore a vital soil quality parameter under irrigated agriculture.

Gypsum ($CaSO_4$)

Gypsum indirectly affects soil physical properties and therefore influences permeability and infiltration rate. It improves the structure and prevents sodium saturation. A small amount of gypsum is favourable for crop growth because it serves as a source of Ca as a plant nutrient and replaces Na in the exchange complex and thus acts to preserve chemical and physical soil degradation.

PART II Physical parameters

Texture

Soil texture refers to the particle size distribution and to particle-size groupings within specific ranges. Textural classes are defined by the relative contents of the three major soil separates, sand, silt and clay. Texture is considered as one of the most important characteristics with regard to physical soil qualities. It influences such important soil properties as soil water availability, infiltration rate, drainage, tillage conditions and capacity to retain nutrients. The effect of texture on those properties may be modified by structure, nature of clay minerals, organic matter content, and lime content.

Soil texture should be determined by the common method of hydrometer or pipette in the laboratory or by the hand feel method in the field.

Structure

Soil structure refers to the aggregation of primary soil particles (sand, silt, clay) into compound soil particles or clusters of primary particles which are separated from the adjoining aggregates by cracks or surface of weakness. Soil structure exerts a dominant influence on soil's air and moisture regime, on its hydraulic conductivity and consequently, on the root growth and (micro) biological activity that occurs within the soil. It is, therefore, an important factor in soil productivity and soil genesis. Structure shall be commonly described in the field under three commonly used criteria, namely:

1. grade which refers to the distinctiveness and durability;
2. size of aggregate;
3. shape of aggregates.

Coarse Fragments or Stoniness

Surface coarse fragments in the top 20 cm will influence tillage conditions as well as the capacity to retain nutrients and water. Coarse fragments can limit the use of agricultural implements and optimum growth of roots. Coarse fragments with a diameter between 2-75 mm are termed gravel; those between 75-250 mm are called cobbles and those more than 250 mm are called stones (Sys et al.,1991).

Coarse fragments shall be quantified on volume or weight percentage basis.

Rooting Depth

Rooting depth is a crucial parameter in soil productivity because it determines soil reserves of water and nutrients. The relationship between rooting depth and productivity is commonly described according to the law of diminishing returns. It is generally defined as the thickness of loose soil above a limiting layer (if any). Limiting layer is impermeable for roots and percolating water. Soil depth is vital for the anchoring of plants and provision of a favourable environment for plant root growth.

Soil depth parameter shall be quantified by direct depth (length) measurements.

Water Holding Capacity (WHC) or Available Moisture Content (AMC).

This is the amount of water which a given soil horizon can store and is estimated from the difference between field capacity and the lower limit of plant available water (wilting point).

The field capacity (-1/3 bar) and wilting point (-15 bar) shall be determined in the laboratory by the pressure plate method. The field capacity value should also be determined in the field by the ponding method.

Drainage and depth to water table

Drainage and depth to water table are vital parameters. The suitability for upland crops decreases when drainage conditions become impeded. Tree crops with a deep root system are more sensitive to poorly drained conditions than annual crops with shallower root systems. Crops like paddy rice react quite differently to drainage conditions; their suitability decreases when drainage conditions improve. For irrigated agriculture, drainage, depth to ground water table and salinity status are critical evaluation parameters.

Drainage classes shall be described in the field as it is normally done. Depth to water table shall be measured in the field.

Slope

Slope angle and length are critical parameters for the assessment of erosion potential. It also influences water movement and distribution within the soil profile.
Slope angles or percentages shall be determined in the field.

Infiltration

Infiltration is a very important parameter in irrigated farming systems. Infiltration is the entry of water into the soil through the soil surface. The rate is dependent on the antecedent moisture, soil structure, pore sizes and their distribution. It is an important parameter in evaluating compacted (physically degraded) soils e.g. degraded rangelands. Rate of water entry is generally very low in degraded areas and most of the water ends up as runoff, causing considerable soil erosion and siltation problems.

Infiltration rate is determined in the field using the common method of double cylinder infiltrometer (Bouwer, 1986).

Bulk Density

This parameter largely depends on the porosity of the soil and is commonly used to evaluate compaction. Loose and porous soils have low values while compacted or physically degraded soils have high values.

Bulk density parameter shall be determined by the core or clod method (Anderson and Ingram, 1993).

Total Porosity

Total porosity is the fraction of the soil mass that is occupied by the pores. The pore space is largely determined by the arrangement of the individual solid particles of the soil. The pore space in the soil is partially occupied by the liquid (water) and partly by air.

Porosity shall be computed from the relationship between bulk density and particle density (Anderson and Ingram, 1993).

Flooding

Flooding is considered as a serious limitation for most crops apart from paddy rice. Flooding interferes with air entry into the soil.

For paddy rice cultivation, flood evaluation is based on duration and depth of flooding.

Optimal duration of flooding is 110 to 160 days; marginal situations are 90-110 days and more than 180 days. The optimal depth shall be considered as 10-30 cm (Sys et al. 1991).

FOURTH SCHEDULE

Regulations 12 and 13

SOIL CONSERVATION MEASURES AND GUIDELINES

Soil conservation is required as a basis for environmentally sound production of food, wood, and other commodities based on sustainable use of land, species and ecosystem. In all these areas, a combination of several conservation practices are recommended and packages will depend on area and crops / livestock/tree species on the land.

1. Lowlands and flat areas (Slopes up to 2%)
   Lowlands are the alluvial plains and the bottom lands of small tributaries in a catchment. The following soil conservation structures and practices are recommended—

   (a) surface or subsurface drainage;

   (b) interception and diversion ditches;

   (c) rows of crops should be laid out at right angles to the contour lines;
   (d) crop rotation; and

   (e) fertility improvement (package will depend on crops and area).

   Diversion ditches or field ditches should be at a spacing of 100 to 200 metres; depth 30 cm and length not more than 500 metres. These should be laid out slightly off the contour to obtain a gradient of 0.3 to 0.5%. The collecting ditches (depth 60 cm), should drain into main ditches or natural drainage ways and should run in the direction of the greatest slope.

2. Medium (Undulating to hilly topography). Slopes of 3 to 15%
   Recommended conservation practices—

   (a) contour cultivation;

   (b) contour ridges or absorption banks at a spacing of 30 m;

   (c) grass strips and strip cropping; width 30 m;

   (d) mulching;

   (e) agroforestry;

   (f) crop rotation and fertility improvement; and

   (g) wind breaks or shelter belts; should be located perpendicular to main erosive wind direction.
3. Steep Topography (Slopes of 15 % and above).
   Simple conservation practices are insufficient to stop erosion. The following management practices are recommended—

   (a) terraces;

   (b) contour cultivation (ploughing and planting along the contour), and absorption banks at a spacing of 10 - 20 m;

(c) crop rotation and fertility improvement;

(d) strip cropping - strip width 10 to 20 m; and

(e) agroforestry.

4. Pasture and Rangelands

(1) Pasture

(a) contour furrows at small distances (20 m);

(b) interception ditches;

(c) stone cordons: loose stones on the surface collected and deposited on contours;

(d) silt traps - built from stones or soil in small depressions; and

(e) pasture and fertility improvement.

In addition, an optimum stocking rate is required. The following are the recommended stocking rates—

(a) areas with fertile soils and rainfall of >850mm per year= 2 cows per hectare; and

(b) areas with low fertility and rainfall of <850mm per year= 1 cow per hectare.

(2) Rangelands
These recommendations are particularly targeted at the "Cattle Corridor". Recommendations will depend on the state of the rangelands.

(a) revegetation or reseeding - close the area to grazing and allow natural grasses to establish or reseed with suitable species of grasses and legumes;

(b) gully control with mechanical barriers (dry reeds, vegetation, stones, etc);

(c) controlled or rotational grazing;

(d) run off harvesting - divert and impound run off to prevent soil erosion, gully development and allow slow permeability into the soil;

(e) fertility improvement; and

(f) remove low value grass and tree species to allow nutritive species to proliferate and cover bare ground.

FIFTH SCHEDULE.

Regulation 13.

RECOMMENDED FREQUENCY FOR MONITORING OF SOIL QUALITY PARAMETERS FOR ENFORCEMENT PURPOSES.

Soil Parameter	Suggested Monitoring Frequency
1. Soil Physical Indicators	
Bulk density and porosity	Annually
Structure	2 years
Texture	3 years
Water holding capacity	3 years
Infiltration	Annual
Coarse fragments and stoniness	Every 5 years
Soil depth	3 - 5 years
Slope, depth to water table, and drainage class	Planning phase
2. Soil Biology Indicators	
Soil organic matter	Annually
3. Soil Chemical Indicators	
pH	Annually
Exchangeable bases	2 years
P	2 years
CEC	2 years
Calcium carbonate and gypsum	Planning phase
Alkalinity, Sodicity (for irrigated agriculture)	3 to 5 years

Form SRO/1

SIXTH SCHEDULE

Regulation 13 (2).

IMPROVEMENT NOTICE

(Issued under section 81(i) of the National Environment Statute, 1995 and regulation 15 of the National Environment (Minimum Standards for Management of Soil Quality) Regulations,2001)

TO: ………………………………………
………………………………………
………………………………………

TAKE NOTICE that on the …………………. of ………………. 20…, an Environmental Inspector(s) from the National Environment Management Authority carried out an inspection of the soils and/or land located in …………………… Village, …………………………. subcounty of …………………………………. District where it was found that you or your agents were carrying on the following soil degrading activities:

1. ……………………………………………………………..
2. ……………………………………………………………..
3. ……………………………………………………………..
4. ……………………………………………………………..

(attach more paper if required)

YOU ARE HEREBY ORDERED to stop all the stated illegal activities which are causing or are likely to cause soil degradation on the above mentioned soils or land within a period of ……………… days from the date of this Notice. You are also required to restore the soil to its original state.

YOU ARE NOTIFIED THAT in accordance with section 96 of the National Environment Statute 1995, failure to comply with this Notice shall result in criminal prosecutions being instituted against you and/or your agent.

…………………………………………………..
Environmental Inspector.
Copy to:

HENRY MUGANWA KAJURA,
Minister of Water, Lands and Environment.