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**भारतीय मानक मसौदा**

**मृदा संरक्षण से संबंधित जलसंभर प्रबंधन के लिए सिफारिशें**

**भाग 1 कृषि संबंधी पहलू**

**(IS 6748 भाग 1 का पहला पुनरीक्षण)**

***Draft Indian Standard***

**RECOMMENDATIONS FOR WATERSHED MANAGEMENT RELATING  
TO SOIL CONSERVATION PART 1 AGRONOMIC ASPECTS**

*(First Revision of IS 6748 Part 1)*

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**Water Resources Planning,  
Management and Evaluation  
Sectional Committee, WRD 06**

**Last Date for comments:**

**06/11/2023**

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**FOREWORD**

*(Formal clauses of the foreword will be added later)*

Sedimentation of reservoirs is a matter of vital concern for any project whether irrigation, hydro-electric power, flood control etc., since it adversely affects the life and functions of the reservoirs. For this, effective measures of soil conservation in the watershed are essential.

Soil conservation is an integrated approach of three disciplines namely, engineering, agronomy and forestry and involves a coordinated effort of these disciplines for a comprehensive and composite programme of development and management of watersheds. Of these three disciplines are given below:

- a) Engineering — Bank protection and roadside control measures, abutment, spurs check-dams, gully plugging, masonry or concrete water disposal system, etc.
- b) Agronomy — Retirement of severely eroded land to permanent protection of vegetation, pasture development, vegetative waterways, contour farming, strip cropping, crop rotation, etc.
- c) Forestry — Like forest conservancy, management and protection, and forest plantation, etc.

A standard for the engineering aspects of watershed management (IS 6518 : 2017) was already published.

In the formulation of this standard due consideration has been given for relating this standard to the practices in the field in this country. This has been met by deriving assistance from the Soil Survey Manual, 1970 of the All India Soil and Land Use Survey Organization, IARI.

The first revision of this standard has been brought out to update the standard with respect to the latest technological advancements and the best practices being followed in the field. The major changes incorporated in this revision are:

- a) Clause **3.2**, **3.3**, **3.4** have been added for quick erosion surveys or rapid reconnaissance surveys of soil requiring soil conservation measures.
- b) The title of Clause **3.4.1** has been modified.
- c) Clause **3.4.2**, **3.4.3**, **3.4.4** have been added to classify soil/land based on the characteristics and qualities of various mapping units.
- d) Annex A has been added for symbols used in soil and land use mapping during detailed soil survey.
- e) Annex B has been added for the classification of land based on cultivation practices.

The composition of the Committee responsible for the revision of this standard is given at Annex 1.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 2022 'Rounding off numerical values (*Second revision*)'. The number of significant places retained in the rounded-off value should be the same as that of the specified value in this standard

**Draft Indian Standard****RECOMMENDATIONS FOR WATERSHED MANAGEMENT RELATING  
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**1 SCOPE**

This standard (Part 1) covers the recommendations on the agronomical aspects for soil conservation in the catchment area and the appropriate method(s) to be adopted.

**2 REFERENCES**

The standards listed below contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
IS 5510 : 1969	Guide for Soil Surveys for River Valley Projects
IS 6518 : 2017	Guidelines for control of sediment in reservoirs (Second Revision)

**3 IDENTIFICATION OF AREAS REQUIRING SOIL CONSERVATION MEASURES ON PRIORITY BASIS**

**3.1** To achieve the maximum benefit of soil conservation and covering as many critical areas as feasible in the minimum possible time, one should know the pockets of sediment-contributing areas and the amount of sediment contributed by them and then have a

comprehensive plan to tackle these areas in the order of priorities taking sub-watershed as a unit of management.

**3.2** A quick erosion survey or rapid reconnaissance survey should be carried out by soil survey parties on a watershed basis using the micro-watershed layer of the Digital Micro-Watershed Atlas of India (2019) (source SLUSI) through remote sensing and GIS techniques. This survey aims to determine the pattern of present land use and the degree of erosion in order to establish priorities for soil conservation measures. Digital Micro-Watershed Atlas of India recognizes each micro-watershed with a distinct spatial extent and unique national code. It will guide the planners in designing location-specific development plans under various agricultural and rural development programs. This will also help in the prevention of overlapping of planning and duplication in the implementation of developmental activities by various agencies.

**3.3** Based on the findings of the quick erosion survey or rapid reconnaissance survey report, the areas falling under the very high and high priority categories of micro-watersheds should be selected for a detailed soil survey at the micro-level planning using remote sensing and GIS techniques at a 1: 10 000 scale. This will facilitate the generation of a village-wise plan for soil conservation measures. The standard symbols for soil and land use mapping are placed in Annex A.

**3.4** The detailed soil survey provides a complete diagnosis of soils that can be interpreted for various purposes. The soil survey database/information is utilized for the appropriate grouping of soils/lands based on preset criteria/norms. The evaluation of soil/lands on the basis of characteristics and qualities of various mapping units followed in the interpretative groupings of soils/lands are

- a) Land Capability Classification,
- b) Soil Irrigability Classification,
- c) Land Irrigability Classification,
- d) Hydrological Groups of Soils, and
- e) Suggested Conservation Measures/Agronomic Practices.

#### **3.4.1** *Land Capability Classification*

##### **3.4.1.1** *Land is classified into the following types:*

- a) Suitable for cultivation, and
- b) Unsuitable for cultivation.

**3.4.1.2** These are further subdivided and the details are given in annex B, based on IS 5510 with additions in Classes VI and VII.

**3.4.2 Soil Irrigability Classification**

It deals with the evaluation of soils for their suitability for irrigation on the basis of quantitative limits of soil characteristics pertinent to irrigation. Classification of soil on the basis of their suitability for irrigation is given in Table 1. The main characteristics of these irrigability classes are: effective depth, texture, structure, consistence, infiltration, permeability, available water holding capacity, presence of coarse fragments, rock-out crops, bulk density, salinity, alkalinity, clay mineralogy, drainage, erosion, etc. The criteria for classification of soils into various irrigable soil classes based on soil properties are provided in Table 2.

**Table 1 Classification of Soil on Irrigability**  
(Clause 3.4.2)

<b>Soil Irrigability Class</b>	<b>Limitation Criteria for Sustained Use Under Irrigation</b>
Class A	None to slight soil limitations for sustained use under irrigation
Class B	Moderate soil limitations for sustained use under irrigation
Class C	Severe soil limitations for sustained use under irrigation
Class D	Very severe soil limitations for sustained use under irrigation
Class E	Not suitable for irrigation

**Table 2 Criteria for Soils Irrigability Classes**  
(Clause 3.4.2)

<b>SI No.</b>	<b>Soil Properties</b>	<b>Irrigable Soil Classes</b>				<b>Non Irrigable Soil Classes (E)</b>
		<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	
i)	Effective Soil Depth (cm)	>100	50-100	25-50	10-25	<10
ii)	Surface Texture (upto 30 cm)	Sandy loam to Clay loam	Loamy sand, Clay	Sand, Clay	Sand, Clay	Any Texture
iii)	Soil Permeability* (mm/hr) (of least permeable layer)	5.0-50	1.3-5.0 50-130	0.3-1.3 130-250	<0.3 >250	Not applicable

iv)	Available water holding capacity to depth of 100 cm	>12 cm	9-12 cm	6-9 cm	2-6 cm	<2 cm
v)	Coarse fragments (%) cobbles and stones (>75mm)	<5	5-15	15-35	35-65	>65
vi)	Gravel and Kankar (>25 to 75 mm)	<15	15-35	35-55	55-70	>70
vii)	Rock out-crops (distance apart in meters)	40	20	15	5	<5
viii)	Salinity (in 1:2 dilution) (mmhos/cm)	<1	1-1.5	1.5-2.5	2.5-3	>3
ix)	Salt affected (% of area affected)	<20%		20-50%		>50%
x)	Severity of alkali problem	ESP <15%		ESP >15%		
xi)	Sub-soil or substrata drainage characteristics	Lower subsoil is at least moderately permeable or a permeable layer of at least 6 inch thickness occurs immediately below the soil but within 10 feet (sand, gravel)		No moderately permeable subsoil or other permeable layer of at least 6 inch thickness occurs within depth of 10 feet		
xii)	Soil Erosion status	Effects of sheets and rill erosion are reflected in effective soil depth, available moisture holding capacity and in some other factors shown above. Moderately or severely gullied soils may be classified based on local experience				

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NOTE — Soil permeability as a criterion is not applicable to very deep black soils due to their unique properties. Very deep and deep black soils (Vertisols), which are inherently slowly permeable due to the presence of expanding 2:1 lattice-type clay minerals, do not qualify for the irrigability soil class A. Instead, they would be classified under classes C, D, and E.

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### 3.4.3 Land Irrigability Classification

The suitability of lands for irrigation depends on physical and socio-economic factors, in addition to the soil irrigability classes. It also depends on the drainability of the land, the quality and quantity of water, and the cost of land development. Classification of lands on the basis of their suitability to irrigation is given in Table 3. The criteria for classification of lands into various irrigable lands classes based on their characteristics are provided in Table 4.

**Table 3 Classification of Land on Irrigability**  
(Clause 3.4.3)

Land Irritability Class	Limitation Criteria for Sustained Use Under Irrigation
Class 1	Lands that have few limitations for sustained use under irrigation
Class 2	Lands that have moderate limitations for sustained use under irrigation
Class 3	Lands that have severe limitations for sustained use under irrigation
Class 4	Lands that have marginal for sustained use under irrigation because of very severe limitations
Class 5	Lands that are temporarily classed as not suitable for sustained use under irrigation and pending for further investigation.
Class 6	Lands not suitable for sustained use under irrigation.

**Table 4 Specification For Land Irritability Classes**  
(Clause 3.4.3)

Land Characteristics	Class 1	Irrigable Land class		Class 4	Class 5 Temporarily Non-irrigable (unclassified)	Class 6 Non-Irrigable Land class
		Class 2	Class 3			
<b>SOILS</b>						
Soil Irritability Class	A	A to B	A to C	A to D		
<b>TOPOGRAPHY</b>						
Slope Surface grading	<1% No restriction	1-3% Moderate restriction	3-5% Moderately severe restriction	5-10% Severe restriction	Further investigation needed	Includes lands which do not meet the requirements for which other land classes are not
<b>DRAINAGE</b>						

Outlet	Suitable outlet available	Suitable outlet available	Suitable outlet available	No drainage outlet available	suitable for irrigation or small isolate tracts (specifying size of distance from the canal) not susceptible to delivery of irrigation water
Surface drainage	Specifications to be developed for each project area				
Subsurface drainage	No Subsurface drainage needed	No Subsurface drainage needed	No Subsurface drainage needed	No natural drainage needed	
Depth of water table	>5 meters	3-5 meters	1.5-3 meters	1.5 meters and below	

### 3.4.4 Hydrological Soil Groupings

**3.4.4.1** Hydrological grouping of soils involves estimating their runoff potential, which is useful for conducting hydrological studies in watershed management programs. Various soil properties that influence runoff, such as effective depth, texture, clay content in the surface layer, average clay percentage in the profile depth, drainage, infiltration, and permeability, are considered when determining the hydrological soil groupings. Based on soil properties, four hydrological groups have been defined as given in Table 5.

**3.4.4.2** The runoff potential of the soil, in combination with terrain features and land use patterns, not only indicates the erosion hazard and sediment yield from the sub-watershed but also provides information about the peak rate and coefficient of runoff perception, which helps assess the flood pattern. Soil infiltration, which is the most crucial hydrological property, determines not only the potential for runoff generation in a sub-watershed but also serves as a valuable input for designing efficient water harvesting structures.

**3.4.4.3** The criteria for classifying soils in hydrological soil groups on their characteristics are provided in Table 6.

**Table 5 Hydrological Grouping of Soils**  
(Clause 3.4.4)

Hydrological Soil Groupings	Runoff Potential	Characteristics
Group A	Low run off potential	Soils which have high infiltration rates, even when thoroughly wetted, consist mainly of deep, well-drained



		to excessively drained sand gravels. These soils exhibit very rapid to rapid rates of water transmission.
Group B	Moderately low run off potential	Soils which have medium infiltration rates when thoroughly wetted consist mainly of medium to deep, moderately well-drained to well-drained soils with moderately coarse textures. These soils exhibit rapid to moderate rates of water transmission.
Group C	Moderately high run off potential	Soils which have low infiltration rates when thoroughly wetted consist mainly of moderately deep to deep, moderately well-drained to well-drained soils with moderately fine to moderately coarse textures. These soils exhibit moderate rates of water transmission.
Group D	High run off potential	Soils which have very low infiltration rates when thoroughly wetted consist mainly of clay soils with a high swelling potential, soils with a permanently high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils lying over nearly impervious materials. These soils are poorly drained and exhibit slow rates of water transmission.

**Table 6 Criteria for Classifying Soils in Hydrological Soil Group**

(Clause 3.4.4)

Hydrological soil group and their runoff potential	Effective soil depth (cm)	Soil texture average clay contents (%)	Soil structure	Basic Infiltration rate cm/hr	Soil permeability cm/hr
Group A Low runoff potential	100 or more	Sand, loamy sand (0-8)	Single grain	5 & above	Rapid to very rapid (13 & above)
Group B Moderately low runoff potential	51-100	Sandy loam, silty loam, loam (9-25%)	Granular or crumb	3.1-5	Moderate to moderately rapid (2-13)
Group C Moderately high runoff potential	26-50	Silty, sandy clay loam, silty	Sub-angular	1.6-3	Moderately slow (0.5 – 2)

		clay loam (26-40%)	columnar		
Group D High runoff potential	< 26 cm	Sandy clay, silty clay, clay (41 & above)	Angular blocky prismatic , platy, massive	<1.6	Slow to very slow (less than 0.5)

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## 4 AGRONOMIC PRACTICES

**4.1** The agronomic practices in respect of soil conservation are the following and they are described in detail in **4.1.1** to **4.1.11**:

- a) Retirement of severely eroded cultivated land for permanent protection by vegetation,
- b) Planting severely erodible areas with feed and cover plants for rehabilitation of wild life,
- c) Pasture development and their protection,
- d) Construction of small water storages,
- e) Vegetated waterways,
- f) Contour farming by bunding and terracing,
- g) Strip-cropping,
- h) Modified strip cropping,
- j) Stubble mulch farming,
- k) Seasonal cover crops, and
- m) Crop rotation.

NOTE — All these aspects are to be simultaneously taken note of for minimizing the erosion and appropriate method(s) should be adopted.

**4.1.1 Retirement of Severely Eroded Cultivated Land for Permanent Protection by Vegetation** — Gullies tend to form wherever runoff is concentrated in unprotected depression channel ways. Once started they increase in size and unless checked ultimately develop into deep, spreading chasms which ruin the land. The best method of treatment of severely eroded cultivated land is to provide permanent vegetal cover.

**4.1.2 Planting Severely Erodible Areas with Feed and Cover Plants for Rehabilitation of Wild Life** — In severely erodible areas wildlife plantings offer the best solution to the erosion problem. This is because the plant species adapted to wildlife succeed under the ecological conditions imposed by such sites and also because the areas are too small or too inconveniently located for the profitable production of economical plants even if they thrive

under such conditions. The plantings may be trees, shrubs, vines, or grasses. The ideal condition to be realized is adequate food and cover at all times.

**4.1.3 Pasture Development and Their Protection** — One of the chief causes of soil deterioration on grazing land is the loss of plant cover due to overgrazing and poor management practices that expose the ground to wind and rain. Properly prepared and managed pastures produce several times more than ill-managed grazing ground. It has been found that an abundance of high-quality forage is the very foundation of any type of livestock farming. Three aspects essential in pasture development are:

- a) Addition of lime and fertilizers according to soil test;
- b) Use of proper seed rates and mixtures; and
- c) Controlled grazing.

**4.1.4 Construction of Small Water Storages** — Small dams for use in farm and grazing lands are usually not expensive, yet they add considerably to the value of dry land farm or grazing lands. Besides supplying water and some recreation facilities, they play an important part in controlling floods. The size and cost of such dams are largely governed by the terrain.

**4.1.5 Vegetated Waterways** — These are waterways protected by vegetation to prevent conversion into gullies. Natural drainage depressions, seeded with an adaptable grass-legume mixture, often may be utilized as satisfactory water channels and meadows at the same time. The vegetated waterways should not be less than 6 m wide. Seeding should not only cover the channel but extend well back on the shoulders.

**4.1.6 Contour Farming by Bunding and Terracing** — Contour farming is preparing, planting, or drilling and cultivating of crops along and parallel to level lines that have been laid out across the field slope. When farming contour strip-cropped fields, terraced fields, fields with diversions, and contour orchards, cultivation should be parallel to guidelines.

**4.1.6.1** Contour cultivation is effective in controlling erosion by surface flow. When carried out properly, it is one of the most effective mechanical control measures for cultivated cropland. It is effective in increasing crop yields, reducing runoff and scour-erosion losses. When contour farming is used alone, new guidelines should be established each time the crop is planted, unless erosion is made to maintain original lines by contour hedges, back furrows or other means.

**4.1.6.2** Contour bunding consists of the construction of small bunds across the slope of the land along contours so that the long stretch of slope is cut into a series of small ones and

each contour bund acts as a barrier to the flow of water. This practice is generally followed in gently sloping lands.

**4.1.6.3** Terraces may be of bench type or graded channel type which is designed to intercept and divert runoff at non-erosive velocities. This practice is generally followed on hill slopes.

**4.1.7** *Strip-cropping* — Strip-cropping is the practice of growing crops in a systematic arrangement, of strips or bands which serve as vegetative barriers to erosion. It includes the utilization of crop rotation, contour cultivation, proper tillage, cover crops, and other related practices. The arrangement of crops in strips should be such that erosion and semi-erosion resistant crops are alternated with clean cultivated crops that are conducive to erosion.

**4.1.7.1** In choosing any system of strip-cropping the following guiding principles should be kept in mind:

- a) Strip-cropping should be made to fit into the farm management
- b) Strip should be laid out as nearly on the contour as possible and
- c) Consideration should be given to the degree of erosion, the percentage of slope, the length of the rotation, and the ratio of erosion-resisting and erosion-permitting crops.

**4.1.8** *Modified Strip Cropping* — Field stripping is a modified form of contour strip cropping under which strips are laid parallel and across the general slope but not exactly on the contour. This system is best suited to land of uniform slopes and to gentle slopes with minor surface irregularities that make accurate strip-cropping impracticable. Field stripping is very beneficial for checking wind and water erosion. If strips deviate from the contour for only short distance, not more than 30 m, and little damage may result especially on soil of high credibility. However, if the deviation should be more than 3 percent, and the distance of such deviation greater than 30 m, field stripping should give way to contour stripping.

**4.1.9** *Stubble Mulch Farming* — Leaving stubble on the surface in sufficient quantity is one of the surest ways to prevent wind erosion, conserve moisture, and add organic matter to the soil. Subtitled stubble mulch gives high yields.

**4.1.10** *Seasonal Cover Crops*— Seasonal cover crops are very important in protecting fields from erosion. They also serve to absorb plant nutrients that otherwise would be lost by leaching and thus aid in their preservation for subsequent crop use. Green manure crops are included under cover crops. Other examples of cover crops are catch crops of various kinds, which leave the soil exposed to erosion for a minimum period during the year and protect the soil when the regular cultivated crops are off the ground.

**4.1.11 Crop Rotation**— Crop rotation reduces runoff and soil loss, both of which are important in maintaining yields. Crop rotation refers to the growing of different crops in regular succession on the same land. For erosion control, a rotation should embody the principle of alternating cultivated crops with erosion-resistant and organic matter building crop. Methods of increasing the erosion control value of a rotation are:

- a) Increasing the number of years of hay and pasture,
- b) Improving the seed mixture to include legumes,
- c) Adequate fertilization, and
- d) Addition of cover crops to provide continuous covers on the field.

NOTE —The capability of the land limits the kind of rotation to be recommended on any field.

## **5 GENERAL TYPES OF CONSERVATION PRACTICES AND USES RECOMMENDED ON THE BASIS OF LAND CLASSIFICATION**

**5.1** The recommended type of conservation practice for several of land on the basis of cultivation is given briefly in annex C.

**ANNEX A**  
(Clause 3.3)

**SYMBOLS FOR SOIL AND LAND USE MAPPING UNDER DETAILED SOIL SURVEY**

**C-1 SOIL DEPTH**

Sl. No.	Description	Depth (cm)	Depth Class
1	Very shallow	0-10	d1
2	Shallow	10-25	d2
3	Moderately deep	25-50	d3
4	Deep	50-100	d4
5	Very deep	>100	d5

**C-2 SOIL TEXTURE**

Sl. No.	Textural Classes	Symbol
1	Sand	a
2	Very fine sand	b
3	Loamy sand	c
4	Sandy loam	d
5	Loam	e
6	Silt loam	f
7	Silt	g
8	Clay loam	h
9	Sandy clay loam	k
10	Silty clay loam	m
11	Sandy clay	n
12	Silty clay	p
13	Clay	r

**C-3 Slope**

Sl. No.	Slope Classes	Symbol	Slope (%)
1	Nearly level	A	0-1
2	Very gently sloping	B	1-3
3	Gently sloping	C	3-5
4	Moderately sloping	D	5-10
5	Strongly sloping	E	10-15
6	Moderately steep sloping	F	15-25
7	Steep Slopes	G	25-33
8	Very steep slopes	H	33-50

9	Extremely steep slopes	I	> 50
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**C-4 Erosion**

Sl. No.	Description	Symbol
1	Slight erosion	e1
2	Moderate erosion	e2
3	Severe erosion	e3
4	Very severe erosion	e4

**C-5 Stoniness**

Sl. No.	Description	Symbol	Percentage
1.	Slight	$S$	15-30% of average percent of stoniness coverage of area
2.	Moderate	$\bar{S}$	31-60% of average percent of stoniness coverage of area
3.	Severe	$\underline{S}$	above 60% of average percent of stoniness coverage of area

**C-6 Rockiness**

Sl. No.	Description	Symbol	Percentage
1.	Slight	$R$	15-30% of average percent of rockiness coverage of area
2.	Moderate	$\bar{R}$	31-60% of average percent of rockiness coverage of area
3.	Severe	$\underline{R}$	above 60% of average percent of rockiness coverage of area

**C-7 Soil Management**

Sl. No.	Description	Symbol
1.	Unmanaged	M0
2.	Poorly Managed	M1
3.	Moderately Managed	M2
4.	Well Managed	M3
5.	Very Well Managed	M4

**C-8 Land Use / Land Cover**

Sl. No.	Major Land Use	Description	Symbol
1.	Agriculture lands	Single crop cultivation (RF/Single Crop)	C1
2.	Agriculture lands	multiple crop cultivation (IR/Multi Crop)	C2

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3.	Agriculture lands	Occasional cultivation /Home estate Farming	Cx
4.	Waste Land	Culturable Wasteland	W1
5.	Waste Land	Unculturable Wasteland	W2
6.	Forest Land	Poor Forest (<10% canopy cover)	F1
7.	Forest Land	Medium forest (10-20% canopy cover)	F2
8.	Forest Land	Medium Forest (20-40% canopy cover)	F3
9.	Forest Land	Dense Forest (40-60% canopy cover)	F4
10.	Forest Land	Very Dense Forest (>60% canopy cover)	F5
11.		Pasture land	P1
12.		Bunded land	B
13.		Unbunded land	UB

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**ANNEX B**  
(Clause 3.4.1)

**CLASSIFICATION OF LAND ON THE BASIS OF CULTIVATION**

**A-1 LAND SUITABLE FOR CULTIVATION**

**A-1.0** Land is categorized under four different classes as given in **A-1.1** to **A-1.4**.

**A-1.1 Class I Land** — This is a very good land that may be cultivated safely with ordinary good farming methods. It is nearly level land (slope less than one percent) and has deep, productive easily worked soils, and is subject to only slight erosion. It is well-drained and is suited for intensive cropping. The land is suited for a wide variety of crops. For continued good production, this land requires the use of fertilizers, green manure crops, and crop rotation.

**A-1.2 Class II Land** — This is good land that may be cultivated with easily available practices. Some of the limitations of this class of land are gentle slope, moderate susceptibility to erosion, moderate depth, moderate overflow, and moderate wetness. Each of these limitations requires special methods for correction, such as contour bunding, strip cropping, contour tillage, crop rotations that include grasses or legumes, drainage, and the application of fertilizers and manures.

**A-1.3 Class III Land** — This class of land has restricted use for cultivation. The land is moderately good and may be used for cropping provided intensive management measures are taken. This kind of land is characterized by one or more of the following limitations:

- a) Moderate steep slope,
- b) High susceptibility to erosion,
- c) Moderate overflow,
- d) Slow sub-soil permeability,
- e) Excessive wetness,
- f) Shallow depth,
- g) Hard pan or clay pan,
- h) Sand or gravelly with low moisture capacity, and
- j) Low inherent fertility.

**A-1.4 Class IV Land** — This class of land has very restricted use for cultivation and needs special care in handling and management. The variety of crops that may be grown is limited.

Its cropping use is restricted by slope, erosion, unfavorable soil characteristics and adverse climate.

## **A-2 LAND UNSUITABLE FOR CULTIVATION**

The land is categorized under four different classes as given in **A-2.1** to **A-2.4**.

**A-2.1 Class V Land** — This land is not suited for cultivation, but is suited for pasture and grassland. Cultivation may not be feasible because of one or more factors, such as wetness, stoniness, or some other limitations. The land is nearly level and not subject to more than slight wind or water erosion. It occurs in many swampy areas that may not be drained easily.

**A-2.2 Class VI Land** — This land is subject to moderate limitations under grazing or forestry use or orchards and plantation crops under suitable geographical and climatic conditions. It is too steep, subject to erosion, shallow, wet, or dry but with careful management may be made suitable either for grazing or forestry. Gullies in such areas should be controlled by diversion of water, and provision of contour furrows or ridges.

**A-2.3 Class VII Land** — This land is very steep, eroded, stony, rough, shallow, dry, or swampy and is recommended particularly in humid regions only for forestry and woodland and not pasture, but the grazing has to be very limited.

**A-2.4 Class VIII Land** — This land includes such areas as marshes, deserts, deep gullies rocky escarpments, and very steep, rough, stony, barren land. It is suited only for wildlife, recreation, or watershed protection uses.

**ANNEX C**  
(Clause 5.1)**GENERAL TYPES OF CONSERVATION PRACTICES AND USES RECOMMENDED ON THE BASIS OF LAND CLASSIFICATION****A. LAND SUITABLE FOR CULTIVATION**

<b>LAND CLASSIFICATION CLASS</b>	<b>SUBCLASS (DOMINANT KIND OF LAND)</b>	<b>SUITABLE FOR (ONLY THE MOST INTENSIVE SAFE USE IS MENTIONED)</b>	<b>SPECIAL NEEDS OR PRECAUTION</b>	
I	Very good cultivable land	Deep nearly level productive valley land	Intensive cultivation to all climatically adapted crops	No special difficulty in farming usual good farming practices to maintain soil fertility and conserve water
II	Good cultivable land	Ile– Good soil on gentle slopes subject to water corrosion or wind erosion on sandy soils	Cultivation with precaution	Protection from erosion, use conservation irrigation methods
		IIw– Good soil, slightly wet or subject to overflow	Cultivation with management of excess water and selection of crops adapted to wet conditions	Drainage improvement or flood protection
		IIs– Soil with minor soil problems such as clay or sandy texture, moderate depth, or slight alkali	Cultivation with selection of crops adapted to soil limitations	Treatments to offset soil limitations and to conserve irrigation water

III	Moderately good cultivable land	IIIe-	Good soil on moderate slopes subject to water erosion, or sandy soil subject to wind erosion	Cultivation with precautions against permanent land damage	Special attention to erosion control and conservation irrigation
		IIIw-	Good soil, moderately wet or subject to overflow	Cultivation with careful management of excess water and selection of crops adapted to wet conditions	Intensive drainage, improvement or protection from flooding
		IIIs-	Good soil, moderately wet or subject to overflow	Cultivation with careful selection of crops adapted to soil limitations	Intensive treatment to offset or overcome soil limitations and conserve irrigation water
IV	Fairly good land suited for occasional or limited cultivation	IVe-	Moderately steep land subject to serious water erosion, or sandy soils subject to wind erosion	Occasional cultivation in rotation with hay or pasture, or orchards protected by permanent cover crops	Intensive erosion control when in cultivation
		IVw-	Bottom land that is very wet or subject to severe overflow	Cultivation to special summer corps, hazard of crop failure is always present	Intensive drainage, special attention to seeding and harvest dates, to minimized crops failure on overflows land
		IVw-	Fairly good land with limitations due to shallowness, gravel, stone, or strong alkali	Occasional cultivation in rotation with hay or pasture	Very intensive treatment to overcome soil limitations, careful selection of crops

IVc-	Good soil with just enough rainfall or crops in favorable years	Cultivation during wet years, frequent crop failure, better in permanent vegetation	Conserve all rainfall, develop water for irrigation or convert to pasture or grazing use
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**B. LAND UNSUITABLE FOR CULTIVATION**

<b>LAND CLASSIFICATION CLASS</b>	<b>SUBCLASS (DOMINANT KIND OF LAND)</b>	<b>SUTABLE FOR (ONLY THE MOST INTENSIVE SAFE USE IS MENTIONED)</b>	<b>SPECIAL NEEDS OR PRECAUTIONS</b>
V	Very well suited for grazing, not arable	Vw- Good productive mountain meadows that are wet and have short growing season	Grazing and production of wild hay Proper season of use and rate of stocking; protect from gullying
VI	Well suited for grazing or forestry, not arable	VIs- Steep land subject to erosion if cover is depleted	Grazing or forestry of both Manage grazing and logging to maintain sufficient residue and litter on the soil for soil and moisture conservation, fire protection
	VIw-	Flat land, occasionally with saline salts, permanently wet or subject to overflow	Grazing Manage grazing to prevent soil puling, and to favour desire forage plants
	VIs-	Flat to gently sloping, shallow, stony, gravelly, or alkali land	Grazing or forestry or both Good range and forestry management, fire protection

		Vlc-	Good or fairly good soil not enough moisture for cultivation	Grazing primarily, some forestry, could be cultivated if water were available	Good range and gores try management practices, fire protection
VII	Fairly well suited for grazing or forestry, not arable	VIIe-	Very steep land subject to erosion if cover is depleted	Grazing or forestry or both	Carefully manage grazing and logging to maintain enough plant litter for soil and moisture conservation, fire protection
		VIIw-	Flat, permanently wet or overflow land along stream, tidal marsh areas	Limited grazing	Range grazing to favor desirable plants
		VIIIs-	Very shallow, stony, or strong alkali land	Grazing or forestry or both	Good range and forestry management, fire protection
		VIIc-	Fairly good soil, not enough moisture for cultivation	Grazing or forestry or both	Good range and forestry management, fire protection
VIII	Suited only for wild life, recreation and protection of water supplies	VIIIe-	Highly erodible gullies, bad lands, and dunes	Watershed and wild life	Maintain maximum cover for erosion control
		VIIIw-	Tidal land, stream channels and swamps	Wild life, recreation, and water spreading	Improve for wild life and recreation
		VIIIIs-	Barren mountain tops, little or no soil mantle	Recreation and watershed	Improve for wild life and recreation

NOTE — These symbols denote sub-clauses:

e — erosion and runoff

w — excess water

- s — root-zone limitations
- c — climatic limitation