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Indian Standard

GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

PART XV CANAL STRUCTURES

Section 4 Regulating Works

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PART XV CANAL STRUCTURES

Section 4 Regulating Works

0. FOREWORD

0.1 This Indian Standard (Part XV/Sec 4) was adopted by the Indian Standards Institution on 31 March 1977, after the draft finalized by the Terminology Relating to River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A number of Indian Standards have been published covering various aspects of river valley projects and a large number of similar standards are in the process of formulation. These standards include technical terms, the precise definitions of which are required to avoid ambiguity in their interpretation. To achieve this end, the Institution is bringing out this glossary of terms relating to river valley projects (IS : 4410) which is being published in parts. This part contains definitions of terms relating to canal structures.

0.3 Part XV covers the important field of canal structures and in view of the vastness of this subject it is being covered in different sections. This section (Sec 4) covers terms relating to regulating works. Other sections in the series are as follows:

Section 1 General Terms

Section 2 Transitions

Section 3 Flumes

Section 5 Cross drainage works

Section 6 Other structures

0.4 In the formulation of this standard, due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the

field in this country. This has been met by deriving assistance from the following publications:

UNITED NATIONS. Economic Commission for Asia and the Far East. Glossary of hydrologic terms used in Asia and the Far East. 1956.

INDIA. International Commission on Irrigation and Drainage. Multilingual technical dictionary on irrigation and drainage. 1967.

INDIA. Central Board of Irrigation and Power. Glossary of irrigation and hydro-electric terms and standard notations used in India. 1954. Manager of Publications. Delhi.

ASCE. Nomenclature for hydraulics. American Society of Civil Engineers, New York. 1962.

0.4.1 All the definitions taken from 'Multilingual technical dictionary on irrigation and drainage' are marked with (*) in the standard.

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1. SCOPE

1.1 This standard (Part XV/Sec 4) covers the definitions of terms relating to regulating works in canal structures.

2. CROSS REGULATOR AND OFFTAKE REGULATORS

2.1 Angle of Offtake, Angle of Obliquity or Angle of Twist* — The angle formed between the centre line of flow through the offtake structure and centre line of the direction of flow in the parent channel; the angle being always measured on the downstream side of the junction of the lines.

2.2 Automatic Constant Flow Offtake Regulator* — An ungated structure yielding constant flow on the module principle.

2.3 Baffle Wall or Breast Wall Offtake Regulator — A distributor built on a canal or a natural stream subject to very varying supplies such that the offtake regulator draws proportionate supplies for, and below, normal discharges in the parent channel, but in case of supplies in parent channel much in excess of the normal, the offtake regulator draws only slightly more than its designed discharge. This is attained by constructing a sill across the parent channel, downstream of the offtake, and a modular weir on the offtake side provided with a baffle or a breast wall.

2.4 Barrel Offtake Regulator — A regulator consisting of buried single or multiple barrel pipe or box sections with gate control at its upstream end and a suitable transition into tail water at the outlet, usually used in embankments.

2.5 Box Offtake Regulator — *See* 2.4.

2.6 Branch Head — Offtake regulator at the head of a branch canal or main lateral.

2.7 Cipolletti Weir Offtake Regulator — A regulator having a Cipolletti weir for its control (*see* **E-20** of IS : 1191-1971†).

2.8 Closed Conduit Offtake Regulator — *See* 2.4.

2.9 Combined Cross Regulator — Structure built across a channel at suitable points to control water levels to maintain water surface above outlets or offtake structure and regulate and escape supplies. This may be a separate structure, or combined with a drop or fall, bridges, etc.

2.10 Constant Downstream Level Offtake Regulator* — A structure designed to deliver automatically, a constant discharge when operated in conjunction with auxiliary equipment or devices to control the downstream water level, which is not affected by the changes in upstream level in the parent channel.

2.11 Constant Upstream Level Offtake Regulator — A structure designed to deliver automatically, a regulated discharge when operated in conjunction with auxiliary equipment, or a structure to control the upstream water level that is not affected, within limits, by changes in downstream level.

2.12 Cross Regulator, Check Structure or Check — *See* 2.9.

2.13 Diagonal Weir* — A weir installed in a parent channel to control upstream water level. It may be diagonal or of other shapes in plan (*see* Fig. 1).

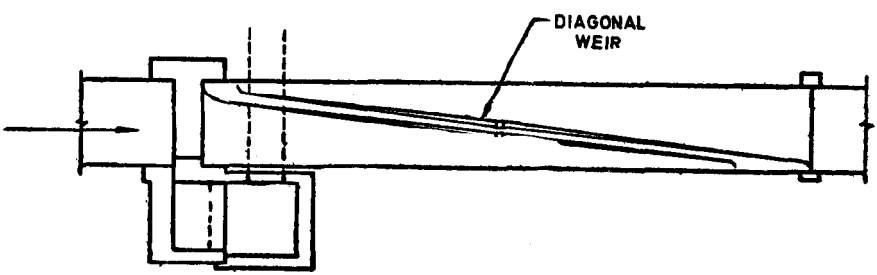

FIG. 1 DIAGONAL WEIR

†Glossary of terms and symbols used in connection with the measurement of liquid flow with a free surface (*first revision*).

2.14 Differential Head* — The difference in water level maintained between upstream and downstream water surface of an offtake structure by the adjustment of inlet and outlet openings through the manipulation of devices, such as gates. It is also the difference in water levels on either side of a pier or divide wall.

2.15 Differential Weir* — *See* **2.13.**

2.16 Disc-Valve Constant Level Offtake Regulator* — An offtake regulator provided with a float-operated disc-valve installed in a basin to regulate water level on the downstream in the basin in which quasi-constant module is built.

2.17 Distributary Head — Offtake regulator at the head of a distributary.

2.18 Feeder Head — Offtake regulator at the head, or an uncontrolled offtake, of a feeder canal or link canal.

2.19 Fixed Proportional Distributor — A proportional distributor which divides the flow in a constant proportion.

2.20 Gated-Offtake Regulator* — An offtake regulator provided with gates, stoplogs, drop bars, etc; or a combination of them.

2.21 Groyne — 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, 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', 'wind dam', jetty, etc. For details of different type of groynes [*see* IS : 4410 (Part III)-1967†].

2.22 Head of Offtake — A structure built at the head of an offtaking canal, branch or distributary channel to control and admit regulated supplies into it from the surface water source, parent canal, etc. Also called 'offtake regulator'.

2.23 Head Regulator — *See* **2.22.**

2.24 Hydraulic Constant Flow Autoregulator* — A module type offtake regulator in which the changes in upstream water level cause movement of the adjustable float that maintains the flow at a constant rate automatically.

2.25 Intake Structure — *See* **5.5** of IS : 4410 (Part X)-1969‡.

2.26 Metering Offtake Regulator* — A regulator designed to measure the discharge passing through it by a metering flume or some other calibration control being a feature of the regulator.

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†Glossary of terms relating to river valley projects: Part III River and river training.

‡Glossary of terms relating to river valley projects: Part X Civil works of hydro-electric generation system including water conductor system.

2.27 Minor Head — Offtake regulator at the head of a minor.

2.28 Modular Offtake Regulator with Two Baffles* — An automatic quasi-constant flow offtake regulator built to draw flood waters from very varying stream supplies for irrigation in a more or less constant discharge irrespective of the large variations in water levels in the parent channel. This is obtained by building two baffles in series, the upstream one working as a submerged orifice and the second one baffle modular weir.

2.29 Non-metering Offtake Regulator* — A regulator which has no provision in the design of the structure for metering the discharge passing through it.

2.30* Overpour Offtake Regulator, Overshot Offtake Regulator or Skimming Type Offtake Regulator — A regulator where the water passes from the parent channel to the offtaking channel by discharing over the crest of a wall, or over the top edge of a gate or flash-boards.

2.31 Parshall Flume Offtake Regulator — *See* **2.17** of IS : 4410 (Part XV/Sec 3)-1977†.

2.32 Preferential Distributor — A distributor built on a canal where two or more canals take off to divide the flow such that one offtake canal draws almost constant discharge irrespective of the variations of discharge in the parent channel, but other offtake canal or canals and the parent channel, divide the balance discharge in constant proportions (example of the offtake canal with constant discharge fitted with an orifice module and constant downstream level gate).

2.33 Proportional Distributor — A distributor which divides the flow either in a constant proportion or in variable proportions.

2.34 Regulated-Flow Offtake Regulator* — A structure through which flow is regulated, as a function of the upstream water level in the parent channel, or in both the parent channel and the offtake by manipulations of devices installed in both the parent channel and the offtake structure or in either of them. Such devices include gates, drop bars, needles, flash boards.

2.35 Right-Angled Offtake Regulator* — A regulating structure with an angle of offtake equal to 90°.

2.36 Silt-Selective Distributary Head* — A distributary offtake regulator designed for approach of the head without appreciable disturbance to ensure exclusion of coarse silt entry into the distributary.

†Glossary of terms relating to river valley projects: Part XV canal structures, Section 3 Flumes.

2.37 Skew Offtake Regulator* — A regulator with an angle of offtake greater or less than a right angle.

2.38 Sluice Offtake Regulator* — A regulator in which discharge is regulated by means of a vertical sliding gate provided on the upstream side.

2.39 Tail Regulator — A structure built on a canal to distribute its flow either between two or more offtakes at the end of a canal or between itself and one or more offtakes; the division of flow remaining unaffected by the water level on the downstream of structure in each channel. Tail regulators may also be built in escapes or waste channels.

2.40 Take-Off Distributor — Device placed in the offtake structure where volume of water to be diverted is only a small fraction of the water flowing in the parent channel, the volume drawn is generally constant in spite of the variations in flow and water levels in the parent channel. Except in small variations of water levels in the parent channel, the water level upstream of these take-off distributors is kept constant by automatic gates.

2.41 Undershot Type Offtake Regulator, or Orifice Type Offtake Regulator — A regulator where the water passes from the parent channel to the off-taking channel formed (when raising the gates) between the sill of the gate opening and the lower edge of the gate.

3. SEDIMENT EXCLUSION WORKS

3.1 Cantilever Skimming Platform or Cantilever Silt Platform* — A horizontal platform either supported on piers or cantilevered from the crest of the offtake regulator, and placed at a level in the parent channel in front of the offtake regulator with a view to excluding heavily loaded bottom water.

3.2 Diaphragm — A thin partition wall.

3.3 Double Chamber Sediment/Silt Excluder* — A sediment excluder having tunnels divided by a horizontal diaphragm into two chambers, the bottom chamber extending further into the river and removing the bottom sediment-laden water back to the river and the upper chamber works when the river is in flood and the excess discharge has to be escaped.

3.4 Dufour Sand Trap — A continuous type of sand trap in which the sediment bearing water is made to pass through hopper-shaped settling basin or basins having a central channel which leads to a sediment sluicing chamber. In the original design the central channel is covered along the entire bottom with inclined distributing sluice openings. The current practice is to remove the sediment from points of depositions (*see* Fig. 2).

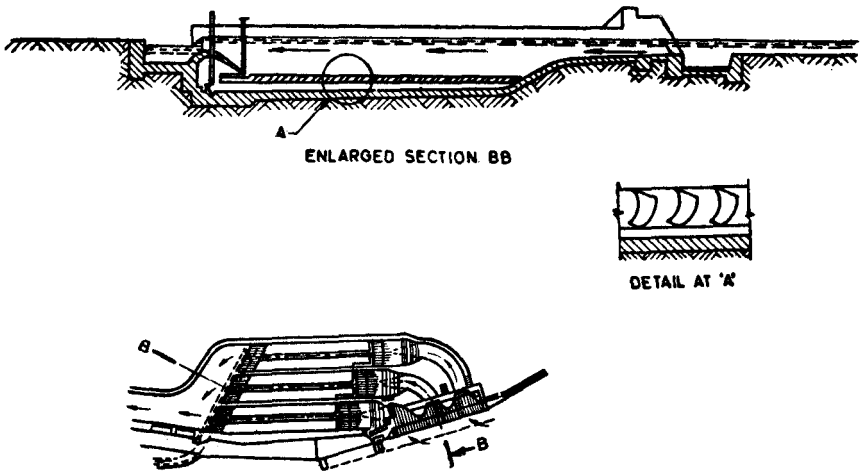

FIG. 2 DUFOUR SAND TRAP

3.5 Escapage or Escapage Discharge — The water escaped through escapes or spillways of otherwise discarded from a water conveyance system after having been diverted into it.

3.6 Exclusion Efficiency — Silt exclusion efficiency is defined below:

$$\eta = \frac{I_a - I_c}{I_a} \text{ or } \frac{(I_e - I_c)\, Q_e}{I_e Q_e + I_c Q_c}$$

where η is the silt exclusion efficiency and I stands for intensity of silt and Q for discharge and suffixes a, c and e stand for approach channel, canal and silt escaping device respectively.

NOTE — The first formula is an index of reduction of silt intensity and the second reduction of total quantity of silt.

The first formula is good for monitoring prototype performance, and simple to apply needing only two measurements of silt intensity U/s and D/s of silt ejector. The second formula is used for model testing, and comparing prototype behaviour to model predictions and needs discharge measurements in addition to silt intensity.

3.7 Flushing — Removal of deposited sediment by means of a rush of water flow at high velocity. Release of the water may be automatically or manually controlled.

3.8 Flushing Water* — The extra water let in at the intake for flushing out the sediment back into the river.

3.9 Horizontal Grill Type Sand Trap — A type of sand trap in which the water is let into a sediment basin immediately above the weir. The water then passes through horizontal grills fixed into the sediment basin and drops its coarse sediment into it which is sluiced away. Desedimented water passes over the weir. Is is good for mountainous rivers with small discharges and heavy bed load.

3.10 King's Vanes or Silt Vanes* — Vertical diaphragm walls of short height parallel to each other, built in the parent channel upstream of an offtaking head of a small channel (distributary or minor) with a view to diverting the bottom silt-laden water smoothly away from the offtake.

3.11 Multi-compartment Settling Basin* — A settling basin comprising several compartments and usually provided with a structure at its end, the sediment being removed hydraulically from the basin by means of a special spillway.

3.12 Outfall Channel — A channel receiving surplus sediment bearing water from the escape silt ejector, sand trap or settling basin and leading to the outfall.

3.13 Outfall Structure — It is a structure on the outfall channel provided with gates to control the flow rate of sediment bearing water and to prevent damage to canal.

3.14 Riffle-Deflector Sand Trap — A continuous type of sand trap consisting of riffles, vortex tube, a middle chamber and a rectangular duct. The riffles, arranged in a series of parabolic lines and extending from either one side or from both sides of the canal towards the middle, divert the bed load toward the middle where it is trapped by the vortex tube which in turn discharges it into the middle chamber from which it is drawn off through a rectangular duct and discharged to a waste channel.

3.15 Rotating Scrapers — A mechanical device with curved blades which rotate and scrape deposited silt into a settling basin whence it is removed to trenches and ultimately to outfall channel.

3.16 Sand and Gravel Trap — A device often a simple enlargement in cross-sectional area in a conduit for arresting the sand or silt carried by the water through deposition or sedimentation. The deposited sediment can be sluiced continuously or intermittently. Sand trap generally includes means for ejecting settled materials. When the sediment load includes gravel, it is called sand and gravel trap.

3.17 Sand Trap — *See* **3.16**.

3.18 Sediment Excluder or Silt Excluder* — A device constructed at the head regulator of a main or principal canal for excluding the harmful coarse silt from entering the canal.

3.19 Sediment Exclusion and Ejection Works* — Structure and devices provided at intakes of canals and at other suitable points in a canal system (a) to exclude the bottom coarse sediment-bearing layers of water (b) to pass part or whole of the canal flow through a nearby depression where a part of its sediment load is dropped, (c) to trap sediment and then to eject it or to eject the bottom sediment-bearing layers of water, (d) to control or regulate sediment distribution between the parent channel and the offtakes.

3.20 Sediment/Silt Ejector or Sediment/Silt Extractor — A structure built in the canal to remove undesirable water-borne sediment that cannot be excluded at intakes. It consists of curved tunnels covered on top and divided into smaller compartments at the entrance to extract bottom layers of the sediment laden water from the canal and discharge them into a waste channel.

NOTE — This structure differs from sand traps in the sense that it has no sediment collecting hopper. This device was developed and is widely adopted in India, sometimes after widening the canal to increase the sediment exclusion efficiency (*see* Fig. 3).

3.21 Settling Basin or Desilting Work — An enlargement at the intake structure itself to permit settlement of bed load of water-borne materials, suspended sand load, and as much as desirable of the suspended silt load; provided with means of ejecting the material so collected.

3.22 Silt Platform-cum-Guide Wing* — A silt platform with a curved wing added to it with a view to guiding the top water into the offtake.

3.23 Silting Tank* — An artificial tank formed by constructing embankments on the sides of a natural depression through which a part or whole of the canal supply is passed to rid itself of a part of its sediment load.

3.24 Silt Vanes-cum-Curved Wing* —A combination of silt vanes and curved wing to reduce sediment entry into an offtaking channel.

3.25 Silt Wall (Curved Wing) — A device to prevent excess bottom sediment entering an offtake channel and to ensure more or less proportional distribution of sediment between the parent and offtake channels consisting of a curved vertical wall projecting from the downstream abutment of the offtake in upstream direction to a distance enough to enclose sufficient discharge to fill the offtake when the parent channel is running at the lowest supply at which the offtake channels is to be fed with full supply discharge.

3.26 Skimming Panel — A wooden plank held floating at or near the water surface to permit flow of clearer and/or quieter water, sometimes used to divert floating debris from entering any structure.

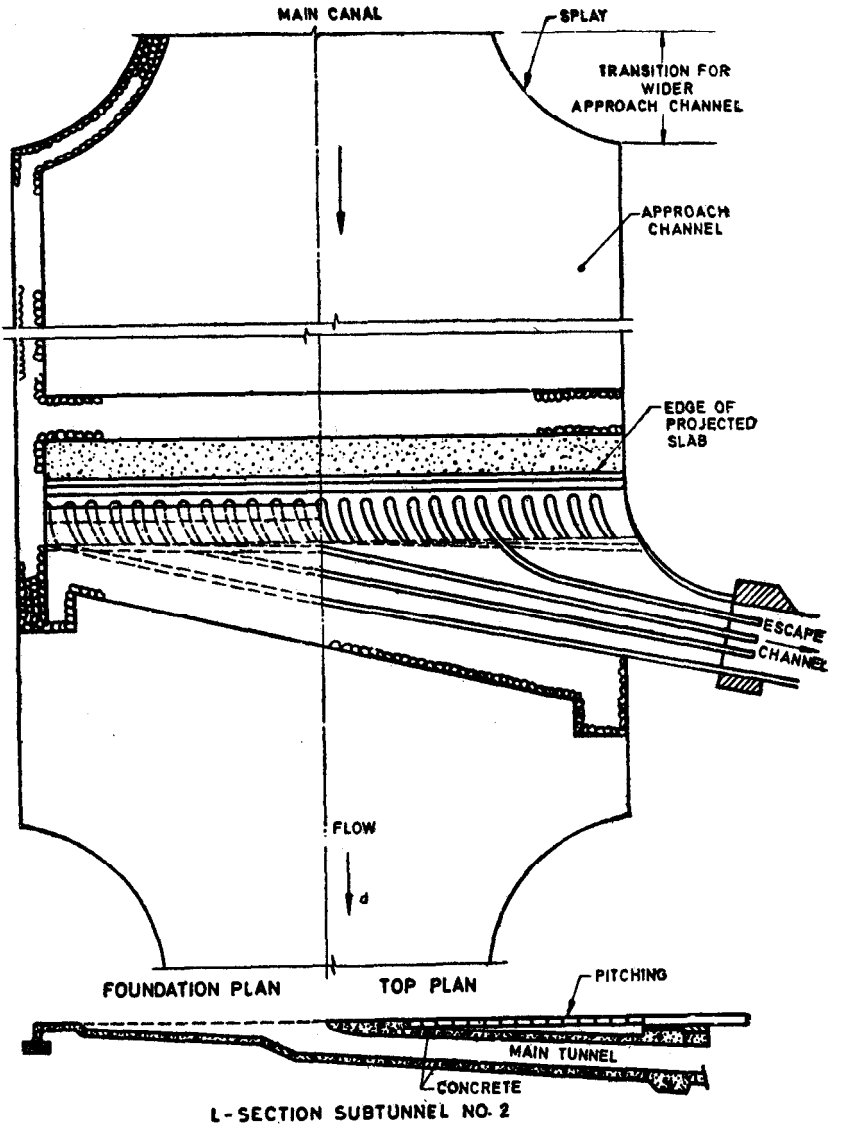

FIG. 3 PLAN AND SECTION OF SEDIMENT EJECTOR

3.27 Skimming Platform, or Silt Platform* — *See* **3.1.**

3.28 Skimming Weir* — A weir provided with gates or flash boards at the downstream end of the enlarged section of the canal.

3.29 Sluiceway — An artificial channel into which water is let by a sluice and which is used for the transportation of water, logs, debris, ice, etc.

3.30 Vortex Tube Sand Trap — A continuous type of sand trap in which a vortex tube is provided at an angle of 45° at the bed across the whole width of a canal. The vortex tube interrupts the flow at the bottom of the canal, and gravel and sand dropped and collected in it are washed out of the outlet by the strong flow in the tube.

4. FALLS OR DROPS

4.1 Baffle or Baffle Wall — A cross wall, set of vanes or blocks or guides, a grid, grating or similar device placed in a conduit or a channel to check eddy currents below them, and to effect a more uniform distribution of velocities and to dissipate energy.

4.2 Baffle Platform* — The platform between the toe of the glacis and the baffle wall provided at a level at which the jump would normally form.

4.3 Baffled Outlet Pipe Drop — Pipe drop having a baffle wall at its outlet.

4.4 Base of the Notch or Sill of the Notch* — The bottom horizontal surface of the notch.

4.5 Bed Drop or Bed Fall* — The vertical difference between the upstream and downstream bed levels of a channel at a hydraulic structure.

4.6 Broad-Crested Fall or Broad-Crested Drop — A free fall in which the nappe is supported for an appreciable length (much larger than the height of the nappe over the crest) at the throat in the direction of flow. Also called ' broad-crested weir '. The essential difference between a broad-crested weir and broad-crested fall is that the former can be built as a spillway, or a measuring device and is not necessarily built for lowering the water level, whereas the latter is essentially constructed along the channel length and has its main function of the lowering of water level.

4.7 Cascade Fall — A series of fall or drop structures built in a canal if the slope of the ground is sufficiently long and involves a big drop. The falls are separated by short basins in which energy of the jet of the preceding fall is dissipated.

4.8 Chute — An inclined conduit or open channel for conveying water for high drops.

4.9 Closed Conduit Drop, or Closed Conduit Fall — A fall structure in which the lowering of the level of water is conveyed through a pipe or pipes. It generally consists of an inlet transition, a pipe or barrel and an outlet transition or baffled outlet. Also known as 'pipe drop' or 'barrel drop'.

4.10 Contracted Fall or Contracted Drop — A fall or drop structure in which the throat width is smaller than the normal channel width.

4.11 Convergence Entrance, Inlet Structure, or Inlet Transition — *See* **2.17** of IS : 4410 (Part XV/Sec 2)-1973†.

4.12 Cylinder Fall, Well Fall, Cylinder Drop or Well Drop — A fall or drop structure in which water falls into a well from where it emerges from the sides of the well near the bottom, dissipating its energy inside the well.

4.13 Drop or Fall (Structure)— A structure designed to secure lowering of the water surface in a channel in a short distance and safe destruction of the liberated surplus energy. It may be vertical or inclined; in the latter case, it is usually called a chute.

4.14 Drop Wall — Retaining wall built across a channel at a drop. It rises from the lower bed to the upper bed and may continue to form raised crest over it.

4.15 Drowned Fall, Drowned Drop, Submerged Fall or Submerged Drop — A drop or fall structure in which the downstream or tail-water level in the channel is higher than the crest or sill level of the drop or fall, and flow and the upstream level are affected by the tailwater level.

4.16 Fall or Drop — *See* **4.13.**

4.17 Flumed Fall or Flumed Drop — A contracted fall or drop which functions as a flume meter and is required to measure the discharge.

4.18 Free Fall, Complete Fall, Free Drop or Complete Drop* — A fall or drop structure with free fall conditions, where the downstream water level or tailwater level is lower than the crest and does not affect the flow.

4.19 Glacis — A straight or curved floor sloping below and in continuation of the raised crest or sill of a weir or a fall structure.

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†Glossary of terms relating to river valley projects: Part XV Canal structures, Section 2 Transitions.

4.20 Inclined Drop (Structure), Inclined Fall (Structure) Glacis Type Drop (Structure) — A fall structure in which a hydraulic jump is designed to form on the down-stream glacis for dissipating energy of the high velocity stream in the course of the change in elevation of the water surface.

4.21 Inglis Type Fall or Poona Type Fall* — A flumed meter type fall structure with dimensions standardized at the Central Water and Power Research Station, Poona (India). In this fall, use is made of horizontal impact for energy dissipation. The jump is held stable by means of a baffle.

4.22 Meter Fall or Meter Drop — A fall or drop structure designed and used for metering discharges.

4.23 Montague Type Fall or Montague Fall — A flumed and broad crested fall having half gravity parabolic profile, designed to impart maximum horizontal acceleration to the overflowing water. Named after the designer of the glacis profile.

4.24 Non-regulating Fall or Non-regulating Drop — A fall or drop structure not combining the functioning of a check or regulating structure.

4.25 Notch Fall or Notch Drop* — A fall or drop structure, the crest or sill of which is at, or nearly at, the bed level of the channel upstream. In irrigation practice, notches are designed, primarily to maintain depth-discharge relation in the canal, with greater or lesser degree of accuracy. This may be rectangular or trapezoidal and the falls are respectively known as ' rectangular notch falls ' and ' trapezoidal notch falls ' the latter having greater accuracy in maintaining the depth-discharge relation in the canal.

4.26 Notch Piers* — Piers separating the various notches in a notch drop.

4.27 Outlet Transition — A length of conduit or channel wherein the cross-sectional shape is gradually changed from that of the conduit or channel upstream to that of the conduit or channel downstream. The transitions are characterized by adjectives bearing on their length (for example, short, long, sudden or gradual); geometrical shape of the side walls (for example, conical frustum); or by the physical appearance of side walls (for example, flared, splayed, straight, warped, or streamlined); or by reference to the adjacent structures (for example, tunnel subcritical, one-dimensional, valve, gate, inlet, outlet, or tail); or by reference to type of flow in the transition length (for example, subcritical, supercritical, one-dimensional or two-dimensional). This is sometimes referred to as ' conversion '.

4.28 Pipe Drop or Barrel Drop — *See* **4.9.**

4.29 Regulating Fall, Regulating Drop, Check and Drop Structure or Check Drop* — A fall or drop structure designed to serve, or serving also, as a check structure.

4.30 Sarda Type Fall — An unflumed vertical drop structure, simple in design suitable for drop not more than 2 metres, evolved on the Sarda Canal System (India) having raised rectangular or trapezoidal crest and short stilling basins.

4.31 Spreader Stone or Lip — A horizontal projection, usually segmental in plan, sometimes provided at the downstream end of each notch flush with the base, sill or crest of the notch from the downstream end.

4.32 Stepped Fall or Stepped Drop — A fall structure with a number of steps just below the crest instead of a straight glacis.

4.33 Straight Glacis Fall or Straight Glacis Drop — A fall structure or drop structure with straight downstream glacis.

4.34 Syphon Well-Drop or Culvert Drop* — A drop structure on small channels when a road crossing is combined with a fall. It consists of two wells connected by a barrel or pipe.

4.35 Trajectory — The curve of the downstream incline of a chute between the flat and the steep portions. Also the paths followed by nappe or jet of water flowing over a weir or through an orifice.

4.36 Unflumed Fall or Unflumed Drop — A fall or drop structure in which the throat width is not less than the normal channel width.

4.37 Vertical Drop, Vertical Fall, Vertical Drop Structure or Vertical Fall Structure — A drop in which the nappe impinges clear into the water cushion (stilling pool) below. There is no glacis or hydraulic jump.

5. ESCAPES, WASTE-WAYS AND CANAL SPILLWAYS

5.1 Breaching Section — A term sometimes used to designate as automatic spillway especially when a low earthen bund or dike is built across a low saddle in the rim of the reservoir intended to be washed out when water reaches an elevation in the spillway which may become dangerous. It is also applied to a similar condition in a canal at the head of escapes.

5.2 Canal By-Pass — A by-pass structure, usually designed to operate automatically, to discharge surplus water as protection for a power plant or similar installation. Functionally, a by-pass differs from a spillway in that, while the former may possibly discharge the entire flow, the latter cannot be used to empty a canal.

5.3 Deprimer — A device which breaks the priming in a siphon by admitting air through its inlet end located at full water level or a little below.

5.4 Escape — A structure through which surplus water may be removed from a canal, reservoir or stream.

5.5 Excess Water or Surcharge Water — Water in excess of the normal supplies flowing past any section of an irrigation canal.

5.6 Gated Spillway — Overflow spillway utilizing gates when automatic, will automatically open or close with the predetermined rise or fall of water surface in the canal.

5.7 Outfall— The mouth of a drain, artificial waste or escape channel, etc, or the lower end of a watercourse.

5.8 Outfall Channel, Escape Channel, Discharge Channel — *See* **3.12.**

5.9 Outlet Seal or Priming Head — The difference of levels between highest level of the invert downstream and water surface level upstream at which priming starts (*see* Fig. 4).

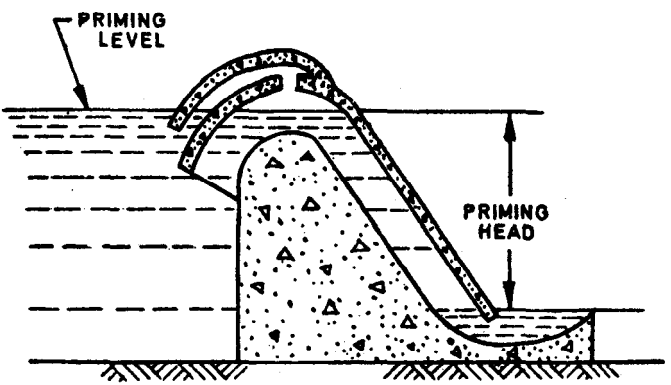

FIG. 4 PRIMING HEAD

5.10 Overflow Wall — The spilling part of a canal overflow escape consisting of a masonry or concrete wall to fit the bank slopes.

5.11 Siphon or Syphon — A closed conduit (duct) a part of which rises above the hydraulic grade line. It utilizes atmospheric pressure to effect or control the flow of water through it.

5.12 Siphon Spillway — A spillway operating on siphonic principle.

5.13 Spillway — A waterway in or about a dam or other hydraulic structure for the escape of excess water.

5.14 Surplus Water — The surplus water in a water conveyance system in excess of the requirements and includes the following:

a) Water that may become surplus with sudden reduction in demand (due to rainfall for irrigation areas or load fluctuations for hydropower systems) after water has been admitted at the point of diversion into the system;

b) Water let into the canal at the head regulator for escapages of extractors or ejectors or due to errors in regulation;

c) Surface runoff or drainage water from higher lands collecting into the canal system above the point of escapes, wasteways and spillways; and

d) Water that unavoidably has to be wasted due to closures, mishaps, breaches, etc.

5.15 Tail Escape — An escape built at the tail of a canal to discharge surplus water.

5.16 Tail Regulator or Outfall Regulator —*See* **2.39.**

5.17 Water Seal — Device for effectively shutting off air from getting into the hood in case of saddle siphon and into the barrel in case of volute siphon. For types of water seals [*see* IS : 4410 (Part IX)-1968†].

6. NAVIGATION LOCKS

6.1 Basin Lock* — Lock built where a navigation canal passes through a basin.

6.2 Bollard, Check, Post or Mooring Post* — A steel or concrete post installed near or on the side walls to secure ropes for mooring purposes and also for retaining vessel entering the lock.

6.3 Capstan* — Revolving barrel worked manually or by power for winding in cable or mooring chain or other purposes.

6.4 Cross Culvert Branch or Culvert* — Culvert running parallel to the sides of a lock. They may connect the economizing basin by another culvert and the locking chamber by a cross or branch culvert, or they may convey water from the upper pool to the lock chamber or from the lock chamber to the lower pool.

6.5 Crosswall or Transverse Wall* — The wall that forms the drop from the upper sill to the chamber floor.

†Glossary of terms relating to river valley projects: Part IX Siphons and spillways.

6.6 Discharge Culverts* —Culverts with opening in the lock chamber upstream of tail gates and downstream of the same, to enable the emptying of the lock chamber during lockage operations.

6.7 Dolphin

a) A bollard or mooring spur or buoy furnished with a ring to which vessels may fasten their cables.

b) Cluster of piles driven in water for mooring purposes or for protection against floating objects.

c) A group of piles driven close together in water and tied together so that the group is capable of withstanding lateral forces from vessels and other floating objects.

6.8 Draught or Draft

a) The depth of water that a vessel will require to float freely in a navigation channel. In naval architecture the draft is the vertical distance from the top of the keel plate or bar keel to the load water line.

b) The area of an opening or group of openings for the discharge of water, as the draft of a turbine wheel.

6.9 Electric Capstan* — An electrically-operated trolley running on overhead tracks used in locks for winding cables for towing ships in and out of the lock, for opening gates, etc.

6.10 Fender* — A protective cover or device fitted in the lock walls or attached to the vessels themselves to prevent damage to the lock walls and the craft as a result of collision against the wall or weir.

6.11 Fender Pile or Fender Post* — A pile or series of piles to guide the vessels, as provided in front of offtake regulators in an irrigation-cum-navigation canal, for protection against collision.

6.12 Filling Culverts* — Culverts with opening on upstream side of the head gate and in the lock chamber to enable filling of the chamber during lockage operations.

6.13 Floating Fender* — A floating device held in position by means of a chain, etc, fixed in the walls or banks as a guard against collision.

6.14 Floor Ports* — Openings in the chamber floor either directly connected to the bay through vertical inlets or through wall culverts.

6.15 Gate Bay* — The water space in the lock head, depending on its position, it may be upper gate bay or lower gate bay.

6.16 Lay Bay, Tie-Up Basin or Shunt* — The widened cross section of the lock channel in a single-lane channel to permit two-way traffic.

6.17 Leading Jetty or Guard Wall* — A structure, for example a pier or mole, provided at the outer and inner ends of a lock for smoother and gentle lead into or out of the lock, to protect entry and exit of vessels, or to provide for tying up berths or mooring space against adverse currents and tides.

6.18 Lift* — The vertical distance through which a vessel is raised or lowered in the process of passing through a lock.

6.19 Lock Chamber or Lock Bay

a) The central portion of the lock bounded by lock walls (chamber walls) on the sides and lock gates on the upstream and downstream sides. The craft or vessel is raised and lowered in this chamber to negotiate the difference in the pool levels.

b) The water space enclosed in a lock chamber.

c) A section of the main waterway of a lock, equipped with gates at each end, into which a vessel passing through the lock is moved, and either raised to a higher level by closing the tail gate, filling the chamber with water, and raising the water surface thereof, or lowered by removing the water from the lock.

d) The space between the head gate and tail gates of a lock.

6.20 Lock Channel* — A diversion channel, or a portion of the parent channel, housing the lock. In the latter case, the lock may be housed on the parent channel with or without diverting the parent channel away from it.

6.21 Lock Flight or Flight of Locks* — A series of locks with common gates leading a vessel from one to another breaking up the lift in a manner resembling a flight of stairs (*see* Fig. 5).

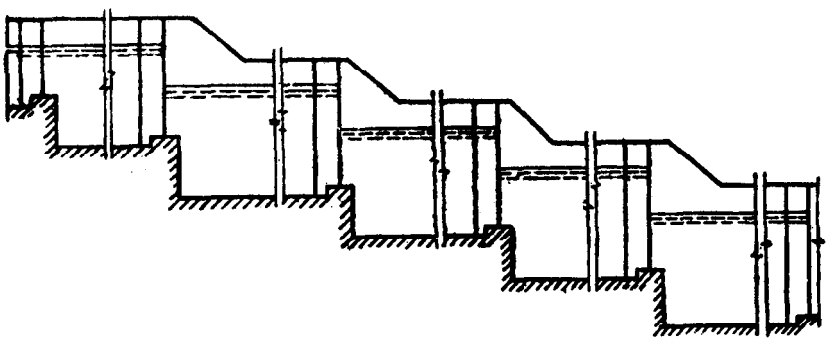

FIG. 5 FLIGHT OF LOCKS

6.22 Lock Floor or Chamber Floor* — The bottom floor of the lock chamber.

6.23 Lock Head or Lock End* — The structural portion of the lock upstream and downstream of the lock chamber. The upstream portion is called 'upper lock head or upper lock end', and the downstream portion 'lower lock head or lower lock end'.

6.24 Lock Lift or Lock Rise

a) The difference between the upper and lower pool elevations of a lock at a time.

b) A canal lock serving to lift a vessel from one reach of water to another.

6.25 Lock Paddle* — A sluice through which water is passed to fill or empty the lock chamber.

6.26 Lock Pool or Layby Basin* — The pools of water, at the upstream and downstream ends of the locks chamber, created to have easy approach and exit conditions, namely 'upper pool' and 'lower pool'.

6.27 Lock Walls or Chamber Walls* — The side walls of the lock chamber.

6.28 Lockage*

a) Act or process of passing a vessel through a lock.

b) Materials for locks, as in a canal, or the works forming a lock or locks.

c) Toll paid for passing through a lock or locks, as of a canal.

d) Amount of elevation and descent made by the locks of a canal.

6.29 Lockage Water — Water lost or transferred from a higher to a lower level, in the operation of passing a vessel through a lock.

6.30 Locking Cycle* — A full cycle of all locking operations, such as manipulation of gates, equalization of water levels including movement of navigation craft from one side of the lock to the other side.

6.31 Locking Operations* — Operations, both hydraulic and mechanical, performed at a lock to pass a vessel through it.

6.32 Locking Time* — The time required to complete locking cycle.

6.33 Longitudinal Culvert or Wall Culvert* — *See* **6.4.**

6.34 Lower Gate Bay or Tail Bay* — *See* **6.15.**

6.35 Lower Lock Head of Lock End* — *See* **6.23.**

6.36 Lower Pool* — *See* 6.26.

6.37 Mitre Sill or Pointing Sill* — A raised sill against which lock gates shut; the edges of the mitre sill are parallel to lock gates in the closed position.

6.38 Mooring*

a) Permanent anchors or other facilities for tying up ships or crafts.

b) Place where a vessel is moored.

6.39 Mooring Ring* — A steel ring hanging in the side wall of a navigation lock for securing ropes to a mooring or for towing purposes.

6.40 Mooring Space* — Space provided in navigable waterways for mooring purposes.

6.41 Navigation Lock or Lock — A communication channel, having gates at both ends, between the higher and lower reaches of a canal waterway. It is used to transfer the water borne traffic from one level to another (*see* Fig. 6).

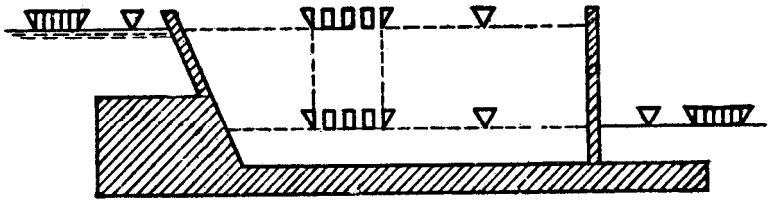

FIG. 6 NAVIGATION LOCK

6.42 Play or Clearance* — The margin between the side walls of a lock at its narrowest section and the outermost part of a vessel when in the central position.

6.43 Shaft Lock — A lock in which tail gate/tail gates does/do not extend up to the level of the upper pool, but is/are partially replaced by a panel wall (breast wall) below which sufficient clearance is available for the vessel to pass. Usually, a sluice or tumble gate operates in the clearance.

6.44 Ship Lift* — An elevator operated hydraulically or mechanically in navigable channel built in due to the scarcity of lockage water.

6.45 Single Lock — A navigation lock with one lock chamber.

6.46 Step Ladder* — A ladder, usually recessed, provided in the chamber walls.

6.47 Thrift Basin Chamber, Economizing Chamber or Water Saving Chamber* — A device to save lockage water by means of providing closed storage capacity at the side/sides of a lock. This also reduces fluctuations of stage in the pools. The lock having such a provision is called ' thrift lock '.

6.48 Thrift Lock* — *See* **6.47.**

6.49 Tidal Lock with Struts* — A tidal lock having a single gate system at each end, but provided with struts, which come into operation only when the lock is to be used in the reverse direction. Such an arrangement is made in those tidal locks which face infrequent fluctuations and handle light traffic.

6.50 Turning Basin* — A widened cross section of the basin adjoining the lock, to permit turning of crafts.

6.51 Twin Lock, Two-Chamber Lock or Double Lock* — A system of two locks built parallel to each other in a two-lane lock channel and frequently having a common central wall. Where there is a longitudinal setback between the two locks for some reason (for example, land movement), the system is known as ' staggered locks '.

6.52 Upper Gate Bay or Head Bay — *See* **6.15.**

6.53 Upper Lock Head or Upper Lock End — *See* **6.23.**

6.54 Upper Pool — *See* **6.26.**

6.55 Wall Ports* — Openings in the side walls for water conveyance in or out of the chamber through the wall culverts.

6.56 Working Length or Usable Length* — The length of the lock chamber from the centre of the downstream end of the cross wall to the beginning of the downstream gate chamber.

6.57 Working Width of the Lock or Controlling Width of the Lock* — The narrowest width of a lock at any point in its length.

7. OUTLETS

7.1 Adjustable Proportional Module — A semi-module orifice outlet with an adjustable roof block designed to distribute small variations in the supply in the parent channel, proportionately when set at the correct level relative to the depth of water in the parent channel.

7.2 Bed Plate* — Steel plate fixed at the bed of a controlling section in an outlet so that the bottom of the section may not be tampered with.

7.3 Branch — A channel taking its supply from the main canal or another branch.

7.4 Check Plates* — Steel plates fixed to the sides of a controlling section in an outlet so that the sides of the section may not be tampered with.

7.5 Cipolletti Weir Type Outlet — A contracted sharp-crested measuring weir, in which each side of the notch has a slope of 1 horizontal to 4 vertical, to compensate for end contractions; named after Cesare Cipolletti, an Italian Engineer.

7.6 Constant-Head Orifice Outlet — A flow regulating and measuring structure independent of the water level in the out fall channel. It uses the principle that a submerged orifice of a given size operating under a specific differential head will always pass a known quantity of water. It consists essentially of a stilling pool and two gates, the upstream adjustable orifice gate and the down-stream regulating gate. The rate of flow is determined by the size of the *u/s* orifice and the specific differential head (usually 60 mm) between the parent channel and stilling pool between the two gates. This differential head is maintained by adjusting the *d/s* regulating gate.

7.7 Contracted Orifice* — An orifice having its downstream end so far removed from the bounding surface of the water prism in the channel or approaches or other surfaces of a disturbing nature, that the filaments of water are fully contracted or deflected before they emerge from the orifice.

7.8 Controlled Pipe Outlet* — A pipe outlet with the upstream socket fitted with an angular ring or plug. The diameter of the hole in the plug is suitable for the discharge required. Adjustment is effected by changing the plug.

7.9 Crest of the Outlet — Highest point (level) on the bed of the outlet at the entry/upstream end.

7.10 Depression, Depression Head or Depression Centre — In a semi-module the depth below supply level of some point of a semi-module fixed by its hydraulics such that as supply level varies, a constant coefficient multiplied by the correct power of that depth gives the discharge.

7.11 Depression Ratio — The ratio between the depression and the height of the opening of an orifice outlet.

7.12 Direct Outlet — An outlet built in a main canal or a branch canal.

7.13 Distributary — A channel taking its supply from a main canal or branch for distributing water to minors and outlets.

7.14 Drowning Ratio — Ratio of tail-water elevation to headwater elevation, when both are higher than the crest of the structure, the elevations being measured with the crest as reference datum; distance upstream and downstream from the crest at which head-water and tail-water elevations are to be measured should be such that levels are not influenced by the structure.

7.15 Field Channel — A channel taking water from outlets to the fields.

7.16 Flexibility* — The ratio which the rate of discharge from the outlet (dq/q) bears to the rate of change of discharge $\frac{dQ}{Q}$ in the supply or distributing channel, that is:

$$F = \frac{dq/q}{dQ/Q}$$

7.17 Free Fall Orifice, Free-Into-Air Orifice, Free Discharge Orifice or Free Orifice — An orifice with jet discharging freely into the air.

7.18 Gibb's Module* — A type of rigid module, without any moving parts, developed by Gibb. The water from the supply channels is let through an inlet pipe which delivers it to a rising pipe which turns through 180° and in which a free vortex flow develops. Water from this rising pipe enters an eddy chamber with a number of cross baffles with bottom edges sloped which serve to skim off part of the flow and turn it back on the approaching flow. This action becomes more pronounced as the upstream head and the velocity in the chamber tend to increase; a retardation is introduced and the velocity is lowered, thus holding the discharge constant. The design is such that the flow passes through critical depth at the downstream end and is unaffected by the downstream water level.

7.19 Glacis — *See* **4.19**.

7.20 Head (of) Over Outlet or Working Head — It is the difference in water level in the supply channel and the water course.

7.21 Head Wall* — A wall of masonry or concrete built at the upstream end of an outlet, parallel to the flow in the supply channel, containing the opening of the orifice or trough.

7.22 Lift Outlet — An outlet serving areas that cannot be commanded by gravity. The water is fed into the lower end of the water lifting device by the outlet.

7.23 Minimum Modular Head or Minimum Modular Loss — The minimum loss of head or difference between the supply and delivery levels which is absolutely necessary, to be maintained to enable the module to pass its designed discharge.

7.24 Minimum Modular Head Ratio* — The ratio between the minimum modular head and the depth of upstream water level on the crest of an outlet (h_m/H_s).

7.25 Minor — A channel taking its supply from a distributory for supplying water to outlets/water course.

7.26 Modular Limits* — The extreme values of any factors at which a module or semi-module ceases to be capable of acting as such.

7.27 Modular Outlet — Modular outlets are the outlets whose discharge is independent of the water levels in the distributing channel and the water course, within reasonable working limits. These type of outlets are either with moving parts or without moving parts. In the later case these are called as ' rigid modular outlets '.

7.28 Modular Range* — The range of conditions between the minimum modular limits, within which a module or semi-module works as designed.

7.29 Module, Rigid Module or Perfect Module — A device for ensuring a constant discharge of water passing from one channel into another, irrespective of the water level in each, within certain specified limits.

7.30 Non-modular Outlet — Non-modular outlets are the outlets whose discharge is a function of the difference in water levels in the distributing channel and the water course and variation in either affects the discharge. Normally outlets are non-modular.

7.31 Open Flume Outlet* — A semi-module in the form of a weir with a throat contracted sufficiently to ensure a velocity above the critical long enough to ensure that the controlling section remains within the parallel throat at all discharges up to the maximum. It may or may not have a roof block fitted in the controlling section.

7.32 Orifice — An opening with closed perimeter, and of regular form in a plate, wall, or partition through which water may flow, generally used for the purpose of measurement or control of such water.

7.33 Orifice Type Module* — An orifice which works as a module.

7.34 Outlet — A structure at the head of a water course or field channel, which connects the latter with a distributing channel.

7.35 Partially Submerged Orifice — An orifice with a partially free jet.

7.36 Pipe Outlet or Barrel Outlet* — An outlet with face and tail walls and a pipe or masonry barrel (circular, rectangular or square) conveying the water from the supply to the watercourse. When it discharges freely into the air, it works as a semi-module as its discharge is then independent of the water level in the water-course.

7.37 Proportional Module* — A semi-module which draws the same percentage of increase or decrease in discharge as a fluctuation of supply in the parent channel bears to its full supply discharge.

In other words, its flexibility is equal to unity of:

$$F = \frac{dq/q}{dQ/Q} = 1$$

7.38 Roof Block* — A block of iron, masonry, concrete or wood fitted to open flume and APM outlets in a part of the throat. In open flumes the bottom of the roof block is slightly above the designed water surface level of the crest and any rise of water level in the parent channel brings the roof block into action and the outlet begins to work as an orifice.

7.39 Semi-modular Outlet — Semi-modular outlets are the outlets whose discharge although depending on the water level in the distributing channel is independent of the water level in the water course so long as minimum working head required for their working is available.

7.40 Semi-module — A device that automatically delivers a discharge which is independent of fluctuations of water level or pressure on the delivery side, and only varies with water level or pressure, on the supply side.

7.41 Sensitivity — The ratio of the rate of the change of discharge of an outlet to the rate of change in level of the distributary water surface, referred to the normal depth of the channel.

7.42 Setting — The term applied to the adjustment of the discharge of an outlet by altering the working head.

7.43 Sharp-edge Orifice* — An orifice with sharp upstream edge.

7.44 Silt Exclusion Efficiency — *See* **3.6**.

7.45 Sluice

a) A conduit, fitted with a gate, for carrying water at high velocity.

b) An opening in a structure through which anything flows, for example water, ice or debris.

c) To cause water to flow at high velocities, for wastage, for purposes of excavation, ejecting debris, transporting waste, etc.

7.46 Spout — Control section at the downstream and of Gibb module where the flow passes through critical depth.

7.47 Submerged Orifice — An orifice discharging completely under water.

7.48 Suppressed Orifice* — An orifice having a perimeter which coincides with the sides of channel of approach or with other surfaces, which would eliminate contraction, wholly or partly.

7.49 Tail Cluster* — Two or more outlets at the tail of a distributing channel.

7.50 Tail Wall* — A wall of masonry or concrete built at the downstream and of an outlet, containing the exit opening of the orifice or trough discharging into the delivery channel. It protects the fill from scour and undermining and serves as a retaining wall.

7.51 Tank Outlet — An outlet supplying water to a tank from a canal whenever in excess of canal requirements, having its own command.

7.52 Temporary Outlet — An outlet which is built for a short period either for a specific purpose after which it is removed or, in the first instance as temporary to be replaced later by a permanent outlet.

7.53 Throat — A contracted section of a channel or structure or constricted section of a closed conduit with a minimum flow section being always less than the normal cross section.

7.54 V-Notch Outlet or V-Notch — A contracted sharp-crested measuring weir notch with sides that form an angle with its apex downwards; the crest is the apex of the angle.

7.55 Water Course — A channel receiving its supply through outlet fixed on the bank of a main canal, branch, distributary or minor for supplying water to the fields.

7.56 Wing Wall — Walls joining the abutment of a structure to an earth dike or the banks to retain and protect the earth fill behind and to provide a longer path of percolation around the end of structure and/or to improve flow conditions upstream and downstream of the controlling section.

7.57 Wooden-shoot Outlet* — Generally a temporary outlet having the barrel made of wood and without face and tail walls.

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