Indian Standards related to Irrigation
**Ground Water and Rain Water Harvesting**

**Groundwater** is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations. Although it is being depleted at an alarming rate, ground water is a reliable source for meeting the requirements for irrigation, drinking and industrial use.

**IS 15792 : 2008 Artificial recharge to ground water guidelines**
- These guidelines provide details of methods and techniques aimed at augmentation of ground water resources by modifying the natural movement of surface water.

**ARTIFICIAL RECHARGE TECHNIQUES**

**Direct Methods:**
- a) Surface Spreading Techniques (Runoff Conservation Structure, Flooding, Ditch and Furrows, Recharge Basins, Stream Modification/Augmentation),
- b) Sub-surface Technique (Injection wells, Gravity head recharge wells, Recharge pits and shafts), and
- c) Combination Techniques

**Indirect Methods:**
- a) Induced recharge from surface water sources, and
- b) Aquifer modification: i) Bore Blasting, and ii) Hydro-fracturing
Ground Water and Rain Water Harvesting

**Measurement of Ground Water**

- **IS 15896 : 2011 : 2005 Manual methods for measurement of ground water level in a well** - This standard lays down procedures and prescribes the accuracy required of water level measurements made in wells using graduated steel tapes, electric tapes, and air lines. The standard discusses the advantages and limitations of each method and requirements for recording the data.

- **IS 16094 : 2018 Hydrometry - Measuring the water level in a well using automated pressure transducer methods** - This standard provides guidance for the proper selection, installation and operation of submersible pressure transducers and data loggers for the collection of hydrologic data, primarily for the collection of water level data from wells.
Ground Water and Rain water harvesting

Rainwater harvesting The term 'Water Harvesting' connotes collection and storage of rain water and also other activities aimed at harvesting surface water, prevention of loss through evaporation and seepage. Natural recharge to ground water has reduced due to shrinkage of open area consequent to increased urban activities. Ground water levels have registered a marked decline. In view of the gap between demand and supply there is an utmost need for adopting roof top rainwater harvesting and augmenting ground water storage.

• IS 15797 : 2008 Roof top rainwater harvesting – Guidelines : This standard lays down guidelines for roof top rainwater harvesting. The standard provides a Tables for calculating the water availability for flat and sloping roof and specifies factors that determine the type and system of water harvesting, design of roof top, storage area, design of efficient artificial recharge structure and Maintenance of Catchment Area, Water Drains and Recharge Structures.

• IS 14961:2001 Guidelines for rainwater harvesting in hilly areas by roof water collection system – The standard lay down the general requirements for roof water collection system and its structure in hilly areas.
Canals

Canals are manmade waterways channels, for water conveyance. They help in irrigation, water control and flood prevention. The canal comprises of earth work, concrete, lining, head regulators and expansive joints.

IS 4701 : 1982 Code of practice for earthwork on canals First Revision - The construction of canals involves a variety of earthwork problems. This standard specifies the planning requirements prior to commencement of the work and describes methods for carrying out excavation and construction of embankments (General requirement and Methods of Construction) on canals, requirements for material, preparation of subgrade, Preparation of Ground Surface for Embankment, compaction methods, Tests for Compaction of Earthworks, and disposal of excavated materials.

This standard does not, however, cover design of cuttings and embankment slopes for canals.
Canals

Standards for lining of Canals: Lining of canals is considered an important feature of irrigation projects as it not only minimizes the loss of water due to seepage but also results in achieving considerable economy in the use of cultivable land which would otherwise be prone to water logging due to rise of the water table. Further, lining of canals permits the adoption of high velocities resulting in proportionate savings of the cross-sectional areas of the canal and land width required with corresponding saving in the cost of excavation and masonry works which in certain cases may offset completely the extra cost of lining. Also, the lining improves stability of channel sections thereby reducing the maintenance/cost. Some of the standards related to Canal Lining are given below:

• IS 11809 : 1994 Lining for canals by stone masonry - Code of practice: This standard covers masonry lining for canals. The standard provide the requirements and guidance for preparation of subgrade, laying and dimension of stone thickness.

• IS 10646 Canal linings – Cement concrete tiles – Specification : This standard lays down requirements of precast cement concrete tiles such as the dimension and flexural strength for canal lining.

• IS 9698 : 1995 Lining of canals with polyethylene film – code of practice : This standard lays down requirements and guidance of lining of canals with polyethylene film and...
Canals

• **IS 9097 : 1979 Guide for laying lining of canals with hot bitumen or bituminous felts** - Bitumen, a bye-product of petroleum industry and well known for its binding and water-proofing qualities is being increasingly used in lining work all over the world. Its main advantage over the conventional materials is that no water is required during construction and no curing is necessary. The structure can be put to use immediately after the construction is over. This standard provides guidelines for laying lining of canals with: (a) hot bitumen, and (b) bitumen felts.

• **IS 7113 : 2003 Soil – Cement lining for canals –Code of practice** : This standard lays down general guidelines for lining irrigation canals with 100 to 150 mm thick soil cement lining. The use of soil-cement lining for irrigation canals shall be restricted to small and medium size irrigation canals with capacities up to 10 cumecs and in which the velocity of water does not exceed 1 m/s. The standard specifies the requirements for data and materials, guidelines for preparation of subgrade, construction and compaction.
**Measurement of seepage loss from unlined canals**

The loss of water by seepage from unlined canals in India generally varies from 0.3 to 7.0 m$^3$/S/106 sqm depending on the permeability of soil through which the canal passes, location of water tables, distance of drainage, bed width, side slope and water depth inside the canal. Additional factors such as flow velocity, soil and water temperature, atmospheric pressure, and stratification of the underlying soil also affect the seepage rate. The seepage losses from unlined canals can be calculated by analytical methods or determined by direct measurement.


These standards provide information on the selection of test site, collection of data, equipment required, procedure, analysis of results, and advantages and limitations of the method.

- **IS 9447: 1980 Guidelines for assessment of seepage losses from canals by analytical method**: The standard lays down estimation for horizontal and vertical drainage with figures and graphs, the data requirement for assessment of the seepage losses. The standard also provides workout examples.
Canal Maintenance

IS 4839 : 1992 Maintenance of canals code of practice:

Part 1 unlined canals
Part 2 lined canals
Part 3 canal structures, drains, outlets, jungle, clearance, plantation and regulation

The standard provides steps to be followed, rules to be observed and actions to be taken to remove aquatic weeds silt disposal, for inspection and maintenance of lining including banks, roads and ramps.

The standard gives necessary guidance regarding the maintenance of a canal for the assistance of engineers in field. However, it is not possible to cover all types of contingencies in this standard and the discretion of the Engineer-in-charge would be required in such cases.
Groynes: A wall, crib, row of piles, stone jetty or other barrier projecting outward from the bank into a stream, for the purpose of protecting the bank from erosion or for arresting sand movement along the bank, concentrating the flow of a stream into a smaller channel, etc. It is also called 'Spur', 'Spur Dike', 'Transverse Dike', 'Wing Dam' or 'Jetties'.

- IS 8408: 1994 Planning and design of groynes in alluvial river – Guidelines: Groynes (spurs) are structures constructed transverse to the river flow and extend from the bank into the river. These are widely used for river training and bank protection. This standard covers the planning and design of groynes (spurs) in alluvial river
**Levees** is an elongated naturally occurring ridge or artificially constructed fill or wall that regulates water levels.

- **IS 12094 : 2018** Planning and design of river embankments (Levees) – Guidelines: An embankment (levee) is an artificial bank built along banks of a river for the purpose of protecting adjacent land from inundation by flood. Such type of structure is also called ‘embankment’, ‘stop-bank’, ‘bund’ or ‘dyke’. Construction of embankment to control flood is an age-old practice and is still being followed due to its proven suitability. This standard covers planning and design of river embankments (levees) on dry land.
River Training and Erosion Management

**Barrages and weirs:** Structure with gates erected across a river to regulate the upstream water surface and the flow across the structure.

- **IS 7349:2012 Barrages and weirs - Operation and maintenance – Guidelines** This standard lays down guidelines for the operation and maintenance of hydro-mechanical installations and civil structures connected with the barrages and weirs.

- **IS 7720:1991 Criteria for investigation, planning and layout for barrages and weirs** - In order to exercise better control on the river and flow conditions, both upstream and downstream and to limit the aflux without recourse to excessive water way, barrages are generally preferred. This standard lays down the criteria for investigation, planning and layout for barrages and weirs.
Guide Bank: To construct an engineering structure across rivers, it is necessary to narrow down its section and restrict its course of flow centrally through the structure built over it. This is achieved by construction of heavy embankments, called ‘Guide Banks’. Guide banks are thus meant to confine and guide the river flow through the structure without causing damage to it and its approaches. They also prevent the outflanking of the structure.

- **IS 10751:1994 Planning and design of guide banks for alluvial rivers – Guidelines**: This standard covers the planning and design of guide banks used for the various engineering structures constructed on the alluvial rivers.

- **IS 12926:1995 Construction and maintenance of guide banks in alluvial rivers – Guidelines**: This standard lays down the guidelines for construction and maintenance of guide banks in alluvial rivers. These are to be deemed as guide to good practice of construction and maintenance of guide banks compatible with the current experience and
Important Standards on Geotextiles

1. **IS 16352:2015 HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANES FOR LINING**

High density polyethylene geomembranes, are very low permeability synthetic liners used to control fluid or gas migration within soil, rock, earth or any other geotechnical material, as integral part of a manmade product, structure or system. Geomembranes have become the design choice as part of a cover system due to a variety of factors such as imperviousness, chemical resistance, inertness to surrounding soils, ease and variety of seaming, mechanical strength and elongation, ease of application and economics, product durability and ageing over the designed life of the containment system.

2. **IS 16653:2017 Geosynthetics — Needle punched nonwoven geobags for coastal and waterways protection — Specification**

Specifies requirements for three types of geobags (300/400/600 GSM) made from needle punched non-woven fabric of polyester (PES) or polypropylene (PP), used for coastal and waterways protection applications such as revetments; river training; construction of groynes and artificial reefs; etc, in order to minimize soil erosion and control floods.

This standard provides requirements of woven jute geotextile (JGT) in control of erosion in rivers and waterways.

Use of woven JGT in controlling river bank erosion is recommended as an eco-friendly substitute of the conventional granular filter comprising graded boulders and ballasts of stone, laterite or similar materials of the desired specific gravity. JGT on its degradation will nourish the bank soil and improve its hydraulic conductivity, fostering quick growth of vegetation under normal situation.
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• Click on the "Published Standards" button
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• This training portal enables Industries (including Industry Associations), Central/ State Government organizations, Consumers (including Consumer groups, NGO, RWAs), Research Institutes, Laboratories, Academia, BIS departments/employees, etc. to participate online in the various training programmes conducted by BIS. The participation can be made individually or on behalf of their organization. The interested participants can also propose their own sector specific/skill based training programmes.

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