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ĐẠI HỌC NHA TRANG
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CÔNG QUANG
TRẦN MẠNH TUÂN

TIẾNG ANH

TRONG KỸ THUẬT TÀI NGUYÊN NƯỚC

English
In water
Resources
Engineering

THU VIEN DH NHA TRANG



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TRƯỜNG ĐẠI HỌC NHA TRANG
VIỆN NGHIÊN CỨU
CÔNG NGHỆ SINH HỌC & MÔI TRƯỜNG

TIẾNG ANH
TRONG KỸ THUẬT TÀI NGUYÊN NƯỚC
ENGLISH
IN WATER RESOURCES ENGINEERING

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NHÀ XUẤT BẢN XÂY DỰNG
HÀ NỘI - 2001

LỜI NÓI ĐẦU

Hiện nay nhu cầu học tập ngoại ngữ nói chung và tiếng Anh nói riêng đang ngày càng tăng đối với mọi người trong xã hội, đặc biệt là sinh viên các trường đại học, các cán bộ kỹ thuật trẻ, những người đang quyết tâm trang bị cho mình vốn kiến thức sâu rộng làm hành trang bước tiếp những chặng đường mới trong sự nghiệp công nghiệp hoá, hiện đại hoá đất nước, tiến tới một nền kinh tế tri thức và toàn cầu hoá. Sách dạy tiếng Anh phổ thông và các từ điển thông thường được phổ biến rất rộng rãi, trong khi đó các tài liệu kỹ thuật tiếng Anh chuyên ngành lại rất hạn chế, nhất là tiếng Anh trong lĩnh vực kỹ thuật tài nguyên nước.

Nhằm phục vụ việc học tập, trau dồi tiếng Anh của sinh viên các ngành kỹ thuật tài nguyên nước, các cán bộ kỹ thuật đang công tác trong các cơ quan đào tạo, nghiên cứu và thiết kế có liên quan, cuốn Tiếng Anh trong kỹ thuật tài nguyên nước (*English in Water Resources Engineering*) được biên soạn với nội dung cơ bản sau:

Phần 1: Các bài đọc về các chủ đề chung của kỹ thuật tài nguyên nước: thuỷ năng, thời tiết, ô nhiễm nước, chu trình thuỷ văn, luật nước, lũ lụt, quản lý tưới, và một số bài đọc bổ sung có nội dung liên quan đến các chủ đề đã nêu như luật về tài nguyên nước, sử dụng và quản lý bền vững tài nguyên nước, giới thiệu lưu vực sông Hồng...; Các nội dung kỹ thuật chuyên ngành: thuỷ lực ứng dụng, sức bền vật liệu, bê tông cốt thép, cơ học đất, chất lượng nước, cấp nước, dự báo thời tiết, ô nhiễm, công trình tưới, cải tạo đất, trạm bơm, thuỷ công, đập đất và đá đổ, thuỷ điện... và các bài đọc bổ sung về xây dựng và quản lý dự án thủy lợi.

Phần này giúp cho người đọc nắm vững được kiến thức chuyên môn và làm quen với công tác quản lý trong lĩnh vực kỹ thuật tài nguyên nước.

Phần 2: Gồm 2000 thuật ngữ kỹ thuật trong lĩnh vực tài nguyên nước: thuỷ văn, thuỷ nông, trạm bơm, hệ thống công trình tưới tiêu, các hạng

mục của công trình đầu mối. Các thuật ngữ được trình bày dưới dạng khái niệm định nghĩa bằng tiếng Anh. Phần này sẽ giúp cho người đọc hiểu rõ bản chất của các thuật ngữ, từ đó dễ dàng ứng dụng khi đọc và viết các tài liệu có liên quan.

Với kinh nghiệm và hiểu biết còn hạn chế, tuy đã cố gắng trong quá trình biên soạn nhưng cuốn sách khó tránh khỏi những thiếu sót. Các tác giả mong nhận được sự góp ý của bạn đọc và chân thành cảm ơn các thầy giáo tiếng Anh, các bạn đồng nghiệp, những người đã đóng góp tư liệu cho nội dung cuốn sách nhỏ này, cảm ơn Nhà xuất bản Xây dựng đã khuyến khích, động viên, tạo điều kiện thuận lợi và nhanh chóng để cuốn sách có thể sớm ra mắt bạn đọc.

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PART I. TECHNICAL TEXTS

ĐƯÁN SRV 2701 - DHNT

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Tel/Fax: 058.3831145

MST: 4200433424-001

I.1. GENERAL TOPIC

UNIT 1. WATER POWER

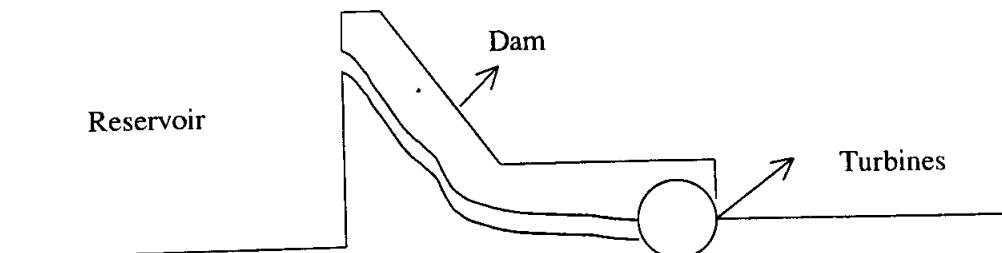
How does man use the power of river water?

Long after the discovery of electricity, man found that he could use the great power of water to produce it. At first, he used natural water falls. Later, man began to build dams to generate hydro-electric power. Dams are immense structures which hold back the water of a river and form a lake behind. The water is let through pipes to the turbines below.



Ban Gioc water fall

These pipes can be up to nine metres in diameter and they can be opened or closed automatically. The rushing water drives the turbines. They revolve, they spin electro-magnets. These electro-magnets generate current in coils of wire. The voltage is then stepped up by a transformer before it is transmitted to homes and factories



Now cover over the text, look at the diagram, and describe how hydro-electricity is produced.

But dams are not only used to produce hydro-electric power. Some of the driest and least fertile areas in the world have been opened to farming by irrigation. Dams have been built in series along rivers to make the fullest use of the water. Irrigation channels radiate from the man-made lakes (or reservoirs) behind the dams and bring life-giving water to the desert around. In Africa, for example, the Aswan Dam on the Nile and the Kariba Dam on the Zambezi have changed the lives of millions of people. The Kariba Dam holds back a 3,220 square kilometre reservoir, one of the biggest man-made lake in the world.

WORD STUDY

Dam (n) (Đập): Barrier (made of concrete, earth etc.) built across a river to hold back the water and form a reservoir for various purposes.

Reservoir (n) (hồ chứa): Natural or artificial lake used as a source or store of water for an area.

Channel (n) (Lòng dẫn, kênh dẫn): Sunken bed of a river, stream or canal; passage along which a liquid may flow.

Turbine (n) (Tuốc-bin): Machine or motor driven by a wheel which is turned by a current of water, steam, air or gas.

UNIT 2. WEATHER

People are most interested in the weather in countries where the climate is varied and uncertain. Human lives often depend on weather conditions. But how much do you know about the causes of different kind of weather?

1. What makes the wind blow?

The pressure of the atmosphere varies over time. Air increases in volume as the temperature rises, and so a cubic metre of cold air is heavier than the same volume of warm air. As warm air is lighter, it rises. It displaces air at lower levels by colder air which moves in. Wind is simply the movement of air between high and low pressure areas. The bigger the difference between the pressure, the stronger the wind is. Atmospheric pressure is measured with a barometer.

2. How are clouds formed?

The moisture in the atmosphere is produced by the evaporation of water and by the breathing of living things. As water vapour is lighter than air, it rises. It goes on rising until it condenses. Then it can be seen in the form of clouds. The process of condensation continues until the water becomes too heavy to stay in the air and it falls as rain.

3. How is snow formed?

Currents of very cold air make the water vapour in clouds freeze. The clouds then consist of minute particles of ice. But these ice particles remain lighter than air until the temperature falls below a certain point. Then they combine, become heavier, and fall as snow. Snowflakes are crystals with a beautiful, patterned structure.

4. What is lightning?

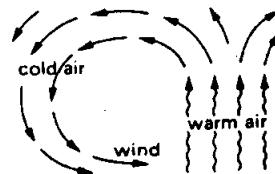
Lightning is a sudden discharge of electricity from cloud to cloud or from cloud to the earth. The same sort of effect can be produced by connecting the positive and negative terminals of storage battery. This creates a short circuit and a violent spark is discharged. Lightning from the sky is produced in the same way, usually between clouds with opposite electrical charges.

WORD STUDY

Climate (n) (Khí hậu): The usual weather conditions in a certain area. The Sahara Desert has a hot, dry climate. What is the climate like in Vietnam?

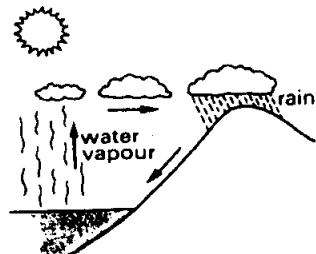
Condense (v) (Ngưng động, ngưng kết): Changes from gas to liquid. Steam from boiling water in a kitchen condenses on the ceiling, walls and windows.

1. What makes the wind blow ?



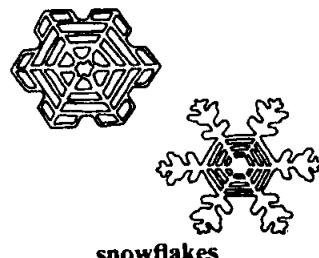
a barometer

2. How are clouds formed ?



the water cycle

3. How is snow formed ?



snowflakes

Minute (adj.) (Nhỏ li ti): Very small. Look up the pronunciation of this word. An amoeba is a minute organism.

Crystals (n) (Đang tinh thể): A crystal is a regular arrangement of molecules in a certain structure.

Patterned (adj.) (Có dạng hoa văn): Arranged in a particular way. A pattern is often beautiful to look at and its shapes are usually repeated. Shirts and dresses often have patterns.

Discharge (n) (Phóng điện): A movement of electricity.

Spark (n) (Đánh lửa): A sudden flash of light. You can make a spark by striking two stones together.

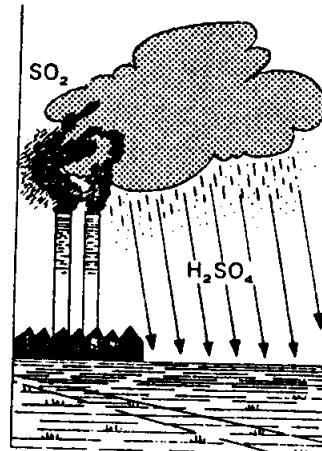
Charge (n) (Tích điện): The electricity contained by a body or a battery.

UNIT 3. WATER POLLUTION

How many times a day do you turn a tap on? How often do you think about where your water comes from and where it goes after you have used it? Did you know that most fresh water sources are so dirty that the water must be purified before it is drunk ? Do you know what makes the water so dirty?

1. Oil

Oil floats on water and does not dissolve in it. If a big oil tanker loses some oil in the sea, sea-birds and fish are killed and beaches are polluted. Fuel oil contains sulphur. When oil is burnt in industry, sulphur dioxide is formed. This combines with water particles in the atmosphere and falls as rain. This rain is dilute sulphuric acid. In some countries, such as Norway and Sweden, the soil does not contain enough of the



Now cover up the text, look at the diagram and describe how sulphuric acid is formed in rainclouds.

alkalis which are needed to neutralise this acid. So the fish in many Scandinavian lakes and rivers are poisoned by high acid concentrations in the water.

2. Poisonous chemicals: Mercury is used as a catalyst in the production of plastics and is also needed in the paper industry. After use, it is pumped out with the other industrial waste. But mercury is highly poisonous. In Japan, people have died after eating fish from mercury polluted water. Mercury is only one example of a chemical poison in water; sadly, there are many others.

3. Sewage: In many cases, sewage is treated and broken down in sewage plants before it is pumped back into lakes, rivers and seas. But it is often returned untreated. Water can usually clean itself of organic waste, but this process takes a long time. In some areas, too much untreated sewage is pumped out and the water never gets clear. There are many other ways in which water is being polluted, by detergents and insecticides, for example. We are slowly poisoning our most important natural resource.

"Water is your life - keep it clean".

WORD STUDY

Sources (n) (Nguồn): Places where something come from. A river's source is the place where it starts. The source of the Rhine is in the Alps. Hydroelectric power stations are important sources of electricity.

Purified (adj.) (Làm sạch): Cleaned. When a liquid is purified, dirt and waste are removed from it.

Dissolved (adj.) (Hoà tan): Some gases and solids dissolve in water - they become liquid and form a solution.

Polluted (adj.) (Ô nhiễm): Made dirty, the opposite of purified.

Fuel oil (Dầu nhiên liệu): Oil used for burning. Fuel is any substance which is burnt to produce heat or energy. Coal and petrol are fuels.

Dilute (adj.) (Pha loãng): A dilute acid is an acid solution with a high percentage of water. This weakens the acid.

Alkali (v) (Chất kiềm): Substance which combines with acids to form salts; in this way an acid is neutralised.

Catalyst (n) (Chất xúc tác): Substance which speeds up a chemical change without changing itself.

Waste (n) (Chất thải, vật thải): Things not needed and thrown away. There is a basket for waste paper in most classrooms and offices.

Sewage (n) (Nuốc cống): Waste organic substance, usually from households. Sewage is carried away in big pipes called sewers.

Radio-active (adj.) (thuộc về phóng xạ): A radio-active substance has atoms which break up without any outside force.

Detergent (n) (Chất tẩy rửa): Substances used for cleaning.

Insecticides (n) (Thuốc sâu): Substances used for killing insects.

Resource (n) (Tài nguyên): Natural resources are those things we get from the earth which are useful. Coal and oil are resources as well as water.

UNIT 4. HYDROLOGIC CYCLE

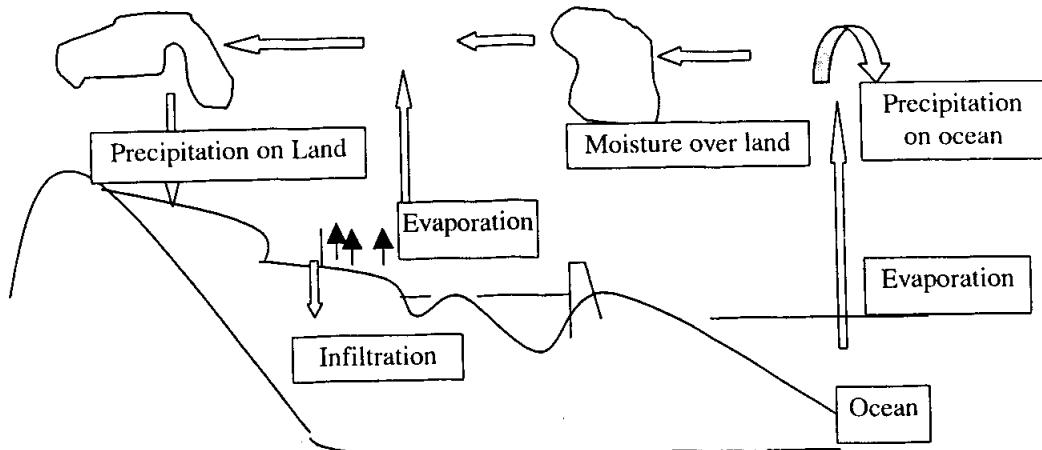
Water on earth exists in a space called the hydrosphere which extends about 15 km up into the atmosphere and about 1 km down into the lithosphere, the crust of the earth. Water circulates in the hydrosphere the maze of paths constituting the hydrologic cycle.

The hydrologic cycle is the central focus of hydrology. The cycle has no beginning or end, and its many processes occur continuously. As shown schematically in Fig. below, water evaporates from the oceans and the land surface to become part of the atmosphere; water vapour is transported and lifted in the atmosphere until it condenses and

precipitates on the land or the oceans; precipitated water may be intercepted by vegetation, become overland flow over the ground surface, infiltrate into the ground, flow through the soil as subsurface flow, and discharge into streams as surface runoff return to the atmosphere through evaporation. The infiltrated water may percolate deeper to recharge groundwater, later emerging in springs or seeping into streams to form surface runoff, and finally flowing out to the sea or evaporating into the atmosphere as the hydrologic cycle continues.

Estimating the total amount of water on the earth and in the various processes of the hydrologic cycle has been a topic of scientific exploration since the second half of the nineteenth century. However, quantitative data are scarce, particularly over the oceans, and so the amounts of water in the various components of the global hydrologic cycle are still not known precisely.

About 96.5 percent of all the earth's water is in the oceans. If the earth were a uniform sphere, this quantity would be sufficient to cover it to a depth of about 2.6 km. Of the remainder, 1.7 percent is in the polar ice, 1.7 percent in groundwater and only 0.1 percent in the surface and atmospheric water systems. The atmospheric water system, the driving force of surface water hydrology contains only $12,900 \text{ km}^3$ of water, or less than one part in 100,000 of all the earth's water.



Of the earth's fresh water, about two-thirds is polar ice and most of the remainder is groundwater going down to a depth of 200 to 600 m. Most groundwater is saline below this depth. Only 0.006 percent of freshwater is contained in rivers. Biological water, fixed in the tissues of plants and animals, makes up about 0.003 percent of all fresh water, equivalent to half of the volume contained in rivers.

Although the water content of the surface and atmospheric water system is relatively small at any given moment, immense quantities of water annually pass through them.

WORD STUDY

Evaporate (v), Evaporation (n) (Bốc hơi): 1- The process by which water is changed from the liquid or the solid state into the gaseous state through the transfer of heat energy. 2- The product or result of evaporating.

Precipitate (v), Precipitation (n) (Giáng thủy) : 1- The total measurable supply of water of all forms of falling moisture, including dew, rain, mist, snow, hail and sleet; usually expressed as depth of liquid water on a horizontal surface in a day, month, or year, and designated so daily, monthly, or annual precipitation; 2- The process by which atmospheric moisture in liquid or solid state is discharged into a land or water surface.

Infiltrate (v), Infiltration (n) (Thâm măt): 1- The flow or movement of water through the surface into the soil body or ground. 2- The absorption of liquid water by the soil, either when it falls as rain, or when applied as irrigation, or from a stream flowing over the ground. 3- Flow from a porous medium into a channel, pipe, drain, reservoir or conduit. 4- The infiltrated water, as infiltrate.

Note: The distinction between infiltration and percolation is that the latter is the movement of water or moisture within the soil through the saturated zone.

Recharge (v, n) (Bổn cát): 1- Replenishment of groundwater supply in the zone of saturation, or addition of water to the groundwater storage by natural processes or artificial methods for subsequent withdrawal for beneficial use or to check salt water intrusion in coastal areas; 2- Also the process of replenishment or addition, of the quantity of such water.

Surface runoff (n) (dòng chảy mặt): Overland runoff when it has reached a definite stream channel.

UNIT 5. WATER LAW

Man uses water in many ways. For some he leaves the water in its natural setting. A boy swims in a neighbour's pond. A trout fisherman casts his fly into the riffles of a mountain stream. A vacationer tows his girl on water skis behind a power boat. The owner of a summer home merely sits and enjoys the view of a lake or brook. The tugs and barges of a navigation company ply a great river. A city discharges the waste of its people and industries into the river.

Most of man's uses of water require that its physical occurrence should be altered. A power company's dam builds up the pressure that enables it to turn turbines and generators. A farmer diverts the water from a stream to irrigate his fields and orchards. A manufacturer withdraws it from an underground water source to use as a raw material or to wash and treat other materials. A city pumps large quantities through its mains for use in homes and commercial establishments. Any of these users may store water for future use, or a government agency may build a great multipurpose reservoir project to supply them all.

Man has slowly come to realize that there is not enough water anywhere on this globe to permit every user to do with it as he pleases. Not even the vast oceans can be mistreated without repercussions.

Although the hydrologic cycle endlessly replenishes the fresh water of the earth there is not enough for all to use at will. Water is to this extent a

scarce commodity and law is needed to allocate its use among men. Water law has arisen, as other laws arise, to order the activities of man in relation to water so as to allow and encourage desirable activities and to prevent or restrict undesirable conduct. Like other laws governing scarce things, the institutional framework of water law is a combination of interacting property rights, economic forces and public regulation.

All of the water uses are desired by and have utility and value to the users. Not all will be protected by law and given the property status of a "water right". The boy's desire to swim is outweighed by the neighbouring landowner's right to full possession of his land. The trout fisherman and motorboater similarly may have "public rights" and be entitled to protection if the water is open to the public under the governing law. The tugboat also operates under a public right of navigation, but if the captain finds his highway blocked by a dam constructed by the sovereign government he will have no resource. The owner of the summer home, who receives not only pleasure but also increased land value from the lake or brook, may have a protected interest in the water in some states but not in others. The city which saves money by discharging raw sewage into a stream, spoiling it for others or imposing costs of treatment on them, has no property right to continue its use.

NEW WORDS

Trout (n)	: Cá hồi
Cast (v)	: Quăng, liêng, thả
Riffle (n)	: Chỗ nước nông
Tow (v)	: Kéo
Brook (n)	: Suối
Ply (v)	: Chạy (tàu, thuyền)
Discharge (v)	: Xả nước
Waste (n)	: Chất thải

Irrigate (v)	: Tưới nước
Multipurpose reservoir	: Hồ chứa đa mục tiêu
Underground water source	: Nguồn nước ngầm
Mistreat (v)	: Ngược đãi
Repercussion (n)	: Hậu quả, tác động ngược lại
Hydrologic cycle	: Chu trình thủy văn
Govern (v)	: Quản lý
Institutional framework	: Khung thể chế
Water law	: Luật về tài nguyên nước
Property right	: Quyền về tài sản
Water right	: Quyền về (khai thác và sử dụng) nước
Public right	: Quyền của công chúng
Sovereign government	: Chính quyền chủ quản (cơ quan chủ quản)
Protected interest	: Quyền lợi được bảo vệ
Raw sewage	: Chất thải thô, chất thải chưa được xử lý.

QUESTION

1. What are water related users known by you?
2. What is main reason causing conflicts between water users?
3. How to regulate the relations between the water related users?
4. Why water is required in water resources management?

UNIT 6. FLOOD DISASTER IN THE CENTRAL PROVINCES

The Central Provinces of Vietnam, from Quang Binh Province in the North to Binh Dinh Province in the South, are both the poorest and the most natural disaster prone areas of one of the most disaster prone countries in the World. Every year these Central Provinces of Vietnam are impacted by typhoon storms with 6 to 12 storms landing per year,

storm surge coastal flooding, monsoon rain mountain flash flooding, river plain delta flooding, and all other types of natural disasters.

Flood Events in Central Vietnam in 1999

The first most severe flood event in memory occurred between 1 and 6 November 1999, following heavy cyclonic rains in the central area of Vietnam. The most affected provinces were those from Quang Tri to Quang Nam. The second major flood event occurred one month later due to similar rainfall and affected mainly the provinces from Thua Thien-Hue to Khanh Hoa. Thus some provinces experienced very severe flooding twice within four weeks.

As reported by the Central Committee for Flood and Storm Control, some areas received twice their mean annual rainfall in just a few days, and historical flood levels were surpassed in almost every location. With the topography of the river catchment areas in the Central Provinces consisting typically of mountainous areas upstream in the west feeding to relatively narrow low-lying coastal areas in the east, the water levels in many rivers rose rapidly - in some cases by several meters per hour. While no firm estimates of the flood probability levels are available, it is possible that both events were in the order of the 5 % probability floods for the catchments, or of an average return frequency of 50 years. Unprecedented levels of physical damage and total economic losses were reported.

Issues Arising from the 1999 Floods

Natural disasters and floods are natural events occurring annually in Central Vietnam. But it is not economically viable to protect against all the effects of the maximum possible floods for any given river basin. Further, physical works to contain or reduce floods may result in adverse consequences elsewhere. A realistic balance must be obtained between protecting life, property, and infrastructure from floods of a selected probability; and making adequate provision for evacuation and other emergency measures to cope with the effects of floods of greater

magnitude. The recommended approach should be a combination of non-structural and structural flood control and flood damage protection - for convenience called flood mitigation.

In providing such natural disaster and flood protection, due account must be taken of social factors and the need to safeguard the interests of people living in poverty in flood-prone areas. Particularly relevant issues in the 1999 and in future floods are:

- Hunger eradication and poverty reduction (HEPR)

- A local participatory approach in the selection of natural disaster and flood mitigation project priorities

- Quality relocation decisions and sites

- Empowerment of women

Effects of the 1999 floods that can be expected in future floods include:

- Loss of life, injury, and disease (mainly diarrhea)

- Evacuation and relocation

- Destruction and damage to homes, schools, clinics, and other public and community buildings

- Destruction and damage to roads and bridges, railways, ports, river banks, estuaries, irrigation systems, aquaculture systems, fishing boats, power supplies, water supplies, and communication systems

- River scour, deposition of sediment, changes to the navigable capacity of rivers and estuaries, and the uncovering of unexploded ordinance (UXO)

- Shortages of food, seeds, fertilizer, and medicine

- Loss of agricultural land, seeds, fertilizer, produce, and livestock

- Disease in livestock

- Loss of livelihood

The most cost effective measures in the immediate and short term to address these relevant disaster mitigation issues, and to mitigate the effects of future floods in the Central Provinces are non-structural disaster mitigation measures including:

1. Natural disaster area flood mapping
2. River flood warning systems
3. Television based disaster information and warning systems
4. Training at all government levels and grassroots levels on these new disaster mitigation technologies.

WORD STUDY

1. *Typhoon, storm (Bão, xoáy nhiệt đới)*: (các tên khác Hurricane, Taino, Cordonazo, Typhoon, Baguio, Baruio, Willy-willy (bão)): A revolving storm originating over the ocean in the doldrum belt of general circulation. Known by various names in different parts of the world-hurricane in the Caribbean and western parts of the Atlantic Ocean, also taino in Haiti, cordonazo in the west coast of Mexico, Typhoon in Japan and adjacent seas of south-eastern Asia, Baguio or baruio in the Philippines, Willy-willy in Australia, cyclone in the Indian Ocean.
2. *Natural disaster (Thiên tai)*: Natural event that causes great harm or damage, eg. A big flood, earthquake, typhoon.
3. *Disaster area (vùng bị thiên tai)*: area affected by a disaster, eg. An earthquake, floods etc.
4. *Natural disaster prone area*: (Vùng thường xảy ra thiên tai)
5. *The Central Committee for Flood and Storm Control (Ủy ban Phòng chống Bão Lũ Trung ương)*.
6. *Hunger Eradication and Poverty Reduction (HEPR)*: Xóa đói giảm nghèo.
7. *Participatory approach*: Phương pháp tiếp cận với sự tham gia của cộng đồng (nhân dân). *Participatory Irrigation Management (PIM)* Quản lý thủy nông có sự tham gia của nông dân.
8. *Catchment*: Lưu vực (sông nhánh) (thường được dùng khác với *River basin* : lưu vực sông lớn).

UNIT 7. IRRIGATION MANAGEMENT

There have been changes in the irrigation management over period of time. In 1960s, the increase in agriculture production was conceived by more investment in the irrigation infrastructure development. Around 1980s, it was found that irrigation infrastructures being built over period of time have been deteriorated. It is recognised that the participation of the beneficiaries is important for the better maintenance and management of the irrigation systems so there has been promotion of participatory irrigation management.

Irrigation has traditionally consumed a large proportion of the world's water. At the beginning of the century, 90% of water use in the world was for irrigation. By 1960, it was about 80%, currently, it is about 70% and by the year 2000, it is expected to be about 60%. In defence of this water use, it was pointed out that irrigated agriculture produced 40% of food and agriculture commodities from 17% agriculture land. This makes food security critically dependent on irrigation. The dependence is most critical for Asia where 60% of food production is from irrigated lands.

Many changes have been taking place. There has been increase in population growth. This has put more pressure for the increased demand on food. This situation puts more pressure in the irrigated agriculture. In 1990s, it is recognised that water is a scarce resource and it will continue to be a scarce resource so increase of agriculture production per unit of water has to be increased. Hence, this new situation also puts pressure in the management of irrigation system for irrigated agriculture.

Irrigation Management as Socio-institutional and technical issue

Irrigation management is not only one-dimensional activity. It has multi-dimensional activities. They include managing organisations, which operate and deliver water. It also deals with farmer's organisation, agriculture credit, extension services and market conditions. So, irrigation management is to be seen as social, institutional and technical activities.

It is no longer considered irrigation management only as technical activity. Hence, irrigation management changes mean the establishment of multi-disciplinary irrigation department open to the farmer's participation in irrigation management.

Different components of the irrigation management

There are many types of activities that are to be performed in the irrigation management. Broadly, the activities can be grouped into three. They are: a).water use activity; b).water control activity and c).organisational activity.

The water use activity consists of a). water acquisition; b). water allocation,c).water distribution and d).drainage.

Water control activity consists of a).design b).construction;c). operation and d).maintenance.

The organisational activity includes a). decision-making; b). resource mobilisation;c).communication and d).conflict management.

NEW WORD

1. *Irrigation infrastructure*: Công trình thủy nông (irrigation works, irrigation structures)
2. *Decision-making*: Ra quyết định, làm quyết định
3. *Beneficiaries*: Người hưởng lợi
4. *Participatory irrigation management (PIM)*: Quản lý thủy nông có sự tham gia của nông dân.
5. *Water acquisition*: Được cấp nước
6. *Water allocation*: Phân chia nước (từ nguồn tự nhiên)
7. *Water distribution*: Phân bổ nước (trong hệ thống thủy nông)
8. *Drainage*: Tiêu thoát nước
9. *Resource mobilisation*: Huy động nguồn lực
10. *Socio-institutional and technical issue*: Vấn đề thể chế-xã hội và kỹ thuật.
11. *Conflict management*: Quản lý mâu thuẫn (giải quyết mâu thuẫn)

ADDITIONAL TEXTS

TEXT 1

LAW ON WATER RESOURCES

*The law passed the third session on May 20, 1998 by the National Assembly
of the Socialist Republic of Vietnam, Xth Legislature*

(Cited)

Water is an extremely important resource, a vital component of the life and environment, a decisive factor for the existence and sustainable development of a country. Conversely, water can also bring disasters for human-beings and the environment.

The purposes of this law are to strengthen the efficiency of State administration; improve responsibilities of State agencies, economic, political, political-social, social organizations, the People's armed force and individuals in protecting and exploiting water resources; to encourage exploitation and utilization of water resources in rational, saving, safe and effective manners; to protect against, control and overcome damages caused by water;

This Law is based on the 1992 Constitution of the S.R. Viet Nam;

This Law stipulates the management, protection, exploitation and utilization of water resources; and the prevention, control and overcoming of damages caused by water.

Chapter I

GENERAL PROVISIONS

Article 1. Ownership of Water Resources

1. Water resources belong to the public ownership under the unified management of the State.

2. Organizations and individuals have rights to exploit and use water resources for living and production, meanwhile have responsibilities to protect water resources and prevent, control and overcome damages caused by water in accordance to the Law. The State shall protect legal interests in exploitation and utilization of water resources.

Article 2. Objectives and Scope to Apply the Law

1. Water resources stipulated in this Law comprises surface, rainfall, underground, marine water located within the territory of the S.R. Vietnam. Marine and underground water located in the special economic zone; other laws regulate the ocean shell. The Mineral Law regulates mineral and natural hot water.

2. This Law applies to the management, protection, exploitation and utilization of water resources; and the prevention, control and overcoming of damages caused by water.

Article 3. Wording Explanation

In this Law, the following terms can be understood to mean:

1. “Water sources” indicate natural or artificial water accumulation which can be exploited and used, including river, stream, canal, creek, sea, lake, swamp, pool, underground water layers, rainfall, ice, snow and other types of water accumulation.

2. “Surface water” is the water existing on the surface of the ground.

3. “Underground water” is the water existing in the tables under the surface of the ground.

4. “Water for domestic consumption” is the water used for daily life of the people.

5. “Clean water” is the water meeting Vietnam quality standards.

6. “Water sources for domestic consumption” is the water supplied for domestic consumption or possibly treated to (the standard of) clean water in an economical manner.

7. “International water sources” include water sources flowing from Vietnam territory to the territories of other countries, from the territories

of other countries to Vietnam territory, or located in the border between Vietnam and her neighboring country.

8. "Development of water resources" are activities addressing at increasing capacity of the exploitation and utilization of water resources in a sustainable manner.

9. "Protection of water resources" are activities addressing at prevention, controlling the degradation, exhaustion of water sources, assuring the safety and capacity of the development of water sources.

10. "Exploitation of water sources" are the activities aiming at getting benefits from those water sources.

11. "Integrated use of water sources" is the rational use, development of all the potentialities of a water source and limit damages caused by that water source in order to intergratedly serve different purposes.

12. "Protection area for water sanitary" is the protecting area nearby the exploitation location regulated for the protection and control of water pollution.

13. "Pollution of water source" is to change physical, chemical characteristics and biological composition of water, which exceeds the allowed standards.

14. "Licensees of water resources" includes licensees of ground water exploring, licensees of water use, wastewater discharge permittees and other licensees.

15. "Degradation and exhaustion of water resources" is the decrease in water quality and quantity.

16. "River basin" is the geological area within which surface water and groundwater naturally flow to the river.

17. "Planning of river basin" is to plan the protection, exploitation and use of the water resources; and the prevention, control and overcoming of the damages caused by water in the river basin.

18. "Hydraulic works" are the works to exploit advantages of water, to prevent and control damages caused by water, to protect the environment and to balance the ecology.

LUẬT TÀI NGUYÊN NƯỚC

Luật này đã được Quốc hội nước Cộng hòa xã hội chủ nghĩa Việt Nam khóa X, kỳ họp thứ 3 thông qua ngày 20 tháng 5 năm 1998

(Trích)

Nước là tài nguyên đặc biệt quan trọng, là thành phần thiết yếu của sự sống và môi trường, quyết định sự tồn tại, phát triển bền vững của đất nước; mặt khác nước cũng có thể gây ra tai họa cho con người và môi trường;

Để tăng cường hiệu lực quản lý nhà nước, nâng cao trách nhiệm của cơ quan nhà nước, tổ chức kinh tế, tổ chức chính trị, tổ chức chính trị-xã hội, tổ chức xã hội, đơn vị vũ trang nhân dân và mọi cá nhân trong việc bảo vệ, khai thác, sử dụng tài nguyên nước; phòng, chống và khắc phục hậu quả tác hại do nước gây ra;

Căn cứ vào Hiến pháp nước Cộng hòa xã hội chủ nghĩa Việt Nam năm 1992;

Luật này quy định việc quản lý, bảo vệ, khai thác, sử dụng tài nguyên nước; phòng, chống và khắc phục hậu quả tác hại do nước gây ra.

Chương I NHỮNG QUY ĐỊNH CHUNG

Điều 1. Sở hữu tài nguyên nước

1. Tài nguyên nước thuộc sở hữu toàn dân do Nhà nước thống nhất quản lý.
2. Tổ chức, cá nhân được quyền khai thác, sử dụng tài nguyên nước cho đời sống và sản xuất, đồng thời có trách nhiệm bảo vệ tài nguyên nước, phòng, chống và khắc phục hậu quả tác hại do nước gây ra theo quy định của pháp luật. Nhà nước bảo hộ quyền lợi hợp pháp của tổ chức, cá nhân trong khai thác, sử dụng tài nguyên nước.

Điều 2. Đối tượng và phạm vi áp dụng

1. Tài nguyên nước quy định trong Luật này bao gồm các nguồn nước mặt, nước mưa, nước dưới đất, nước biển thuộc lãnh thổ nước Cộng hòa xã hội chủ nghĩa Việt Nam. Nước biển, nước dưới đất thuộc vùng đặc quyền kinh tế, thềm lục địa được quy định tại các văn bản pháp luật khác. Nước khoáng, nước nóng thiên nhiên do Luật khoáng sản quy định.

2. Luật này áp dụng đối với việc quản lý, bảo vệ, khai thác, sử dụng tài nguyên nước; phòng, chống và khắc phục hậu quả tác hại do nước gây ra.

Điều 3. Giải thích từ ngữ

Trong Luật này, các từ ngữ dưới đây được hiểu như sau:

1. "Nguồn nước" chỉ các dạng tích tụ nước tự nhiên hoặc nhân tạo có thể khai thác, sử dụng được, bao gồm: sông, suối, kênh, rạch; biển, hồ, đầm, ao; các tầng chứa nước dưới đất; mưa, băng, tuyết và các dạng tích tụ nước khác.

2. "Nước mặt" là nước tồn tại trên mặt đất liền hoặc hải đảo.

3. "Nước dưới đất" là nước tồn tại trong các tầng chứa nước dưới mặt đất.

4. "Nước sinh hoạt" là nước dùng cho ăn uống, vệ sinh của con người.

5. "Nước sạch" là nước đáp ứng tiêu chuẩn chất lượng nước sạch của Tiêu chuẩn Việt Nam.

6. "Nguồn nước sinh hoạt" là nguồn có thể cung cấp nước sinh hoạt hoặc nước có thể xử lý thành nước sạch một cách kinh tế.

7. "Nguồn nước quốc tế" là nguồn nước từ lãnh thổ Việt Nam chảy sang lãnh thổ các nước khác, từ lãnh thổ các nước khác chảy vào lãnh thổ Việt Nam hoặc nằm trên biên giới giữa Việt Nam và nước láng giềng.

8. "Phát triển tài nguyên nước" là biện pháp nhằm nâng cao khả năng khai thác, sử dụng bền vững tài nguyên nước và nâng cao giá trị của tài nguyên nước.

9. "Bảo vệ tài nguyên nước" là biện pháp phòng, chống suy thoái, cạn kiệt nguồn nước, bảo đảm an toàn nguồn nước và bảo vệ khả năng phát triển tài nguyên nước.

10. "Khai thác nguồn nước" là hoạt động nhằm mang lại lợi ích từ nguồn nước.

11. "Sử dụng tổng hợp nguồn nước" là sử dụng hợp lý, phát triển tiềm năng của một nguồn nước và hạn chế tác hại do nước gây ra để phục vụ tổng hợp cho nhiều mục đích.

12. "Vùng bảo hộ vệ sinh khu vực lấy nước" là vùng phụ cận khu vực lấy nước từ nguồn nước được quy định phải bảo vệ để phòng, chống ô nhiễm nguồn nước sinh hoạt.

13. "Ô nhiễm nguồn nước" là sự thay đổi tính chất vật lý, tính chất hóa học, thành phần sinh học của nước vi phạm tiêu chuẩn cho phép.

14. "Giấy phép về tài nguyên nước" bao gồm giấy phép thăm dò nước dưới đất; giấy phép khai thác, sử dụng tài nguyên nước; giấy phép xả nước thải vào nguồn nước và giấy phép về các hoạt động phải xin phép trong phạm vi bảo vệ công trình thủy lợi.

15. "Suy thoái, cạn kiệt nguồn nước" là sự suy giảm về chất lượng và số lượng của nguồn nước.

16. "Lưu vực sông" là vùng địa lý mà trong phạm vi đó nước mặt, nước dưới đất chảy tự nhiên vào sông.

17. "Quy hoạch lưu vực sông" là quy hoạch về bảo vệ, khai thác, sử dụng nguồn nước, phát triển tài nguyên nước, phòng, chống và khắc phục hậu quả tác hại do nước gây ra trong lưu vực sông.

18. "Công trình thủy lợi" là công trình khai thác mặt lợi của nước; phòng, chống tác hại do nước gây ra, bảo vệ môi trường và cân bằng sinh thái.

TEXT 2

SUSTAINABLE USE OF WATER RESOURCES

Presently the definition most often used of sustainable development is: the ability of the present generation to utilise its natural resources without putting at risk the ability of future generation to do likewise.

Water resources development that is not sustainable is ill-planned. In many parts of the world, fresh water resources are scarce and to a large extent finite. Although surface water may be considered a renewable resource, it only constitutes 1.5% of all terrestrial fresh water resources; the vast majority is ground water (98.5%). Consequently, there are numerous ways to jeopardise the future use of water, either by overexploitation (mining) of resources or by destroying resources for future use (e.g. pollution). Besides physical aspects of sustainability there are social, financial and institutional aspects. The following aspects of sustainability are distinguished:

- technical sustainability (balanced demand and supply, no mining)
- financial sustainability (cost recovery)
- social sustainability (stability of population, stability of demand, willingness to “pay”)
- economic sustainability (sustaining economic development or welfare and production)
- institutional sustainability (capacity to plan, manage and operate the system)
- environmental sustainability (no long-term negative or irreversible effects).

The core of sustainable water resources management is the balance between supply and demand of water related goods and services. The Water Resources System (WRS) which consists of the water infrastructure (both natural and manmade) and the administrative infrastructure (institutional frameworks), supplies goods and services to the Water Users (WU), which are all activities in society that use water,

whether consumptive or not. The WRS only supplies water to the WU on the basis of explicit demands, often expressed in a willingness to pay, not on the basis of forecasts or some vague ideas. A direct and explicit interest from the WU is a condition to guarantee the sustainability of the supply, both in terms of quality and quantity.

In the interaction between WRS and WU, Water Resources Development activities take place. These activities impact on both the state of the Environmental resource base and the resource base of Society within the planning unit (river basin, region or state). At the same time, these activities are only possible if they are supported by and draw upon, on the one hand, the Environment resource base, consisting of the water resources, the land resources and the ecosystems, and on the other hand, the resources base of Society, consisting of financial resources, human resources and knowledge base.

The water resources manager interferes with the system through two types of actions: supply oriented measures, such as building infrastructure, drilling boreholes, or building dams, and through demand oriented measures to influence demand. The water resources manager is prompted to take actions by triggers from the state of the resource base of Society or the Environmental resource base.

In the past, most of the attention of water managers has been dedicated to supply, the main task being to match the ever increasing demand projections with options for water supply. As a result, in many parts of the world, the most attractive alternatives for the development of water resources infrastructure have already been implemented and in many places it is hard to think of feasible alternatives for a further increase of the supply. When put against the sharp increase in water demand, which is occurring and expected to increase even more during the coming decades, the problem of water shortage takes dramatic proportions. In short, a further growth of demand is no longer sustainable and increase the problems to be solved by future generation.

As a consequence, leading water resources managers believe that further development should be based on the principle that water is finite,

and consequently that the attention should be shifted from managing the supply to influencing the demand. Demand Management is defined as : The development and implementation of strategies aimed at influencing demand, so as to achieve efficient and sustainable use of a scarce resource.

SỬ DỤNG BỀN VỮNG NGUỒN TÀI NGUYÊN NƯỚC

Hiện nay khái niệm về phát triển bền vững thường được hiểu là : thế hệ ngày nay sử dụng nguồn tài nguyên nước hiện có sẽ không gây ra những rủi ro cho thế hệ mai sau.

Quy hoạch kém dẫn đến phát triển tài nguyên nước không bền vững. Trên thế giới, nhiều vùng đất rộng lớn nhưng lại có rất ít tài nguyên nước ngọt. Mặc dù nước mặt được coi là nguồn tài nguyên có thể tái tạo được nhưng chỉ chiếm 1,5% tài nguyên nước ngọt trên đất liền; trong khi đó số lượng lớn lại là nguồn nước ngầm (chiếm 98,5%). Như vậy, sẽ có nhiều các tác động xấu đến việc sử dụng nước trong tương lai, ví dụ như khai thác quá mức (khai thác mỏ) hoặc phá hoại các nguồn tài nguyên tương lai (ví dụ như gây ô nhiễm). Ngoài các khía cạnh bền vững về cơ sở vật chất còn có bền vững về xã hội, tài chính và thể chế. Các khía cạnh bền vững bao gồm:

- bền vững về kỹ thuật (cân bằng cung và cầu, cân bằng giữa lượng bổ sung và lượng khai thác nước ngầm đối với tầng ngầm nước)
- bền vững về mặt tài chính (hoàn lại vốn)
- bền vững về xã hội (ổn định dân số, ổn định nhu cầu, sẵn sàng trả các khoản phí)
- bền vững kinh tế (phát triển kinh tế, phúc lợi, sản xuất một cách bền vững)
- bền vững về thể chế (khả năng lập kế hoạch, quản lý và vận hành hệ thống)
- bền vững về môi trường (không có các tác động tiêu cực lâu dài hoặc các ảnh hưởng không thể khắc phục được).

Vấn đề cốt yếu của quản lý tài nguyên nước bền vững là sự cân bằng giữa cung và cầu của mọi mặt hàng và dịch vụ liên quan tới nước. Hệ

thống tài nguyên nước (WRS) gồm có các công trình thủy lợi (gồm cả công trình tự nhiên và nhân tạo) và cơ cấu hạ tầng hành chính (khung thể chế), các dịch vụ và hàng hoá đối với các hộ sử dụng nước, bao gồm tất cả các hoạt động trong xã hội có sử dụng nước, không xét đến việc có tiêu hao nước hay không. Hệ thống tài nguyên nước chỉ cung cấp nước cho những hộ sử dụng nước trên cơ sở có nhu cầu rõ ràng, thường biểu thị qua việc sẵn sàng chi trả các khoản phí, chứ không phải dựa trên cơ sở dự báo hoặc những dự định mơ hồ. Lợi ích rõ ràng và trực tiếp đối với những hộ sử dụng nước là một điều kiện để đảm bảo sự bền vững của việc cung cấp nước cả về mặt số lượng và chất lượng.

Các hoạt động phát triển tài nguyên nước diễn ra trong mối quan hệ qua lại giữa hệ thống tài nguyên nước và hộ dùng nước. Các hoạt động này tác động đến trạng thái của cơ sở tài nguyên môi trường và cả cơ sở nguồn xã hội trong đơn vị không gian lập quy hoạch (lưu vực sông, vùng hay quốc gia). Đồng thời, các hoạt động này chỉ có thể thực hiện được nếu được trợ giúp và sử dụng đến, một mặt, cơ sở tài nguyên môi trường, bao gồm tài nguyên nước, tài nguyên đất và hệ sinh thái, và mặt khác cơ sở nguồn xã hội, bao gồm nguồn tài chính, nguồn nhân lực và cơ sở kiến thức.

Người quản lý nguồn tài nguyên nước can thiệp vào hệ thống thông qua các hành động: Cung cấp các biện pháp đã được định hướng, như xây dựng cơ sở hạ tầng, khoan các giếng khoan, hoặc xây dựng các hồ chứa, và thông qua các biện pháp định hướng theo yêu cầu gây ảnh hưởng lại các yêu cầu. Người quản lý tài nguyên nước nhận phản hồi từ trạng thái của cơ sở nguồn của xã hội hay cơ sở tài nguyên môi trường và thực hiện lại các hành động.

Trước đây, người quản lý tài nguyên nước tập trung hầu hết chú ý vào việc cung cấp nước, nhiệm vụ chính là đáp ứng nhu cầu ngày càng tăng của các kế hoạch sử dụng nước theo các phương án cung cấp nước. Kết quả là, ở nhiều nơi trên thế giới, các phương án hấp dẫn nhất đối với phát triển cơ sở hạ tầng tài nguyên nước đã được thực hiện và ở nhiều nơi khó có thể nghĩ ra các phương án khả thi nào khác để tăng thêm lượng nước cung cấp. Khi nhu cầu dùng nước tăng cao như hiện nay và dự đoán sẽ

tăng nhiều hơn nữa trong những thập niên tới, vấn đề thiếu nước sẽ hết sức trầm trọng. Nói tóm lại, việc gia tăng nhu cầu dùng nước là không ổn định và các vấn đề này sẽ do các thế hệ sau giải quyết.

Cuối cùng, những người quản lý tài nguyên nước tiên phong tin rằng, sự phát triển hơn nữa cần phải dựa trên nguyên tắc: nguồn nước là hữu hạn, vì thế phải chuyển sự quan tâm từ quản lý hoạt động cung cấp nước sang tác động vào nhu cầu dùng nước. Quản lý nhu cầu dùng nước được định nghĩa là: phát triển và thực hiện các chiến lược nhằm mục đích tác động vào nhu cầu dùng nước để đạt được việc sử dụng một cách hiệu quả và bền vững nguồn tài nguyên khan hiếm này.

TEXT 3

WHAT IS WATER RESOURCES MANAGEMENT ?

People from different professional backgrounds tend to view water resources management differently. To the ecologist, water resources management is often connected with reversing the effects of the deterioration of ecosystems, land degradation, pollution and destruction of wetlands. To the water engineer, water resources management is about dams, reservoirs, flood protection, diversions, river training, water treatment and reclamation. To the lawyer, the main issues in water resources management are the ownership of water, systems of water rights, the priority of use, water markets, water legislation, and international water law. To the economist, water resources management is connected with economic efficiency, cost recovery and the attainment of national objectives. It can be truly said that the Water Resources Management, in all its components, is multi-disciplinary field.

In recent years, a number of concepts related to water resources are widely used, such as Water Resources Development, Water Resources Planning, Water Resources Management, and more recently, Integrated Water Resources Management. It is useful to define these terms, or at least agree on some broad definitions so that those involved in this work have a common understanding of their meaning.

Water Resources Development : actions, mostly physical, that lead to the beneficial use of water resources for single or multiple purposes.

Water Resources Planning : planning of the development, conservation and allocation of a scarce resource (sectoral and intersectoral), matching water availability and demand, taking into account the full set of national objectives and constraints and the interests of stakeholders.

Water Resources Management : The whole set of technical, institutional, managerial, legal and operational activities required to plan, operate and manage water resources. In other words, Water Resources Management can be considered as a process, including all activities of planning, design, construction and operation of water resources systems.

In recent years, definition of the integrated water resources management has been used. Integrated Water Resources Management takes account of: i) all natural aspects of the water resources; ii) all sectoral interests and stakeholders; iii) the spatial variation of resources and demands; iv) relevant policy frameworks (national objectives and constraints); and v) institutional levels.

Why Integrated Water Resources Management ?

In order to have effective water resource management, the following principles are required:

- National water resource management should be undertaken in a holistic, determined and sustained manner to meet national development goals and protect the environment.
- Management of specific water resources should be decentralized to an appropriate level responding to basin boundaries.
- Delivery of specific water services should be delegated to autonomous and accountable public, private, or co-operative agencies providing measured water services in a defined geographical area to their customers, and/or members, for appropriate fee.

- Water use in society should be sustainable - with incentives, regulatory controls, and public education promoting economic efficiency, conservation of water resources and protection of the environment - with a transparent policy frameworks.
- Shared water resources within and between nations should be allocated efficiently for the mutual benefit of all riparian users.

The integrated water resource management will be an effective tool to implement the above principles.

QUẢN LÝ TÀI NGUYÊN NƯỚC LÀ GÌ ?

Những người thuộc chuyên môn khác nhau có cách nhìn về quản lý tài nguyên nước khác nhau. Đối với nhà sinh thái học, quản lý tài nguyên nước thường gắn liền với những ảnh hưởng làm suy giảm hệ sinh thái, làm suy thoái đất, gây ô nhiễm và phá hoại vùng đất ướt. Đối với các kỹ sư thủy lợi nói đến quản lý tài nguyên nước có nghĩa là nói tới các hồ chứa, đập, chuyển nước, phòng chống lũ, chính trị sông, xử lý nước và khai hoang. Với các luật sư, các vấn đề chủ yếu trong quản lý tài nguyên nước là quyền sở hữu nước, hệ thống quyền dùng nước, ưu tiên sử dụng nước, thị trường nước, các vấn đề pháp lý về nước và luật quốc tế về nước. Đối với các nhà kinh tế, quản lý tài nguyên nước liên quan tới hiệu quả kinh tế, hoàn vốn và việc đạt được các mục tiêu quốc gia. Có thể nói rằng, quản lý tài nguyên nước với tất cả các thành phần của nó là một lĩnh vực liên ngành.

Trong những năm gần đây, nhiều khái niệm liên quan tới tài nguyên nước được sử dụng rộng rãi, như *phát triển tài nguyên nước, quy hoạch tài nguyên nước, quản lý tài nguyên nước*, và gần đây nhất là *quản lý thống nhất và tổng hợp tài nguyên nước*. Cần thiết phải định nghĩa các thuật ngữ này, hoặc ít nhất cũng phải thống nhất các khái niệm định nghĩa một cách rộng rãi để tất cả những ai làm việc trong lĩnh vực này có một khái niệm chung.

Phát triển tài nguyên nước : Các hành động, phần lớn là xây dựng các công trình để đưa tới việc sử dụng hữu ích tài nguyên nước cho một mục đích hoặc nhiều mục đích.

Quy hoạch tài nguyên nước: Quy hoạch sự phát triển, bảo vệ và phân phối nguồn nước khan hiếm (trong ngành nước và giữa các ngành với nhau), cân đối giữa nguồn nước có sẵn và nhu cầu, xem xét các mục tiêu quốc gia và các khó khăn, trở ngại và quyền lợi của các bên có liên quan.

Quản lý tài nguyên nước: Toàn bộ các hoạt động vận hành, pháp lý, quản lý, thể chế và kỹ thuật cần thiết để quy hoạch, vận hành và quản lý tài nguyên nước. Nói một cách khác, *quản lý tài nguyên nước* có thể được coi là một quá trình, bao gồm tất cả các hoạt động quy hoạch, thiết kế, xây dựng và vận hành hệ thống tài nguyên nước.

Trong những năm gần đây, khái niệm *quản lý thống nhất và tổng hợp tài nguyên nước* đã được dùng. *Quản lý thống nhất và tổng hợp tài nguyên nước* xét đến: (i) tất cả các khía cạnh tự nhiên của tài nguyên nước; ii) những đối tượng quan tâm và các ngành liên quan; iii) sự thay đổi theo không gian của tài nguyên nước và nhu cầu dùng nước; iv) các khung chính sách liên quan (trở ngại và mục tiêu quốc gia); v) các cấp thể chế.

Tại sao phải quản lý thống nhất và tổng hợp tài nguyên nước ?

Để hoạt động quản lý tài nguyên nước có hiệu quả, cần phải thực hiện các nguyên tắc sau:

- Quản lý tài nguyên nước phải được tiến hành theo một cách thức tổng thể, nhất quán và bền vững để đáp ứng được các mục tiêu phát triển và bảo vệ môi trường.
- Quản lý tài nguyên nước cụ thể cần phải được phân cấp quản lý thích hợp theo gianh giới lưu vực.
- Các dịch vụ cấp nước cụ thể phải được giao cho các cơ quan tự chủ và có trách nhiệm của Nhà nước, tư nhân hay tổ chức tập thể thực hiện các dịch vụ cung cấp nước có định lượng trong một khu vực địa lý xác định cho khách hàng hoặc các thành viên trong tổ chức đó với một mức phí phù hợp.
- Sử dụng nước trong cộng đồng phải bền vững - có chế độ khuyến khích, kiểm tra, giám sát thường xuyên, giáo dục cộng đồng nâng

cao hiệu quả kinh tế, bảo vệ tài nguyên nước và bảo vệ môi trường với khung chính sách công khai.

- Tài nguyên nước dùng chung trong quốc gia và giữa các quốc gia phải được phân chia một cách hiệu quả đảm bảo có lợi ích của tất cả các hộ sử dụng nước ven sông.

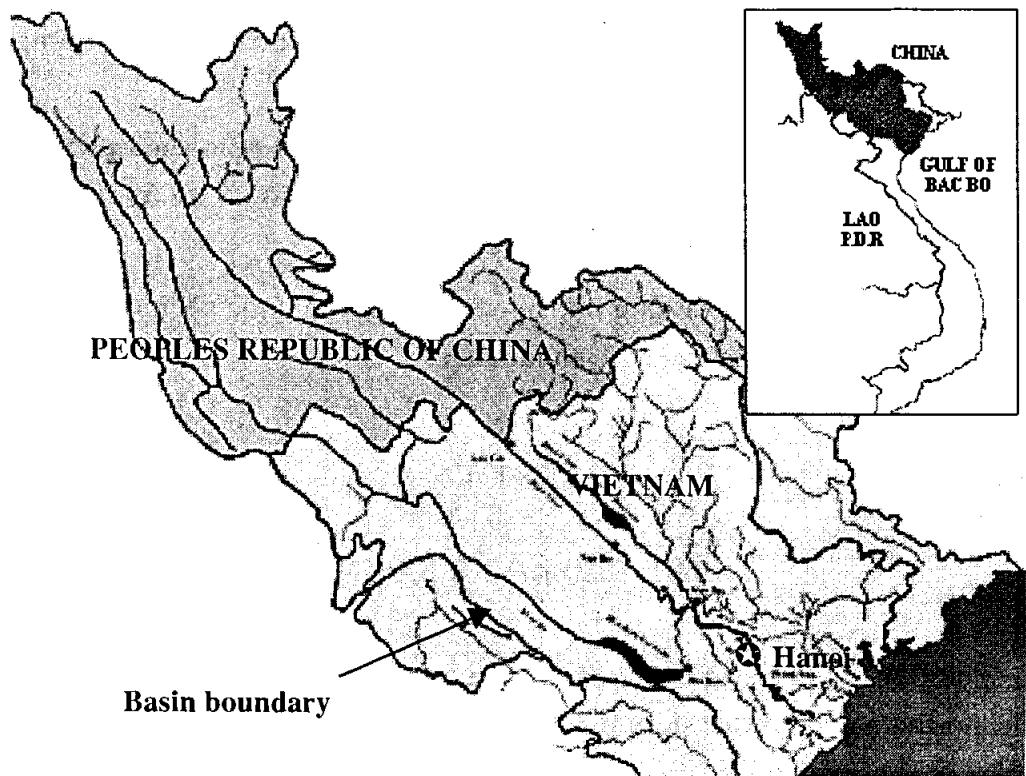
Quản lý thống nhất và tổng hợp nguồn tài nguyên nước sẽ là một công cụ hiệu quả để thực thi các nguyên tắc trên.

TEXT 4

THE RED RIVER BASIN

The Red River Basin is one of the largest in Vietnam and is located in the northern and northeastern part of the country (see Figure 1). The river rises in the mountains of Yunnan Province in the People's Republic of China (PRC) and flows through Vietnam to the Gulf of Bac Bo (part of the South China Sea) where it forms an extensive delta. Its total catchment area is 169,000 km², of which 48% lies in PRC and about 1% lies in the Lao PDR.

The climate of the basin is tropical to sub-tropical. It is dominated by the monsoon winds of eastern Asia. The mean annual rainfall varies from 1,200 mm to 4,800 mm. In the delta area the average rainfall is between 1,700 and 1,800 mm. There is a significant seasonal variation in rainfall. Only about 20% of the annual rainfall occurs in the dry season, November to April, with the remainder occurring in the rainy season of May to October. The annual discharge volume of the basin is around 130 billion m³, representing a mean discharge of about 3,600 m³/s. This accounts for about 16% of the total runoff for the whole country. The minimum recorded discharge is 370 m³/s, while the highest discharge recorded is 38,000 m³/s (in 1971).



About one third of the Vietnamese population lives in the Red River Basin-about 24 million people, 15 percent of whom live in urban areas. The average population density for the entire basin is about 280 persons/km². However, with almost 17 million people living in the delta, the Red River Delta is one of the most densely populated rural areas in the world - about 1,000 persons/km². A total GDP of \$2.8 billion in the delta represents more than 80 percent of that of the whole basin and 20 percent of the national total. However, because of the large population, average income is only about \$150. Agriculture accounts for about 35 percent of the basin's economy, industry for 24 percent and services for 41 percent. Crop production has been growing at about 9 percent per year for the past few years and the total cultivated area of the basin is now close to 2 million ha. There are about 80,000 hectares of land irrigated from 530 reservoirs and almost 570,000 hectares irrigated by pumping from the rivers. The Basin has an extensive water control infrastructure for water supply, irrigation, drainage, flood control and hydropower.

With its mountainous areas, the Basin has a large potential for hydropower generation. So far, two major hydropower projects have been constructed in the basin. Hoa Binh Dam on the Da River has a total storage capacity of 9.5 billion m³, an installed generating capacity of 1,920 MW and produces about 7.8 billion kWh annually. A smaller scheme, Thac Ba Dam on the Chay River, with an active storage capacity of 1.2 billion m³ and an installed generating capacity of 120 MW, produces about 0.4 billion kWh annually. Both are multipurpose reservoirs and besides hydropower contribute to flood control downstream. Hoa Binh, for example, is expected to reduce the peak flood level of the 1971 flood at Hanoi (the largest since hydrologic recording commenced) by 1.5 m (from 14.8 m to 13.3 m).

Floods are a major problem in the Red River Basin. In the delta, a comprehensive system of dykes, with a total length of about 3,000 km, has been established over a period of around one thousand years to protect the low lying land, its infrastructure and people. These dykes are deteriorating and require continual rehabilitation to maintain their effectiveness, resulting in high maintenance costs. In the mountainous areas of the basin, because of the steep terrain, flash flooding is common. Numerous towns in these areas suffer frequent and severe flooding, but despite the damage and disruption caused annually, it is not considered economically feasible to protect them.

LƯU VỰC SÔNG HỒNG

Nằm ở phía Bắc và Đông bắc của đất nước, lưu vực sông Hồng là một trong những lưu vực lớn nhất ở Việt Nam. Sông Hồng bắt nguồn từ tỉnh Vân Nam, Cộng hoà nhân dân Trung Hoa (PRC) chảy qua Việt Nam tới vùng biển Nam Trung Hoa tạo nên một đồng bằng rộng lớn. Tổng diện tích lưu vực là 169.000 km² trong đó 48% thuộc Cộng hoà nhân dân Trung Hoa và khoảng 1% thuộc Cộng hoà nhân dân Lào.

Khí hậu của lưu vực là nhiệt đới và cận nhiệt đới. Chủ yếu chịu tác động của gió mùa Đông Á. Lượng mưa trung bình hàng năm là từ 1.200mm đến 4.800mm, lượng mưa mùa biến động khá lớn, 80% lượng

mưa rơi vào mùa mưa từ tháng 5 đến tháng 10. Tổng lượng nước hàng năm của lưu vực vào khoảng 130 tỉ m³. Lưu lượng trung bình khoảng 3.600 m³/s.

Một phần ba dân số Việt Nam sống ở lưu vực sông Hồng - khoảng 24 triệu người, 15% số dân này cư trú tại các đô thị. Mật độ dân cư bình quân của toàn lưu vực là 280 người/km². Với gần 17 triệu người sống ở vùng chau thổ, Đồng bằng sông Hồng là một trong các khu vực nông thôn có mật độ dân cư cao nhất thế giới - khoảng 1.000 người/km². Tổng sản phẩm quốc nội GDP của khu vực Đồng bằng là 2,8 tỷ USD, chiếm 80% GDP của cả lưu vực hoặc 20% của cả nước. Do số dân đông, thu nhập bình quân đầu người mới chỉ là 150 USD/một năm. Nông nghiệp chiếm 35% sản lượng của nền kinh tế lưu vực, công nghiệp 24% và dịch vụ 41%. Sản lượng cây trồng trong vài năm gần đây tăng khoảng 9% một năm và tổng diện tích canh tác của toàn lưu vực hiện gần tới 2 triệu hecta. Khoảng 80.000 hecta đất được tưới tiêu từ 530 hồ chứa và gần 570.000 hecta được tưới bằng bơm nước sông. Lưu vực này có nhiều công trình hạ tầng cơ sở phục vụ cho các mục đích cấp nước, tưới tiêu, phòng chống lũ lụt và thủy điện.

Với một phần diện tích nằm ở vùng rừng núi, lưu vực sông Hồng có tiềm năng thủy điện khá lớn. Cho đến nay, đã có hai công trình thủy điện lớn được xây dựng trong lưu vực. Đập Hoà Bình trên sông Đà có dung tích chứa 9,5 tỷ m³, công suất phát điện 1.920 MW và sản lượng điện hàng năm khoảng 7,8 tỷ kWh. Công trình nhỏ hơn, đập Thác Bà trên sông Chảy, với dung tích chứa là 1,2 tỷ m³ và công suất phát điện 120 MW, sản xuất khoảng 0,4 tỷ kWh mỗi năm. Cả hai đều là các công trình đa mục tiêu và bên cạnh lợi ích thủy điện chúng còn góp phần điều tiết lũ cho vùng hạ lưu. Ví dụ, hồ Hoà Bình được thiết kế để giảm đỉnh lũ 1971 tại Hà Nội (đỉnh lũ cao nhất kể từ khi có công tác quan trắc thủy văn) tới 1,5 m (từ 14,8 m xuống còn 13,3 m).

Lũ lụt là một vấn đề lớn đối với lưu vực sông Hồng. Ở vùng đồng bằng chau thổ, hệ thống đê điều hoàn chỉnh với tổng chiều dài khoảng 3.000 km đã được hình thành và xây dựng qua hơn một nghìn năm để bảo vệ tài sản và con người sống ở vùng đất thấp này. Những tuyến đê này đang bị xuống cấp và đòi hỏi có sự tu bổ, cải tạo thường xuyên để bảo

đảm tính hiệu quả của chúng, dẫn đến chi phí duy tu bảo dưỡng cao. Ở khu vực miền núi của lưu vực, vì địa hình dốc, thường hay có lũ quét. Nhiều thị xã, thị trấn ở những khu vực này thường xuyên phải chịu các trận lũ nặng nề, nhưng kể cả khi có nhiều thiệt hại hàng năm, việc bảo vệ chúng thường không được xem là khả thi về mặt kinh tế.

I.2. SPECIFIC TOPICS

UNIT 8. APPLIED HYDRAULICS

1. Fluid Property

Applied hydraulics is concerned with the physical action and the interaction of particular masses of fluid in either the static or kinetic states. These actions and interactions are analyzed by attributing to the fluid certain physical properties each of which is defined to be the controlling property for a particular type of action. Viscosity plays an important role in the problem of hydraulic friction. Mass density is important in non-uniform flow. Unit weight is of concern in stratified flow. Surface tension is a factor in model experiments. Compressibility is a factor in water hammer. Vapor pressure is a factor in high velocity flow.

2. Friction Losses

Application of the Bernoulli equation requires a clear understanding of the factors which affect the head loss (HL). Head losses are commonly classified as boundary losses and form losses. Boundary losses are those arising from shear forces between the fluid and the boundary materials. In addition, cross-sectional shapes are significant to boundary losses because they affect the ratio of the flow area to the wetted perimeter. The effects associated with the cross-sectional shape of a uniform conduit are not classified as form losses. Form losses arise from recirculating eddies produced by the geometry of the containing vessel such as bends and either expanding or contracting, transitions.

Two types of flow must be considered: laminar flow in which the fluid may be envisioned as flowing in parallel layers and turbulent flow in which the particles are moving in all directions, causing a complete mixing of the fluid. The concept of laminar flow as moving in parallel layers is actually an artificial one which is useful as an aid to theoretical analyses-for engineering practice, conditions of turbulent flow are encountered more frequently than those of laminar flow. As will be shown elsewhere in this section, different laws govern the two types of flow. The principles and equations of fluid resistance, as developed by Chezy, Manning, Kutter, Darcy-Weisbach, and Hazen and Williams, apply to turbulent-flow conditions.

3. Hydraulic Transient

Hydraulic transients consist of pressure disturbances within closed conduit systems when the system undergoes a change from one operational steady-state condition to another. The disturbances are initiated by the application of a definite action and are dissipated during the flow-transition period to the successive steady state by some forms of damping within the system. In the case of hydro-electric or water-supply project, hydraulic transients are usually initiated by an adjustment in the setting of a control valve or the change in operation of hydromachinery such as turbines or pumps. The damping of pressure transients during the transition to the second steady-state flow condition is achieved when system energy loss occurs in the form of conduit friction or minor losses.

Consideration of the unsteady-flow phenomenon in closed-conduit water conveyance systems is essential for the determination of system design pressures and the establishment of operational procedures for achieving the desired project performance. Underestimation of the effects of hydraulic transient has resulted in system instabilities which either have placed severe operational constraints on the project or have resulted in system failure, causing excessive damage.

The hydraulic design engineer is mainly concerned with identifying how the unsteady-flow phenomenon is initiated and what governs the degree of the resulting pressure fluctuations. The engineer must be

familiar with the theory of hydraulic transients and the development of basic water-hammer equation from the equations of continuity, motion, and wave speed. From these equations a method of analysis must be developed by which studies can be made to determine the response of the system to transient flow conditions. Hydraulic transients analyses are routinely made to establish operational procedures, identify pressure control device requirements, and determine system design pressures.

TERMINOLOGIES

- Fluid (n) : Chất lỏng
- Applied hydraulics : Thủy lực ứng dụng
- Viscosity (n) : Độ nhớt
- Hydraulic friction : Ma sát thủy lực
- Fiction loss : Tổn thất ma sát
- Head loss : Tổn thất đầu nước
- Boundary loss : Tổn thất biên
- Form loss : Tổn thất do hình dạng
- Laminar flow : Dòng chảy tầng
- Turbulent flow : Dòng chảy rối
- Unsteady flow : Dòng chảy không ổn định

UNIT 9. THE SCIENCE OF STRENGTH OF MATERIALS

In designing structures and machines, an engineer has to select the material and the cross-sectional area of each element of the structure or machine so that it enables the element to have strength to resist external forces transmitted to it by adjacent elements of the structure without failure of strength or distortion of shape, i.e. the element should function properly. Strength of materials provides the engineer with fundamentals for a proper solution of this problem.

Strength of materials deals with the behaviour of various materials under the action of external forces and points out how to select the appropriate material and the cross-sectional area of each element of the structure so as to provide fully reliable functioning and the most economic design.

Sometimes, strength of materials has to deal with the problem in a modified form-to check the dimensions of a designed or existing structure.

The conditions for maximum economy in design and reliability of functioning are contradictory. The former demand minimum consumption of materials whereas the latter lead to increase in consumption. This contradiction forms the basis of the technique, which has facilitated the development of strength of materials.

Often the existing methods of checking the strength and available materials are unable to meet the practical requirements for providing answers to new problems (for example, attaining high speeds in engineering in general and in aerostatics in particular, long-span structures, dynamic stability, etc). This initiates a search for new materials and study of their properties, and inspires research for improving the existing methods of designing and devising the new ones. Strength of materials must keep pace with the general development of engineering and technology.

Sometimes, besides the chief requirements of maximum reliability and economy, an engineer has to ensure fulfilment of other conditions too, such as quick building (when restoring broken structures), minimum weight (in aircraft design), etc. These conditions influence the dimensions, the shape and the material of the various elements comprising the structure.

The emergence of strength of materials as a separate science dates back to 1638 and is intimately connected with the works of Galileo Galilei, the great Italian scientist. Galileo was a professor of mathematics at Padua. He lived in a period which saw the disintegration of the feudal system, the development of trade capital and international maritime transport, and the birth of mining and metallurgical industries.

The rapid economic developments of those times called for speedy solutions of new technological problems. Increase in international maritime trade perpetuated the need for bigger ships which in turn entailed changes in their design; at the same time it became necessary to reconstruct the existing and to build new internal waterways, including canals and sluices. These new technical problems could not be solved by simply copying the existing designs of ships; it became necessary to judge the strength of elements keeping in mind their size and the forces acting upon them.

Galileo devoted a considerable part of his work to the study of the dependence between the dimensions of beams and bars and the loads they could withstand. He pointed out that the results of his experiments may prove very useful in building big ships, especially in strengthening the deck and covering because low weight is very important in structures of this type. Galileo's works have been published in his book: Discorsi Dimostrazioni Matematiche ... ("Dialogue on Two New Sciences...") (1638, Leiden, Holland).

Further development of strength of materials went on in step with the progress of mechanical and civil engineering, and materialized owing to the research work done by a large number of eminent scientists, mathematicians, physicists and engineers.

TERMINOLOGIES

- Strength of materials : Sức bền vật liệu (Resistance of)
- Cross-sectional area : Diện tích mặt cắt ngang
- External forces : Ngoại lực
- Reliability : Độ tin cậy
- Checking the strength : Kiểm tra cường độ
- Long-span structure : Kết cấu nhịp lớn
- Dynamic stability : Ổn định động học
- Civil engineering : Xây dựng dân dụng
- Mining industry : Công nghiệp mỏ
- Aircraft design : Thiết kế máy bay

QUESTIONS

- 1) What is the science of strength of materials ?
- 2) What are the problems of designing and checking the strength of constructions ?
- 3) What conditions influence the dimensions, shape and material of the structural elements ?
- 4) Who has devoted a considerable part of his life to the development of the science of strength of materials ?
- 5) Who has made a great contribution to the progress of mechanical and civil engineering ?

UNIT 10. NATURE OF REINFORCED CONCRETE

Reinforced concrete is a complicated structural material consisting of concrete and steel bars combined in a rational way for joint behaviour in a member.

The main idea in the formation of reinforced concrete is to use the concrete to resist compression but its tensile strength is very low. A plain concrete beam (without reinforcement) resting on two supports, and subjected in bending to tension below the neutral plane and to compression above it (Fig. 1a), has a very low load-carrying capacity, limited by the low resistance of the concrete to tension. In such a beam the high-compressive strength of the concrete is not utilized.

Reinforced concrete members with reinforcement in the tension zone, giving them a tensile strength many times greater than that of plain concrete, possess a significantly higher load-carrying capacity. For example, a reinforced concrete beam (Fig. 1b) in which the tensile stresses are resisted by reinforcement distributed in the lower part may have a load-carrying capacity nearly 20 times greater than that of a plain concrete beam of the same dimensions.

Other reinforced concrete members resisting compression such as columns (Fig. 1c), are also reinforced with steel bars. Since steel has high resistance both to tension and compression, the introduction of a small amount of reinforcement increases the load-carrying capacity of the compression member.

Thus, by combining concrete and steel for joint work qualitatively new material, reinforced concrete, is created whose sphere of application is broadening without limit.

The basis of the joint behaviour of concrete and steel is the advantageous natural combination of several important physical and mechanical properties of the two materials.

1. Concrete on hardening forms a strong bond with the steel reinforcement, and in a reinforced concrete member under load both materials are strained or deformed together.

2. Dense concrete (with an adequate cement content) protects the steel in it against corrosion and the direct action of fire.

3. Steel and concrete have coefficients of linear expansion with very close values -0.00001 -0.000015 per deg.C for concrete and 0.000012 for steel - and so under changes in temperature not exceeding 100°C no noticeable initial stresses appear in the materials, and no harmful strains involving slipping of the reinforcement in the concrete are observed.

Reinforced concrete has found wide application in building because of such positive attributes as durability, fire-resistance, weathering resistance, high resistance to static and dynamic loads, the possibility of using local raw materials in preparation of the concrete (crushed stone, sand), and the low maintenance costs of buildings and structures.

Compared with other building materials, reinforced concrete is distinguished for its very long service life. With proper service conditions, reinforced concrete members can last an indefinite time without reduction of their load-carrying capacity. This arises from the fact that the strength of the concrete does not decrease with time but, on the contrary, increase, and the steel embedded in it is protected against corrosion.

In considering the fire resistance of reinforced concrete it may be noted that at an ambient temperature of around 1000°C it will take an hour to heat reinforcement covered by a layer of concrete 2.5 centimetres thick to about 500°C.

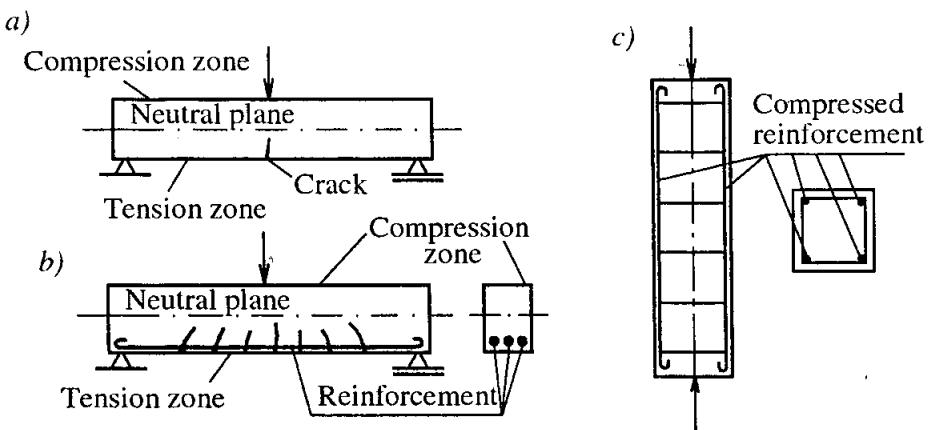


Fig. 1. Plain and reinforced concrete

Experience has shown that in fires of average intensity lasting several hours, reinforced concrete structures with the necessary protective coating of concrete sustain only surface damage, but are not destroyed.

The wide distribution of sand and gravel, which are used in great quantities in mixing concrete, make reinforced concrete available for use almost everywhere.

A special feature of the behaviour of reinforced concrete structures under load is the possibility of crack formation in the tension zone of the concrete. The opening of such cracks under service loads is so insignificant in many kinds of members, however, that it does not hinder their normal use.

Where it is necessary to prevent the formation of cracks or to limit their width, the concrete is subjected to intensive preliminary compression, generally by tensioning the reinforcement, before application of the external load. Concrete made in this way is called prestressed.

The drawback of the relatively high weight of reinforced concrete has been eliminated to a great extent by the introduction of thin-walled and

hollow members made from high strength prestressed concrete, and of reinforced concrete made with lightweight aggregates.

The high sound transmission and heat conductivity of reinforced concrete sometimes requires additional outlay on the provision of sound and heat insulation.

The complications in the casting of reinforced concrete, linked with the need to keep components in forms until the concrete acquires the appropriate strength, have largely been eliminated with the introduction of mechanized industrial production and the employment of hig' strength concrete made from high-early-strength cements.

Because its merits essentially outweigh its shortcomings, reinforced concrete is widely used in building and civil engineering.

TERMINOLOGIES

- Nature	: Bả ⁿ chất
- Reinforced concrete	: Bê tông cốt thép
- Compression - tension	: Nén - kéo
- Reinforcement	: Cốt thép
- Resistance	: Sức chịu, khả năng, cường độ
- Support	: Gối tựa
- Tension zone	: Vùng chịu nén
- Load-carrying capacity	: Khả năng chịu lực
- Hardening	: Cứng hóa, đông cứng
- Corrosion	: Xâm thực, ăn mòn
- Coefficients of linear expansion	: Hệ số giãn nở tuyến tính
- Service life	: Thời gian sử dụng
- Prestressed concrete	: Bê tông ứng lực trước
- Heat conductivity	: Dẫn nhiệt

QUESTIONS

1. What is reinforced concrete ?
2. What beams among plain concrete and reinforced beams have higher load carrying capacities if they have the same dimensions ?
3. Why can concrete and steel combine in a structural member ?
4. Why has reinforced concrete found wide application in building ?
5. What is prestressed concrete ?

UNIT 11. THE SOIL

All our food comes from the soil. Some of us eat meat, of course but animals live on plants. If there were no plants, we should have no animals and no meat. So the soil is necessary for life.

The top of the ground is usually covered with grass or other plants. There may be dead plants and dead leaves on the grass. Plants grow in soil which has a dark colour. This dark soil is humus.

Humus contains materials taken from dead plants and the waste matter from animals also falls on it. This gives it its colour. The soil under the humus is not dark. This lighter soil is rather like sand; it is made of bits of rock.

Heat makes rocks, like other things, expand, and cold makes them contract. They expand and contract in summer and winter, on hot days and cold days; so they are often broken. Bits fall off. Sometimes, too, rain-water runs into space in a bit of rock. Then, on a cold day, the water freezes. When water freezes, it expands. This is a strange fact, but it is a fact. The ice takes up more space than water, and this may also break the rock.

The roots of trees sometimes grow into the spaces in rocks, and as they grow they press the rock apart like ice. This pressure breaks the rock too.

The bits of rock lie on the ground, or under it, and they form a kind of soil; but it is very bad soil. Dead plants and waste material from animals

make it better, and slowly change it into humus; but this takes a long time. Then the humus has been formed, plants can grow well in it.

All soil needs food. If we do not give it any, the plants will be weak. Animal waste is the best food for the soil; but chemical fertilizers are also very useful. The same crop ought not to be grown in the same place every year; it is better to have a different crop. A change of crop and the use of a good fertilizer will keep the land in good condition.

When the soil is dry, the wind blows it away. Some of the humus is lost; and if this continues the land will soon look like a desert. The farmer ought to prevent this. He can grow trees near his fields. These will stop the force of the wind, and then it can not blow the humus away.

Sometimes after heavy rain, the water carries the humus down to the river. This often happens if the field is on the side of hill. The water rushes down the hill and the river carries the humus away to the sea. The farmer can not make any more humus quickly, but he can prevent this if he makes his fields level. He can make the side of the hill like the stairs of a big house. Then the water will not rush down to the river and the humus will stay in its place.

It takes hundreds of years to make humus, and so we ought to save every bit of it. We need more and more food. About 200 babies are born every minute. Of course, some people die; but every day there are 120,000 more people than there were on the day before. There are about 4,000 million people in the world now. At the end of the century there will be about 7,000 million. Where will the other 3,000 million grow their food ?

PHRASES AND WORDS

- Humus : Đất mùn
- Expand : Nở ra
- Contract : Co lại
- Fertilizer : Phân hóa học
- Desert (Desertification) : Sa mạc (sa mạc hóa)
- Stair field : Ruộng bậc thang
- Waste matter : Chất thải

QUESTIONS

- 1) What is the relationship between the human body, animals, plants and soil ?
- 2) How does the rock change into soil ?
- 3) How can the farmers prevent the process of desertification ?
- 4) How can we solve the problem of population expansion ?

UNIT 12. **QUALITY OF WATER**

With the rapid growth of the demand of water, there is corresponding insistence of a higher standard of quality of water. Many various industrial processes are causing pollution of natural water.

In general two standards are laid down, a higher one for domestic use and a lower one for industrial use. Water for domestic use must be free not only from impurities but also it must be free from any odour, in addition it should be palatable, since even a small trace of salt will make it unacceptable. The regulation for industrial water are, on other hand not so severe as for domestic water, water for industrial use must be suitable for the special process involved.

As regards, water for agriculture purpose no regulations have been laid down. However, water must not contain objectionable salts, solids and other substance, either dissolved or suspended in excess of certain limit.

It may be added that quality of water is an important element in the brewing and distilling industry, not only because of considerations of health but because the very quality of the final products depends considerably on the water used in the process.

Indeed some beverages have become famous largely because of the quality of the local water used in processing.

Few people realized the extent of underground contamination or its adverse impact on ground water until recently. In the past, many believed nature provided much better protection for ground water quality than it actually does.

With over a million carcinogenic and toxic organic chemicals in existence and several thousand synthetic ones being developed each year, natural ability to protect our water sources is more fantasy than fact. The effects on ground water through leaking industrial lagoons, septic tanks and agricultural chemicals can be long lasting and devastating.

Contamination of ground water is more serious than surface water pollution because it is more difficult to detect in a timely manner, and it moves more slowly and requires special expertise to predict the path and rate of contamination movement. In addition the complex geochemical reactions taking place in the subsurface between myriad contaminants and earth materials are not well understood, and thus the ability to predict the concentration of a contaminant at any point is limited.

Ideally, contamination should be prevented from occurring; successful prevention means that potential contaminants must be controlled so they can not react with the ground water system. Land-use planning is a major form of prevention in which the producers of hazardous wastes are kept away from areas overlying ground water resources so that in the event of an accidental spill little damage will occur.

TERMINOLOGIES

- Domestic use : (nước) Dùng cho sinh hoạt
- Industrial use : (nước) Dùng cho công nghiệp
- Brewing and distilling : Công nghiệp sản xuất rượu bia
- Contamination : Nhiễm bẩn, vật nhiễm bẩn
- Toxic organic chemical : Chất hữu cơ độc hại
- Carcinogenic : Chất gây ung thư
- Devastation (-ing) : Sự tàn phá
- Lagoon : Vũng nước mặn, hồ mặn
- Special expertise : Biện pháp chuyên môn đặc biệt

QUESTIONS

- 1) What are two basic standards of water quality ?
- 2) What are the requirements of water for agriculture purpose?
- 3) What is the better source of water for domestic use ?
- 4) What are the measures for the protection of water from pollution ?

UNIT 13. WATER SUPPLY- A GROWING PROBLEM

Our need for water is constantly increasing. There is an automatic increase due to population growth, while the overall improvement of living standards, the fight against hunger through the irrigation of more land for food growing, and the creation and expansion of new industries, all foretell the need for even greater water supplies throughout the world. Though it is difficult to calculate the exact amount, it is safe to say that in 20 years' time the demand for water will be roughly double. Faced with such a situation it is obvious that we should search as widely as possible and with every available means for sources of fresh water that seem to be the least costly. But where do these sources exist? Only a sustained and co-ordinated programme of scientific observation and research in hydrology will tell us the answer. This is the purpose of the International Hydrological Decade.

Underground water reserves are much larger than those on the surface, but as they are unseen we tend to underestimate them. It is vitally important that we make use of these underground reserves, but never haphazardly. For example, where does the water come from which we find in one or another of the underground water-bearing layers (aquifers) ?

How does it move ? How is it renewed ? And if this water is used, what effect will it have on the discharge and future level of the water table ? What are the laws of hydro-geology ?

Despite the immense progress of recent years, all these questions have still not been fully answered.

A similar need for scientific research exists in the branch of hydrology that deals with the quality of water. In nature, there is no water like the pure water defined by chemists, made up of only hydrogen and oxygen. River water, ground water, and even rainwater always contain other dissolved or suspended elements, and these, even when present in small quantities, play an important role. In the case of irrigation farming, for instance, every drop of water brings with it a little salt : the water evaporates, but the salt remains and gradually poisons the soil and plants. In general, we know how to remedy this problem of salinity with the help of leaching and drainage.

But many questions remain unanswered regarding the effect of irrigation and drainage on the quality of ground water and the possibility of maintaining the ground-water level below the zone of the plant roots while bringing to the surface the water necessary for irrigation.

Evaporation from the soil and transpiration from vegetation are responsible for the direct return to the atmosphere of more than half the water which falls on the land. How exactly do these phenomena work ? What part does a forest play in the water balance-sheet of a given area ? Does it act merely as a water-consuming mechanism operating through the absorption and transpiration of the trees - thereby reducing the quantity of runoff which reaches the rivers - or, on the contrary, does it result in a slow seepage into the earth which can later be recovered in the form of ground water while at the same time preventing erosion ?

These are the kinds of problems which still have to be resolved : the answers will only be found through a vast programme of scientific research.

TERMINOLOGIES

- | | |
|-------------------------------------|----------------------------|
| - Living standard | : Mức sống |
| - International Hydrological Decade | : Thập kỉ thủy văn quốc tế |
| - Haphazardly | : Ngẫu nhiên, tình cờ |
| - Water-bearing layer | : Tầng chứa nước (Aquifer) |
| - Level of water table | : Mực nước ngầm |

- | | |
|-------------------------|------------------------------|
| - Leaching and drainage | : Thau chua, rửa mặn và tiêu |
| - Preventing erosion | : Chống xói mòn |

QUESTIONS

- 1) Why is our need for water constantly increasing ?
- 2) What is the purpose of the international hydro... decade ?
- 3) What is the role of ground water in the water supply ?
- 4) What measure can be applied for the reclamation of saline soil ?
- 5) What is the effect of the forest on the water balance ?

UNIT 14. WEATHER PREDICTION

In many cities and large towns there are weather observatories suitably situated. The local observatory is probably familiar to most geography students. Here scientists make observations and collect and classify facts about the weather either recorded by special instruments which can also observe more accurately than any human eye.

Weather scientists, or weather men as they are often called, are not only interested in recording features of the weather at the time when they occur. They are also interested in future occurrences, for example in tomorrow's rain and next week's sunshine. It is their job not only to observe and describe the weather but to predict it. They must tell people what kind of weather to expect in the future.

It is obviously important to a farmer, a fisherman, an airplane pilot, and a ship's captain to know what the weather will be like. Unless they know what weather to expect, they can not plan their activities of operation. A farmer waits for the weather to improve before he sows his grain. An airplane pilot may wait for the weather to improve before he climbs into his plane and begins his journey. The meaning of the word "improve" may of course differ for the farmer and the pilot. For the farmer, better weather may mean wetter weather and for the pilot better weather may mean drier weather.

But farmers, pilots and captains are not the only people who are interested in the weather. Almost everyone at some time listens to weather reports on the radio. Outdoor games cannot be played unless the weather is suitable. Housewives listen to the weather predictions or weather forecasts and wait for the weather to improve before they wash a lot of clothes. Businessmen driving to work or driving home after office hours need information about the surfaces of the roads and any other information which will enable them to avoid accidents. Even school children may want to know if it will be warm enough to go out without a coat.

How can scientific workers predict rain or sunshine, cold weather or hot weather ? They keep records of a very large number of occurrences rainfall, clouds of various kinds, winds, temperatures. They observe the exact time and place of each occurrence and also the order and connection of the occurrences. They observe how weather changes, how clouds and winds travel from one place to another, how a cold front displaces a warm front. These facts enable them to form a map or chart of the weather.

It is true that a weatherman does not always predict correctly. The estimates of future occurrence are often slightly inaccurate and sometimes completely wrong. This is not because he is careless or irresponsible but because the weather at particular place and time is not the result of a simple cause but the result of several causes operating together. For this reason future weather events cannot be predicted without some errors. The weatherman is never in a position know all the facts or all their possible patterns.

TERMINOLOGIES

- | | |
|-------------------------------------|-------------------------------------|
| - Weather observatory | : Đài khí tượng |
| - Weather forecast | : Dự báo thời tiết |
| - Cold front and warm front | : Frôn nóng và frôn lạnh |
| - To avoid accidents | : Tránh tai nạn |
| - Several causes operating together | : Một vài nguyên nhân cùng tác dụng |

- | | |
|--------------------|---------------------|
| - Possible pattern | : Mẫu có thể xảy ra |
| - Record | : Bản ghi (số liệu) |

QUESTION

- 1) What do the scientists do at the observatories ?
- 2) What is the importance of weather predicting ?
- 3) How can the scientists predict the future weather ?
- 4) Do you believe in the weather forecasts ?

UNIT 15. POLLUTION

To maintain his standards of living, 20th century man employs technology to produce an enormous variety of goods and services. Technology needs energy and matter. But energy and matter can be neither created nor destroyed, only transformed. And since everything must go somewhere, the transformations which are part of production processes cause pollution in some forms or other - this is unavoidable. So talk of "cleaning up the environment" and "pollution-free" cars, products or industries is a scientific impossibility.

For example, we can collect particulates (such as smoke, dust or soot) from factory chimneys by means of filters, but these solid wastes will then contaminate our water or soil.

Similarly, we can collect rubbish, and remove solid wastes from sewage, but they must then be either burned (causing air pollution), dumped into our rivers, lakes and oceans (water pollution), or deposited on the land (soil pollution, and water pollution if they run away).

Another example is air pollution from cars. We can reduce air pollution from petrol and diesel-propelled cars by changing over to electric cars. But electric cars would need to have their batteries recharged almost every night, and so we should need to increase the number of power plants to generate the extra electricity required. And an increase in the number of power plants that use fossil fuels would result

in increased air pollution (from sulphur oxides, nitrogen oxide and smoke), increased water pollution (from heat), and increased land pollution (from mining). We can shift to nuclear power, which is not dependent on fossil fuels. But nuclear power increases thermal pollution of the water, and adds the danger of releasing radioactive substances into the environment.

From these examples it can be seen that pollution elimination is impossible. Instead, our aim must be pollution reduction and control. One means of doing this is to make the best possible use of technology. In fact, technology is essential in keeping pollution below the danger level. However, pollution control alone is not enough. It must be accompanied by population control, and control over production and consumption. The reason is that there is no point in controlling pollution without at the same time stabilising world population, production of goods, and consumption of materials. But if we tackle all these matters at the same time, pollution control is possible.

Time is running out, however. Everything must go somewhere, and so pollution is beginning to have serious effects. Already many of the world's rivers and lakes are devoid of marine life - killed by industrial waste. Already the amount of lead in the bodies of people living in urban areas is dangerously high, because of car exhaust gases. Already the hearing of millions of factory workers is irreparably damaged, as a result of industrial noise. Everything must go somewhere. But it is for man to decide how much pollution he creates, what form it takes, and where it goes.

TERMINOLOGIES

- | | |
|--------------------------|---|
| - Pollution | : Ô nhiễm |
| - Environment | : Môi trường |
| - Rechargeable batteries | : Pin (ắc quy, nguồn điện) xác lại được |
| - Radioactive substance | : Chất phóng xạ |
| - Car exhaust gas | : Khí thải từ xe ô tô |

QUESTIONS

- 1) What causes the pollution of air, soil and water in the production process ?
- 2) Which solution of the new cars will be instead of petrol and diesel-propelled cars ?
- 3) Which wastes from power plants cause environmental pollution ?
- 4) Talk about the role of water resources in the global problem of environmental protection ?

UNIT 16. IRRIGATION HISTORY

In some countries in which there is very little rain at any time, the farmers have to irrigate their fields. Irrigation is easy enough if there is a great river near the crops and if there is plenty of water in it. Canals carry the river water to the fields when necessary. In some seasons there may be too much water in river and the water may flood all the land near it. All other times the river water may not be enough for all the farmers, and then it will be difficult to irrigate the fields.

To prevent these difficulties, a dam may be built across the river. This will store water for dry seasons, and in wet seasons it will prevent the flooding of the land. A great lake will, no doubt, be formed and this may mean that houses and fields will be covered with water. Most people will accept that and will be ready to move to other places. Then the country can have the right amount of water at all times, more crops will be grown, there will be more food for everyone and there will be no more floods.

Dams have been built for centuries in different part of the world. Modern dams are usually built of concrete, but earth dams were used in India about 2,500 years ago. There was another across the River Tigris very long ago, and large numbers of irrigation canals was made in Iraq to

irrigate the land. The Romans were great dam-builders and there was also famous dam at Ma'rib in Arabia.

The Ma'rib dam was a great piece of engineering but it was less famous than the Pyramids of Egypt because it was hard to reach. If Greek travellers had crossed the desert and had seen it, they would, no doubt have included it among the wonders of the world. But there is not much of it to be seen now, the pyramids have lasted longer.

Some great modern dams have been built in Africa. Kariba dam is one example. No doubt many other dams will be built in the future, but in some places there are no rivers to dam.

We cannot use sea water for irrigation, the salt will not allow the crops to grow. Fresh water is always needed, and it is very difficult and costly to make fresh water from sea water. This is done in a few countries, but the fresh water is for drinking. There is not enough at present for irrigation.

Perhaps a scientist will one day invent a cheaper way of producing fresh water from the sea. If fresh water could be made cheaply, we could grow more food. The world needs a machine to do this, and anyone who invents it will soon be a rich man.

TERMINOLOGIES

- Dam-builder : Người xây dựng đập
- Wonders of the world : Kỳ quan thế giới
- Fresh water : Nước ngọt
- Sea water : Nước biển

QUESTIONS

- 1) What happens when the dam is built across the river ?
- 2) How long have dams been built in different part of the world ?
- 3) Why can't we use sea water to irrigate the crops ?
- 4) Do you know the technology of producing fresh water from the sea ?

UNIT 17. METHODS AND STRUCTURES OF IRRIGATION

There are four methods of applying water:

1. By flood, thus wetting all the land surface;
2. By furrows, thus wetting only part of the ground surface;
3. By sprinkling, in which the soil is wetted with spray;
4. By sub-irrigation, in which the soil is wetted only a little, but in which the subsoil is saturated.

The first three methods come under the general heading of surface irrigation.

Flood irrigation generally requires large streams or canals, gentle topography (ground slopes should usually be no greater than three percent) and careful levelling of the land. In theory, it should be possible to ensure that every part of the area to be irrigated absorbs the predetermined amount of water but in practice, although some parts usually receive too much. For this reason, flood irrigation is more suited to close-growing crops like rice.

Furrow irrigation is a method by which water runs in furrows, normally made by cultivating between crop rows. The earth is thrown up into ridges between the furrows and the seed are planted in the centre of the ridges. Furrow irrigation is very common because it is adaptable to a great variety of land slopes and soil textures and can be used with either large or small streams of irrigation water.

Structures on irrigation projects include dams, canals, spillways, desilting works, intakes, pumping stations, tunnels pipelines, inverted siphons, chutes, drop, checks, turnouts, measuring devices, wasteways, culverts, overchutes, drainage systems, and other features peculiar to the project.

Dams vary from low diversion weirs to high storage structures. Distribution channels vary from small farm ditches where the flow can be

controlled by movable canvas barriers, to huge supply canals carrying several thousand cfs.

The Marala Ravi canal in West Pakistan has a maximum capacity of 22,000 cfs. In United States, some sections of the All-American Canal, built to carry water to Imperial Valley, Southern California, have a bottom width of 160 ft, a permissible flow depth of 22 ft, and a capacity of 15,000 cfs. Other irrigation structures vary almost as widely.

Hydraulic features of reservoirs, dams, spillways, tunnels, canals, and other major structures are described in other sections.

TERMINOLOGIES

- Flood irrigation : Tưới ngập
- Furrow irrigation : Tưới dài
- Sprinkling irrigation : Tưới phun mưa
- Subirrigation : Tưới nhỏ
- Inverted siphon : Xi phông ngược
- Measuring devices : Công trình đo nước
- ft (foot-feet) : Đơn vị đo bằng 0,3048 mét
- cfs (cubic foot per second) : (Đơn vị đo)

QUESTIONS

- 1) How many methods are there in the supply of water for irrigation ?
- 2) Which structures are necessary for irrigation systems ?
- 3) How can the flow be controlled on the distribution channel ?

UNIT 18. TECHNOLOGY OF THE COASTAL LAND RECLAMATION

Coastal land reclamation is a traditional form of agricultural development in our country. The sea-dyke embankment and land expansion toward the sea are processes happening always at the estuary regions and forming newly-reclaimed areas, which have good conditions

for economic development (agriculture, aquaculture and breeding of sea-products).

The basic characteristics related to the agriculture exploitation of newly-land region may be generally described as follows :

- Land elevation is low and effected strongly by sea water and saline ground water.
- Soil is salted seriously and drainability of soil is very weak.
- Insufficiency of fresh water, especially in winter crop.

In such complicated natural conditions it must be a general measure of land reclamation with high efficiency including adapt ability based on the water engineering measure for objective of long-term reclamation with combination of partial reclamation and exploitation.

History of coastal land reclamation, expansion of cultivated land in the North delta regions and corresponding studies have confirmed a reasonable technology as follows:

Six-step technology of exploitation guarantees the optimal transformation from newly-reclaimed region to stable agricultural production region.

- First step : Isolating the effect of external salinity by a system of sea dykes and drainage canals (with depth over 1.5m); isolating partly effect of external saline ground water to exploitable region. The saline ground water in the region is drained to a definite place. This is first step and not ignorable.

- Second step : "Dilution".

Dilution is reclamation measure at the first stage of the saline-soil region. Rain and tide water are used for active leaching in wet season and for planting trees on the saline soil in dry season. If surface-water drainage is improved, the "Dilution" will last from 1 to 3 years, then the diluted land can be cultivated as a rice field with low productivity. In this step, the soil is still ploughing but not cultivating. Rain water and fresh tide are used to dilute salinity in soil and drain out when falling tide. Rush and sedge are often planted for saline absorption.

- Third step : Agricultural exploitation at low level (planting autumn paddy rice) is combined with leaching and land reclamation. If the water drainage is carried out intensively and fresh tide is more supplied, this step often lasts about 3 years and then.

- Fourth step can be implemented: Planting autumn paddy rice with stable, high productivity and summer paddy rice with unsteady, low productivity.

- After implementing fourth step, the soil is gradually diluted and productivity of summer paddy crop will be increased and stabilized.

- Finally, three crops per year will be cultivated with high, stable productivity (step 6).

The process of expansion to the sea and land reclamation according to above-mentioned technology may be last from 10 to 20 years.

With water engineering investment (fresh water supply in summer-autumn crops and leaching water is actively drainaged in autumn crop), the better to manage and exploit water engineering system, the shorter process of reclamation will be.

In sum, basic technical measure for reclamation of newly-expanded land is rice planting with intensive water drainage at the first stage in order to leach saline soil.

The highly-adaptable exploitation of coastal land can be displayed as the reasonable selection of plants, taking advantage of tide and economic factors when combining the long-term surface leaching and the limited seepage leaching in the natural condition of North coastal regions.

TERMINOLOGIES

- | | |
|---|--------------------------|
| - Land reclamation | : Cải tạo đất |
| - Newly-reclaimed area | : Vùng đất mới cải tạo |
| - Breeding of sea products | : Nuôi trồng hải sản |
| - Dilution | : "Dã mặn", sự pha loãng |
| - Rush, sedge | : Cói, lau lách |
| - Expansion toward the sea
(encroachment toward the sea) | : Lấn biển |

QUESTIONS

- 1) What are the characteristics of a newly-reclaimed area in the process of agriculture exploitation?
- 2) How many steps are there in the technology of coastal land reclamation?
- 3) What is "dilution" process? and how long will it last?
- 4) Which plants are often planted for the purpose of saline absorption?
- 5) How many crops can be cultivated on the reclaimed land after completion of the reclamation process?

UNIT 19. PUMPING AND DEWATERING EQUIPMENT

Pump is the basic tool in the operation of a water handling system on any construction project. The water needs that are commonly felt on such a project may be for supply of water for human consumption and for process work, such as for washing, curing, jetting etc. Besides, equipment is also needed for drainage and dewatering. This equipment quite often plays a prominent part in the successful completion of a construction project.

A pump is a device which transfers the mechanical energy supplied from an external source to the liquid flowing through the machine. This liquid may be water, oil, spirit, milk, sludge etc. In construction work we are principally concerned with water as the liquid, though it may be pure water or dirty water with suspended matter. A battery of pumps installed at a large pumping station is electric motor.

Pumps have a large variety of types and makes. However on the basis of working principle all these types fall under one of the following two classes : (i) Positive displacement pumps, and (ii) rotodynamic pumps.

The positive displacement pumps may be of the reciprocating type or of the rotary type. The operating force in these pumps is applied directly to the liquid, thereby increasing the energy of the liquid. In the reciprocating pump the pump chamber is alternately filled with and

emptied of the liquid which is pumped. The rotary type, though it resembles the rotodynamic pump in appearance and embodies the rotation of the impeller as against the forward and backward movement of the piston of the reciprocating type, is essentially a positive displacement pump. It gives characteristics which are in some respects midway between those of reciprocating and centrifugal types. In both, the reciprocating and the rotary types, the discharge of liquid depends almost entirely on speed of rotation and little, if at all, upon the pressure developed. Rotary pumps have little direct application in pumping water on construction jobs and are widely used for transfer of oils, hydraulic power transmission, pressure lubrication, paint spraying, machine tool coolant circulation, etc.

The rotodynamic pumps employ a rotor moving in a liquid in the casing. The movement of the rotor imparts high velocity to the liquid which is then discharged due to its centrifugal force. The force applied to the liquid generates acceleration in a direction at right angles to the general direction of flow. There is a constant flow of liquid from the pump unlike in the reciprocating type where the flow is usually pulsating or intermittent.

The above classification is based upon the operating principles of the pumps and not upon the service for which the pumps are intended. Quite often pumps are designed and constructed for specific jobs. While selecting such a pump it is essential to consider several factors other than the broad classification as mentioned above.

The two broad classes of pumps, viz, the reciprocating and the rotodynamic are further sub divided into subclasses depending on their construction features. The reciprocating pumps are of direct driven, power driven, diaphragm and rotary piston types. A further classification based on construction is - simplex, duplex, triplex etc. Rotary pumps are of the gear, vane, cam and piston, screw and lobular types, depending upon the design of the rotating element. The rotodynamic pumps are of volute, circular, diffuser, regenerative turbine, vertical turbine, centrifugal, mixed flow and propeller types. Again, these may be made

single-stage or multi-stage. Other specifications of the pumps include disposition of the axis-horizontal, vertical or inclined shaft; intensity of pressure generated - low lift, medium lift or high lift, disposition of casing; drive-belt, gear or direct; primemover - diesel, petrol or gas engine, or electric motor; and the duty to be performed by it, such as water supply, sewage, dredging etc. Any of the above classes of pumps may be made stationary or portable. The latter construction permits mobility for one place to another and finds great application in the construction field.

Another important distinction in pump construction is due to the material used in its construction. Thus, a pump may be designated as bronze-fitted, all-bronze, special composition bronze, all iron, stainless steel fitted and all stainless steel. The choice of the material is primarily influenced by the nature of the liquid handled and it is necessary to make a proper choice when selecting pumps for special jobs.

TERMINOLOGIES

- Reciprocating pump	: Bơm tịnh tiến qua lại
- Rotary pump	: Bơm quay
- Centrifugal pump	: Bơm ly tâm
- Rotodynamic pump	: Bơm gia tốc
- Stationary, portable pump	: Bơm cố định, xách tay
- Dredging	: Hút bùn
- Sewage	: Nước thải

QUESTIONS

- 1) Classify water pumps and distinguish between different types of pumps?
- 2) What considerations affect pump selection on a construction jobs?
- 3) Compare the three principal types of pumps?

UNIT 20. WATER USE AND HYDRAULIC ENGINEERING

Water Resources of the Earth, i.e. its hydrosphere, are the totality of the oceans, seas, glaciers, inland seas and lakes, rivers, underground and atmospheric waters. This totality amounts to almost 1,450,000,000 km³, of which over 90% are the world's seas and oceans, the remainder, inland water resources.

Of latest estimates, the world's annual (mean) river runoff is 38,150 km³, of which 2,950 km³ is drained in Europe and 12,860 km³ in Asia.

The annual river runoff drained from the entire territory of the USSR (22,400,000 km³) is 4,350 km³ (4,700 km³, of Voznesensky's estimates), i.e. 11.5% of the world's runoff. The underground water runoff in this country is estimated at 1,020 km³. All in all, the Soviet Union has nearly 90,000 rivers with the total length in excess of 5,000,000 km and almost 250,000 lakes with an overall surface area of 2,300,000 km².

The major economies utilizing water resources are: (1) electric power generation based on the use of water energy of seas and rivers; (2) water transportation, i.e. ship and timber handling by sea, lake and river; (3) land reclamation (amelioration) which includes: watering of farm lands (irrigation), delivering water to dry land grazing fields and diverting excessive water from waterlogged areas (drainage); (4) water supply for domestic, communal, industrial comforts and wastes disposal (sewerage) inclusive of treated waters; (5) commercial use of waters, interior, i.e. fishing, hunting sea animals for sports and fur, extracting salts, and ore deposits, harvesting sea weeds, algae etc.

The governing principle in water management is a comprehensive approach to the utilization of water resources.

It must be noted, however, that water usage for various economic purposes has two important aspects : one is a mere consumptive, i.e. the use of water for, e.g. water supply, irrigation, water delivery where water drawn off from various water sources (rivers, lakes, underground waters)

hardly ever returns thereto, and the other, exclusively exploitative, e.g. electric power generation, water transportation, fishing.

In view of the comprehensive approach to the utilization of water resources it is not often possible to match up both the consumptive and exploitative uses because of inadequate requirements for water. The consumptive demands may, sometimes, exceed the natural capacity of a given water source thereby giving rise to the problem of a territorial redistribution of water resources, i.e. channeling of the runoff from regions of high rainfall to arid and semi-arid areas.

Hydraulic engineering is an applied science and a branch of mechanical engineering concerned with the utilization of water resources for various economic needs to the benefit of National Economy and the control of wild manifestations of water energy which may take disastrous proportions. Hydraulic engineering tackles a wide range of problems : water sources and their behavior, the structure of the landform of the Earth' crust as the receptacle of waters, the foundation of hydraulic constructions, and the problems related to the design, construction, and operation of water resources developments.

Engineering constructions designed and mechanically fit for managing and utilizing water resources to the best of advantage are known as hydraulic structures, also water works.

The major purpose of hydraulic engineering is to alter the natural behavior of a water source, i.e. river, lake, sea, underground waters, and adapt it to a purposeful use for the benefit of National Economy and to protect the environment.

Another purpose of hydraulic engineering is to provide artificial watercourses and reservoirs where natural water sources are but few or non-existent, whatever.

Yet another purpose is to provide special installations or water works, such as navigation locks, powerplant buildings, pumping stations, fish-handling and protecting facilities, etc. to meet the specific requirements of various water-dependent economies.

Hydraulic structures designed under the first two objectives are common for all interests of the water economy and are termed general purpose hydraulic structures of water works. Water works which meet particular requirements (electric power generation, ship-and-timber handling irrigation, water supply, etc.) are known as special hydraulic structures.

Hydraulic structures designed for river, lake or sea water projects are referred, respectively, to river, lake and marine water works.

TERMINOLOGIES

- | | |
|-----------------------------|-----------------------------------|
| - Electric power generation | : Phát điện |
| - Watering of farm lands | : Tưới đất trồng trọt |
| - Hydraulic structures | : Thủy công (công trình thủy lợi) |
| - Marine water works | : Công trình biển |
| - Artificial reservoir | : Hồ chứa nhân tạo |

QUESTIONS

- 1) How many rivers and lakes are there in the Russia? What is the length of these rivers? and surface area of the lakes?
- 2) What major industries are utilizing the water resources ?
- 3) What is the governing principle in water management ?
- 4) What are the purposes of the hydraulic structures or water works ?
- 5) What are hydraulic structures designed for ?

UNIT 21. EARTH AND ROCKFILL DAMS

Earth and rockfill dams are water impounding structures composed of fragmental materials. These materials are made up of discrete particles which maintain their individual identities, and which have spaces or voids between them. They derive their strength from position, internal friction, and mutual attraction of their particles. Unlike materials which are rigidly cemented together, they form a somewhat flexible structure which can

deform slightly to conform to the deflection of the foundation without failure.

There is no standardized terminology for these structures. They are most commonly known as *earth dams* or *dikes* (sometimes spelt as dykes). They are also occasionally referred to as *embankment dams* or simply *embankments* or *banks*. Earth dams that follow rivers and are used to confine flood waters are called *levees* or *guide banks*. They are also termed as *parallel dikes*. *Rockfill dams* are essentially no different from earthfill dams except that the particles of which these embankments constructed are larger than a man can easily lift.

Use of Earth and Rockfill Dams

Earth and rockfill dams have been in existence for countless centuries. The earliest forms of these were not made by man. Landslides and rock-falls in mountainous areas frequently cut off streams and form natural dams, some of which are very large and have a surprisingly long life. Most of these, however, are temporary and remain only until the lakes which they create cause them to burst or wash out. An example is a landslide which occurred in 1840 on the upper reaches of the Indus River (1). The failure took place at the foot of Nanga Parbat (altitude 26,660 ft. or 8,000m) just south of Gilgit. A dam 1,000 ft. (300m) high was formed which soon impounded a lake over 900 ft. deep. Six months later, the dam burst, flooding the valley below and causing great loss of life and property. Similar failures have occurred in the Alps and in the Rocky Mountains of North America.

Glacial action has also formed numerous earth dams. During the periods when formations of ice are advancing, they thrust up large ridges of materials, including both soil and broken rock, like giant bulldozers. When the climatic changes cause the glaciers to retreat, the melting water from the ice is trapped between the earth ridges (or terminal moraines). Many of the natural lakes in North America and Northern Europe were formed in this way. It is remarkable how well some of these glacial moraine dams have stood up for the ensuing thousands of years.

Animals other than men have also been builders of earth dams. The beavers of North America (large animals of the rodent family weighing about 40 lb. and equipped with flat tail for swimming and long incisor teeth for gnawing) construct large dams of wood, leaves, and earth. These animals cut trees as much as 4 inches in diameter, haul them or float them to a stream, and lodge them together to form a crude framework. Small sticks, leaves, and mud are worked into this frame to create a dam. Some of these have been several hundred feet long and three or four feet high. While they leak badly, they are fairly durable, and last for many years if given constant repair. The beaver creates these lakes to submerge entrances to his grass and stick huts which dot the lake like small stacks of hay, and thereby to preserve his winter supply of food which consists of tree bark submerged by the rising water.

Man has built dikes of earth to impound water since pre-historic times. Reservoirs to hold water for irrigation have been found in Iraq, Jordan, and Israel which were built by tribes whose other works have since disappeared. Numerous "tanks" or reservoirs are found in South India and Ceylon, many of which are over 2,000 years old. One such tank in Ceylon is said to be 30 miles long. The Moti Talab tank in Mysore, India, which is over 1,000 years old, is an earth embankment 80 ft. high at places. Dumped earth and rock barrages have been used in many parts of the world to divert rivers and create deep ponds on otherwise shallow streams. Dikes or levees were built to protect land from flooding by rivers in ancient China, and for centuries the Dutch have increased their land area by walling off the sea by earth dikes.

Earth and rockfill dams are being constructed nowadays at an increasing rate throughout the world. Many such structures over 300 ft. high are successfully impounding water. In fact several earth dams have also been constructed even over 500 ft. in height. The largest structure ever built by man is an earth dam. The Fort Peck Dam in Montana has a volume of 130,000,000 cu.yd. (100,000,000 cu. meter). It can, therefore, be said that the use and safety of earth and rockfill dams have been established by long experience of structures both small and large.

TERMINOLOGIES

Earth dam	: Đập đất
Rockfill dam	: Đập đá đổ
Discrete particles	: Các phân tử rời rạc
Internal friction	: Ma sát trong
Mutual attraction	: Lực hút tương hỗ
Glacial action	: Hoạt động băng hà

UNIT 22. EARTH DAMS

Earth dams are the oldest type of artificial retaining structures. Simplest earth dams were known already several millennia B.C. in Egypt, India, Peru and other countries.

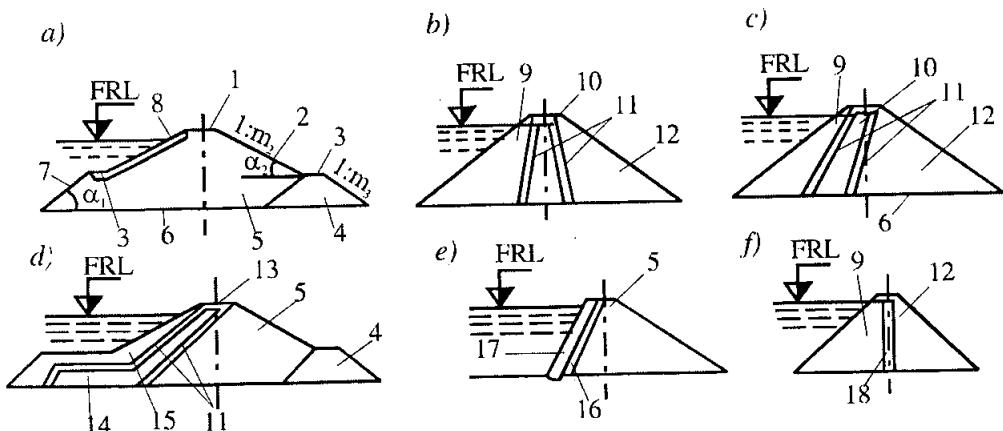
Earth dams can be classified into plain earth dams, in which the bulk of the dam body (more than 50%) is composed of small size clayey, sandy or sandy-gravelly soils; rock and earth-fill dams, in which the bulk of the dam body is composed of large-size gravelly-pebble soils or rock mass, and the antiseepage device is made from small size material; soil rock-fill (stone) dams, in which the body of dam, like in rock and earth-fill dams, is made of large-size material and the antiseepage device, if need be, from other than earth materials.

All these dams have trapezoidal cross section with straight or broken contour of upstream and downstream slopes. The tangent of the angle of slope inclination relative to the horizon is known as slope gradient (grade) $\tan\alpha = 1:m$, and $m = \cot\alpha$ is side slope.

The topmost edge of the slope is its crest and the lower edge is the toe of the slope.

Horizontal portions of slope surfaces are called berms. By design, the earth dams are divided into homogenous dams which are raised without special antiseepage devices, and heterogenous dams whose body is composed of two or more kinds of soil materials. Heterogenous dams are

further divided, according to the location of the antiseepage device, into dams with central core when antiseepage device composed of small grain soil material is located exactly along the axis of dam; dams with inclined core when the downstream face of the antiseepage device is inclined to the horizon at acute angle β , the angle of inclination β being larger than the angle of repose of large-size soil material; dams with membranes when β is less than or equal to the angle of repose of large grain soil material.



Types of dams

1- crest of dam; 2 - downstream slope; 3- berm; 4- drainage prism;
 5- material prism; 6- foot of dam; 7- upstream slope; 8- upstream
 slope cover; 9- upstream thrust prism; 10- corewall; 11- transition
 zones; 12- downstream thrust prism; 13-material diaphragm; 14- rear
 apron; 15- surcharge (additional load); 16- priming coat under
 non-earth diaphragm; 17- non-earth diaphragm; 18 - diaphragm

If the antiseepage device is made of other than earth material (concrete, asphaltic-concrete, steel, wood, etc.), then by its position in the body of dam, distinguished is the membrane shield located on the upstream side of the dam slope, and the diaphragm located along the dam axis.

According to the construction practice, the dams can be: filled, hydraulically filled, rip-rap, blast-filled, dry masonry dams. Combination of construction practices can also be used.

Filled dams are distinguished as dams constructed with mechanical compaction of soil by filling layers of material, erected with subsequent rolling or ramming ; dams raised by filling soil material in water without mechanical compaction; dams constructed by filling (10-50) m thick layers into water either dry or by compacting these with hydraulic monitor (giant).

By height, the dams are sometimes divided into low dams (under 30m), medium ($30 \leq H \leq 75$ m), high ($75 < H \leq 125$ m), and very high dams ($H > 125$ m).

Earth dams can also be distinguished by the manner of discharging both construction releases and operational run-off as non-overflow or blind (fixed crest), filtrating and overflow dams. Non-overflow earth dams are structures through which the seepage discharge is small compared to construction and service releases. Filtrating dams are structures whose seepage flow is comparable with water discharges that are to be released through surplusing works. This type of dam can be made of rock mass without special antiseepage devices.

Overflow dams are structures having on crest and slopes free-flow spillway works to ensure the passage of construction releases and operational discharges.

TERMINOLOGIES

- | | |
|------------------------------|-----------------------------|
| - FRL (Full reservoir level) | : Mực nước dâng bình thường |
| - Antiseepage device | : Thiết bị chống thấm |
| - Trapezoidal cross section | : Mặt cắt ngang hình thang |

QUESTIONS

- 1) How can earth dams be classified ?
- 2) What are the main parts of earth dams ?
- 3) Why do earth dams need antiseepage devices ? What are they made of ?
- 4) Do you know the method for evaluating slope stability of earth dam ?
- 5) How are dams divided by height ?
- 6) Please, name some earth dams built in Vietnam and abroad ?

UNIT 23. HYDRO - ELECTRIC POWER

For many hundreds of years the running water of streams and rivers has been used as a direct source of power. In medieval times mills were built on the banks of rivers and a large water wheel with broad, flat paddles was kept turning by the current of the river. When the water wheel turned, the large grindstone revolved and the grain was crushed between the grindstones and made into flour.

During the latter part of the nineteenth century it was realised that the power of water could be used to make electricity. Electricity is generated when falling water is made to drive a turbine or water wheel to which is attached a dynamo. Equally important, however, is the fact that the electricity can be carried away from the power station where it is made and conducted by overhead wires to different parts of the country. This power is called hydro-electricity and this name simply means electricity made from water power. Hydroelectric power is now used in many countries of the world.

The Niagara Falls, on the border of Canada and USA, are a tremendous source of power. The power station generates electricity from the mighty Niagara and the electricity is carried by overhead wires to be used for lighting and industrial power.

The Colorado river, in Arizona, USA, is the swiftest river in the world. Boulder Dam has been built across the Colorado river and electricity is generated in the power station there. This dam is 229 metres high and 305 metres across and generate 1,835,000 horse power.

In Scotland, dams have been built across river valleys to enlarge existing lochs or to create new ones. Hydro-electric power is generated in power stations which are fed with water from these lochs. The electricity is then carried by wires supported on steel pylons.

Hydro-electric power is especially valuable to countries such as Switzerland, Norway and Egypt. These countries have no coal supply with which to drive engines and dynamos and therefore, they use the power that can be obtained from their rivers-hydro-electric power.

TERMINOLOGIES

- Loch (Lake)	: Hồ (Tiếng Anh của Scotland)
- Horse power (HP)	: Mã lực (công suất)
- River valley	: Thung lũng sông
- Steel pylon	: Cột điện bằng thép
- Power station	: Nhà máy điện

QUESTIONS

- 1) For what purpose was water energy used in medieval times?
- 2) Describe how the electricity is made from the power of water ?
- 3) Where is hydro-electric power especially valuable ?

ADDITIONAL TEXTS

TEXT 5. WHAT IS A PROJECT ?

An agricultural project is an activity where money is spent on physical assets to produce benefits over a period of time.

The boundaries of a project may not be clear.

A project should:

- Have one clear objective;
- Be able to be planned, evaluated and implemented as a unit;
- Be different from other recent expenditure.

A project may be part of :

- A regional management program;
- A national development plan;
- A long term water development program (eg. Stage 1 of a three stage development).

It is preferable to evaluate projects in small units. This avoids of parts of projects with poor economic returns being considered and implemented as part of a project with good economic returns.

However a project should be consistent with the aims of national and regional plans.

A project format allows:

- Data from many sources to be put together and its accuracy evaluated;
- Gaps in available data to be clear and able to be rectified;
- Costs year by year to be specified;
- Administration and organization problems to be identified and addressed;
- Allows alternative projects (or impact of no project) to be assessed;
- Allows implementation and success of project to be monitored.

A project format is therefore useful for much more than assessing the benefit and costs of a proposed investment.

Limitations of a project format

- (i) The analysis is only as good as the data fed into the analysis (garbage in = garbage out).
- (ii) We are trying to predict the future (acceptance by farmers, yields obtained, prices, inflation, progress of national economy).
- (iii) The assumption is made that an individual project is too small to have an impact on prices used.

For example, it is assumed that the implementation of a rice project will not produce so much rice in a region that the price will go down, nor will the project add to the demand for labour or cement that the price of these goods will rise.

- (iv) Some costs and benefits are difficult to measure.

For example, improved education, improved quality of water supply, costs of reduced wildlife. Evaluation of projects where these costs or benefits are significant are difficult to evaluate.

- (v) The value placed on goods as measured by prices reflects the current distribution of income. Project analysis is based on an assumption that any inequities in the distribution of income can be overcome over a period of time.

- (vi) Non-economic objectives are not considered. Objectives such as national interest, equitable development.

Note: In Australia it has been estimated that about 70% of its current water resource development would not have been undertaken if only economic factors had been taken into account.

Project choice is made taking into account all these limitations.

Formal project evaluation enables a much better informed choice between alternatives to be made.

TERMINOLOGIES

- Expenditure	: Chi phí
- Inflation	: Lạm phát
- Demand for labour	: Yêu cầu nhân lực
- Non-economic objectives	: Những mục đích phi kinh tế

QUESTIONS

- 1) What is an agriculture project ? or water project ?
- 2) What are we trying to predict ?
- 3) What are the limitations of a project format ?
- 4) What is a project based on during its analysis and evaluation ?

TEXT 6. HOW A PROJECT PROPOSAL SHOULD BE FORMULATED ?

The content of a Project Proposal is as follows:

1. Project summary
2. The project:
 - (a) Background
 - (b) Justification
 - (c) Objectives
 - (d) Outputs and Activities

(e) Input and budget

(f) Implementation Arrangements

3. Annexes (Several of these may need to be prepared only when a funding source is available and a Project Document is prepared. For example, the detailed Work Plan of the project).

The content and length of a Project Proposal is adjusted to the requirements of each project. An elaborate Project Proposal may be necessary only in complex cases.

Guidance on preparing the various parts of a Project Proposal is given below.

1. Project Summary (one page)

The Project Summary is to be prepared after the Project Proposal has been drawn up. It should provide on one page the following concise information, drawn from sections of the proposals according to the format below:

Project Title: Project Code:

Location:

Objective(s): Duration: (new item)

Justification:

Output and Activities :

Inputs (Government and external) : (Formerly this was called "Requirements"). This includes inputs of the Government(s) and designation of the Implementing Agency.

External Funds Required: Donor's commitment.

The Project Summary page will be repeated in the Work Programme.

2. Background (up to three pages)

This section should briefly present relevant descriptive information about the proposed project based on the following questions :

- What is the main idea of the project and where did it come from ? (two - three sentences).

- What is the problem this project is meant to address? This answer should explain the problem. It does not justify the intervention. (One paragraph).

- What geographical area does the proposed project cover? State relevant basic data on the project site : location, population, size, pertinent geographical, social and economic features. Include a map of the project locale (one-two paragraphs, plus a map which should be included as an Annex to the Project Proposal).

- Describe past and ongoing work relevant to the proposed project that has been or is being carried out by the Mekong Committee and riparian Governments, including work supported by donor or funding agencies (two pages).

- Identify all institutional participants in the proposed project. (In one paragraph state who are the likely players to be involved in the project).

3. Justification (up to two pages)

For the justification portion of this section, present arguments that defend the creation of the project.

- Why is this project important ? (two-three paragraphs).

This question seeks to determine the priority of this particular project. It can be answered in various ways: by referring to priorities in the development plans of the riparian countries; by estimating losses/costs from the continued existence of the problem; and/or by stating the consequences of doing nothing.

- How will the proposed project solve the problem described in the Background portion above ? (one-two paragraphs).

- What alternatives to the proposed project were considered and why was the proposed approach selected over other portions ? (up to one page).

Alternatives could include non-project solutions to the problem, e.g., recommendations to Governments to accept previously offered advice, changes in the administered prices that might encourage private sector solutions, taking no action, etc., as well as other project approaches.

- Who will benefit from this project ? (one paragraph)
- Are there negative impacts of the project on certain groups such as women, children, the elderly or handicapped ? If so, what are these impacts and how will the project deal with them ? (two-three paragraphs).
- What is the rationale for Mekong Committee participation in this project ? (two-three paragraphs).

The answer to this question should be in terms of the Committee's mandate and in relation to programme and Sub-Programme objectives of the Committee's current Work Programme. Additional supporting information could describe specific requests from riparian Governments Committee resolutions, and the comparative advantage of the Committee's regional role or the Secretariat's technical capabilities.

4. Objectives

An objective is a statement of the measurable conditions or results to be achieved by project activities (see Outputs below).

The achievement of all of a project's objectives should solve or greatly contribute to the solution of the problem presented in the Background. Thus, the statement of objectives indicates the results that will be achieved to solve the problem(s).

5. Outputs and Activities

An output is the result of a set of activities. For a given objective, the production of all relevant outputs, according to plan and determined standards, should result in the achievement of that objective.

Outputs, as results, should be stated as finished products. For example, "trained personnel" are an output (not "training" which is the activity that produces the output). Other common outputs could be completed studies, plans or reports; installed equipment; completed and inspected construction works; etc.

The presentation of outputs and activities should be organized in outline form by objective so that it is clear which outputs relate to which objectives and which objectives relate to which outputs. Follow the outline provided below. List only major activities needed to produce each output.

6. Inputs

This section should have two parts describing, in turn, (1) resources to be committed from Governments which will presumably be mainly in-kind; and (2) resources to be pledged by an external donor(s).

6.1. National contribution

This sub-section should describe in narrative fashion the resources of Government(s), non-governmental organizations and beneficiary groups that will be committed to the project including counterpart personnel, commodities, equipment, facilities and land. If Government(s) will budget cash for this project, estimate the amount and identify the inputs it will fund. The in-kind contribution will no longer be given a monetary value.

6.2. External contribution (Project Budget)

This sub-section will describe , in the form of a budget, the resources to be provided from external sources. To assist project designers in the determination of external resources required, a procedure and work sheet are provided. This procedure, based on the draft work plan, assists in the identification and quantification of inputs required from the project.

Once external inputs have been identified, they must be costed. These costs should be aggregated by budget category and by year of planned expenditures.

7. Implementation Arrangements

The implementation arrangements should identify the organization with primary responsibility for implementing the project which may be the Mekong Secretariat, a Government institution, or sub-contractor or other agency. The roles and responsibilities of all participating organizations, including the external donor, should be clearly defined, especially for institution-building projects. After discussions, an organizational chart should be prepared. Responsibilities for financial management, monitoring, reporting and project evaluation should be described. Reference should also be made to procedures for project revision.

8. Annexes

Any information that is too long or too technical for inclusion in the proposal but deemed to be essential for the consideration of a potential donor should be appended as an annex. All information generated in project formulation need not become Annexes. However, the Work Plan should be included as one of the important Annexes.

The Work Plan is graphic description of project implementation as a horizontal bar chart. The Work Plan shows in detail the sequence and duration of project activities by objective and output and the relationship of project activities to produce different outputs. The preparation of the Work Plan is basically a scheduling exercise that ensures the economical and coordinated use of inputs during the duration of the project. In other words, the Work Plan arranges project activities in their logical sequence, facilitates the scheduling of inputs, and avoids possible time conflicts in the utilization of inputs.

TERMINOLOGIES

- Justification	: Luận chứng
- Inputs and Budget	: Đầu tư và ngân sách
- Implementing agency	: Cơ quan thực hiện
- Donor's commitment	: Ủy nhiệm của nhà tài trợ

QUESTIONS

- 1) What does the content of a project include ?
- 2) How long is project summary ?
- 3) How many questions must be answered in the part "Background" of a project ? What are they about ?
- 4) Where can too long or too technical information be written in the project ?
- 5) What is a work plan ? and How is it drawn ?

TEXT 7. SPECIAL CHARACTERISTICS OF WATER PROJECT

The preceding sections relate to all projects including water projects. This section looks at special characteristics of water projects, in particular looking at the appraisal of

- a new project;
- a rehabilitation proposal; and
- management of a water operation.

Types of water projects include:

- irrigation water supply
- drainage
- flood protection or flood control
- hydro-electric generation
- fisheries
- environmental maintenance or enhancement
- urban water supply
- navigation

Many projects are multi-purpose

The limits of a project may not be clear. For practical purposes it is necessary to set a geographical limit and specify which activities are to be included in the project.

Water project normally have the following economic characteristics which distinguish them from others in the economy.

- 1) Assets in water projects normally have long lives. In Australia the average life of assets in the economy is about 18 years, for the water industry it is 70 years.
- 2) Water projects are normally capital intensive, that is capital costs are high compared to annual operating costs.

In the Victorian irrigation system, capital costs are over half of all costs of providing irrigation.

3) Projects are frequently multi-purpose.

Multipurpose projects may require allocation of joint costs.

For example:

A dam is constructed to supply hydro-electricity and to supply irrigation water.

"Separate" costs are first identified:

- Channels are attributed to irrigation
- Turbines are attributed to power.

Remaining costs are "joint costs"

These should be assigned

- So that the assigned cost is less than the benefit
- So that the assigned cost is less than if the service were provided by a single purpose asset (eg. power from an alternative thermal plant).

These principles will avoid cross subsidy.

In practice, allocation is likely to occur after negotiation taking into account "capacity to pay" and shares of water used.

Economic activities that are usually included as part of the project

- Building of main structures (dams, distribution system, etc.)
- Agriculture and forestry receiving water from the structures.
- Benefit from flood-control in areas for agriculture and industry.
- Generation of electricity for domestic consumption and industry.
- Creation of recreational area.
- Fisheries
- Water storage for water quality management
- Fire protection for urban and forested areas.

TERMINOLOGIES

- | | |
|---------------------------|--------------------|
| - Water project | : Dự án thủy lợi |
| - Rehabilitation proposal | : Đề nghị sửa chữa |

- Annual operating costs : Chi phí vận hành hàng năm
- Capital investment : Đầu tư cơ bản

QUESTIONS

- 1) What are the types of water projects ?
- 2) Give an example of a multi-purpose project ?
- 3) Why are the channels attributed to irrigation and turbines to power ?
- 4) What comprises the distribution system on the irrigation network ?
- 5) What is a recreational area and where is it usually situated ?
- 6) Why do forested areas need fire protection ?

PART II . TECHNICAL TERMS

II.1 HYDROLOGY - THỦY VĂN

II.1.1. GENERAL TERMS-CÁC THUẬT NGỮ CHUNG

1. **Hydrology (Thủy văn học):** Science dealing with waters of the earth in rivers, streams, lakes, in or below the land surface, in the atmosphere (related aspects only), in all its states-their occurrence, distribution and circulation through the endless hydrologic cycle of precipitation, consequent runoff, stream flow, infiltration and groundwater, eventual evaporation and reprecipitation. It is concerned with the physical, chemical and physiological reactions of the water with the rest of the earth and its relation to the earth life.
2. **Agrohydrology (Thủy văn nông nghiệp):** The study of the movement of water in the unsaturated zone of the soil and the shallow groundwater under the effect of rainfall, evaporation, all forms of irrigation and drainage, natural and artificial. The study includes the effects of these processes on crop growth.
3. **Applied hydrology (Thủy văn ứng dụng):** The application of hydrological principles to specific practical problems.
4. **Dynamic hydrology (Thủy văn động lực học):** The dynamics of the physical processes involved in hydrology.
5. **Engineering hydrology (Thủy văn công trình):** The application of hydrological principles to problems posed by civil engineering structures.
6. **Flood hydrology (Thủy văn lũ):** The branch of surface hydrology dealing with all aspects of floods.
7. **Forest hydrology (Thủy văn rừng):** The application of hydrological principles to wooded areas.
8. **Kerst hydrology (Thủy văn Caxto):** The branch of geohydrology dealing with natural processes occurring in limestone, dolomite or gypsum environments.
9. **Surface hydrology (Thủy văn nước mặt):** the branch of hydrology dealing with surface waters including the presence or absence of water on or above the earth's surface.
10. **Urban hydrology (Thủy văn đô thị):** The application of hydrological principles to inhabited areas.
11. **Hydrologic equation (Phương trình thủy văn):** The water balance equation ($\text{inflow} = \text{outflow} + \text{storage}$) which expresses the basic principle that during a given time interval the total inflow to an area must equal the total outflow plus the net change in storage.

12. **Hydrological network (Mạng lưới thủy văn):** Network of hydrological stations designed and used to study the hydrologic regime within a given area.
13. **Hydrological service (Cơ quan thủy văn):** Department, branch, office or system responsible for the performance of hydrological activities.
14. **Hydrological yearbook (Niên giám thủy văn):** A book issued once a year giving information about hydrological data within a given area.
15. **Hydrologist (Nhà thủy văn):** A university graduate who specializes in hydrology.
16. **Potamology (Sông ngòi học):** The branch of hydrology which pertains to surface streams, the science of rivers.
17. **Geohydrology, or Groundwater hydrology (Thủy văn địa chất hay Thủy văn nước ngầm):** The branch of hydrology that deals with groundwater, its occurrence and movements and its replenishment and depletion, the properties of rocks that control groundwater movement and storage and the methods of investigation and utilization of groundwater.
18. **Lake (Hồ):** An inland body of water, small to moderately large, with its surface water exposed to the atmosphere.
19. **Limnology (Hồ ao học):** The scientific study of fresh waters, especially of lakes and ponds. It includes physical, chemical, biological, hydrological and meteorological conditions.
20. **Hydrography (Địa lý thủy văn):** Science dealing with certain aspects of all the waters of the earth's surface, particularly sounding, charting and mapping them, and analysing and describing their forms, positions and physical features of rivers, lakes, reservoirs, shallows, deeps, etc, and magnitudes and directions of winds, tides, currents, and the like.
21. **Orohydrography:** The branch of hydrography which deals with the relations of topography to drainage. (Một ngành của địa lý thủy văn liên quan tới các mối quan hệ của địa hình đối với tiêu thoát nước).
22. **Meteorology (Khí tượng học):** The branch of science that deals with atmospheric phenomena and the basic laws that produce and control such phenomena.
23. **Hydrometeorology (Khí tượng thủy văn):** Meteorology concerned with water in the atmosphere, as rain, clouds, snow, hail, and its effects on river flow, soil moisture, ect.
24. **Synoptic meteorology (Khí tượng Sy-nóp):** The study of atmospheric processes on the basis of weather conditions prevailing at a given time over a wide area.
25. **Micrometeorology (Khí tượng học vi mô), Macrometeorology (Khí tượng học vĩ mô):** The study of variations in meteorologic conditions over very small areas, such as hillsides, forests, drainage areas of rivers, and even individual cities. Contrast "macrometeorology" which is the study of meteorological variations over very large expanses of areas, as deserts or oceans.

26. **Climatology (Khí hậu học):** Science dealing with the study of climate over a given area within a specified period of time. Also, statistical relations, mean values, normals, frequencies, variations, distribution, etc. of the meteorological elements.
27. **Microclimate (Khí hậu vi mô, vi khí hậu), Macroclimate (Khí hậu vĩ mô):** Detailed climate of very small area of the earth's surface, for example, a single forest or crop field. Contrast "macroclimate" which is the climate over a very large area, such as desert or ocean.
28. **Microclimatology (Khí hậu học vi mô), Macroclimatology (Khí hậu học vĩ mô) :** Study of microclimates. Contrast "macroclimatology" - study of macroclimates.
29. **Hydrometry (Đo đặc thủy văn):** 1- The measurement and analysis of the flow of water. 2- The art or operation of determining specific gravities of liquids, use of the hydrometer.
30. **Hydrogeology (Địa chất thủy văn học):** The part of geology concerned with the functions of water in modifying the earth, especially by erosion and deposition, also the phenomena with which it deals. The term is also used to indicate the relation of ground water to the geological environment.
31. **Hydromorphometry (Đo đặc địa mạo thủy văn học):** The science and technology of measuring variables characterizing size and shape of a drainage basin.
32. **Hydrologic cycle (Chu trình thủy văn):** The circulation of water from the sea, through the atmosphere, to the land, and then, often with many delays, back to the sea or ocean through various stages and processes as precipitation, interception, runoff, infiltration, groundwater storage, evaporation and transpiration, also the many short circuits of the water that is returned to the atmosphere without reaching the sea.
33. **Hydrologic process (Quá trình thủy văn):** A series of hydrologic events.
34. **Hydrologic regime (Chế độ thủy văn):** The behaviour of water in the hydrologic cycle during a given period.
35. **Climatic cycle (Chu trình khí hậu):** Actual or supposed cyclic recurrences of such weather phenomena as wet and dry years, hot and cold years, at more or less regular intervals, in response to long-range terrestrial and solar influences, such as volcanic dust and sun-spots.
36. **Hydrosphere (Thủy quyển):** 1- The aqueous vapour of the entire atmosphere. 2- The aqueous envelope of the earth including the ocean, all lakes, streams and underground waters, and the aqueous vapour in atmosphere.
37. **Barograph (Máy tự đo khí áp):** A self-recording barometer.
38. **Thermograph (Máy đo tự đo nhiệt độ):** A self-recording thermometer.
39. **Isobars (Đường đẳng áp):** Lines joining points of equal pressure.
40. **Isotherms, or Osothermal lines (Đường đẳng nhiệt):** Lines joining points of equal temperature.

41. **Thornthwaite moisture index, or Moisture index (Chỉ số độ ẩm Thornthwaite hay chỉ số độ ẩm):** In the system developed by Thornthwaite, an index based upon the adequacy of rainfall to the need of the plants.
42. **Zero moisture index (Chỉ số độ ẩm Zé-rô):** The index of moisture when the precipitation analysed month by month is just adequate to supply all water needed for maximum evaporation and transpiration in the course of a year.
43. **Arid (Khô hạn):** An area or climate that lacks sufficient moisture for agriculture without irrigation. According to Thornthwaite, areas having moisture index below -40 Thornthwaite.
44. **Subarid, or Semiarid (Bán khô hạn):** A term applied to an area or climate, neither strictly arid nor strictly humid, in which inferior crops can be grown without irrigation.
- According to Thornthwaite, areas having moisture index between -20 and -40 Thornthwaite.
45. **Subhumid, or Semihumid (Bán ẩm ướt):** A term applied to an area or climate that has on the whole sufficient moisture to support all crops but irregularity of precipitation during the year making it essential to provide irrigation facilities to raise better crops.
- According to Thornthwaite, areas having moisture index between 0 and -20 Thornthwaite.
46. **Humid (Ẩm ướt):** An area or climate that has more moisture than the actual agricultural requirement and where drainage facilities are generally essential to get rid of surplus moisture. According to Thornthwaite, areas having moisture index above 0 Thornthwaite.
47. **Drought, or Dryspell (Hạn):** A sustained period of time with insufficient precipitation. Also called "dryspell".
48. **Drought forecasting, or Drought prediction (Dự báo hạn):** Statistical estimate of the occurrence of future periods of drought.
49. **Climatic year (Năm khí hậu):** A continuous twelve-month period during which a complete annual climatic cycle occurs and which is selected for the presentation of date relative to meteorological phenomena.
50. **Hydrological year, or Water year (Năm thủy văn hay năm nước):** A continuous twelve-month period during which a complete annual stream-flow cycle occurs and which is selected for the presentation of data of stream-flows.
51. **Current, or Stream (Đòng hay dòng chảy):** 1- A body of flowing water. The term is usually applied to water flowing in a natural surface channel (water course, river), but is also applied to water flowing in an open or closed conduit, a well-defined sea or oceanic current and to a set of water issuing from an opening; sometimes also for a body of underground-flowing water. 2- Water course. 3- River, or Stream, 4- Major river: Large river characterized by its number of tributaries, its high discharge, the length of its course, especially when debouching into the sea.

52. **Brook (Suối):** A small shallow stream usually in continuous flow in a somewhat turbulent manner.
53. **Torrent (Dòng thác):** A stream of water flowing with great velocity or turbulence, as during a freshet of down a steep in cline.
54. **Wadi (Suối cạn):** 1- A ravine or valley, dry except in the rainy season. 2- Sometimes also a stream running through such a valley.
55. **Affluent (Sông nhánh (phụ lưu, chi lưu)):** A stream or river flowing into a larger river or into a lake; a tributary system.
56. **Effluent (Dòng nhánh):** 1- An outflowing branch or distributary of a main stream or lake. 2- A liquid which flows out of a containing space. 3- A stream fed by groundwater.
57. **Anabanch (Đoạn sông cát dòng):** An effluent of a stream that rejoins the main stream, forming an island between the two watercourses.
58. **Channel (Lòng dẫn):** 1- A natural or artificial but clearly distinguishable waterway which periodically or continuously contains moving water, or which forms a connecting link between the two bodies of water. 2- The deep portion of a river or waterway where the main current flows. 3- The part of a body of water deep enough to be used for navigation through an area otherwise too shallow for navigation.
59. **Confluence (Nơi hợp lưu, ngã ba sông):** The joining of two or more rivers.
60. **Headwater, or Headwaters (Thượng lưu):** The upper reaches of a stream near its source.
61. **Ephemeral stream (Dòng chảy tạm thời):** A stream or portion of a stream which flows only in direct response to precipitation and whose channel is completely dry at certain times.
62. **Perennial, Perennial stream (Dòng chảy thường xuyên):** Flowing all through the year, e.g. "perennial stream", perennial canal.
63. **Dry weather flow (Dòng chảy kiệt):** The flow of water in a stream during the non-rainy weather.
64. **Regeneration, or Return flow (Nước hồi quy):** Water, having been diverted from a stream or other body of water for irrigation purposes, passes downwards to the subsoil water table and ultimately reaches a surface stream or other body of water.
65. **Desiccation (Khô hạn):** The process by which a region suffers a complete loss of its water, due to decrease of rainfall, failure to maintain irrigation or deforestation or overcropping, or to changes in other climatic controls. Desiccation is manifested by the drying up of streams and lakes, the destruction of vegetation, the loss of surface soil, ect.
66. **Exsiccation (Làm khô đất):** In climatology, the drying up of an area due to some change which decreases the amount of moisture without reducing the rainfall. Draining a marsh is an example of exsiccation, which should be carefully distinguished from desiccation.

II.1.2. RAINFALL, RUNOFF - MƯA, DÒNG CHẢY MẶT

II.1.2(a). PRECIPITATION AND RUNOFF - GIÁNG THỦY VÀ DÒNG CHẢY MẶT

67. **Precipitation (Giáng thủy):** 1- The total measurable supply of water of all forms of falling moisture, including dew, rain, mist, snow, hail and sleet; usually expressed as depth of liquid water on a horizontal surface in a day, month, or year, and designated so daily, monthly, or annual precipitation. 2- The process by which atmospheric moisture in liquid or solid state is discharged into a land or water surface.
68. **Channel precipitation (Mưa trên lòng dãy):** Precipitation which falls directly on the surface of lakes and streams.
69. **Convective precipitation (Mưa đối lưu):** Precipitation resulting from the upward movement of air that is warmer than its surroundings. It is generally of a showery nature with rapid changes in intensities.
70. **Cyclonic Precipitation (Mưa lốc):** The precipitation associated with the passage of cyclones.
71. **Orographic precipitation (Mưa định hình):** Precipitation which results from the lifting of moist air over an orographic barrier, such as a mountain range.
72. **Antecedent precipitation (Mưa kỳ trước):** Rainfall that occurs a given number of days prior to a particular rain storm under consideration.
73. **Antecedent precipitation index (Chỉ số mưa kỳ trước):** A weighted summation of daily precipitation amounts, used as an index of soil moisture. The weight given to each day's precipitation is usually assumed to be an exponential or reciprocal function of time with the most recent precipitation receiving the greatest weight. Such indices are used in estimating runoff and as a measure of drought severity.
74. **Maximum probable precipitation (Lượng mưa có khả năng lớn nhất):** Precipitation of a given amount and duration derived by a technique of maximization of all contributing factors like moisture content, precipitable water, wind velocity and spatial distribution. It is a value which has an unknown low probability of occurrence.
75. **Mean annual precipitation (Lượng mưa trung bình năm):** The average over a period of years of the annual amounts of precipitation.
76. **Weighted mean monthly precipitation (Lượng mưa trung bình tháng có trọng lượng):** The weighted mean precipitation for each month for a large area derived from the study of the isohyetal map of the area.
77. **Point precipitation (Mưa điểm):** Precipitation at a particular site in contrast to the mean precipitation over an area (a real precipitation).
78. **Trace of precipitation (Vết mưa):** An amount of precipitation not large enough to be measured in a gauge.

79. **Precipitation mass curve** (**Đường lũy tích mưa**): Graph showing accumulated precipitations against time.
80. **Precipitation data** (**Số liệu mưa (giáng thủy)**): Data on all forms of falling moisture.
81. **Storm** (**Bão, giông**): **1-** A meteorological disturbance accompanied by such phenomena as rain, snow, hail, thunder and lightning, and wind, although wind storms may be described in accordance with the material, such as dust and sand, which is carried in suspension in the air. **2-** A meteorological disturbance which is either unusual or of great magnitude, rate, or intensity.
82. **Rain storm** (**Giông có mưa (mưa giông)**): Storm associated with rainfall.
83. **Thunderstorm** (**Giông sấm chớp**): Storm associated with lightning and thunder.
84. **Cloud burst, Rain gush, or Rain gust** (**Mưa bồng mây**): Storm of rain of extraordinary intensity and of relatively short duration, usually over a rather small area.
85. **Thermal convection storm** (**Mưa đối lưu nhiệt**): A storm caused by local inequalities in the temperature in which the rainfall is of high intensity, short duration, and limited to only a small area.
86. **Storm eye, Eye of the storm, or Quiet rainless centre** (**Mắt bão**): The centre of the area covered by a storm, especially the place of lowest pressure in a cyclonic storm.
87. **Storm lane** (**Đường đi của bão**): A narrow belt over which storm centres pass with a certain degree of regularity.
88. **Storm distribution pattern, or Storm smear** (**Phân bố mưa**): The manner in which depth of rainfall varies from station to station throughout area for a given storm.
89. **Depression, Low, or Trough** (**Áp thấp**): Area of low pressure generally surrounded by closed isobars, usually associated with storm and rain; winds blow around the depression counterclockwise in the northern hemisphere and clockwise in the southern hemisphere.
90. **Cyclone** (**Xoáy**): The term applied to any storm area of low barometric pressure where the winds blow spirally inwards.
91. **Tropical cyclone, Tropical revolving storm, Hurricane, Taino, Cordonazo, Typhoon, Baguio, Baruio, Willy-willy** (**Xoáy nhiệt đới, bão**): A revolving storm originating over the ocean in the doldrum belt of general circulation. Known by various names in different parts of the world - hurricane in the Caribbean and western parts of the Atlantic Ocean, also taino in Haiti, cordonazo in the west coast of Mexico, typhoon in Japan and adjacent seas of south-eastern Asia, baguio or baruio in the Philippines, willy-willy in Australia, cyclone in the Indian Ocean.
92. **Tornado** (**Tô**): Circular whirl of great intensity and small horizontal extent, with winds of hurricane force, accompanied by heavy rain or hail, thunder and lightning;

- it is short-lived, usually not lasting more than an hour or two, but causes heavy damage.
93. **Anticyclone (Xoáy nghịch):** Area of relatively high pressure surrounded by closed isobars, the pressure gradient being directed from the centre so that the wind blows spirally outward in a clockwise direction in the northern hemisphere, counterclockwise in the southern hemisphere.
 94. **Meteorologically homogeneous (Đồng nhất về mặt khí tượng):** Said of an area, throughout which the probability of occurrence of a storm of any given intensity is the same at every point.
 95. **Rain (Mưa):** Precipitation in the form of liquid water drops greater than 0.5mm.
 96. **Rainfall (Mưa, lượng mưa):** 1- A fall of rain; precipitation in the form of liquid water. 2- The amount of rain, usually expressed in millimetres (inches) depth of water on an area, that reaches the surface of the earth. The term is sometimes expanded to include other forms of atmospheric precipitation, such as snow, dew, but technically the term precipitation would be used in this broader scope.
 97. **Rainfall data (Số liệu mưa):** Data on the amounts of rain reaching the surface of the earth.
 98. **Mean annual rainfall (Lượng mưa trung bình năm):** The mean of annual rainfall observed over a period which is sufficiently long to produce fairly constant mean value.
 99. **Maximum probable rainfall (Lượng mưa có khả năng lớn nhất):** The rain of a certain amount and duration that can reasonably be expected to occur on a basin with a known frequency.
 100. **Point rainfall (Mưa điểm):** A term applied to rainfall at single station to distinguish it from average rainfall over an area.
 101. **Rainfall intensity (Cường độ mưa):** The rate at which rainfall occurs expressed in depth units per unit time. It is the ratio of the total amount of rain to the length of the period in which the rain falls.
 102. **Rainfall intensity curve (Đường cong (triết giảm) cường độ mưa):** A curve which expresses relation of the intensities to their duration.
 103. **Rainfall intensity frequency, or Rainfall recurrence interval (Tần số cường độ mưa hay khoảng thời gian suất hiện lại cường độ mưa):** The average time interval between the occurrence of rainfall of a given intensity and that of an equal or greater intensity.
 104. **Rainfall area (Khu vực mưa):** Geographical extent of a given storm.
 105. **Rainfall province (Vùng mưa):** An area characterized by similarity in distribution and seasonal concentration of precipitation.
 106. **Initial rainfall, Residual rainfall, Net supply rainfall (Lượng mưa ban đầu, lượng mưa dư, lượng mưa cung cấp thực):** The rain that fall at the beginning of a storm before the depression storage is completely filled is called the "initial rainfall";

that falling near the end at a rate less than the infiltration capacity is called "residual rain"; the intervening rainfall is the "net supply rainfall".

107. **Priming rain (Mưa mồi):** The amount of rain that does not produce runoff. In semiarid and arid zones, the rain that falls weeks or months before the first runoff.
108. **Rainwash (Cuốn trôi do mưa):** 1- The effect of rain in washing away silt, earth, ect.; also the matter thus washed away.
109. **Rainfall penetration (Độ thấm sâu của mưa):** The depth below the soil or rock surface reached by a given quantity of rainfall which has passed below such surface. The maximum extent of penetration is down to groundwater.
110. **Effective rainfall (Lượng mưa hiệu quả):** 1- Rain that produces runoff; 2- In irrigation practice, that portion of the total precipitation which is retained by the soil so that it is available for use for crop production; 3- In geohydrology, effective rainfall is defined as that part of the total precipitation that reaches the groundwater (recharge).
111. **Essential effective rainfall (Lượng mưa hiệu quả thực chất):** Part of a rainfall which produces the main part of the runoff (according to a hydrograph).
112. **Maximum effective rainfall (Lượng mưa hiệu quả lớn nhất):** Part of rainfall producing the maximum flow (according to a hydrograph).
113. **Rain discharge, Rainwater discharge, Rainwater flow, or Stream-waterflow (Lưu lượng mưa, lưu lượng nước mưa, dòng chảy nước mưa):** The average rain (amount of a certain rain series) of the whole drainage area divided by time in seconds.
114. **Maximum rain discharge (Lưu lượng mưa lớn nhất):** The average rain-amount of a certain rain maximum (of a day or a part of it) divided by its time in seconds.
115. **Rain gauge, Rain gage, pluviometer, or Ombrometer (Thùng đo mưa):** An instrument for measuring the quantity of rain that falls at a given place and time.
116. **Catch of gauge (Bè mặt hứng mưa của thùng đo mưa):** The area at the top of gauge which receives the precipitation.
117. **Rain recording gauge, Rain recorder, Self-registering gauge, or Hyetograph (Máy tự động đo mưa, máy đo mưa tự ghi):** A rain gauge which automatically records, usually in graph form, the cumulative amount of rainfall with reference to time.
118. **Vectopluviometer (Thùng đo mưa đổi hướng):** A device for separating and measuring the rainfall according to the variation in wind direction during a storm. It consists of a rain gauge with a swinging catchment funnel operated by a wind vane so that the rain received from the different directions is caught in the corresponding sections of the measuring container.
119. **Rain-gauge station (Trạm đo mưa):** The station where the rain gauge is located.
120. **Totalizer, or Storage rain gauge (Thùng đo mưa tổng cộng):** A type of rain gauge which totalizes the quantity of precipitation.

121. **Pluvial index (Chỉ số mưa):** A quantity which is used as an index of the depth of the total rainfall which will probably be equalled or exceeded during a given period, such as one day, two days, in a given locality during a given number of years.
122. **Rainfall index (Chỉ số tiêu chuẩn mưa):** The average rainfall intensity above which the volume of rainfall equals the volume of observed runoff; it represents the combined effects of interception and depression storage as well as of infiltration.
123. **Rainfall distribution coefficient (Hệ số phân bố mưa):** The distribution coefficient for any storm is obtained by dividing the maximum rainfall at any point by the mean on the basin.
124. **Pluviometric coefficient, or Hyetal coefficient (Hệ số mưa):** The ratio of the actual precipitation in a month to what would have fallen had the rainfall been uniformly distributed throughout the year.
125. **Index of wetness (Chỉ số ẩm ướt):** The precipitation/rainfall/runoff for a given year expressed as a ratio to the mean annual precipitation/ rainfall /runoff over a considerable period of time.
126. **Isohyet, Isohyetose, Isohyetal line, or Isopluvial line (Đường đẳng trị mưa):** A line connecting points of equal rainfall depth.
127. **Isohyetal map, or Isopluvial map (Bản đồ đẳng trị mưa):** A map showing isohyets.
128. **Isopercental map (Bản đồ đẳng trị phần trăm):** Lines connecting points of equal percentages of rainfall drawn on a map after showing the annual or monthly rainfall at each rain-gauge station as a percentage of the annual long-average figures for that station.
129. **Depth-duration curve, or Rainfall intensity-duration curve (Đường quan hệ độ sâu lớp nước mưa và thời gian hay đường quan hệ cường độ mưa và thời gian):** A curve showing the relationship between the average intensity of the rainfall of a storm and the duration of the storm.
130. **Depth-area curve, or Rainfall intensity-area curve (Đường quan hệ độ sâu lớp nước và diện tích hay đường quan hệ cường độ mưa và diện tích):** A curve showing the relationship between the average intensity of the rainfall of a storm and the area of the storm.
131. **Mass rainfall curve, or Mass precipitation curve (Đường lũy tích mưa):** A plot of accumulated precipitation against time.
132. **Residual mass rainfall curve (Đường lũy tích mưa dư):** A plotting of the year-to-year residual departures of rainfall from the arithmetic average accumulated for the period under consideration.
133. **Thiessen polygon (Đa giác Thiessen):** The points of rain gauges on a map are joined by straight lines and their perpendicular bisectors are drawn. The polygon formed round each rain-gauge station by these perpendiculars is known, after its originator, as the Thiessen polygon.

134. **Lag (time):** 1- Referring to discharge or water level: The time elapsing between the occurrence of corresponding changes in discharge or water level at two points in a river; 2- Referring to runoff of rainfall: The time between the centre of mass, or beginning, of rainfall to the peak, or centre of mass, of runoff; 3- Referring to snow melting: The time between the beginning of snow melt and start of the resulting runoff; 4- Time of travel.
- Thời gian lệch định:** 1- Dùng cho lưu lượng hay mực nước: Thời gian giữa sự xuất hiện những thay đổi tương ứng trong lưu lượng hay mực nước tại hai điểm trên sông; 2- Dùng cho dòng chảy mặt do mưa rào sinh ra: Thời gian giữa tâm trận mưa hay bắt đầu trận mưa tới đỉnh hay tâm của trận lũ; 3- Dùng cho tuyết tan chảy: Thời gian giữa khi bắt đầu tuyết tan và khi bắt đầu sinh dòng chảy mặt; 4- Thời gian di chuyển.
135. **Sleet (Mưa tuyết):** 1- Precipitation in the form of frozen or partly frozen snow; 2- Glaze particularly in the United States; 3- Mixture or combination of rain and snow.
136. **Hail (Mưa đá):** Small, roughly spherical lumps of approximately concentric shells of clear ice and compact snow, collectively, that are precipitated during thunderstorms.
137. **Drainage area, Drainage basin, River basin, Catchment area, Catchment basin, Catchment, Watershed (Lưu vực):** The area from which a lake, stream or waterway and reservoir receives surface flow which originates as precipitation. Also called "watershed" in American usage.
138. **Experimental basin, or Experimental watershed (US) (Lưu vực thí nghiệm):** Drainage basin or catchment area in which natural conditions are deliberately modified and in which the effects of these modifications on the hydrologic cycle are studied.
139. **Water parting, Divide, Watershed (Đường phân nước):** A summit or boundary line separating the adjacent drainage basin. Also called "watershed" in English usage.
140. **Topographic divide (Đường phân nước trên mặt):** A divide that demarks the boundary of the area from which surface runoff is derived.
141. **Phreatic divide (Đường phân nước ngầm):** An underground divide that fixes the boundary of the area that contributes ground water to each stream system.
142. **Bolson (Lưu vực dạng hướng tâm (lưu vực dạng hồ ao)): A topographic basin with centripetal drainage system.**
143. **Runoff (Dòng chảy mặt):** 1- Portion of the total precipitation from a given area that appears in natural or artificial surface streams; 2- Also the total quantity of runoff during a specified period; 3- The discharge of water in surface streams above a particular point.
144. **Total runoff (Tổng lượng dòng chảy mặt):** The runoff, from all sources, from a drainage area for a definite period of time or for the duration of a particular storm.

145. **Cumulative runoff (Lũy tích dòng chảy mặt):** The total summation of runoff over a specified period of time. Successive summations are frequently plotted against time.
146. **Mean annual runoff, Mean monthly runoff (Dòng chảy mặt trung bình năm, dòng chảy mặt trung bình tháng):** The value of the annual volume of water discharged by the stream drainage of the area, the period of observation being sufficiently long to secure a fair mean; similarly "mean monthly runoff".
147. **Depth of runoff (Độ sâu dòng chảy mặt):** The total runoff from a drainage basin divided by the area.
148. **Rate of runoff (Lưu vực dòng chảy mặt):** The volume of water running off in a unit of time from a surface.
149. **Economical rate of runoff (Lưu lượng dòng chảy mặt kinh tế):** The critical rate of runoff for which it is economically feasible to provide a control channel in drainage schemes.
150. **Runoff coefficient (Hệ số dòng chảy mặt):** 1- The ratio of the maximum rate of runoff to the uniform rate of rainfall with a duration equalling or exceeding the time of concentration which produced this rate runoff. 2- Also used incorrectly for "percentage runoff".
151. **Percentage runoff (Phần trăm dòng chảy mặt):** The amount of runoff expressed as a percentage of the total rainfall in a given area.
152. **Yield of drainage basin, Annual yield of drainage basin (Lượng sinh thủy của lưu vực, lượng sinh thủy năm của lưu vực):** Total volume or flow from a drainage basin for a long stipulated period of time, e.g. "annual yield of drainage basin" is the mean annual runoff.
153. **Runoff cycle (Chu trình dòng chảy mặt):** Portion of the hydrologic cycle between incident precipitation over land areas and subsequent discharge through stream channels or direct return to the atmosphere through evapotranspiration.
154. **Storm runoff, or Storm-water runoff (Dòng chảy mưa rào):** That portion of the total runoff from storm rainfall which reaches the point of measurement within a relatively short period of time subsequent to the occurrence of rain. It essentially excludes the base flow.
155. **Overland runoff (Dòng chảy tràn trên mặt):** Runoff water flowing over the land surface before it reaches a definite stream channel.
156. **Surface runoff (Dòng chảy mặt):** Overland runoff when it has reached a definite stream channel.
157. **Surface flow (Dòng chảy mặt):** A stream of water on or above the earth's surface.
158. **Interflow, Subsurface runoff (Dòng chảy sát mặt):** That portion of the precipitation which has not passed down the water table but discharged from the area as subsurface flow into stream channels. Also known as "subsurface runoff".
159. **Subsurface flow, or Underground flow (Dòng chảy ngầm):** A stream of water under the earth's surface.

160. **Direct runoff (Dòng chảy mặt trực tiếp):** The sum of surface runoff, interflow and channel precipitation.
161. **Riverflow, Streamflow, or River discharge (Dòng chảy sông hay Lưu lượng sông):** The volume-rate of flow, expressed in m³/s, passing a particular point along a river at a particular instant.
162. **Streamflow record (Tài liệu dòng chảy):** Data of river flow measured and recorded on any type of storage medium.
163. **Groundwater runoff (Dòng chảy mặt do nước ngầm cung cấp):** That part of the runoff which has passed into the ground, becomes groundwater, and is discharged into a stream channel as spring or percolation water.
164. **Drainage modulus, or Drainage coefficient (Mô-đun tiêu, hệ số tiêu):** The runoff from a drainage district expressed in depth units removed from the area in 24 hours.
165. **Depression storage, or Pocket storage (Chứa điện trũng):** The volume of water expressed as depth on the entire water surface of the area, which is required to fill natural depressions, large or small, to their overflow levels..
166. **Initial abstraction(Tổn thất ban đầu):** The sum of interception and depression storage.
167. **Initial detention (Tổn thất trữ ban đầu):** The part of precipitation which does not appear either as infiltration or as surface runoff during a period of precipitation or immediately thereafter; includes interception by vegetal cover, depression storage and evaporation during precipitation; does not include surface detention.
168. **Surface detention (Tổn thất trữ mặt):** The part of precipitation which deposits thin sheets of water over soil surface when overland flow takes place; does not include depression storage which does not contribute to surface runoff. Detention depth increases until discharge reaches equilibrium with a rate of supply to surface runoff.
169. **Bank storage (Trữ nước ven bờ):** Water absorbed and stored in returned in whole or in part as the level of the surface of the water body falls.
170. **Channel storage, or Temporary storage (Trữ trong lòng dân hay Trữ tạm thời):** When the flow into a channel is greater than the channel capacity, it can not discharge immediately, a certain amount goes into temporary storage in the channel by increasing its water level and is called channel storage. It is maximum when in a rising stage the inflow and outflow are equal and the depth of flow is a maximum.
171. **Residual mass curve (Đường lũy tích):** A plotting of the year-to-year residual departure of rainfall or runoff from the arithmetical average accumulated for the period under consideration.
172. **Pluviograph (Biểu đồ dòng chảy cực hạn hoặc máy đo mưa tự ghi):** 1- A theoretical hydrograph which would result from a storm if the runoff were 100 percent of the precipitation and if the proportions fixed by the distribution graph were applicable to the gross precipitation. It is in theory, therefore, a limiting hydrograph that would be caused by that storm. 2- Recording rain gauge.

173. **Distribution graph, or Distribution curve (Biểu đồ phân bố dòng chảy hay Đường phân bố dòng chảy):** A graph showing the typical distribution of runoff from a drainage basin in terms of the percentage of the total runoff that occurs in each of a number of equally spaced intervals of time.
174. **Histogram (Biểu đồ phân bố tần suất):** A graphical representation of frequency distribution by means of rectangles whose widths are the class intervals and whose heights are the corresponding frequencies.
175. **Histogram, or Isochrone (Bản đồ đường đẳng thời):** A map or chart of a river or drainage basin on which a series of time lines give the time of transit of water, originating on a time line, to flow down to the outlet of the system.

II.1.2(b). WATERLOSSES - TỔN THẤT NƯỚC

176. **Infiltration (Thấm mực):** 1- The flow or movement of water through the surface into the soil body or ground; 2- The absorption of liquid water by the soil, either when it falls as rain, or when applied as irrigation, or from a stream flowing over the ground; 3- Flow from a porous medium into a channel, pipe, drain, reservoir or conduit; 4- The infiltrated water, as infiltrate.

Note: The distinction between infiltration and percolation is that the latter is the movement of water or moisture within the soil through the saturated zone.
177. **Rainfall infiltration (Thấm mực từ mưa):** The portion of rainfall which passes downward from the surface into the soil or rock. It is equal to the total precipitation less the losses due to interception by vegetation, depression or other storage, evaporation from all moist surfaces, and surface runoff.
178. **Deep percolation (Thấm lọc sâu):** 1- In a geologic sense, this is the amount of water that is lost from a basin area by leakage through the geologic formation; 2- With respect to irrigation and precipitation, that amount of water which passes below the root zone of crop or vegetation.
179. **Seepage, Absorption loss, Influent seepage, Effluent seepage (Thấm thấu (thẩm lậu), rò rỉ, tổn thất thẩm lậu, rò rỉ vào dòng chảy, rò rỉ ra ngoài dòng chảy):** 1- The slow movement of water through small cracks, pores, interstices, ect., in the surface of unsaturated material into or out of a body of surface or subsurface water; 2- The loss of water by infiltration from a canal, reservoir, or other body of water or from a field. It is generally expressed as flow volume per unit time. Seepage into a body is referred to as "influent seepage"; that away from a body, as "effluent seepage". During the process of priming, such a loss is termed as "absorption loss". 3- Water escaping through or emerging from the ground along an extensive line or surface as contrasted with a spring where the water emerges from a localized spot.
180. **Storm seepage (Thẩm trong khi mưa):** That portion of the rainfall during a storm which infiltrates into the surface soil, and moves away from the area on which it falls

through the upper horizons at a rate much in excess of the normal groundwater seepage.

181. **Retention (Tổn thất cát giữ trên mặt):** The part of the precipitation falling on a drainage area which does not escape as surface stream flow, during a given period. It is the difference between total precipitation and total runoff during the period, and represents evaporation, transpiration, subsurface leakage, infiltration, and when short periods are considered, temporary surface or underground storage on an area. When a period of several years is considered, it approximates actual evapotranspiration.
182. **Initial-abstraction retention (Tổn thất cát giữ trên mặt giả định ban đầu):** Total amount of rainfall that may fall without causing a significant amount of direct runoff.
183. **Infiltration head (Đầu thấm nước (cột nước thấm):** The head of water which makes it flow or infiltrate through the media.
184. **Infiltration capacity (Khả năng thấm):** The maximum rate at which a given soil in a given condition can absorb rain as it falls, or irrigation water as it is applied.
185. **Infiltration rate (Cường độ thấm, tốc độ thấm):** 1- The rate at which water penetrates the surface of a soil. The term is usually used to refer to water occurring as precipitation, but is also applied to water flowing or standing upon soil; 2- The rate at which groundwater enters an infiltration ditch, gallery, drain, sewer or other underground conduit.
186. **Average infiltration rate (Tốc độ (cường độ) thấm trung bình):** The rate obtained by dividing the mass infiltration, that occurs during the time rainfall intensity exceeds the infiltration capacity, by the time during which infiltration occurs at capacity rate.
187. **Infiltration volume (Tổng lượng thấm):** Rainfall, expressed in millimetres (inches) depth over a given area, that passes below the rootzone of plants and ultimately reaches the zone of saturation.
188. **Ground rainfall (Mưa rơi trên mặt đất):** The part of rainfall which actually reaches the ground, i.e. the total rainfall minus interception by vegetation.
189. **Infiltration coefficient (Hệ số thấm):** The ratio of infiltration to rainfall.
190. **Infiltration index (Chỉ số thấm):** The average rainfall intensity over and above which the mass of rainfall (the supra-rain) equals the mass runoff.
191. **Φ-Index (Chỉ số Φ):** The average rainfall intensity above which the volume of rainfall equals the volume of observed runoff and equals total basin discharge divided by the duration of rainfall, provided that the rainfall intensity is continuously in excess of the index.
192. **W-Index (Chỉ số W):** The average rate of infiltration during the time the rainfall intensity exceeds the infiltration capacity.
193. **Wmin-Index (Chỉ số Wmin):** With very wet conditions, when the retention rate is at a minimum, the values of W-index and -index are almost identical, and W-index is termed Wmin-index.

194. **Infiltrometer:** A device or method to measure infiltration in experimental plots (Một thiết bị hay phương pháp để đo thấm tại các điểm thí nghiệm).
195. **Infiltration rate curve (Đường cong thấm):** Curve showing the actual rate of infiltration during a particular storm.
196. **Infiltration capacity curve (Đường cong khả năng thấm):** Curve showing what the infiltration rate would be at any period during a specific storm if the rainfall intensity were to equal or exceed the capacity at that instant.
197. **Standard infiltration curve (Đường cong thấm tiêu chuẩn):** Curve showing what the rate of infiltration would be under a standard rain condition during which the rainfall intensity continuously exceeds the infiltration rate.
198. **Evaporation (Bốc hơi nước):** 1- The process by which water is changed from the liquid or the solid state into the gaseous state through the transfer of heat energy; 2- The product or result of evaporating.
199. **Soil additives (Phụ gia đất):** Chemical materials which when added to the soil, change its physical characteristics as well as its infiltration capacity.
200. **Mean annual evaporation (Bốc hơi trung bình năm):** The mean value in depth-units of evaporation, the period of observation being of adequate duration to secure approximate constancy.
201. **Temperature loop (Đường vòng dây nhiệt độ):** A condition which sometimes arises when mean monthly depths of evaporation for similar mean monthly air temperatures are higher during the spring and early summer than during the late summer and fall and is found by plotting evaporation against temperature.
202. **Relative humidity (Độ ẩm tương đối):** Expressed as a percentage representing the ratio of the water vapour present in the air to the vapour which the same air could contain if saturated.
203. **Vapour pressure (Áp suất hơi nước):** 1- The pressure exerted by a vapour when in a confined place. It is a function of the temperature; 2- The partial pressure of water vapour in the air or atmosphere.
204. **Dewpoint (Điểm sương):** There is a maximum limit to the amount of water vapour a confined space or air can contain. This maximum depends on temperature, the dewpoint, and is known as saturation condition. Under this condition water vapour (or air containing water vapour) and plane surface of pure water at the same temperature are in equilibrium.
205. **Vapour tension (of the water) (Sức căng hơi nước (của nước)):** It is the vapour pressure corresponding to the temperature of the water.
206. **Psychrometer (Âm kế Psychrometer):** A hygrometer, or an instrument for measuring the aqueous vapour in the atmosphere, consisting essentially of two similar thermometers, the bulb of one being kept wet.
207. **Psychograph (Âm kế tự ghi):** A self-recording psychrometer giving simultaneous readings of the dry-bulb and wet-bulb thermometers.

208. **Evaporativity, Evaporative capacity, Evaporation power, Potential rate of evaporation, or Evaporation potential (Khả năng bốc hơi, tiềm năng bốc hơi):** Rate of evaporation under existing atmospheric conditions from a surface water that is chemically pure and has the temperature of the surrounding atmosphere.
209. **Evaporation opportunity, or Relative evaporation (Cơ hội bốc hơi hay Bốc hơi tương đối):** The ratio of evaporation from a land or water surface to the potential rate of evaporation (evaporativity) under existing atmospheric conditions.
210. **Soil evaporation (Bốc hơi đất):** The loss of water by evaporation into the atmosphere from water contained in the soil.
211. **Land evaporation (Bốc hơi mặt đất):** Soil evaporation plus interception.
212. **Interception, Canopy interception (Tổn thất cát giữ do thực vật, tổn thất cát giữ do tán thực vật):** The process by which precipitation is caught and held by foliage, twigs and branches of trees, shrubs and other vegetation and lost by evaporation, without reaching the ground surface. Also the quantity thus evaporated. Also sometimes known as "canopy interception".
213. **Interceptometer (Thiết bị đo lượng cát giữ do thực vật):** A rain-collecting device placed under a tree or amid bush and crops, the catch of which is compared with that of a rain gauge set in the open, in order to determine the amount of rainfall loss by interception.
214. **Interception capacity (Khả năng cát giữ do thực vật):** The maximum depth of precipitation a particular vegetal cover can intercept and retain under most favourable conditions of rainfall intensity and wind velocity.
215. **Interception storage (Lượng trữ cát giữ do thực vật):** The actual depth of precipitation intercepted and held above the ground during any particular storm.
216. **Evaporation tank, or Evaporation pan (Thùng đo bốc hơi):** An experimental tank used to determine the amount of evaporation from the surface of water under measured or observed climatic and cultural conditions.
217. **Pan coefficient, or Conversion coefficient (Hệ số thùng hay Hệ số chuyển đổi):** The ratio of evaporation from a large body of water to that from a pan.
218. **Evaporation station (Trạm đo bốc hơi):** A station set up on the surface of a water body or on land for making evaporation measurement.
219. **Lysimeter:** A device for measuring the percolation of water through soils and determining the soluble constituents removed in the drainage. (Một thiết bị để đo thấm sâu của nước qua các lớp đất và xác định các thành phần hòa tan bị mang đi trong tiêu thoát).
220. **Transpiration (Thoát hơi nước):** The emission or exhalation of watery vapour from the living plant.
221. **Transpiration ratio, Water-use ratio, Relative transpiration, Transpiration coefficient, or Transpiration efficiency: Tỷ lệ thoát hơi, tỷ lệ dùng nước, thoát hơi nước tương đối, hệ số thoát hơi hay Hiệu quả thoát hơi**

222. **Cuticular transpiration (Thoát hơi qua tiểu bì):** Direct evaporation from the moist membranes into the atmosphere through the cuticle.
223. **Stomatal transpiration (Thoát hơi qua khí khổng):** Outward diffusion into the atmosphere through the pores of stomata and lenticula, of water vapour previously evaporated from imbibed membranes into gas spaces within the plant leaf.
224. **Total evaporation, Total loss Water losses, or Fly-off (Bốc hơi tổng cộng, tổng tổn thất, tổn thất nước hoặc Bay hơi):** The sum of water lost from a given land area during any specific time by transpiration from vegetation (agricultural crops or native vegetation) and building of plant tissue, by evaporation from water surfaces, moist soil and snow; and by interception.
225. **Initial soil storage (Lượng trữ ban đầu trong đất):** The maximum amount of precipitation that is necessary to satisfy moisture deficiency under specific conditions of soil before any runoff takes place.
226. **Initial foliage storage (Lượng trữ ban đầu của lá):** The maximum amount of precipitation that is necessary to satisfy foliage deficiency before some of it drips to the ground under the trees or another foliage plant.
227. **Basin recharge (Tổn thất trên lưu vực, lượng bổ cập của lưu vực):** That portion of the storm rainfall that is required to satisfy the demands of interception, depression storage, and soil moisture. It is the difference between rainfall and runoff and often referred to as loss.
228. **Watershed leakage (Thá m ra ngoài lưu vực):** The geological formation under many drainage basins is such that precipitation falling on one basin finds its way underground through fissures and water-bearing strata an outlet either in a nearby or a remote drainage basin, or directly to the sea. This is called "watershed leakage".
229. **Net return flow (Dòng chảy hồi quy thực):** Amount of water applied to the cropped area in excess of the consumptive use by crops minus the unavoidable non-productive consumptive uses drawing upon that excess before it can be reused.

II.1.2(c). HYDROGRAPH - ĐƯỜNG QUÁ TRÌNH DÒNG CHÁY

230. **Hydrograph, Discharge hydrograph, Sediment hydrograph, Flood hydrograph, Overland flow hydrograph, Stage hydrograph, Well hydrograph (Đường quá trình, đường quá trình lưu lượng, đường quá trình bùn cát, đường quá trình lũ, đường quá trình dòng chảy tràn, đường quá trình mực nước, đường quá trình mực nước giếng):** A graph showing the stage, discharge, velocity, or some other features of water, with respect to time. For example, a graph showing the discharge of a stream against a time is called "discharge hydrograph". A graph of sediment concentration or sediment charge with respect to time is "sediment hydrograph". Other examples of hydrographs are "flood hydrograph", "overland flow hydrograph", "stage hydrograph", "well hydrograph".

231. **Base flow, Basic flow, or Permanent flow (Đòng chảy cơ bản hay Đòng chảy thường xuyên):** The sustained or dry weather flow of streams resulting from the outflow of permanent or perched groundwater, and from the drainage of large lakes and swamps. Also water from glaciers, snow and all other possible sources not resulting from direct runoff.
232. **Recession, Recession hydrograph (Đường nước rút):** The falling limb of a hydrograph after a flood event representing the withdrawal of water from storage in the valley, stream channel and the subsurface runoff. A recession curve may sometimes be referred to as a "recession hydrograph".
233. **Normal recession curve (Đường nước rút chuẩn):** This is derived from segments of hydrograph that represent discharge from a natural valley or channel storage after the base flow has been subtracted.
234. **Groundwater depletion curve, Groundwater recession curve (Đường hạ thấp nước ngầm, đường rút nước ngầm):** The recession, after the flow created by direct runoff has ceased, is the groundwater depletion curve. A normal groundwater depletion curve is the mean of a number of such curves. A groundwater depletion curve is also known as "groundwater recession curve".
235. **Valley storage, Lateral storage (Trữ trong thung lũng, trữ bờ):** 1- The volume below the water surface profile. 2- The natural storage capacity or volume occupied by a stream in flood after it has overflowed its banks. It includes the quantity of water within the main channel (channel storage) and that which has overflowed its banks (lateral storage). 3- The same term, expressed in time units, is used to designate the average ratio of storage volume to discharge capacity of the river.
236. **Groundwater storage curve (Đường trữ nước ngầm):** A curve derived by summing the area under the groundwater depletion curve, so as to show the volume of water remaining in the ground that is available for runoff, at specific rates of groundwater flow.
237. **Compound hydrograph, or Compound normal hydrograph (Đường quá trình kép hay Đường quá trình chuẩn kép):** The hydrograph of an overlapping storm when the flow on account of one sub-storm continues during the next sub-storm.
238. **Design flood hydrograph (Đường quá trình lũ thiết kế):** The hydrograph of flow adopted to represent limiting volumes and concentration of runoff for use in determining design capacities of spillways for dams, etc., or other hydraulic studies.
239. **Hydrograph separation (Phân tách đường quá trình):** The division of a hydrograph which results from a specific storm into its groundwater and direct runoff components.
240. **Hyetograph (Biểu đồ phân bố mưa):** 1- A graphical representation of average rainfall, excess rates or volumes over specified areas during successive units of time during a storm. 2- Also a "self-registering rain gauge".
241. **Unit hydrograph, or Unitgraph (Đường đơn vị):** Hydrograph of storm runoff at a given point on a given stream which will result from an isolated rainfall excess of

- unit duration occurring over the contributing drainage area and resulting in a unit of runoff.
242. **Rainfall excess, or Net rainfall (Lượng mưa hiệu quả, lượng mưa thực):** The volume of rainfall available for direct runoff.
 243. **Mass curve, Mass diagram, Summation graph, Summation curve (Đường lũy tích, biểu đồ lũy tích):** A curve in which values of cumulative rainfall or runoff are plotted against time. Also sometimes referred to as "summation graph" or "summation curve".
 244. **Double mass curve (Đường lũy tích kép):** A plot of accumulated annual or seasonal precipitation at an individual station against the concurrent accumulated mean precipitation for a graph of surrounding stations.
 245. **Mass centre (Trung tâm khối):** The centre of gravity of the mass curve.
 246. **Unit-rainfall duration (Thời đoạn mưa đơn vị):** The duration of runoff-producing rainfall or excess rainfall that results in a unit hydrograph.
 247. **Rise, Rising period, Recession period (Thời kỳ lũ lên, thời kỳ lũ xuống):** It is the period during and following rainfall from the time when the hydrograph first departs from the normal depletion curve until it again becomes coincident with the normal depletion curve. A rise consists of a period of increasing flow, which may result either from increased groundwater flow, from surface runoff, or both. This culminates in the crest or peak of the rise which is followed by a "recession period".
 248. **S-curve, or S-curve hydrograph (Đường S hay Đường quá trình S):** A graph showing the summation of the ordinates of a series of unit hydrographs spaced at unit-rainfall duration intervals. It represents the hydrograph of unit rate of rainfall excess continued indefinitely. If the ordinates of the S-curve are expressed as a percentage of the total unit hydrograph volume and the abscissa as unit of time or as percentage of lag time, the S-curve is known as a "summation graph".
 249. **Synthetic unit hydrograph (Đường đơn vị tổng hợp):** A unit graph developed on the basis of an estimation of coefficients expressing various physical features of a catchment.
 250. **Composite unit graph, or Composite unit hydrograph (Tổng hợp đường đơn vị):** A tabular presentation of unit hydrograph for the important subdivisions of a large area, with the times of beginning of rise appropriately lagged by the times of travel from the outlets of the sub-areas to the major gauge station. The runoff is computed independently for each area multiplied by unit graph ordinates for that area. The sum of all flows thus computed in a vertical column gives the flow to be expected at the outlet of the basin.
 251. **Dimensionless unit graph (Đường đơn vị không thứ nguyên):** A unit graph useful for comparing unit hydrographs of different drainage areas or those resulting from different storm patterns. It is derived either from an observed storm-flow hydrograph of a flood event or from a unit hydrograph or can be constructed from a summation graph.

252. **Coaxial graphical relationship, or Coaxial graphical correlation (Quan hệ đồ giải đồng trục hay Tương quan đồ giải đồng trục):** A group or series of three or four variable graphs connected with common axes to facilitate plotting and computing. It is based on the premise that if any important element is omitted from a relation, then the scatter of points in the plotting of observed values of dependent variables versus those computed by the relation will be at least partially explained by the omitted factor; a family of curves fitting the data can be used to modify or correct the values computed from the original relation.
253. **Flood absorption effect of a reservoir (Ảnh hưởng giảm lũ của hồ chứa):** The effect of a reservoir in damping down the effect of a flood.

II.1.2(d). HYDROLOGICAL MODELS - CÁC MÔ HÌNH THỦY VĂN

254. **Hydrological system (Hệ thống thủy văn):** A set of hydraulic processes transforming an input variable (like rainfall) into an output variable (like runoff). The processes may also be of chemical or biological nature and there may be several input variables (like rainfall and evaporation).
255. **Hydrological models (Mô hình thủy văn):** A simplified representation of a hydrological system leading to an acceptable simulation of the physical and other processes in hydrology.
256. **Rainfall-runoff models (Mô hình mưa rào dòng chảy):** Any type of model simulating runoff processes as a function of rainfall and evaporation.
257. **Runoff models (Mô hình dòng chảy mặt):** Any type of model simulating runoff processes.
258. **Electric analog models (Mô hình tương tự điện):** Models based on the analogy between water flow in the prototype and the resistance-capacitance processes of electric flow in an electric system.
259. **Physical scale models (Mô hình tỷ lệ vật lý):** Models based on the similarity between flow of the water in the prototype and the flow of water in an imitation of the prototype at a reduced scale.
260. **Deterministic models (Mô hình tất định):** 1- Models based on physical loss governing the flow of water and relationships with system properties. 2- Any type of model yielding a single response to a given input.
261. **Black box simulation models, or Mathematical models (Mô hình mô phỏng hộp đen hay Mô hình toán):** Models in which the physical processes of the system ("box") are not considered but where the simulation is obtained by a set of mathematical equations (mathematical models) or by a graphical relation obtained from records (like the method of the unit hydrograph).
262. **Lumped parameter models (Mô hình thông số gộp):** Hydrologic models which do not consider spatial variations in parameters throughout the system.

- 263. **Conceptual models (Mô hình nhận thức):** Models applied to transfer the net rain on a catchment area into the direct runoff from that area. These models are based on the concepts of translations and storage which govern the flow process. Therefore this process can be simulated by routing the input through an abstract system of channels and reservoirs.
- 264. **Distributed parameter models (Mô hình thông số phân phôi):** Hydrologic models which account for spatial variations from point to point in parameters throughout the system.
- 265. **Time series (Chuỗi thời gian):** Sequences of hydrological events, like water level, discharge, etc., of specified magnitude.
- 266. **Historic time series (Chuỗi thời gian lịch sử):** Sequences of observed historic events. The significance of this information increases length of the period of record.
- 267. **Auto-correlation (Tự tương quan):** Statistical relation between the magnitude of an event in a time series at a certain time and the magnitude and the event at certain period earlier.
- 268. **Auto-regressive scheme, Synthetic time series (Phương trình tự hồi quy, chuỗi thời gian tổng hợp):** Simple and widely used model for the generation of synthetic time series. In this model, the current values of the series are expressed as a function of the preceding values and a random component.
- 269. **Thomas-Fiering model (Mô hình Thomas - Fiering):** Auto-regressive scheme to generate annual and monthly flows.
- 270. **Stochastic hydrology (Thủy văn quá trình ngẫu nhiên):** The study and application of random processes involved in hydrology.
- 271. **Real time forecasting (Dự báo theo thời gian thực):** Forecasting by means of a mathematical or other type of model in which the programmed responses to an event are essentially simultaneous with the event itself.
- 272. **Stochastic model (Mô hình quá trình ngẫu nhiên):** Mathematical model simulating random processes.

II.1.3. FLOODS - LŨ

- 273. **Flood, or River flood (Lũ hay Lũ sông):** A relatively high flow or stage in a river, markedly higher than the usual. A mass of water, rising, swelling and overfowing land.
- 274. **Inundation, Flood, or Flooding (Ngập lụt):** The inundation of low land resulting from a flood.
- 275. **Flash flood (Lũ đột ngột (lũ quét)):** A flood of short duration and abrupt rise with a relatively high peak rate of flow, usually resulting from a high intensity of rainfall over a small area.

276. **Annual flood, Monthly flood (Định lũ năm, định lũ tháng):** The highest daily peak flood in a water year. The maximum flow occurring in a stream during a calendar month is known as a "monthly flood".
277. **Annual flow, or Annual discharge (Dòng chảy năm hay Lưu lượng năm):** The volume of water passing a particular point during one year.
278. **Monthly flow, or Monthly discharge (Dòng chảy tháng hay Lưu lượng tháng):** The volume of water passing a particular point during one month.
279. **Average annual flood, Minimum annual flood (Lưu lượng lũ trung bình năm, lưu lượng lũ nhỏ nhất của năm):** The mean of the annual floods over a number of years. The smallest of the annual floods during the period of record is called the "minimum annual flood".
280. **Maximum flood (Lưu lượng lũ lớn nhất):** The highest of the recorded floods, at a section of a stream, during a specified period; the period may be a week, a month, a year or even the entire period of record.
281. **Flood duration (Thời gian lũ):** Time during which a certain (high) water level is equalled or exceeded.
282. **Flood estimation (Ước tính lũ):** Approximate calculation or assessment of the probable height of a flood.
283. **Flood event (Trận lũ):** The flow pattern in a stream, constituting a distinct progressive rise culminating in a peak or summit together with the recession that follows the crest.
284. **Forecasting system (Hệ thống dự báo):** Method to produce data on future situations.
285. **Flood stage (Mực nước lũ):** The elevation of the water surface fixed by local usage above which the stream is considered to be in flood.
286. **Peak flood, Momentary flood peak, or Maximum intensity of flood (Định lũ):** Maximum rate of flow that occurred during a flood event.
287. **Daily flow, or Daily discharge (Dòng chảy ngày, lưu lượng ngày):** The volume of water passing a particular point during one day.
288. **Maximum computed flood (Lưu lượng lũ tính lớn nhất):** The largest momentary discharge believed possible from a consideration of meteorological condition and snow cover on the watershed. It pre-supposes simultaneous occurrence of all possible natural contingencies favourable to high floods.
289. **Maximum probable flood (Lũ có khả năng lớn nhất):** Flood which would be produced by the maximum probable precipitation and which is computed using a rainfall-runoff relationship (like unit hydrograph).
290. **N-Year flood (Lũ N năm):** A flood which has a probability of being equalled or exceeded once every N-years or has one chance in N of occurring in any one year.
291. **Design flood (Lũ thiết kế):** 1- The maximum flood that any structure can safely pass. 2- The flood adopted to control the design of a structure. 3- The flood against which a given area to be protected.

292. **Design storm (Trận mưa thiết kế):** The design storm is that estimate of a rainfall, amount and distribution over a particular drainage area which is accepted for determining the design flood.
293. **Extreme flood, or Extraordinary flood (Lũ cực hạn):** The highest flood observed during a given period.
294. **Initial flood (Lũ ban đầu):** Flood caused by a continuous light rainfall preceding the major storm.
295. **Confined flood (Lũ vỡ bờ):** A term applied to a hypothetical flood in case of a breach or crevasse in a certain reach of a river that would have reached the lowest point had there been no breach.
296. **Sharp-crested flood (Lũ đỉnh nhọn):** A flood in which the crest occurs over a very short period and falls rapidly below the flood stage.
297. **Catastrophic flood (Lũ thảm họa):** A flood due to meteorological conditions of exceptional rarity, and due either to catastrophical rainfall spread over a period considerably longer than the time of concentration for the area, or to violent rain of the cloud burst type.
298. **Sheet flood (Lũ tràn mặt):** A flood which spreads as a thin sheet channels. Sheet flood are of short duration, generally being measured in minutes or hours, and the water is always muddy.
299. **Urban flood (Lũ đô thị):** Flood occurring in an inhabited area.
300. **Flood frequency (Tần suất lũ):** Over a period of years, the average number of times a flood of a given magnitude is likely to occur.
301. **Percentage frequency of a given flood (Tần suất phần trăm của một trận lũ xác định):** The percentage of observed floods that were equal to or larger than a given flood within the period of observation or the percent of floods that will be equal to or larger than a given flood.
302. **Flood series (Liệt lũ):** A list of flood events, usually arranged in order of magnitude, which occurred during a specified period of time.
303. **Envelope curve (Đường bao):** Curve which envelops all the plotted points representing maximum recorded flood peaks and volumes from comparable areas.
304. **Channel phase (Pha chảy trong lòng dân):** The phase following the land phase which starts with the entry of surface runoff into stream channels.
305. **Warning stage (Mực nước cảnh báo):** The stage at which damage or inconvenience begins locally or near a particular gauge. It may be either above or below a bankful flood storage.
306. **Channel capacity (Khả năng lòng dân):** The maximum flow which a given channel is capable of carrying without overtopping its banks.
307. **Bankfull, or Bankfull stage (Mực nước trứ bờ):** The stage or gauge height attained by a river or stream when flowing at a capacity above which the banks are overflowed.

308. **Overland flow (Dòng chảy tràn trên mặt):** The flow of storm water over the ground before becoming channelized.
309. **Flood volume (Tổng lượng lũ):** The sum of the mean daily discharge passing at a particular site during a flood event.
310. **Flood runoff (Dòng chảy mặt của lũ):** The total quantity of water flowing from the catchment during the period of the flood.
311. **Flood crest, Flood peak, or Flood summit (Đỉnh lũ):** The highest elevation reached by flood waters in a flood event.
312. **Flood wave (Sóng lũ):** A rise in stream flow to a crest consequent of runoff, generated by precipitation, and its subsequent recession constitutes a flood wave. A flood wave may also be regarded as a temporary unbalance in river regime resulting from the application of more water to the land in the form of precipitation or by the melting of snow that can be absorbed by the land itself. The regime during the resulting unsteady flow is determined, largely, by complex local transfers of energy and of volume.
313. **Prism storage, Wedge storage (Trữ dạng lăng trụ, trữ dạng nêm):** An element of flood wave which represents that portion of the total storage which would correspond to the condition of flow. Wedge storage is superimposed thereon and may be positive or negative according to whether the river is rising or falling.
314. **Flood mark, High watermark, or Swash mark (Vết lũ, vết triều):** The mark or line left by silt debris or other means at the highest water level reached during a flood or tide.
315. **Flood index (Chỉ số lũ):** Is the sum of the depths of flooding observed at a number of key stations on a river each year. This index gives a physical representation of the extent of flooding each year that is independent of any economic factor.
316. **Flood plain (Bãi ngập lũ):** The portion of a river valley, outside the stream channel but adjacent to it, which is described by the perimeter of the probable limiting flood. It is land which is not covered by the stream at low flow or average flow, but which has been flooded in the past or is likely to be flooded.
317. **First bottom (Lòng bãi thứ nhất):** The flood plain of streams; land that is overflowed by normal floods; the bottom nearest the stream.
318. **Second bottom (Lòng bãi thứ hai):** A terrace level next above the flood plain or bottom. Second bottom land is above any ordinary flood.
319. **Flood zones (Vùng lũ):** Subdivisions of a flood plain; all the lands which are subject to floods of approximately the same frequency.
320. **Flood plane (Mặt bằng lũ):** The position occupied by the water surface of a stream during a particular flood. Also loosely, the elevation of the water surface at various points along the stream during a particular flood.
321. **Poin of concentration (Điểm tập trung nước):** Outlet of the catchment.

322. **Period of concentration, or Time of concentration (Thời kỳ tập trung dòng chảy hay Thời gian tập trung dòng chảy):** The time taken by the runoff from the farthest point of the catchment to reach the point of concentration.
323. **Nature's double zero (Kết thúc mùa đông băng tuyết):** A snowy winter ended by a rainy thaw.
324. **Critical storm period (Thời kỳ trận mưa tối hạn):** The duration of that storm which causes the greatest peak in a drainage basin.
325. **Flood routing (Diễn toán lũ):** 1- The process of progressive determination of the timing and shape of a flood wave at a successive point along a stream. 2- The procedure by which the hydrography at any point on a stream is determined from a known hydrograph at some point upstream.
326. **Stream routing (Diễn toán dòng chảy):** The flood routing of a stream when the only storage is that furnished by the stream channel and valley.
327. **Reservoir routing (Diễn toán lũ trong hồ chứa (tính toán điều tiết lũ):** The flood routing when the flood wave is passed through a reservoir.
328. **Flood protection (Chống lũ):** The protection from flood damage afforded by a given programme of flood control.
329. **Flood control (Phòng chống lũ, kiểm soát lũ):** The provision of a specific amount of protection from floods.
330. **Floodway (Đường thoát lũ):** 1- A natural or artificial channel designed to pass flood flow; 2- Also land, subject to overflow and adjacent to an existing channel, designed as a floodway.
331. **Flood walls (Tường chắn lũ):** Walls constructed for protection against flood.
332. **Channel improvement (Cải tạo lòng dẫn).**
333. **Land management (Quản lý đất đai):** All activities of man that affect the land; as a flood control technique it includes conservation practices on agricultural land, grazing, regulation, forest-utilization on a sustained yield basis.
334. **Land elevation (Độ cao mặt đất):** The elevation (upbuilding) of the surface of a flood plain so as to render it less susceptible to flooding.
335. **Flood abatement (Biện pháp giảm lũ):** Any measure taken outside a stream channel with the effect of reducing the crest of flood flows or changing the debris load for a flood event.
336. **Direct costs (Chi phí trực tiếp):** Cost of a flood protection programme, including design and construction of engineering structures, loss of productive land coming under reservoirs, relocation of transportation and other facilities occasioned by construction of the project, amortization tax costs, etc.
337. **Flood damage, or Flood losses (Thiệt hại do lũ gây ra):** The destruction or impairment, partial or complete, of the value of goods or services, or of health, resulting from the action of flood waters and the silt and debris they carry.

338. **Flood disaster, Flood catastrophe (Thảm họa do lũ lụt):** Disaster caused by an extreme flood, especially after the failure of dikes or dams.
339. **Direct damage, or Direct losses (Thiệt hại trực tiếp):** All losses resulting from inundation or directly from the action of flood water.
340. **Indirect damage, or Indirect losses (Thiệt hại gián tiếp):** Losses resulting from but not from direct action of flood water; for example, losses resulting from the interruption of the production of goods and services.
341. **Tangible losses (Tổn thất tính được thành tiền):** Flood damage that is susceptible to assessment in terms of money.
342. **Intangible losses (Tổn thất không tính được thành tiền):** Flood damage that is not susceptible to assessment in terms of money.
343. **Storage (Lượng trữ):** The impounding of water in surface or underground reservoirs for future use. The term differs from regulation which refers to more or less temporary detention of water. Also the volume of water stored.
344. **Detention storage (Ngăn trữ nước):** The volume of water which can be stored temporarily, as during a flood period; usually applies to a volume in a reservoir but may be applied to storage volume in a channel or on the ground surface.
345. **Flood absorption (Sự cát lũ):** Reduction in flood discharge resulting from accommodation of flowing water in a reservoir, channel, valley or lake.
346. **Flood storage basin (Lưu vực chứa lũ):** A basin or reservoir into which a part of the flood water can be passed and held until the flood has subsided when it can be released.
347. **Regulating reservoir (Hồ chứa điều tiết lũ):** A reservoir formed in a river valley or other basin by a barrier or dam having controlled outlets.
348. **Retarding reservoir, or Detention reservoir (Hồ chứa chậm lũ):** A flood control reservoir with uncontrolled outlets.
349. **Basin (Lưu vực):** Area drained by a river or its tributaries (hydrology) or a level plot or field, surrounded by dikes, which may be flood irrigated (irrigation) (recharge).
350. **Retarding basin (Lưu vực chậm lũ):** A basin reducing peak flood flows of a stream through temporary storage.
351. **Headwater storage (Trữ nước đầu nguồn):** Works designed to store or otherwise retain rain water, where it falls or as near thereto as practicable, to hold back the crest.
352. **Boundary river, or Border river (Sông biên giới):** The part of a river which constitutes the boundary between two states or countries.
353. **Case study (Nghiên cứu cụ thể):** Record of the past history of a specific study or project performed.
354. **Development project (Dự án phát triển):** Plan in a developing-country which is realized with the help of development-aid workers.

355. **International hydrological programme (Chương trình thủy văn quốc tế):** The continuation of the international hydrological decade (1965-1974).
356. **Kalman-filter (Phép lọc Kalman):** A linear system in which the mean-squared error between the desired output and the actual output is minimized when the input is a random signal generated by white noise.
357. **Kriging (Phương pháp nội ngoại suy theo không gian):** A statistical method for spatial interpolation or extrapolation of hydrological data.
358. **Master plan (Quy hoạch tổng thể):** General framework which controls subsidiary plans.
359. **Multireservoir system (Hệ thống hồ chứa lợi dụng tổng hợp):** Group of reservoirs functioning together in a regular relation.
360. **Origin, or River head (Nguồn hoặc đầu sông):** The beginning of a river.
361. **Pilot project (Dự án thử nghiệm):** An early, mostly small project set up to gain experience in operating the actual project.
362. **Risk analysis (Phân tích rủi ro):** Qualification of the various sources of uncertainty in risk prediction and comparison of relative risk.
363. **River basin management, Watershed management, or River management (Quản lý lưu vực sông, quản lý lưu vực hứng nước hoặc quản lý dòng sông):** Planned use of river basins in accordance with predetermined objectives.
364. **River basin model, or Watershed model (US) (Mô hình lưu vực sông hoặc mô hình lưu vực hứng nước):** Mathematical model simulating major hydrologic processes occurring in the catchment area of an entire river system.
365. **River regime (Chế độ sông ngòi):** The flow characteristics of a stream with respect to velocity, volume, form of and alterations in the channel, sediment-transporting capacity and the amount of material supplied for transportation.
366. **Seasonal flow (Dòng chảy mùa):** The volume of water passing a particular point during a certain season.
367. **Simulation model (Mô hình mô phỏng):** Any type of model simulating the behaviour of one system with a different, dissimilar system.
368. **Source (Nguồn):** Place where groundwater emerges, forming an origin of a stream.
369. **Spatial data (Số liệu theo không gian):** Data considered with relation to space, e.g. the spatial distribution of rainfall.
370. **Flood forecasting, or Flood prediction (Dự báo lũ):**
371. **State of the art (Trạng thái hiện thời):** Pertaining to the current stage of development or knowledge of a subject.
372. **Ungauged basin, or Ungaged watershed (US) (Lưu vực không quan trắc hoặc lưu vực hứng nước không quan trắc):** Drainage basin of which no regular hydrological records are available.

- 373. **Urban drainage** (**Tiêu nước đô thị**): The removal of excess water from inhabited areas.
- 374. **User manual** (**Cẩm nang cho người sử dụng**): A handbook explaining the use of complex machines or methods.
- 375. **Water balance, or Water budget** (**Cân bằng nước**): A systematic review of inflow, outflow and storage as applied to the computation of changes in the hydrologic cycle.
- 376. **Water temperature** (**Nhiệt độ nước**): The temperature of water.
- 377. **Water Well** (**Giếng nước**): A shaft or hole sunk, dug or drilled into the earth to extract water.
- 378. **Wetland, or Marshland** (**Đất ướt hay Đất đầm lầy**): An area covered permanently, occasionally, or periodically by fresh or salt water.

II.1.4. GROUNDWATER - NƯỚC NGÂM

- 379. **Groundwater storage** (**Trữ lượng nước ngầm**): The term "groundwater storage" applies to that stage of hydrologic cycle during which water occurs as groundwater in the zone of saturation, including that part of such a stage when the water is entering and leaving storage.
- 380. **Groundwater province** (**Vùng nước ngầm**): An area characterized by a general similarity in the mode of occurrence of groundwater.
- 381. **Subsurface Water** (**Nước dưới đất**): All water that occurs beneath the surface of the earth (i.e. within the lithosphere). This term is sometimes loosely used as synonymous with groundwater, underground water, subterranean water and subsoil water.
- 382. **Ground water** (**Nước ngầm**): The water that occurs in the zone of saturation, from which wells and springs or open channels are fed. This term is sometimes used to also include the suspended water and as loosely synonymous with subsurface water, underground water or subterranean water.
- 383. **Underground water, or Subterranean water** (**Nước dưới đất**): These terms are sometimes used as synonymous with groundwater and sometimes as synonymous with subsurface water.
- 384. **Zone of rock fracture** (**Vùng đứt gãy của đá**): The upper part of the lithosphere, in which rocks are under stresses less than those required to close their interstices by deformation of the walls of the interstices. It is part of the lithosphere between the surface of the earth and the lower limit of the porous water-bearing rock formations.
- 385. **Zone of aeration, aeration zone of suspended water, or Unsaturated zone** (**Vùng cho khí vào, vùng thông khí, vùng nước treo hay Vùng không bão hòa**): That portion of the lithosphere in which the functional interstices of permeable rock or

earth are not (except temporarily) filled with water under hydrostatic pressure; that is, the interstices are either not filled with water or are filled or partly filled with water that is held by capillarity. The zone of aeration comprises the area where fringe water, intermediate water, and groundwater may be found.

- 386. **Zone of weathering (Vùng phong hóa):** The outer layer of the crest of the earth, including the exposed surface and that part which, as a result of porosity, cracking, and jointing, is subject to the destructive action of atmospheric influence, rain, frost and oxidation.
- 387. **Zone of saturation (Vùng bão hóa):** The part of the lithosphere in which the functional interstices of permeable rock or earth are completely filled with water under positive hydrostatic pressure, that is, pressure in excess of atmospheric pressure. It is that portion of the lithosphere that supplies water to springs and wells and which contains the groundwater. Strictly speaking, part of the capillary zone is also saturated.
- 388. **Zone of rock flowage (Vùng đá trượt):** That part of the lithosphere in which all rocks are under stresses exceeding their elastic limits. In it, the rocks undergo permanent deformation and are said to flow, hence in this zone interstices are absent or insignificant.
- 389. **Zone of rock - flowage - and fracture (Vùng đá trượt và đứt gãy):** That part of the lithosphere lying between the zone of the rock fracture and the zone of rock flowage. In it, the strongest rocks behave as in the zone of rock fracture and the weakest rocks as in the zone of rock flowage.
- 390. **Belt of soil water (Vành đai nước thô nhuộm):** The part of the zone of aeration which consists of soil and other materials that lie near enough to the surface to discharge water into the atmosphere in perceptible quantities by the transpiration of plants or by evaporation from the soil.
- 391. **Intermediate belt (Vành đai trung gian):** Zone that lies between the belt of soil water and the capillary fringe.
- 392. **Pellicular zone (Vùng nước màng):** The maximum depth from the natural surface up to which the evaporation can have its effect.
- 393. **Field capacity zone (Vùng ngâm nước dã ngoại):** A buffer zone in which water is held against gravity under free drainage. It is this zone which prevents the moisture and consequently the salts from moving in a vertically upward direction.
- 394. **Pendular stage, Funicular stage, Capillary stage (Tầng dao động, tầng hút nước, tầng mao quản):** Term suggested by Versluys who distinguished three stages in the zone of aeration: the pendular stage, the funicular stage and the capillary stage. In the first, the water particles surround the points of contact of the solid particles, forming separate rings. In the second, these water rings fit together and, in the third, they will fill the capillary channels.
- 395. **Capillary fringe (Vùng mao quản):** The zone immediately above the water table in which water is held above the water table by capillarity.

396. **Interstitial water (Nước khe rỗng):** Water which occurs in the interstices in rocks.
397. **Suspended water (Nước trong tầng thoáng khí):** Water in the zone of aeration.
398. **Capillary groundwater, or fringe water (Nước ngầm mao quản hay Nước trong biên mao quản):** Water in the capillary fringe.
399. **Soil water (Nước thô nhuộm (đất canh tác)): Suspended water in the uppermost belt of soil the of the zone of aeration and lying near enough to the surface to be discharged into the atmosphere by the transpiration of plants or by evaporation from the soil. (Includes hygroscopic, capillary and non-capillary water).**
400. **Verkhovorka (Nước dưới đất tạm thời):** Subsurface water of a temporary water-bearing formation underlain by a lens of impervious rock or slightly permeable layer, and embedded not far from the earth surface within the limits of possible evaporation or transpiration into the air. This kind of water may be lost too, due to gradual percolation through the slightly permeable layer.
401. **Intermediate water (Nước trong vùng trung gian):** Water in the intermediate belt.
402. **Pellicular front (Mặt tiếp súc màng mỏng):** The even front, developed only in pervious granular material, on which pellicular water depleted by evaporation, transpiration, or chemical action is regenerated by influent seepage.
403. **Adhesive water, of pellicular water (Nước dính hay nước màng mỏng):** Water forming a film around soil particles over adsorption water and held by the forces of molecular attraction, but with less strength than adsorption water and without perceptible emission of heat. Adsorption water is entirely fixed, whereas pellicular water may move from one particle to another. Certain writers apply the term pellicular water also to adsorption water.
404. **Vadose water, gravity suspended water, or gravitational water (Nước trong tầng thoáng khí, nước treo trọng lực trong đất thoáng, nước trọng lực):** Water in excess of adsorption water and pellicular water seeping towards water table.
405. **Pendular water (Nước biến động):** Water in the pendular stage.
406. **Funicular water (Nước trong tầng hút nước):** Water in the funicular stage .
407. **Free groundwater, Phreatic water, or Non - artesian water (Nước ngầm tự do, nước ngầm hoặc Nước ngầm ổn định):** Groundwater limited above by a water table opposed to confined groundwater limited above by an impervious formation.
408. **Confined water, or Confined groundwater (Nước ngầm có áp):** Groundwater limited above by an impervious formation.
409. **Perched water, or Perched groundwater (Nước ngầm treo):** Groundwater of a limited aquifer embedded in different depths but lower than Verkhovodka, on small impermeable or relatively impermeable lenses.
410. **Semiperched groundwater (Nước ngầm bán treo):** Groundwater that has a greater pressure head than an derlying body of groundwater, from which it is not separated by any unsaturated rock.

411. **Fixed groundwater (Nước ngầm cố định):** Water held in saturated material with interstices so small that it is permanently attached to the pore walls or moves so slowly that it is usually not available as a source of water for pumping.
412. **Connatewater (Nước chôn vùi):** Water entrapped in the interstices of a sedimentary rock at the time it was deposited.
413. **Adsorption (Sự hút bám):** A phenomenon consisting in the adhesion, in an extremely thin layer, of the molecules of gases, of dissolved substances, or of liquids, to the surfaces of solid bodies, with which they are in contact, distinguished from absorption.
414. **Attached groundwater (Nước ngầm liên kết):** That portion of groundwater adhering to the pore walls. It is assumed to be equal in amount to the residual water left after drainage and is measured by specific retention.
415. **Cavern water (Nước trong hang động):** Water in large tubular or cavernous openings.
416. **Main water table, or Phreatic surface (Mực nước ngầm chính hay mực thủy áp):** The upper limit of the zone of saturation above the first impermeable or almost impermeable formation.
417. **Cavern water reservoir (Hồ chứa nước trong hang động):** Large natural temporary, or permanent storage of percolated or inflow water in dolines (hollows) through ponore's (abyss'e's) in drastic karstic formations which sometimes finds its way out through large springs.
418. **Cosmic water (Nước trong vũ trụ):** Juvenile water that comes in from space with meteorites.
419. **Fissure water, or Fault water (Nước trong kẽ nứt hay Nước đứt gãy):** Water in open fractures usually abundant only near the ground surface.
420. **Juvenile water (Nước trẻ):** Water from the interior of the earth which is new or has never been a part of the general system of groundwater circulation.
421. **Metamorphic water (Nước trong đá biến chất):** Water that is driven out of rocks by the process of metamorphism. It is a kind of rejuvenated water.
422. **Meteoric water (Nước khí quyển):** Water derived from the atmosphere.
423. **Pore water (Nước kẽ rỗng):** Water in interstices of granular permeable rocks as in sedimentary and alluvial deposits.
424. **Primitive water (Nước nguyên thủy):** Geological term meaning water originating within the earth.
425. **Rejuvenated water (Nước được làm trẻ lại):** Water returned to the terrestrial water supply by geologic processes of compaction and metamorphism. It is divided into water of compaction and metamorphic water.
426. **Water of compaction (Nước nén chất):** Water furnished by destruction of pore space owing to compaction of sediments.

427. **Water of infiltration (Nước thâm):** Water which appears as the result of percolation of surface waters or atmospheric precipitation into the upper parts of the lithosphere through the small capillary pores and interstices in the rock.
428. **Influent water (Nước ngầm chảy vào trong đất (nhập ngầm)):** Subsurface water due to penetration into the lithosphere of surface waters, or atmospheric precipitation through large interstices or fractures.
429. **Water of condensation (Nước ngưng kết (ngưng đóng)):** Water formed by condensation of water vapours appearing from the atmosphere or soil air in rock interstices and also of water vapours arising from the magmosphere or from the volcanic focuses of the lithosphere.
430. **Groundwater flow (Dòng ngầm):** 1- Flow in an aquifer; 2- That portion of the discharge of a stream which is derived entirely from groundwater, through spring or seepage water. Groundwater flow usually forms the major part of the base flow.
431. **Lithosphere (Thạch quyển):** The outer solid shell of the earth.
432. **Rock (Đá):** All formations in the lithosphere whether consolidated or unconsolidated.
433. **Aquiclude (Hệ địa chất chứa nước nhưng không chuyển nước):** A formation which, although porous and capable of absorbing water, does not permit its movement at rates sufficient to furnish an appreciable supply for a well or spring.
434. **Aquifuge (Hệ địa chất không chứa nước, không chuyển nước):** A formation which has no interconnected openings and hence cannot absorb or transmit water.
435. **Artesian water (Nước phun (nước có áp)):** Subsurface water under sufficient pressure to cause it to rise above the bottom of some fissure or other opening in the confining bed that overlies the aquifer.
436. **Groundwater reservoir (Kho nước ngầm):** 1- A reservoir in which groundwater is stored for future extraction and use. The water may be placed in the reservoir by artificial means (spreading, ect) or by natural means (seepage, infiltration, ect.). 2- Aquifer.
437. **Water - bearing formation, water - bearing media, or water - bearing strata (Hệ tầng ngầm nước, môi trường ngầm nước hoặc Địa tầng ngầm nước):** A term, more or less relative, used to designate a formation that contains considerable groundwater. It is usually applied to formations from which the groundwater may be extracted by pumping, drainage, ect.
438. **Artesian aquifer (Tầng chứa nước có áp):** An aquifer in which the water is confined by an overlying, relatively impermeable bed and is, therefore, under pressure sufficient to raise the water in wells above the top of the confined aquifer.
439. **Intake area (of an aquifer) (Khu vực cấp nước (của tầng chứa nước)):** The surface area where the water, from precipitation or surface flow, which eventually reaches the zone of saturation of an aquifer, is absorbed.

440. **Catchment area, or Basin (of an aquifer) (Diện tích lưu vực hay Lưu vực (của tầng chứa nước)):** The surface area composed of the intake area of an aquifer and all other areas which contribute surface water to the intake.
441. **Confining bed, confining layer or confining stratum (Lớp không thấm của tầng ngầm nước có áp):** An impervious stratum directly above or below one bearing water.
442. **Groundwater divide (Đường phân lưu nước ngầm):** 1- A line on a water table on each side of which the water table slopes downward in a direction away from the line. 2- The boundary of the cone of pumping depression.
443. **Interstice, or Void (in a rock, or soil) (Khe nứt hoặc Khe rỗng (trong đá hay đất)):** An interstice, or void, in a rock or soil, is a space that is not occupied by solid matter.
444. **Positive confining bed (Tầng có áp dương):** A formation that prevents or retards upward movement of groundwater where the underlying water has a higher static level than the overlying water and where there is, therefore, a resultant upward pressure.
445. **Negative confining bed (Tầng có áp âm):** A formation that prevents or retards downward movement of groundwater where the overlying water has sufficient head to produce a resultant downward pressure.
446. **Primary openings (Các khe hở nguyên sinh):** Those interstices that were made contemporaneously with rock formation as the result of the processes which formed the rocks that contain them.
447. **Secondary openings (Các khe hở thứ sinh):** Openings in rocks that were developed by processes that affected the rocks after they were formed.
448. **Artesian pressure (áp lực phun):** Pressure of the artesian water.
449. **Artesian head (Cột nước phun):** Pressure head of artesian water.
450. **Isopiestic line, or Pressure surface contour (Đường độ dốc áp lực của nước hay Đường đồng mức mặt áp lực):** Contour drawn on the piezometric surface of an artesian aquifer.
451. **Pressure surface map (Bản đồ mức thủy áp):** A map showing the contours of the pressure surface of a confined water system.
452. **Piezometric interval (Khoảng chênh giữa các đường đẳng áp):** The difference in static levels between two isopiestic lines.
453. **Piezometric surface, or Pressure surface (Bề mặt thủy áp hay Mặt áp lực):** An imaginary surface that everywhere coincides the head of the water in an aquifer.
454. **Artesian capacity (Công suất giếng phun):** The rate at which a well will yield water at the ground surface as the result of artesian pressure.
455. **Artesian discharge (Lưu lượng của giếng phun):** The discharge of water from a flowing well.

456. **Area of artesian flow (Khu vực giếng phun tự chảy):** A land or water surface which lies below a piezometric surface. It is an area in which the water of some underlying aquifer is under sufficient pressure to rise above the surface.
457. **Storage coefficient of artesian aquifer (Hệ số chứa nước của tầng chứa nước áp lực):** A dimensionless fraction representing the volume of water released from a vertical prism of the aquifer having a base of unit area and a height equal to the thickness of the aquifer when the piezometric surface falls one unit of height.
458. **Spring (Mạch nước):** 1- A surface where, without the agency of man, water issues from a rock or soil on to the land or into a body of water, the place of issuance being relatively restricted in size. Springs are classified in accordance with many criteria, including character of water, geologic formation, geographical location. 2- Pertaining to tides which have an increased range as the result of the moon being full or new. They occur semi-monthly (lunar month).
459. **Alluvial - slope spring, Boundary spring, or Border spring (Mạch nước sườn dốc trầm tích, mạch nước ranh giới đường biên):** A spring which occurs on the lower slope of an alluvial cone at point where the water table slope and the surface gradient are equal. This point is often located at the point of gradation from pervious sand with a flat water table slope to less pervious alluvial material which calls for a steep slope to carry the water supplied from above.
460. **Artesian spring (Mạch nước phun):** A spring whose water issues under artesian pressure, generally through some fissure or other opening in the confining bed that overlies the aquifer.
461. **Barrier spring (Mạch nước lộ thiên):** A spring which occurs when a raising of the confining bed forces the groundwater to rise to ground surface.
462. **Geyser (Giếng phun nước nóng):** An intermittent thermal spring which periodically discharges a column of boiling water and/or mud.
463. **Faul spring, or Fisure spring (Mạch khe nứt, mạch kẽ):** Spring fed by deep groundwater, usually hot and mineralized, connected with a recent fault of great throw.
464. **Valley spring (Mạch lũng sông) :** A spring due to a sudden change of slope on the side of an erosion valley.
465. **Cliff spring (Mạch vách đứng):** A spring occurring at the base of a cliff, where the water table is intersected by the face of the cliff.
466. **Contact spring (Mạch tiếp xúc):** A spring whose water flows to the surface from permeable material over an outcrop of less permeable or impermeable material which retards or prevents the downward percolation of the groundwater and thus deflects it to the surface.
467. **Depression spring (Mạch nui trũng):** A spring occurring in any small depression reaching below the water table.

468. **Periodic Spring, or Intermittent Springs (Mạch nước theo chu kỳ hoặc Mạch nước gián đoạn):** A spring which has periods of relatively large continuous discharge occurring at more or less regular and frequent intervals. Such springs may be classified intermittent. While the discharge of such a spring somewhat resembles that of a geyser in its rhythmic action, such discharge is due to an entirely different cause.
469. **Gravity Spring (Mạch trọng lực, mạch tự chảy) :** A spring whose water flows from permeable material, or from openings in a rock formation entirely under the action of gravity.
470. **Knoll spring, or Mound spring (Mạch nước trong con chạch):** A spring occurring on the top of a small knoll or mound. They are produced, wholly or in part, by precipitation of mineral matter from the spring water; or by vegetation and sediments blown in by the wind - a method of growth common in arid regions.
471. **Seepage spring, or Filtration spring (Mạch nước thấm):** A spring whose water percolates from numerous small openings in permeable material.
472. **Terrace spring (Mạch bậc thềm):** A spring which has built up at its mouth a series of terraces or basins through deposition of material carried out of the earth in solution.
473. **Water - table spring (Mạch giáp mặt nước ngầm):** A spring that occurs at the intersection of the water table and the surface.
474. **Water - table contour, or Groundwater contour (Đường đồng mức nước ngầm):** A line drawn on a map and passing through the points where the water table has the same elevation above a specified datum plane.
475. **Hydro - isobaths, or Isobaths of water table (Đường đẳng thủy áp hay Đường đồng mức mặt nước ngầm):** Contour of similar depth of the subsoil water table below the ground surface.
476. **Belt of fluctuation of water table, or Belt of phreatic fluctuation (Dải dao động của mặt nước ngầm hay Dải dao động của mức nước ngầm):** A part of the lithosphere which, because of the fluctuation of the water table, lies a part of the time in the zone of saturation and a part of the time in the overlying zone of aeration.
477. **Cycle of fluctuation, or Phreatic cycle (Chu trình dao động):** The total time occupied by a period of rise and a succeeding period of decline of a water table. The most common kinds of cycles are daily, annual, and secular.
478. **Recovery cycle (Chu trình hồi phục):** The general rise in elevation of the water table due to addition of water usually extending over several years and following a period of cyclic depletion.
479. **Phreatic decline, or Decline of water table (Sự hạ thấp mức nước thủy áp hay Sự hạ thấp mặt nước ngầm):** The downward movement of the water table.
480. **Highest stage of the water table, or phreatic height (Mức nước ngầm cao nhất):** At a given place and for a given cycle of fluctuation, it is the highest altitude reached by the water table at the place in that cycle.

481. **Groundwater trench (Rãnh nước ngầm):** A trench-shaped depression of the water table caused by effluent seepage into a stream or drainage ditch.
482. **Groundwater withdrawal, or Groundwater extraction (Sự bơm hút nước ngầm hay Sự khai thác nước ngầm):** Deliberate removal of subsurface water.
483. **Effluent seepage (Dòng ngầm chảy ra (xuất lưu)):** Diffused discharge of groundwater to the ground surface.
484. **Influent seepage (Dòng thấm vào):** Movement of gravity water in the zone of aeration from the ground surface towards the water table.
485. **Water table (Mực nước ngầm):** The upper surface of a zone of saturation, where the body of groundwater is not confined by an overlying impermeable formation. Where an overlying confining formation exists, the aquifer in question has no water table. It is not the water surface which in permeable material, in general, is above the water table.
486. **Water surface (groundwater) (Mặt nước (nước ngầm)): Water surface in the permeable material (held up somewhat by the force of capillarity) is in general above the water table and is very irregular and interrupted, consisting of many little surfaces that are concave upward, each occupying an interstitial chamber that may be connected with its neighbour by a tiny start or walled off from it by a grain of sand.**
487. **Phreatic low, or Lowest stage of the water table (Mức thấp nhất của đường mặt nước ngầm):** The lowest level reached by the water table at a given place and for a given cycle of fluctuation.
488. **Natural water table (Mực nước ngầm tự nhiên):** The surface at which the hydrostatic pressure of the groundwater is equal to the atmospheric pressure.
489. **Profile of water table (Mặt cắt mặt nước ngầm):** A vertical section of the water table.
490. **Perched water table (Mực nước ngầm treo):** The upper surface of the perched groundwater.
491. **Semiperched water table (Mực nước ngầm bán treo):** The upper surface of a body of free groundwater having a greater pressure head than an underlying body of groundwater not separated from it by unsaturated material and lying within the same zone of saturation; semiperched and perched groundwaters are supported by semipermeable confining beds.
492. **Porosity (Độ xốp, độ rỗng):** 1- The state of being porous or containing interstices. 2- An index of the void characteristics of a soil or stratum as pertaining to percolation; degree of perviousness. 3- The ratio, usually expressed as a percentage of (i) the volume of the interstices in a given quantity of material, to (ii) the total volume of its mass.
493. **Effective Porosity (Độ xốp, độ rỗng hiệu quả):** The ratio between (i) the volume of water that a pervious material previously saturated with water will yield in specified hydraulic conditions and (ii) the total volume of the material.

494. **Pereability (Tính thấm thấu, độ thấm):** 1- The property of a material which permits appreciable movement of water through it when saturated and actuated by hydrostatic pressure of the magnitude normally encountered in natural subsurface water. 2- Also, quantitative expression of this quality or state, synonym of "coefficient of permeability".
495. **Coefficient of permeability, hydraulic conductivity, Coefficient of conductivity, unit of permeability, transmission constant, coefficient of transmission (Hệ số thấm, độ dẫn thủy lực, đơn vị thấm, hàng số truyền, hệ số truyền):** The rate of flow of a fluid through a unit cross section of a porous mass under a unit hydraulic gradient, at a specified temperature. Also, sometimes called "unit of permeability", "transmission constant" or "coefficient of transmission".
496. **Field coefficient of permeability (Hệ số thấm hiện trường):** Coefficient of permeability at the prevailing temperature of water.
497. **Coefficient of transmissivity (Hệ số suất dẫn nước):** of an aquifer is the product of the field coefficient of permeability multiplied by the thickness of the saturated portion of the aquifer.
498. **Field capacity, normal field capacity, normal moisture capacity, maximum field carrying capacity, field capillary (moisture) capacity, effective water holding capacity, specific retention (Độ ẩm đồng ruộng, khả năng giữ ẩm của đất):** The amount of water held in the soil after the excess gravitational water has drained away and after the rate of downward movement of water has materially decreased. Essentially the same as "specific retention", a more general term used in studies of groundwater, except that specific retention is generally given as a percentage by volume whereas field capacity is usually given as a percentage of weight. Field capacity is sometimes referred to as "normal field capacity", "normal moisture capacity", "(maximum) field carrying capacity", field capillary (moisture) capacity", "effective water-holding capacity".
499. **Specific yield (Hệ số nhả nước):** The ratio of (i) the volume of water which a rock or soil, after being saturated, will yield by gravity, to (ii) the volume of rock or soil.
500. **Coefficient of storage (Hệ số trữ nước):** The amount of water in cubic units, discharged from each vertical column of aquifer with a basal unit area as the water level falls unit depth. In an unconfined aquifer, the coefficient of storage is essentially equal to the specific yield.
501. **Effective velocity (of groundwater), Actual velocity (of groundwater), Truevelocity (of groundwater), or Field velocity (of groundwater) (Lưu tốc hiệu quả (của nước ngầm), lưu tốc thực tế (của nước ngầm), Lưu tốc thực (của nước ngầm) hay Lưu tốc hiện trường :** The velocity measured by the volume of groundwater passing per unit time through unit cross-sectional area divided by the effective porosity of the water transmitting material.

502. **Apparent velocity (of groundwater) (Lưu tốc biểu kiến (của nước ngầm)):** The apparent distance moved in unit time by ground water. It is determined by $V=Q/F$ where F is the cross sectional area perpendicular to the streamlines and Q the volume of water passing through this cross section in unit time.
503. **Average velocity (of groundwater) (Lưu tốc trung bình (của nước ngầm)):** The velocity measured by the volume of groundwater passing through a unit cross-sectional area divided by the porosity of the water transmitting material.
504. **Critical velocity (of groundwater) (Lưu tốc giới hạn (của nước ngầm)):** For porous media the maximum velocity under which laminar flow can occur.
505. **Discharge of groundwater (Xuất lưu của nước ngầm):** The flowing out of groundwater from the lithosphere to the earth surface.
506. **Groundwater turbulent flow (Dòng chảy rối của nước ngầm):** Turbulent flow which occurs in large opening in the zone of saturation under high velocities.
507. **Influent stream, or Losing stream (Dòng nhập lưu hay Dòng chảy mất do nước ngầm cung cấp):** A stream which contributes water to the zone of saturation.
508. **Subterranean stream (Sông ngầm):** A body of flowing water that passes through a very large interstice, such as a cave or cavern, or a group of large communicating interstices.
509. **Effluent Stream, or Gaining stream (Xuất lưu):** 1- A stream fed by groundwater.
2- A stream flowing out of another stream or out of a lake.
510. **Groundwater recharge (Bổ cập nước ngầm):** 1- Replenishment of groundwater supply in the zone of saturation, or addition of water to the groundwater storage by natural processes or artificial methods for subsequent withdrawal for beneficial use or to check salt water intrusion in coastal areas. 2- Also the process of replenishment or addition, of the quantity of such water.
511. **Groundwater balance, or Groundwater budget (Cân bằng nước ngầm):** A systematic review of inflow, outflow and storage as applied to the computation of groundwater changes.
512. **Groundwater increment, or Groundwater accretion (Sự gia tăng nước ngầm hay Lượng tăng của nước ngầm):** Water added to the groundwater reservoir in any given time interval from all sources, influent seepage from streams, rainfall, and irrigation and inflow of groundwater from outside the area under consideration.
513. **Groundwater decrement (Sự triết giảm nước ngầm):** Water abstracted from a groundwater reservoir by evaporation, transpiration, spring flow and effluent seepage, pumping wells and outflow of groundwater in the area under consideration.
514. **Groundwater inventory (Kiểm kê trữ lượng nước ngầm):** A detailed estimate of the amount of water added to the groundwater reservoir of a given area (recharge) balanced against estimates of amounts of withdrawals from the groundwater reservoir of the area during a specified period.

515. **Groundwater model (Mô hình nước ngầm):** Planned use of groundwater in accordance with predetermined objectives.
516. **Groundwater monitoring network (Mạng đo giám sát nước ngầm):** Network designed and used for continuous measurement or control of the flow of subsurface water.
517. **Groundwater pollution (Ô nhiễm nước ngầm):** Contamination of groundwater by unwanted quantities of sewage, chemicals, detergents or fertilizers.
518. **Groundwater quality (Chất lượng nước ngầm):** The degree to which groundwater meets the legal standards.
519. **Groundwater stress (Ứng suất nước ngầm):** The force acting across a unit area of groundwater in resisting deformation that tends to be induced by external forces.
520. **Induced recharge of an aquifer (Bổ cập từ dòng chảy mặt):** Discharge of water from a stream into an aquifer.
521. **Economic yield (Lưu lượng bơm kinh tế):** The maximum rate at which water can be artificially withdrawn from an aquifer throughout the foreseeable future without depleting the supply or altering the chemical character of the water to such an extent that withdrawal at this rate is no longer economically possible. The economic yield varies with the economic conditions and other factors, such as recharge, natural discharge, pumping head. The term may be applied with respect to the economic feasibility of withdrawal from the standpoint only of those who artificially withdraw water or from the standpoint of the economy of a river valley or other longer area to which the aquifer contributes water.
522. **Physical yield limit, or potential yield (Giới hạn bơm tiềm năng):** The greatest rate of artificial withdrawal from an aquifer which can be maintained throughout the foreseeable future without regard to cost of recovery. The physical yield limit is, therefore, equal to the present recharge, or that anticipated in the foreseeable future, less the unrecoverable natural discharge.
523. **Annual depletion rate (Tốc độ giảm nước ngầm hàng năm):** The average rate over a period of years at which withdrawals deplete the storage in groundwater reservoir.
524. **Drawdown (Hạ thấp mực nước ngầm):** The lowering of the water table or piezometric surface caused by the discharge of groundwater through wells, springs or other openings.
525. **Overdevelopment, Local overdevelopment (Phát triển quá mức (Sử dụng nước ngầm quá mức), Phát triển quá mức cục bộ):** When the economic yield of an aquifer is exceeded, that aquifer is said to be overdeveloped. If the transmissibility of an aquifer is limited, excessive withdrawals in a restricted area may cause sufficient drawdown locally as to make it uneconomic to continue to withdraw water at that rate, even though the physical yield limit for the entire aquifer has not been reached. That condition is called "local overdevelopment".

526. **Aquifer loss (Tổn thất qua tầng chứa nước):** The head loss at a pumped or overflowing well associated with groundwater flow through the aquifer to the well face.
527. **Aquifer properties (Các đặc tính tầng chứa nước):** The properties of an aquifer that determine its hydraulic behaviour and its response to abstraction.
528. **Aquitard (Tầng nước ngầm yếu):** It is a formation which has low to medium permeability which is not sufficient to be a source of water to flow on a regional scale, from one aquifer to the other due to leakage. Aquitards behave as semi-confining layers.
529. **Artesian free flow (Dòng chảy tự do của giếng phun):** Natural over ground flow from well and springs in the artesian basins.
530. **Confined aquifer (Tầng chứa nước có áp):** An aquifer bounded above and below by impermeable beds. Both the aquifer and the water it contains are said to be confined.
531. **Groundwater balance (Cân bằng nước ngầm):** It is a concept which states that all inputs of water in a defined space and time are equal to the sum of all outputs of water, and the changes of water storage, in the same space and time.
532. **Groundwater basin (Lưu vực nước ngầm):** Physiographic or geological unit containing at least one aquifer of significant area extent.
533. **Impermeable material (Vật liệu không thấm):** Material that does not permit water to move through it at a perceptible rate under the hydraulic gradients normally present.
534. **Intermediate zone (Vùng trung gian):** It is the portion of the zone of aeration which lies between the soil water zone and the capillary fringe.
535. **Leaky aquifer (Tầng ngầm nước bán áp):** Aquifer overlain and/or underlain by a relatively thin semi-permeable layer, through which flow into or out of the aquifer can take place.
536. **Natural recharge (Bổ cập tự nhiên):** It is that portion of water which gravitates to the zone of saturation under natural conditions.
537. **Perennial spring (Mạch nước quanh năm):** A spring that discharges continuously in all seasons of the year.
538. **Permeable material (Vật liệu thấm):** Material that permits water to move through it at perceptible rates under the hydraulic gradients normally present.
539. **Potentiometric surface (Mực thủy tĩnh nước ngầm):** The surface that represents the static head of groundwater.
540. **Saturated zone (Vùng bão hòa):** That part of an aquifer, normally beneath the deepest water table, in which ideally all voids are filled with water under pressure greater than atmospheric.

541. **Soil water zone (Vùng nước thổ nhưỡng):** Part of the zone of aeration that consists of soil and other materials near the ground surface, capable of discharging water in to the atmosphere by transpiration of plants or by evaporation. The zone extends from the ground surface to major root zone and the thickness varies with the soil type and vegetation cover.
542. **Cone of water - table depression, or Cone of pumping depression (Nón trũng nước ngầm hay nón trũng do bơm):**
543. **Unconsolidated aquifer (Tầng chứa nước không cố kết):** An aquifer in which a water table serves as the upper surface of the zone of saturation.
544. **Zone of fluctuation of water table, or Zone of phreatic fluctuations (Vùng dao động đường mặt nước hay Vùng biến động nước ngầm):** The zone through which the water table fluctuates from its highest to the lowest level within the formation, in response to the discharge and recharge conditions. Depending upon the position of the water table in the zone, a part of the zone will lie in the zone of aeration and the other part will lie in the zone of saturation.

II.1.5. DISCHARGE MEASUREMENTS - ĐO LƯU LƯỢNG

545. **Open Conduit, or Open channel (Lòng dẫn hở hay kênh hở):** Any conduit in which water flows with a free surface.
546. **Discharge, or Rate of flow (Lưu lượng hay suất dòng chảy):** The volume of water which flows past a particular cross section of a channel or conduit in a unit of time.
547. **Dead water (Nước tù):** Water which is not flowing with a significant velocity.
548. **Surface slope, Slope, Waterslope (Độ dốc bề mặt, độ dốc, độ dốc mặt nước):** The inclination of the water surface expressed as change of elevation per unit of slope length; the sine of the angle which the surface makes with the horizontal. The tangent of the angle is ordinarily used, no appreciable error resulting except for the steepest slopes. Also called "waterslope" in Australia.
549. **Mean monthly discharge (Lưu lượng bình quân tháng):** Discharge observed or interpolated and averaged over a calendar month.
550. **Discharge Coefficient (Hệ số lưu lượng):** The ratio of the actual discharge to the discharge calculated according to a theoretical formula.
551. **Stage - discharge relation, Rating curve, Discharge rating curve, or Station rating curve (Quan hệ mực nước - lưu lượng, đường cong mực nước - lưu lượng, đường cong quan hệ mực nước - lưu lượng trạm đo):** A curve which expresses graphically the relation between the discharge and its corresponding stage (or elevation of water surface) in a stream or conduit at a given point.
552. **Loope rating curve (Đường cong quan hệ mực nước - lưu lượng dạng vòng dây):** Is the result of the differences in the water surface slope and bed roughness in rising and falling stages of the hydrograph.

553. **Discontinuous rating curve (Đường cong mực nước - lưu lượng gián đoạn):** Is the result of the abrupt changes in bed configuration from a dune bed with high roughness and low velocity to a flat bed with lesser roughness and higher velocity.
554. **Insensitive rating curve (Đường cong mực nước - lưu lượng phản bội ngập):** This type of a curve results largely from over bank flow where the stream flow may spread out from its well defined low-flow channel to cover a wide flood plain, where a large increase in discharge may result in an almost negligible change in stage.
555. **Shiftting rating curve (Đường cong mực nước - lưu lượng di chuyển):** This type of a curve reflects local changes in water surface slope, local scour or fill at the rating section or if the shift is systematic with time, a long term aggradation or degradation process.
556. **Discharge mass curve (Đường cong lũy tích dòng chảy):** A curve in which cumulated values of recorded discharge are plotted against time. The slope of the curve at any time represents the discharge at that instant.
557. **Residual discharge mass curve, or Residual discharge mass diagram (Đường cong lũy tích dòng chảy hiệu số hoặc biểu đồ lũy tích dòng chảy hiệu số):** A plotting of the year-to-year residual departure of discharge from the arithmetic average accumulated for the period under consideration.
558. **Rating, Calibration, Calibrating (Kiểm định):** 1- The relation, usually determined experimentally, between mutually dependent quantities, such as gauge and discharge of a stream; current meter vane revolutions and water velocity. Also "calibration". 2- The taking of measurement or the making of observations to establish a rating "calibrating".
559. **Rating curve (Đường cong kiểm định):** A graphic representation of a rating.
560. **Discharge table, or Rating table (Bảng lưu lượng hay Bảng kiểm định):** A table showing the relation between gauge height and discharge of (i) a stream or conduit at a particular gauging station and (ii) outlets, sluices, etc.
561. **Stream gauging (Đo đặc thủy văn):** The operation of measuring the velocity of the flow of water in a channel or conduit, and the area of cross section of the flow for the purpose of determining discharge.
562. **Dilution gauging, Chemical gauging, Chemihydrometry, Radioactive solution gauging (Đo lưu lượng bằng phương pháp dùng chất chỉ báo, phương pháp hóa học, phương pháp thủy hóa và phương pháp dùng dịch phóng xạ):** A method of measuring the flow of water by introducing a constant flow of a solution of known concentration for a sufficient lapse of time at one section of the water channel and then by determining the resulting degree of dilution of this solution at another downstream section. "Chemical gauging", "electro-chemical gauging" and "radioactive solution gauging" are different forms of dilution gauging.
563. **Electro - Chemical gauging (Đo lưu lượng bằng phương pháp hóa điện):** A method for the measurement of flow of water based upon the nearly linear relation between the concentration and the electrical conductivity of a salt solution, which

makes it possible to determine the degree of dilution by integrating a conductivity time graph.

564. **Cloud - velocity gauging, Allen's method of velocity gauging, colour velocity gauging** (**Đo lưu tốc theo phương pháp màn muối, phương pháp A-len, phương pháp nhuộm màu nước**) : A method of determining the velocity of a slug of dye between two stations in the channel. This velocity, used as the mean velocity of flow, in the case of adequate spreading, multiplied by the cross-sectional area of the channel, gives the discharge. "Allen's method" and "colour-velocity method" are different forms of cloud-velocity gauging.
565. **Float gauging** (**Đo vận tốc bằng phao**): Measurement of velocities of water by weighted floats for the determination of discharge.
566. **Spot measurement** (**Đo điểm**): A single and random measurement of a stream as distinguished from a systematic or continuous record.
567. **Gauging station** (**Trạm thủy văn**): A gauging station is a selected site on a stream equipped and operated to furnish basic data from which systematic records of discharge may be derived.
568. **Discharge site, Gauging site, or Velocity - area gauging station** (**Tuyến lưu lượng, tuyến đo lưu lượng theo phương pháp lưu tốc mặt ngang**): A selected site on a stream for making observations of velocity and area of cross section with a view to determining the discharge.
569. **Dosing station** (**Trạm do dòng chảy dùng dung dịch hóa học**): In chemical gauging, the station on the stream from where a chemical solution is fed into the water.
570. **Sampling station** (**Trạm lấy mẫu nước**): In chemical gauging, the station downstream of the dosing station from which samples of water are taken to find out the concentration of the diluted chemical solution with a view to determining the discharge.
571. **Bench mark** (**Mốc cơ bản**): A permanent point on a monument or permanent structure whose elevation above a datum is known or fixed by precise levelling, and which is used as a point of reference in the determination of other elevations.
572. **Gauging datum** (**Mặt chuẩn (mốc số 0) của trạm thủy văn**): The elevation of the zero of the gauge above a certain point.
573. **Permanent gauging** (**Trạm đo cố định**): A gauge which is permanent.
574. **Direction peg** (**Tuyến ngầm**): A point on the direction peg line through which ray from one of the observation points passes when converging on the pivot point.
575. **Control, control section, complete control, partial control** (**Mặt cắt không chẽ, tuyến ngang thủy văn, mặt cắt không chẽ đầy đủ, mặt cắt không chẽ toàn phần**): 1- A section or reach of an open conduit or stream channel where artificial or natural conditions exist, such as the existence of a dam or a stretch of rapids, that make the water level above it a stable index of the discharge. Controls may be

complete or partial. "Complete control" exists where the elevation of the water surface above the control is entirely independent of the fluctuations of water level downstream of it. "Partial control" exists where downstream fluctuations have some effect on the upstream water level. 2- The cross section in a waterway which is the bottle neck for a given flow and which determines the energy head required to produce the flow. In the case of open channels, it is the point where the flow is at a critical depth; hydraulic conditions above the point being wholly dependent upon the characteristics of the control section and entirely independent of hydraulic conditions below the point. In the case of closed conduits, it is the point where the hydrostatic pressure in the conduit and cross-sectional area of flow are definitely fixed, except where the flow is limited at some other point by a hydrostatic pressure equal to the greatest vacuum that can be maintained unbroken at that point.

576. **Shifting control, or Unstable control (Mặt cát không chế di động hay Mặt cát không chế không ổn định):** A station is subject to shifting control when the stage-discharge relation changes, either gradually or rapidly, as the result physical changes in the control.
577. **Gauging, or Gage (Thủy chí):** 1- An instrument, contrivance, graduated scale or other device installed at a gauging station for observing or recording the stage of a stream. It may be an automatic gauge recorder or a non-recording gauge. 2- Height recorded by the gauge.
578. **Temporary gauge (Trạm thủy văn tạm thời):** A gauge, connected to the permanent gauge, for the purpose of recording water-surface levels under the prevailing conditions.
579. **Gauge line (Tuyến đo):** The line across a channel passing through a given gauge.
580. **Gauge line pillars (Cọc quan trắc mực nước):** The structural landmarks fixing the position of the gauge line.
581. **Chain gauge, or Tape gauge (Thước đo nước bằng xích hay dây):** Device consisting of a tagged or indexed chain or other line attached to a weight which is lowered to the water surface, whereupon the gauge height is read on graduated staff or opposite an index. Especially suited to bridges.
582. **Float gauge (Trạm đo nước bằng phao):** Consists essentially of a float of wood, cork, or usually hollow zinc or copper which rides on the liquid surface and rises or falls with it, its movement being indicated on a scale.
583. **Inclined gauge, Sloping gauge (Thủy chí nghiêng):** A staff gauge on a slope, graduated to read vertical heights above a datum. Sometimes referred to as a "sloping gauge".
584. **Slope gauge (Tuyến độ dốc):** Gauges with the same datum fixed above and below a discharge section for the purpose of determining the water-surface slope between the gauge run.
585. **Staff gauge (Thước đo mực nước):** A graduated scale on a staff, plank, metal plate, pier, wall, ect., by which the elevation of the water surface may be read.

586. **Specific gauge reading (Số đọc mực nước cụ thể):** The gauge reading or level of the water surface at any particular site for a given discharge.
587. **Water stage recorder, or Water - level recorder (Máy tự ghi mực nước):** An instrument that produces a graphic representation of the rise and fall of the water surface with respect to time.
588. **Gauge well, stilling well, Float, or recorder well (Giếng đo nước):** A chamber or a compartment with closed sides and bottom, provided with an inlet or inlets communicating with the river or canal. Its purpose is to dampen waves or surges in the parent stream while permitting the water level in the well to rise and fall with the major fluctuations of the level in the river or canal. The gauge device is installed in this.
589. **Pivot - point layout (Sơ đồ bố trí điểm đo định vị):** A geometrical layout of points on one or both banks for the purpose of locating observation points in a river without direct measurement along the discharge section line.
590. **Pivot point (Điểm định vị):** The point at a fixed distance from the discharge section line onto which rays from the observation points converge .
591. **Discharge area, or Discharge section area (Diện tích mặt cắt đo lưu lượng):** The area of the waterway of a channel at the discharge section line corresponding to the related water-surface level.
592. **Observation point (Điểm quan trắc) :** The points at segmented intervals along a discharge section line at which the velocities and depths are measured.
593. **Mean depth, or Average depth (Độ sâu trung bình (bình quân)):** The average depth of water in a stream channel or conduit. It is equal to the cross-sectional area divided by the surface width.
594. **Segment (Diện tích bộ phận):** The area bounded by two consecutive verticals in a cross section, the bed of the channel and the free surface.
595. **Segmentation (Phân chia thành diện tích bộ phận để đo lưu lượng):** The division of the total discharge section line into segments.
596. **Sounding wire, log line, lead line (Dây cáp, dây roi đo sâu):** A flexible wire, with weight attached to it at the bottom used for determining the depth of rivers. Also known as "log line" or "lead line".
597. **Torpedo sinker (Cá sát đo nước):** A type of weight attached to the bottom of the log line when observing depths in rapid streams.
598. **Soundings (Đo sâu theo phương pháp hồi âm):** Depths of water in a stream as measured from the water surface level to the bed at one or several points with a sounding rod or sounding wire.
599. **Air - line correction, Wet line correction (Hiệu chỉnh độ lệch của dây đo sâu ở phần không khí, hiệu chỉnh độ lệch của dây đo sâu ở phần ngập nước):** In situations where large vertical angles are induced by high velocities, great depth, insufficient sounding weight, or any combination thereof, two separate corrections

are required to be made to the measured depth for determining the true depth. The air-line correction is for that part of the line which is above the water surface and "wet-line correction" for that portion of the line which is under water.

- 600. **Angle of sag (Góc lệch):** The average angle that a sounding line makes with the vertical.
- 601. **Sag correction (Hiệu chỉnh sai số độ sâu):** The amount by which soundings must be reduced to obtain true vertical values.
- 602. **Echo sounder (Máy đo hồi âm):** An instrument for estimating the depth of water in a stream or pondage. The time interval between the generation of sounding signals and the return of its echo, after striking the bed, measured and converted into depth, is automatically recorded by the instrument.
- 603. **Echo sounding (Đo độ sâu bằng một máy hồi âm):** Measuring depths by an echo sounder.
- 604. **Kelvin tube (Ống Kelvin):** A device for measuring the depth of water consisting of a glass tube with a chemical inside fixed in a lead tube. It is thrown into the water and taken out as soon as it touches the bed. The colour of the chemical changes according to the depth of water which is measured by a scale provided by the manufacturer.
- 605. **Haigh sounder (Máy đo sâu Haigh):** A device, based on Boyle's law, invented by F.F Haigh for measuring depth.
- 606. **Mean velocity, Average velocity (at a vertical), Overall mean velocity (Lưu tốc trung bình, lưu tốc bình quân thủy trực, lưu tốc trung bình mặt ngang):** 1- The velocity at a given section of a stream obtained by dividing the discharge of the stream by the cross-sectional area at that section; "overall mean velocity". 2- Mean velocity may also apply to a reach of a stream by dividing the discharge by the average area of the reach. 3- On a vertical, it is the weighted average of the velocities observed at different depths.
- 607. **Mean velocity position (Vị trí có lưu tốc trung bình):** The point lying between the water surface and the bed of a channel at which the velocity is equal to the mean velocity on a vertical.
- 608. **Surface velocity (Lưu tốc bề mặt):** The rate of movement of water at a point at or near the surface.
- 609. **Central surface velocity (Lưu tốc mặt giữa dòng):** The rate at which the surface layer of water moves in the centre of a channel.
- 610. **Drift velocity (Lưu tốc trôi):** Velocity due to drift.
- 611. **Modified velocity (Lưu tốc được hiệu chỉnh):** The velocity as observed after correcting for drift and angularity.
- 612. **Velocity of retreat (Lưu tốc trung bình hạ lưu):** The mean velocity immediately downstream of a structure.

- 613. **Vertical (Đường thủy trực):** Imaginary vertical line at any point in a stream or other body of water extending from the bottom up to the surface.
- 614. **Angulartyi correction, or Skew correction (Hiệu chỉnh góc lệch hay Độ nghiêng):** The correction to be made to an observed velocity when the direction of the current is not exactly at right angles to the discharge section line.
- 615. **Velocity rod correction (Hiệu chỉnh sào đo lưu tốc):** The correction to be applied to the velocity given by a velocity rod in order to convert it into mean velocity.
- 616. **Mean velocity curve (Đường cong lưu tốc trung bình):** A curve showing the relation between mean velocity and gauge heights at a given section of an open channel.
- 617. **Vertical velocity curve (Biểu đồ phân bố lưu tốc trên thủy trực):** A curve showing the relation between the depth and velocity along a vertical line at a given section of an open channel or conduit.
- 618. **Drift (Độ trôi, chêch):** The distance that a discharge boat, whether anchored or not, travels downstream with the current during the time taken to make a velocity observation.
- 619. **Direction float (Phao xác định hướng dòng chảy):** A standard float of metal or wood carrying a small flag used for indicating the direction of flow of a river so that the angle that direction of flow makes with the discharge section line at any observation point may be measured.
- 620. **Surface float (Phao đo lưu tốc mặt nước):** A float with its greatest drag near the surface for measuring surface velocities.
- 621. **Subsurface float (Phao đo lưu tốc sát mặt):** A float with its greatest drag below the surface for measuring subsurface velocities.
- 622. **Double float (Phao kép):** A body of a slightly negative buoyancy which moves with the stream at a known depth and whose position is indicated by a small surface float from which it is suspended.
- 623. **Captive float, or Reefing float (Phao buộc hoặc Phao ống):** It has a buoyancy chamber which supports a canvas skirt having stiffening rings at intervals. The overall length of the float is adjusted, so as just to clear the stream bed, by reefing the skirt and clamping against the buoyancy chamber.
- 624. **Diaphragm float (Phao màng):** A float mounted on a truck running on rails along a straight and uniform section on a channel wherein the velocity is to be gauged; it is so devised that it can be quickly lowered into the water, made to occupy nearly the whole area of the channel during the run, and lifted out at the end.
- 625. **Rod float, or Velocity rod (Phao sào hoặc Sào đo lưu tốc):** A rod which may be either one of fixed length or of an adjustable telescopic pattern, weighted at the base so that it floats in a vertical position and, on being timed through a float run, gives the mean velocity of water between water surface and the bottom of the rod float or velocity rod.

626. **Float run (Khoảng cách đo phao nổi):** The fixed distance over which any type of float including velocity rod is timed.
627. **Current meter (Lưu tốc kế):** An instrument for measuring the velocity of water at a point by ascertaining the revolutions of buckets or propellers against which the current impinges. It may be a vertical axis (e.g. Price type) or a horizontal axis (e.g. Ott) type of current meter.
628. **Rack and pinion (Sào gắn lưu tốc kế):** A device incorporating a toothed wheel and a toothed rod to the bottom of which the swivel and current meter are attached, to provide rigid suspension and to insure the measurement of velocity at the desired point and depth.
629. **Suspension rod (Sào treo máy đo lưu tốc):** The hand-operated rod used in shallow water instead of a rack and pinion.
630. **Swivel (Thiết bị treo lưu tốc kế):** The device fixed between the current meter and its means of suspension so that it may be free to swing in a horizontal plane.
631. **Bucket wheel (Lưu tốc kế kiểu cốc quay):** The revolving portion of one type of current meter driven by the force of the current and whose revolutions are an indication of the velocity of that current. In the other type, the revolving parts are the propellers.
632. **Rating of current meter (Kiểm định lưu tốc kế):** Testing under controlled conditions of current meters in order to determine the basic essential relationships, etc.
633. **Rating flume (Máng kiểm định):** 1- An open conduit built in a channel (carrying flowing water) to maintain steady distribution of velocities over the channel section for the purpose of measuring the flow and developing stage-discharge relations. 2- A flume containing still water for rating the current meter, Pitot tube, ect., rating tank.
634. **Integration method of velocity measurement (Phương pháp tích phân đo lưu tốc):** A means of determining the mean velocity at a vertical depth of a stream by noting the total number of revolutions of a current metal vane and the time consumed, while the meter is slowly lowered from the surface to the bed and returned one or more times.
635. **Pitot meter (Ống Pitô):** A device used for determining the velocity of water in pipes and other closed conduits which utilizes the principle of the Pitot tube.
636. **Velocity head rod, velocity - head stick, run - up (Thước đo lưu tốc theo chênh lệch đầu nước):** A device for measuring velocity through culverts, or over weirs, dams, ect., by placing the rod vertically in the flow and observing the "run-up" (the difference in water levels obtained at upstream and downstream of the rod); the rod is, generally, calibrated to read velocity, or discharge.
637. **Pitot tube, Pitot cylinder, Pitot sphere (Ống Pitô, trụ Pitô, Pitô hình cầu):** 1- A device for observing the velocity head of flowing water, consisting essentially of a

small open-ended tube pointed upstream in flowing water and connected with a vertical tube by which the rise of water in the tube above the water surface may be observed. It may be constructed with an upstream and a downstream orifice and two water columns, the difference of water levels being an index of the velocity head.

2- The "Pitot cylinder" and the "Pitot sphere" are modifications the Pitot tube intended to measure the magnitude and direction of currents with different directions.

- 638. **Sloping recorder (Máy tự ghi kiểu nghiêng):** A float recorder in which the float does not move vertically, but is guided to move at an angle to the vertical.
- 639. **Indicator (Bộ phận hiện thị):** A device that shows by an index, pointer, dial, ect., the instantaneous values of such quantities as water depth, pressure, velocity, stage, or the movements or position of water-controlling devices.
- 640. **Register (Thiết bị ghi):** A device that notes quantities. It may make a graph, a printed or stamped record in figures or symbols, or may indicate on a dial or an assembly of dials by pointer/pointers under or otherwise such quantities as stage, pressure, velocity and water depth. It may also note the position or movement of water-controlling devices, such as gates and valves.
- 641. **Velocity of approach (Lưu tốc tới gần):** The mean velocity in the conduit or stream immediately upstream of a weir, dam, Venturi throat, orifice or other structures.
- 642. **Contraction (Sự co hẹp):** The extent to which the cross section area of a jet, nappe or stream is decreased after passing an orifice, weir or notch.
- 643. **Bottom contraction (Co hẹp đáy):** The reduction in the area of overflowing water caused by the crest of a weir or baffle contracting the nappe.
- 644. **End contraction (Co hẹp sau):** The contraction in the area of overflowing water caused by the ends of a weir notch.
- 645. **Vena contraction (Co hẹp ven):** The most contracted sectional area of a stream, jet or nappe beyond the place of the orifice, or notch, through which it issues.
- 646. **Weir (Đập tràn, đập dâng):** A continuous solid, not necessarily fixed, barrier across a stream for diverting, for control or for measuring the flow.
- 647. **Sharp - Crester, Sharp - edged weir, or Thin - plate weir (Đập tràn đỉnh nhọn, mép nhọn hay thành mỏng):** A weir constructed with a crest of vertical thin plate shaped in such a manner that the nappe springs clear from the crest.
- 648. **Measuring weir, of notched weir (Đập tràn dùng để đo đặc, máng đo nước):** A device or structure for measuring flow of water. It generally consists of broad-crested weir or rectangular, triangular or other shaped notch. The weir head is an index of the rate of flow.
- 649. **Rectangular weir (Đập tràn chữ nhật):** A sharp-crested measuring weir with a rectangular notch. It may be contracted or suppressed.
- 650. **Contracter weir (Đập tràn co hẹp):** A sharp-crested measuring notch with sides designed to produce a contraction in the area of the overflowing water.

651. **Suppressed weir (Đập tràn bị hạn chế):** A sharp-crested measuring notch whose sides are flush with the channel, thus eliminating (suppressing) end contraction of the overflowing water. The weir may be suppressed on one end, two ends, bottom, or any combination of them.
652. **Cipolletti weir, or Trapezoidal weir (Đập tràn Cipolletti hoặc Đập hình thang):** A contracted sharp-crested measuring weir, in which each side of the notch has a slope of one horizontal to vertical, to compensate for end contractions; named after Cesare Cipolletti, an Italian engineer.
653. **Triangular weir, V - Notch weir, or Thompson weir (Đập tam giác, máng do chữ V hoặc Đập Thompson):** A contracted sharp-crested measuring weir notch with sides that form an angle with its apex downward; the crest is the apex of the angle.
654. **Broad - crested weir (Đập tràn đỉnh rộng):** An overflow structure having a horizontal crest or one with a very gentle slope. The length of the crest in the direction of the flow is much larger than the height of the nappe over it.
655. **Submerged weir, or Drowned weir (Đập tràn chảy ngập):** A weir when in use has the water level on the downstream side at an elevation equal to, or higher than, the weir crest; the rate of discharge is affected by the tail water.
656. **Partially drowned weir (Đập tràn chảy ngập riêng phần):** A weir at which the level of water upstream is being affected to some extent by the level of water downstream.
657. **Meter (Thiết bị đo nước):** A device for measuring quantities of water passed or the rate of flow.
658. **Measuring flume, or Discharge measuring flume (Máng đo, máng đo lưu lượng):** The device for measuring discharge from the direct measurement of the depth of water flowing over it.
659. **Control flume (Máng khống chế):** An open conduit or artificial channel arranged for measuring the flow of water, generally including a constricted section wherein a critical depth exists.
660. **Venturi flume (Máng Venturi):** A type of open flume, used for measuring flow, with a contracted throat that causes a drop in the hydraulic grade line.
- Note: The essential difference between Venturi flume and standing wave flume is that observation of both upstream and downstream water levels are necessary with the former, whereas with the latter, the upstream water level observation is by itself enough to determine the discharge.*
661. **Venturi meter (Lưu tốc kế Venturi):** A constriction type flow meter inserted in a pipe line and consisting of a short parallel circular section (termed the throat) coaxial with the pipe to which it is connected by a converging conical section upstream and a diverging section of a lesser angle downstream; used for measuring flow and having the properties of a lesser head loss than an orifice meter.

662. **Venturi tube (Ống Venturi):** A closed conduit which is gradually contracted to a throat causing a reduction of pressure head by which the velocity through the throat may be determined. The contraction is generally followed, but not necessarily so, by gradual enlargement to original size. Piezometers connected to the pipe above the contracting section and at the throat indicate the drop in the pressure head which is an index of flow.
663. **Modified Parshall flume (Máng Parshall cải tiến):** An improved type of Parshall flume, which eliminates the short rise at the end of the dip below the throat and provides a stilling pool for the hydraulic jump at the required place.
664. **Portable flume, or Portable weir (Máng di động, hay đập tràn di động):** A portable flume for measuring small discharges, such as in farm laterals or water-courses, and consisting of a miniature broad-crested weir made of either wood or iron sheets.
665. **Parshall measuring flume, improved Venturi flume (Máng đo lưu lượng Parshall, máng Venturi cải tiến):** An improved Venturi flume developed by the U.S. Department of Agriculture and the Colorado Experiment Station at Fort Collins, Colorado, under the direction of Ralph L. Parshall, to measure the flow of water in open conduits. It consists essentially of a contracting length, a throat and an expanding length. At the throat is a sill over which the water is intended to flow at Belanger's critical depth. The upper head is measured at a definite distance downstream from the sill. The lower head need not be observed except where the sill is submerged more than 67 percent approximately.

II.1.6. QUALITY OF WATERS - CHẤT LƯỢNG NƯỚC

666. **Quality of Water (Chất lượng nước):** As referred to in this dictionary, "Quality of water" means the suitability of water for irrigation use.
667. **Water - quality standards, or water standads (Tiêu chuẩn chất lượng nước):** Definitions of water quality established as a basis of control for various water-use classifications.
668. **Ions (Các ion):** Acids, bases and salts (electrolytes) when dissolved in certain solvents are more or less dissociated into electrically charged units or parts of the molecules called ions. Ions carry charges of electricity and in consequence have different properties from the uncharged radicals.
669. **Acidic (Tính A-xít):** pH value below 7 designates water as acidic.
670. **Alkaline (Tính kiềm):** pH value above 7 designates water as alkaline.
671. **Salinity (Độ mặn):** The relative concentration of salts, usually sodium chloride, in a given water. It is usually expressed in terms of the number of parts per million of chlorine.

672. **Salinometer, Salinometry (Máy đo mặn, đo đặc độ mặn):** An instrument for measuring the amount of salt in a solution; a hydrometer especially graduated so as to indicate directly the percentage of a particular salt (especially common salt) in a solution of it; the process is called "salinometry".
673. **Alkalinity (Độ kiềm, kiềm hóa):** A term used to represent the content of carbonates, bicarbonates, hydroxides, and occasionally borates, silicates and phosphates in water. It is expressed in parts per million of calcium carbonate.
674. **Osmosis (Tác dụng thẩm thấu):** The process of diffusion of a solvent through a semi-permeable membrane from a solution of lower to one of higher concentration.
675. **Osmotic equivalent (Đường lượng thẩm thấu):** The ratio between the amount of solvent water that passes through the membrane or septum of an osmotic call and the amount of solute which passes in the opposite direction.
676. **Osmotic pressure (Áp lực thẩm thấu):** The excess pressure that the solvent molecules possess on the side of the pure solvent over the solvent molecules on the solution side of the semi-permeable membrane. It may be measured by determining the excess of pressure that has to be applied upon the solution to produce a state of equilibrium in the system in order to prevent osmosis.
677. **Concentration (Nồng độ):** The amount of a substance in weight, moles or equivalents contained in unit volume; in expressing quality of irrigation waters the concentration is expressed as milligram equivalent per litre or equivalent per million parts of water.
678. **Critical concentration (Nồng độ tối hạn):** The limiting concentration of an impurity in an irrigation water after which it adversely affects crop growth, impairs the quality of the crop products, or damages the soil on which the crops are grown.
679. **Turbidity (Độ đục):** 1- A condition of a liquid due to fine visible material in suspension which may not be of sufficient size to be seen as individual particles by naked eye but which prevents the passage of light through the liquid. 2- Determination of that condition by means of the measure of the optical interference to the passage of light rays through a water sample and the comparison with standard samples of known turbidity.
680. **Specific electrical conductance, or Electrical conductivity (Suất dẫn điện hay độ dẫn điện):** Of water is the reciprocal of electrical resistivity measured at a temperature of 2°C.
681. **Combining weight (Trọng lượng hóa hợp):** Of an element or radical is its atomic weight divided by its valency.
682. **Milligram equivalent (Đường lượng miligam):** Of a salt constituent is the number of milligrams represented by its combining weight.
683. **Milligram equivalent per million (Đường lượng miligam tính bằng phần triệu):** Parts per million divided by its combining weight.
684. **Sodium percentage (Tỷ lệ phần trăm natri):** The ratio of the total sodium cations, or the total sodium plus potassium cations, to the total cations held in the solution, multiplied by 100.

- 685. **Chloride percentage (Tỷ lệ phần trăm Clo):** The ratio of the total chloride anions or the total chloride plus nitrate anions, to the total anions held in the solution, multiplied by 100.
- 686. **Salt index (Chỉ số muối):** A formula for ascertaining whether water is suitable for irrigation.
- 687. **Salt balance (Cân bằng muối):** The salt balance of an irrigated area is commonly defined as the difference between the total dissolved solids brought to the land annually by the irrigation water and by seepage water and the total solids carried away annually by the drainage water and by seepage water.
- 688. **Toxic (Chất độc hại):** Poisonous; tending to reduce the yields of crops below the normal.
- 689. **Hardness (of water) (Độ cứng của nước):** A measure of calcium and magnesium salts (carbonates, sulphates, chlorides, ect.) expressed as parts of calcium carbonate per million parts of water.
- 690. **Coefficient of fineness (Hệ số độ mịn):** The ratio of the suspended solids to the turbidity, and is a measure of the size of particles causing turbidity, the particle size increasing with the coefficient of fineness.
- 691. **Saline water (Nước mặn):** Water which contains moderate concentration of total dissolved salts.
- 692. **Saline - Alkaline water (Nước kiềm mặn):** Water which has moderate concentration of soluble sodium salts.
- 693. **Alkaline water (Nước kiềm):** Water which is high in sodium percent but relatively low in total dissolved salts.
- 694. **Boron water (Nước Bo):** Water with or without the conditions of salinity and alkalinity but containing limited or excess boron as well.
- 695. **Mineral water (Nước khoáng):** Water that contains a high quantity of mineral salts, such salts usually.

II.2. PUMPING STATION - TRẠM BƠM

II.2.1. LIFTING DEVICE - THIẾT BỊ NÂNG NƯỚC

II.2.1(a). MAN POWERED - DÙNG SỨC NGƯỜI

- 696. **Scoop (Gầu sòng):** A spoon-shape ladle with a long handle, worked either as a simple hand tool or supported from a tripod, and involving a sequence of dipping, swinging and tipping with a minimum of lifting; used for dewatering a well and for supplying water to fields.

697. **Doon (Gầu máng):** A wooden or metal trough which oscillates on a fixed centre, so that one end is alternately depressed into the water and raised above the level of delivery. The weight of water is equalized by a counterbalance, so that a man, who stands over there on a plank, can depress the end of the doon into the stream with his feet, and then, by stepping on the plank and lifting slightly with his hands, can slope the trough towards the point of delivery, and thus enable the water to run into the channel. This device is used in some parts of India for very small lifts.
698. **Swing bucket, or bucket (Gầu dai):** A device for lifting water up to small heights. It consists of a basket or shovel-like scoop with four ropes attached to it and worked by two men.
699. **Rati, or charkhi (Gầu múc nước):** Local terms used in India for a pulley-block arrangement for lifting water from wells for domestic purposes or for irrigating small gardens.
700. **Counterpoise lift, Shaduf, Shadoof, Shadouf, Denkli, Lat, Khetara, Kerkaz, Kheeraz, or Guennina (Gầu múc nước cân vọt (kiểu đối trọng)): A primitive device for raising water. It consists of a lever in the form of a pole pivoted near the centre of a cross-bar or other means of support like a see-saw: a weight is fixed to the end of the lever which serves as a counterpoise to a bucket-type dipper suspended from a rope or rod attached to the other arm of the lever. By rocking the pole, the full bucket is raised to the desired height at which point it is emptied by a sideways tipping motion.**
701. **See-saw water lift, Picotah, Picottah, Piccotta or Pikota (Gầu múc ba người):** A device, somewhat similar to counterpoise, but more massively built and operated differently, used for lifting irrigation water from wells. One man empties the full container when it reaches the surface and the other two cause the device to operate by walking back and forth along the pivoted pole.
702. **Archimedean screw, or Archimedes' screw (Dụng cụ kiểu xoắn vít Ác-xi-mét):** A device attributed to Archimedes, consisting of a tube bent spirally around an axis or, alternatively, a broad threaded screw encased by a hollow open cylinder. The apparatus is partly immersed in the water source at an angle to the horizontal. Water is raised when the screw is rotated.
703. **Paddle wheel (Guồng đập nước):** A simple device operated by persons treading on foot tradles, with arms and upper part of the body supported on a bamboo frame, for the watering and dewatering of paddy and other fields.
704. **Tympانum, or Rue tympان (Guồng nước):** A water raising device in use in part of Vietnam, operated in a manner very similar to that of improved paddle wheel but resembling more nearly the Egyptian sakia in construction and in principle of lifting the water.
705. **Water-ladder, Chinese dragon wheel, Rahad (Guồng thang):** A water lifting device consisting of a series of small boards made up into an endless link chain which runs in a wooden trough and passes over spoke-type wheels mounted on both

ends of the trough. The upper, or driving, spoke-type wheel is mounted on a horizontal pole or shaft fitted with foot treads on which men tread, thus the chain is dragged up through the trough, each board on the endless chain pushing a little water which is spilled out the top. Water ladders are also operated by animal power and windmills. The water ladder is known as "rahad" in Thailand.

706. **Chain pump (Bơm xích):** A device for raising water through small lifts, consisting of an endless chain dipping below the water to be raised and running over a drum or wheel by which it is moved. In the most common form the chain has at intervals discs or lifts which fit the tube through which the ascending part passes and which carries the water.

II.2.1(b). ANIMAL-POWERED - DÙNG SỨC KÉO GIA SỨC

707. **Rope and bucket lift, Churus, Charsa, Mot, Mote, Mohte, Pur, Daly, Delu (Gâu ròng rọc dùng gia súc kéo):** An old device for lifting water from wells, commonly used in India and in Near East countries. It consists of a leather bag or bucket of varying capacity (-1 litres), depending upon the depth of the well, the size of bullocks and the manner of operation, attached to an iron or timber ring suspended from a rope on a pulley and worked by cattle walking on a ramp. One man is required to empty the bag as it comes to the surface. This device is known in India as "churus", "charas", "mot", "mote", "mohte" or "pur" and in Arabic speaking countries as a "daly" or "dalu".

708. **Lagor:** A local term used in India for one of two systems of working the rope-and-bucket lift. In this system the cattle have to return back on the same ramp.

Thuật ngữ địa phương được sử dụng ở Ấn Độ dùng cho một hay hai hệ thống chuyển nước dây thừng - gâu múc. Trong hệ thống này gia súc phải quay trở lại trên cùng một quãng đường.

709. **Kili:** A term used in India for a system of working the rope-and-bucket lift. In this system, the rope is fastened to the yoke by a wedge and when the cattle have reached the bottom of the rope and is pulled up the ramp by the weight of the bucket going down. The cattle walk back on a parallel ramp and take few mouthfuls from the feeding troughs.

Thuật ngữ được dùng ở Ấn Độ để chỉ một hệ thống chuyển nước dây thừng - gâu múc. Trong hệ thống này, dây thừng được buộc chặt vào ách gia súc bởi một chốt. Khi gia súc đã tới cuối đoạn đường dốc, chốt này được bung ra. Người chủ khiến cầm dây thừng đang bị kéo do sức nặng của gâu. Gia súc phải quay trở lại đường cũ và được ăn một chút trong máng ăn.

710. **Rope-and self-emptying bucket (Gâu - thùng tự động đổ):** The same as rope-and-bucket except that the bucket is so arranged as to discharge automatically into the receiving trough.

711. **Two-bucket lift, or Circular mohte (Hệ thống hai gâu hay gâu quay vòng):** A device using two buckets which are alternatively raised, emptied, lowered and filled,

i.e. while the one bucket if lifted, the other is lowered empty into the well. The raising and lowering of the bucket is accomplished by a chain linkage which passes from the bucket over an array of pulleys to a horizontal sweep. The sweep is turned in a circular motion by one or two bullocks.

712. **Persian wheel, or Rahat (Còn nước kiểu Ba-tu):** A water lifting device consisting of a large open-spoked drum and two parallel loops of rope or chain, joined by spacing-bars and having buckets (earthen-ware pots or metal containers) attached to them at intervals which pass over the drum and descend into the source from which water is to be lifted. The drum, rotated by a pair of bullocks or a camel by a simple gear arrangement fills the buckets as they dip into the water and empties them into a trough placed across the well as they move to the top.
713. **Baldeo balti (Gầu thuyền có bò kéo):** An ingenious device used to some extent in U.P. (India), consisting of two large boat-shaped buckets of iron hinged on a piece of wood placed on the edge of a water tank or channel. These buckets are filled alternatively. When one goes down, the other comes up and discharges water. It is operated by a bullock or a pair of bullocks.
714. **Sakia, Saqia, Saqiya, Sakieh or Saklyeh (Còn nước Ai-cập):** A kind of water wheel used in Egypt for lifting water up to two metres. It consists of a double-sided all metal wheel which has volute-shape compartments within it. These compartments are open at the periphery of the wheel and curve inward toward a central opening around the axis. When the wheel revolves, water is scooped up at trough. Usually the sakia is operated by animal-power but in more recent years internal combustion engines have come to be used for turning it.
715. **Zawafa (Guồng nước Ai-cập):** An Egyptian water lifting device used for lift exceeding two metres. It is a modern version of the chain and bucket type of Persian wheel but its design results in the water being lifted only a small distance above the delivery level.
716. **Tabba, or Taboot:** An Egyptian water lifting device for lifts midway those of sakia and Zawafa; actually the delivery level.
- Một kiểu dụng cụ chuyển nước của người Ai-cập, nằm trung gian giữa kiểu còn nước Ai-cập và guồng nước Ai-cập, trong thực tế loại này là loại còn nước Ai-cập đổ nước ra phía ngoài.
717. **Kharbauwy:** An Egyptian water lifting device used in areas where the lift is from 0. to 1.0 metre. It is an improved paddle wheel worked by animal power. Instead of the blades turning within the side and the whole device rotates as a drum.
- Một dụng cụ chuyển nước của người Ai-cập dùng ở những nơi có độ cao chuyển nước từ 0 đến 1,0 m. Nó là một guồng nước cải tiến do sức vật kéo. Thay vì các mái guồng quay trong thành bên, các mái guồng được gắn chặt vào các bên và toàn bộ thiết bị quay tròn như một tang trống.
718. **Coefficient of utility (Hệ số sử dụng):** Useful works done (mean lift multiplied by quantity of water raised per hour) divided by the weight of the animal.

II.2.2. MECHANICAL POWERED - NĂNG LƯỢNG CƠ GIỚI

- 719. **Pump (Bơm):** 1- A mechanical device for causing flow for raising or lifting water or other fluids. 2- To work or raise water, etc. with a pump.
- 720. **Pumpage (Lưu lượng bơm):** The quantity of liquid pumped or lifted in a given time.
- 721. **Pump house (Nhà trạm bơm):** A building in which are located and operated the pumps of a system of irrigation drainage or the like.
- 722. **Pumping station (Trạm bơm):** An installation consisting of one or more pumps, power units, controls, intake and discharge piping, often housed in a building or otherwise sheltered.
- 723. **Pumping plant (Nhà máy bơm):** An installation, usually consisting of one or more horizontal centrifugal or vertical, deep-well turbine pumps, and of electric motors or internal combustion engines to power the pumps.
- 724. **Displacement pump (Bơm dịch chuyển qua lại):** A type of pump in which the water is introduced to flow from the source of supply through an inlet pipe and inlet valve and into the pump chamber by vacuum created therein by the withdrawal of some physical agency which, on its return displaces a certain volume of the water contained in the chamber and forces it to flow through the discharge valves and discharge pipes.
- 725. **Rotary pump (Máy bơm quay):** A displacement pump for raising a liquid by use of rotating elements instead of by a piston. It may operate at almost any speed, and does not depend on centrifugal force to lift the water.
- 726. **Reciprocating pump, or Positive displacement pump (Máy bơm pít-tông):** A type of displacement pump consisting essentially of a closed cylinder containing a piston or plunger as the displacing mechanism, drawing liquid into the cylinder through an inlet valve, and forcing it out through an outlet valve.
- 727. **Single-action pump (Máy bơm cửa đơn):** A reciprocating pump where the suction inlet admits water to one side of the plunger or piston, the discharge being intermittent.
- 728. **Double-action pump (Máy bơm cửa kép):** A reciprocating pump where the suction inlet admits water to both sides of the plunger or piston, the discharge being more or less constant.
- 729. **Air displacement pump (Bơm không khí nén kiểu pít-tông):** A displacement pump where compressed air is used as the means of displacement in the cylinders instead of pistons or plunger.
- 730. **Air-chamber pump (Máy bơm có buồng khí):** A displacement pump equipped with an air chamber, in which the air is alternately compressed and expanded by the water displaced by the pump, with the result that the water is discharged at a more even rate.

731. **Air-lift pump, or Air lift (Máy bơm khí nén):** A pump, used largely in lifting water from wells, where air under pressure is discharged, as fine bubbles, into the water and reduces the apparent specific gravity of the air-water mixture. The pressure of the surrounding denser water causes the resulting mixture of water and air to rise in the discharge (or eduction) pipe to the outlet.
732. **Buoyancy pump (Bơm Buoyancy):** A general name for an air lift pump.
733. **Foot piece (Cút nối):** In air lift, the device used to connect the air pipe and discharge pipe, and to admit compressed air into a column of water.
734. **Submergence (Độ chìm):** The discharge that the pump or foot piece is submerged below the level of the water in the well, usually expressed as a percentage of the total height from the foot piece to the point where the water is discharged.
735. **Compressed air type pump (Bơm loại khí nén):** A type of pneumatic pump in which compressed air force liquid from a closed vessel or tank to another vessel or tank at a higher level.
736. **Pneumatic (Dùng khí nén):** Powered or inflated by compressed air.
737. **Pneumatic pumps (Bơm khí nén):** Pumps worked by compressed air.
738. **Single-entry pump, or single-suction pump (Bơm miệng hút đơn):** A type of pump in which water is admitted from a suction pipe on one side of the impeller.
739. **Double-suction pump (Bơm miệng hút kép):** A centrifugal pump with suction pipes connected to the casing from both sides.
740. **Continuous-flow pump (Bơm dòng liên tục):** A displacement pump where the direction of flow of the water passing through it is not changed or reversed.
741. **Piston Pump (Bơm Pít-tông):** A reciprocating pump wherein the cylinder is tightly fitted with a reciprocating piston.
742. **Double pump (Bơm kép):** A reciprocating pump, consisting of two cylinders placed side by side and connected to the same suction and discharge pipe, the pistons moving so that one exerts suction while the other exerts pressure, with the result that the discharge from the pump is continuous.
743. **Three-throw pump, or Triplex pump (Bơm ba pít-tông):** A reciprocating pump with three single-acting cylinders placed next to each other in line, all connected with the same suction and discharge line, with valves so arranged that the intake and discharge through the pump is continuous.
744. **Direct-acting reciprocating pump (Bơm Pít-tông hoạt động trực tiếp):** A steam-driven reciprocating pump in which the steam piston is directly connected to the liquid piston or plunger through the piston rod.
745. **U-pump (Bơm hình chữ U):** A reciprocating piston pump in which the valves are placed in the piston and the flow through the cylinder is one direction with no reversal.

746. **Chain pump (Bơm xích gầu (guồng gầu)):** A displacement pump with piston arranged as links on a chain, which partially or completely fill a pipe or passage, which the pistons pass continuously in one direction. One end of the pipe is placed in the water and the space in the cylinder is filled with water, which is moved along through it into the outlet where it is discharged.
747. **Paternoster pump (Bơm kiểu chuỗi hạt):** A chain pump, named from a fancied resemblance of the discs and the endless chain to a rosary.
748. **Force pump (Bơm cưỡng bức):** A reciprocating pump that has a solid piston for drawing in and forcing out liquid through valves. It can develop high pressure.
749. **Plunger pump (Bơm cần đẩy):** A reciprocating pump that has a plunger that does not come in contact with the cylinder walls, but enters and withdraws from it through packing glands. Such packing may be inside, outside or outside the centre, according to the design of the pump. It may be a “single-acting plunger pump” or a “double acting plunger pump”.
750. **Differential pump (Máy bơm phân kỳ):** A reciprocating pump with a plunger so designed that it draws the liquid into the cylinder on the upward stroke, but is double acting on the discharge stroke.
751. **Deep-well pump (Bơm dùng cho giếng sâu):** A pump used for lifting water from deep wells, the pumping mechanism usually being installed within the well at a considerable depth below the surface. The pump may be of the reciprocating or rotating type.
752. **Single-stroke deep well pump (Bơm giếng sâu hành trình đơn):** A reciprocating power-driven, deep-well pump, having a single pump rod connecting the reciprocating mechanism of the power head with the cylinder plunger. This plunger may be either a single-acting type or double-acting type.
753. **Double-stroke deep well pump (Bơm giếng sâu hành trình kép):** A reciprocating power-driven, deep-well pump, having two sets of balanced pump rods connecting the reciprocating mechanism of the power head with the cylinder plunger. One line of rod is hollow and the other is solid and works inside of the hollow rods. The cylinder plunger are single-acting in type and work one above the other in the same cylinder.
754. **Trip-stroke deep-well pump (Bơm giếng sâu ba hành trình):** A reciprocating power-driven, deep-well pump having three sets of pump rods connecting the reciprocating mechanism of the power head with the cylinder plungers.
755. **Diaphragm pump (Bơm màng):** A reciprocating pump in which a flexible diaphragm, generally of rubber, is the operating part; it is fastened at the edges in a vertical cylinder; when the diaphragm is raised, suction is exerted and when it is depressed, the liquid is forced through a discharge valve.
756. **Power pump (Bơm động lực):** 1- A term applied to all classes of pumps that require a separate power unit for their operation. 2- A reciprocating pump driven by power from an outside source applied to the crankshaft of the pump.

757. **Steam pump (Máy bơm hơi nước):** A pump operated by a steam engine where the steam and water cylinders, placed in the same machine, are considered as a single unit.
758. **Crank-and-fly wheel pump (Bơm có trục khuỷu và bánh đà):** A steam-driven reciprocating pump with a crankshaft on which a flywheel is mounted for storing energy during the early part of the stroke and imparting it to the liquid piston or plunger during the later part of the stroke, after steam is cut off in the steam cylinder.
759. **Bull pump (Bơm đầu bò (Bơm Bull):** A direct single-acting steam pump, the cylinder of which is placed over the top of a shaft or slope, and the piston rod attached to the pump rods. The steam lifts the piston and pump rods and the weight of these produces the down stroke.
760. **Close-coupled pump, or Direct connected pump (Bơm nối trực tiếp):** A pump directly connected to its power unit without any reduction gearing or shafting.
761. **Compound pump (Bơm hỗn hợp):** A direct connected steam pump in which the steam is allowed to expand in two or more cylinders.
762. **Trip-expansion steam pump (Bơm hơi nước ba lần chuyển đổi):** A direct connected steam pump in which the steam is exhausted from the high-pressure cylinder to an intermediate cylinder, wherein it expands, and then is further exhausted to a third cylinder.
763. **Donkey pump (Bơm Donkey):** Any of several kinds of combined pump and steam engine. The pump may be operated independently of the engine.
764. **Jet pump (Bơm phun):** A pump where a moving jet of water steam, or air, delivered through a restricted throat at high velocity, creates a suction and draws in the water to be raised. The velocity energy imparted to such water is later converted into pressure energy by an expansion.
765. **Vacuum pump (Bơm chân không):** 1- A pump for creating a partial vacuum in a closed space. 2- A pump in which water is forced up a pipe by the difference in pressure between the atmosphere and a partial vacuum. 3- An air compressor used in connection with steam condensers for improving the suction head on other pumps; the compressor takes its suction at low absolute pressure, compresses through a large number of compressions, and generally discharges at atmospheric pressure.
766. **Steam vacuum pump (Bơm chân không hơi nước):** A displacement pump where steam admitted to the cylinder is condensed therein by a stream of water, thereby creating a vacuum which serves to draw the water into the cylinder. When the cylinder is full, or nearly so, steam under full boiler pressure is admitted, forcing the water through the outlet valve.
767. **Pulsometer:** A type of displacement pump for pumping water by steam applied directly to the water. It consists of two pear-shaped vessels in one casting, the necks of which terminates in a single chamber having two valve seats with one ball valve, which oscillates between them. It also has an air chamber and suction and discharge lines.

Một loại máy bơm pít-tông để bơm nước bằng hơi nước tác dụng trực tiếp với nước. Nó bao gồm hai buồng hình quả lê nằm trong một thân, cổ của hai buồng này ở cuối một buồng đơn có đế van với một van bi, van bi này dao động qua lại giữa hai vị trí. Máy bơm cũng có một buồng khí và các đường hút, xả.

- 768. **Suction pump (Bơm hút):** A pump set above the surface of the body of water which supplies the pump, necessitating the lifting of water from such a surface to the pump cylinder or casing.
- 769. **Lift pump (Bơm đẩy):** A pump which lifts the liquid and discharges it without forcing it out under pressure; a suction pump.
- 770. **Wind pump (Bơm bằng sức gió):** A pump operated by the force of the wind rotating a multi-bladed propeller.
- 771. **Impulse pump (Bơm xung kích):** A type of pump that raises water by periodic application of a force suddenly applied and suddenly discontinued. The hydraulic ram is the most common example of such a type.
- 772. **Hydraulic ram (Bơm nước va):** A device for lifting water. Uses water hammer or impulse of water produced by checking periodically the flow of water in the supply pipeline, to lift a portion of the water to an elevation greater than that of the source of supply.
- 773. **Straight-flow pump (Bơm dòng thẳng hướng):** A pump in which the suction and discharge pipe and the pump are all in line, the water not changing direction of flow as it passes through.
- 774. **Propeller pump, or axial flow pump (Bơm cánh quạt hay bơm hướng trục):** A pump that develops most of its head by the propelling or lifting action of the vanes on the liquid. It has a single inlet impeller with the flow entering axially and discharging nearly axially into a guide case.
- 775. **Centripetal pump (Bơm hướng tâm):** A pump with a rotating mechanism that gathers a fluid at or near the circumference of radial tubes and discharges it at the axis.
- 776. **Centrifugal pump (Bơm ly tâm):** A water lifting device that utilizes the centrifugal force imparted to the water by a rapidly rotating impeller. It is essentially a reversed inward-flow turbine, the water being admitted to the centre of the impeller and discharged at its outer periphery. It is not a displacement pump and, therefore, differs mettially from a rotary pump.
- 777. **Vertical pump (Bơm trục đứng):** A centrifugal pump in which the shaft is vertical, to the bottom of which an impeller is attached in a horizontal plane. If the impeller is submerged, it is called "submerged type" and priming of the pump is not necessary. If not submerged, it is called "suction type".
- 778. **Horizontal pump (Bơm trục ngang):** 1. A reciprocating pump in which the piston or plunger moves in a horizontal direction. 2. A centrifugal pump in which the pump shaft is in a horizontal position.

779. **Kaplan pump (Bơm Kaplan):** A propeller type pump having adjustable impeller.
780. **Radial-flow pump (Bơm dòng hướng tâm):** A pump classified according to the direction of flow, in which fluid enters the rotating impeller near the axis of rotation and discharges from the impeller into the casing with a combined radial and tangential motion. Fluid accumulating in the casing is passed continuously out of the discharge nozzle. There is, in general, a continuous increase in pressure in the direction of motion.
781. **Mixed-flow pump, Screw pump, Angular flow pump, or Semiaxial pump (Bơm hỗn lưu):** A pump embodying some of the desirable features of both the centrifugal and axial flow types of pumps. The impeller imparts to the water an axial thrust, as does the propeller of the axial flow pump, as well as an outward thrust, as does the impeller of the centrifugal pump.
782. **Closed centrifugal pump (Bơm ly tâm kín):** A centrifugal pump where the impeller is built with the vanes enclosed within circular discs.
783. **Single-centrifugal pump (Bơm ly tâm đơn):** A central pump with one suction inlet, the water entering one side of the impeller.
784. **Volute pump (Bơm xoán):** A centrifugal pump having the case made in the form of a spiral or volute, as an aid to the partial conversion of the velocity energy of the water into the pressure head as it leaves the impeller.
785. **Turbin pump (Bơm tuốc-bin):** A centrifugal pump where the velocity energy of the water is partially converted into the pressure head as it leaves the impeller, by fixed guide vanes.
786. **Deep-well turbine pump, or Bore-hole pump (Bơm tuốc-bin giếng sâu hay bơm giếng khoan):** A vertical shaft centrifugal pump with a rotating impeller or impellers, suspended from the pump head by a column or eduction pipe that also serves as a support for the shaft and bearings. It is primarily designed for installation in bored wells, but it may be used in ditches, dug wells, mine shafts, sumps, and many other applications.
787. **Single-suction pump (Bơm hút đơn):** A pump equipped with one or more single-suction impellers.
788. **Double-suction pump (Bơm hút kép):** A centrifugal pump with suction pipe connected to the casing from both sides.
789. **Single-stage pump (Bơm một cấp):** A centrifugal pump with but one impeller.
790. **Multi-stage pump (Bơm nhiều cấp):** A centrifugal pump with two or more set of vanes, or impellers, connected in series in the same casing. Such a pump may be designed as two-stage, three-stage, etc., according to the number of sets of vanes used.
791. **Vertical screw pump (Bơm xoắn trục thẳng đứng):** A pump similar in shape and characteristics to a horizontal screw pump, but which has the axis of its runner in a vertical position.

792. **Centrifugal screw pump (Bơm xoắn ly tâm):** A centrifugal pump having a screw-type impeller; may be axial-flow, or combined axial and radial flow type.
793. **Horizontal screw pump, Screw deep pump, or Wood screw pump (Bơm xoắn trục ngang):** A pump with a horizontal cylindrical casing, in which rotates a runner with radial blades, like those of a ship's propeller.
794. **Peripheral pump (Bơm ngoại biên):** A pump having an impeller that develops head by recirculating the liquid through a series of rotating vanes.
795. **Circular casing pump (Bơm vỏ tròn):** A pump having a casing of constant cross section concentric with the impeller.
796. **Well point pump (Bơm điểm giếng):** A pump, usually a centrifugal pump, that can handle considerable quantities of air, and is used for removing underground water to dry up an excavation, particularly dewatering local pits.
797. **Piston (Pít-tông):** A disc-like sliding piece receiving and transmitting motion between a machine and a fluid. The piston is usually shaped as a short cylinder and is located inside a large cylinder and connected to the driving or driven machinery by a piston rod passing through the end of the larger cylinder.
798. **Plunger (Trục trượt (pít-tông lăng-go)): A variation of a piston where the entire part that enters the cylinder is of a uniform cross section. It displaces fluid directly by submersion. A plunger is longer than the stroke while the piston is shorter, and the plunger has a stuffing box at the end of the cylinder whereas the piston has a packing inlaid on its rim to provide a tight joint.**
799. **Pump barrel (Tang máy bơm):** The closed cylinder in which the plunger, diaphragm, or piston of a pump moves.
800. **Pump case, or Pump top (Vỏ máy bơm):** The pump case includes both suction and delivery entrances, supports the bearings carrying the shaft and houses the rotors assembly consisting of the impeller blades and the shrouds.
801. **Diffuser, or Diffuser vanes (Bộ phận khuếch tán):** In centrifugal pumps, a fixed or removable casting between the impeller and the casing with liquid passage designed to convert velocity head to pressure head.
802. **Diffusion casing (Vỏ khuếch tán):** A pump casing equipped with a diffuser.
803. **Lantern (Lồng máy bơm):** In a centrifugal pump, a hollow casing on the engine side of the pump body.
804. **Impeller (Bánh xe công tác):** A rotating set of vanes in a pump, etc. designed to impel rotation of a mass of fluid. The head produced and the working pressure of a pump depends upon the peripheral speed of the vane tips.
805. **Open impeller (Bánh xe công tác hở):** An impeller without attached side walls.
806. **Open impeller pump (Bơm có bánh xe công tác hở):** A pump in which the impeller vanes are without any shrouds; used for viscous liquids.
807. **Closed impeller pump (Bơm có bánh xe công tác kín):** A pump with an impeller having the side walls extended from the outer circumference of the suction opening to the vane tips.

808. **Semi-open impeller (Bơm có bánh xe công tác bán mở):** A pump in which the impeller has shrouds on one side.
809. **Screw impeller (Bánh xe công tác xoắn):** The helical impeller of a screw pump.
810. **Nonclogging impeller (Bánh xe công tác không bịt kín):** An impeller of the open, closed, or semi-closed type, designed with large passages for passing large solids.
811. **Single-suction impeller (Bánh xe công tác hút đơn):** An impeller with one suction inlet.
812. **Propeller-type impeller (Bánh xe công tác loại chong chóng):** An impeller of the straight axial-flow type.
813. **Double-suction impeller (Bánh xe công tác hút kép):** An impeller with two suction inlets, one on each side of the impeller.
814. **Shroud (Bộ phận bao bọc):** A covering around the impeller to direct the liquid through it.
815. **Balancing chamber (Buồng cân bằng):** A hydraulic chamber in a centrifugal pump to prevent the shaft from bending under the forces exerted on it when the pump is in action.
816. **One-way surge tank (Bể áp lực một chiều):** A tank built adjacent to the main pipeline and connected to the line near the location where the initial water column separation is most likely to occur. This tank provides a safe, adequate control of the fluctuations due to surges.
817. **Regulating reservoirs, or Balancing reservoir (Bể điều tiết hay bể cân bằng):** Reservoirs constructed in a project type sprinkler system primarily to provide adequate pressure in all parts of the distribution and to afford a means of controlling the frequency of the pump operation.
818. **Volute chamber (Buồng xoắn):** The space enclosed between the volute casing and the impellers, with a gradually increasing area towards the discharge nozzle, in which the major part of conversion of velocity energy to pressure head takes place.
819. **Diffusion chamber (Buồng khuếch tán):** Another type of volute chamber in which the conversion of energies takes place between diffusion vanes.
820. **Volute, or Volute casing (Vỏ xoắn):** A spiral casing of a centrifugal pump, so shaped as to reduce gradually the speed of water or air leaving the impeller, transforming it into pressure without shock.
821. **Tongue (Lưỡi):** The point where the volute begins.
822. **Foot valve (Van chặn):** A check valve installed at the inlet end of the suction pipe to retain water in a pump for priming.
823. **Lost head, or Head loss (Tổn thất đầu nước):** The head lost by flow in a stream or conduit in overcoming resistance to its motion, such as friction, bends, expansions, obstruction, impact.

824. **Static suction head, or Suction head (Cột nước hút tĩnh hay Cột nước hút):** The vertical distance from the source of supply to the centre line of the pump positive when the source is above the pump.
825. **Total suction head (Cột nước hút tổng cộng):** Sum of suction head plus head lost in friction on suction side.
826. **Static head (Cột nước tĩnh):** 1- The head produced by the static pressure of the water. The sum of pressure head, velocity head, and lost head. 2- The total head without deduction for velocity head or losses; for example, the difference in elevation of headwater and tailwater of a power plant. 3- The vertical distance between the free level of the source of supply and the point of free discharge, or the level of the free surface and the delivery head. It is independent of the density of the liquid.
827. **Delivery head, or Discharge head (Cột nước xả):** Discharge pressure of which pump is capable, expressed as equivalent vertical height to which the liquid can be raised above the centre line of the pump.
828. **Total delivery head, or Total discharge head (Cột nước xả tổng cộng):** Sum of delivery head plus lost head on delivery side.
829. **Pumping head, or Working head (Cột nước bơm hay cột nước công tác):** The sum od the static head and lost head on a pump when discharging a given rate of flow.
830. **Total pumping head (Tổng cột nước bơm):** The sum of total discharge head and the total suction head.
831. **Dynamic Head (Cột nước động)** 1- When there is flow: (i) the head at the top of a water wheel; (ii) the height of the hydraulic grade line above the top of a water wheel; (iii) the head against which a pump works. 2- That head of fluid which would produce statically the pressure of a moving fluid.
832. **Total dynamic head (Tổng cột nước động):** For a pump, the difference between the elevation corresponding to the pressure at the discharge flange of a pump and the elevation corresponding the vacuum or pressure at the suction flange of the pump, corrected to the same datum plane, plus the velocity head at the discharge flange of the pump, minus the velocity head at suction flange of the pump.
833. **Dynamic suction head (Cột nước hút động):** The vertical distance from source of supply, when pumping at required capacity, to centre of pump, minus velocity head, entrance and friction losses, but not minus internal pump losses.
834. **Power head (Cột nước công suất):** 1- An actuating mechanism at the power end od a deep-well pump which transmits power for the lifting of water. 2- The head available for power generation.
835. **Velocity head (Đầu nước tốc độ).**
836. **Centrifugal head (Cột nước ly tâm):** Head of impending delivery: The head developed due to centrifugal action at the periphery of mass of liquid revolving in a forced vortex. In a centrifugal pump, this represents the head developed when the pump is not discharging also termed “head of impending delivery”

- 837. **Centrifugal propeller pump (Bơm ly tâm cánh quạt).**
- 838. **Horizontal centrifugal pump (Bơm ly tâm trực ngang):** A horizontal centrifugal pump usually requires priming to start it.

II.2.3. POWER FOR LIFTING WATER - NĂNG LƯỢNG ĐỂ CHUYỂN NƯỚC

- 839. **Windmill (Cối xay gió):** A contrivance for lifting water from ponds, rivers, wells, or for electric generation, etc and operated by the wind acting on oblique vanes or sails which radiate from a shaft.
- 840. **Wind motor, Arro motor, or Wind turbine (Động cơ gió, Mô-tơ gió hay Tuốc-bin gió):** Any wind-driven machine.
- 841. **Wing, or sail (Cánh quạt):** 1- The extended surface of a windmill. 2- Windmill sail collectively.
- 842. **Conning (Côn (Nón)): Umbrella-like system of folding the blade.**
- 843. **Feathering (Bước răng thay đổi của cánh quạt):** Pitch changing of blades.
- 844. **Yaw (Độ lệch):** Sudden and temporary change of direction.
- 845. **Rated wind speed (Tốc độ gió danh định):** Minimum wind velocity at which a windmill gives the power for which it is designed.
- 846. **Furling velocity (Tốc độ cuộn):** Maximum wind velocity at which windmill can be operated.
- 847. **Tip speed (Tốc độ đầu mút):** The velocity of the outer edge of the sail.
- 848. **Isovent (Đường đẳng tốc độ gió):** Curve of equal average wind velocities.
- 849. **Water wheel (Còn nước):** 1- A wheel-shaped contrivance installed in an irrigation channel or river to lift water. The wheel is worked by the velocity of the flow of water in the channel. 2- A similarly shaped contrivance to harvest the energy of flowing water.
- 850. **Undershot water wheel (Còn nước dội lại):** A water wheel moved by water passing beneath and striking against curved blades set in the outer rim.
- 851. **Hurdy-gurdy (Còn nước kiểu Ca-li-phooe-nia):** In California, a water wheel with radial buckets, driven by the impact of a jet.
- 852. **Paddle (Cánh conDelete):** One of the broad board, or flats, at the circumference of a water wheel.
- 853. **Bucket (Gầu):** One of the receptacles on the rim of a water wheel into which the water rushes, causing the wheel to revolve.
- 854. **Noria (Guồng đập nước):** An undershot water wheel of the bucket type used to raise water from rivers and streams by means of a device, such as the Taboot mounted integrally on the same shaft.

- 855. **Poncelet wheel (Còn nước Poncelet):** An undershot water wheel with curved vanes.
- 856. **Overshot wheel (Còn nước chạy bằng sức nước):** A water wheel in which the discharge flume or head race is at the top, the water flowing tangentially into the bucket.
- 857. **Breast wheel (Còn nước hình ngực):** A type of water wheel on to which water led at about half the height of wheel. It acts partly by impulse and partly by the weight of the descending water in the buckets.
- 858. **Electric motor (Động cơ điện):** Motor driven by electric power.
- 859. **Internal combustion engine (Động cơ đốt trong):** An engine in which heat is added to the working agent (air) by the combustion of an atomized liquid, or pulverized solid fuel within the cylinder and converted into mechanical work through a piston.

II.3. IRRIGATION SYSTEMS - HỆ THỐNG TƯỚI

II.3.1. GENERAL NOTIONS - CÁC THUẬT NGỮ CHUNG

- 860. **Collective irrigation system (Hệ thống tưới tổng hợp):** The system meant to make possible and to facilitate the irrigation of the field (or farms) of an area. It includes all following works or part thereof: storage, intake, diversion or pumping works (headworks; conveyance system through canals and or pipes for bringing water up to the area; delivery structures, within the area, up to the intakes of the farms or fields to be served protective, delivery, regulation, operation structures; model or experimental farms, access ways, technical and administrative buildings necessary to operate, maintain and control the system. The system is operated by the technical and administrative staff of a body called "system operator".
- 861. **Individual irrigation system (Hệ thống tưới riêng lẻ):** Systems located downstream of the outlets served by the collective irrigation system and meant to deliver water to the farms or field of an area. The systems are operated by agriculturists.
- 862. **Perennial irrigation (Tưới quanh năm):** An irrigation is said to be perennial when the lands of the area can be irrigated throughout the year and have the volume of water actually required.
- 863. **Seasonal irrigation (Tưới vụ):** An irrigation is said to be seasonal when the lands of the area irrigated only during a part of the year called watering season.
- 864. **Supplemental irrigation (Tưới bổ sung):** An irrigation is said to be supplemental when it is carried out only occasionally to make good for short and irregular drought periods.

865. **Systematic irrigation** (**Tưới mang tính hệ thống**): An irrigation is said to be systematic when it includes watering which is repeated at definite intervals of time during the growing season of the crop(s).
866. **Flow irrigation, or Gravity irrigation** (**Tưới tự chảy**): Method of operating a system or part of a system using only gravity, water being available at a sufficient level (or pressure) to ensure its conveyance to the fields, its delivery to the fields or its distribution in the fields.
867. **Pumping irrigation** (**Tưới động lực (tưới bằng bơm)**): Method of operating a system or part of a system using, fully or partly, an artificial pressure for ensuring the conveyance of water, its delivery or distribution in the fields.
868. **Inundation irrigation** (**Tưới ngập**): Irrigation system in which water is drawn directly from the flow of a stream without passing through a storage structure whether it is perennial or not, by gravity or pumping.
869. **Irrigation from a storage reservoir** (**Tưới từ hồ chứa nước**): Irrigation system in which water is drawn from a reserve stored beforehand during the period of high waters, whether it is perennial or not, by gravity or pumping. "Bandharas" is a series of dams constructed along a stream to feed small irrigation canals.
870. **Irrigation from groundwater** (**Tưới dùng nước ngầm**): Water can flow by gravity by means of sub-horizontal canals (the Kanats of Iran and the foggeras or rettaras of North Africa) which enable to drain the groundwater, or by pumping from boring or wells.
871. **Irrigation by flood water spreading** (**Tưới bằng cách cho tràn nước lũ**): Earthen diversion embankment are built across a normally dry stream for diverting, during a flood, the waters into canals leading to recharge basins. There are many numerous variations among which.
872. **"Sailab" irrigation (a term used in India or in Pakistan)** (**Tưới kiểu Sailab (thuật ngữ dùng ở Ấn-dộ hay Pakistan)**): Flood waters are allowed to spread, without controlling them, on the first bottom of river, the surplus water flowing out through wastewater. Water thus stored in the soil enables to raise a crop.
873. **"Flush" irrigation (term used in Sudan)** (**Tưới kiểu "flush" (thuật ngữ dùng ở Xu-dang)**): In the deltas of rivers which are subject to violent floods and the waters of which are heavily loaded with silt, the water is diverted into canals by means of intake structures which are reconstructed every year or every two years.
874. **Micro basin irrigation** (**Tưới lưu vực nhỏ**): When the catchment area gets reduced, a molding of the land surface enables to create on very small slope an artificial micro-relief in each small field where the runoff water from the upper portion gets concentrated in the lower portion where the crops area raised and which are often reduced to a single tree.
875. **Irrigation by spreading** (**Tưới bằng cách tràn nước thải**): Use of waste waters for crops. Irrigation by spreading differs from waste water irrigation by the fact that in the case of spreading elimination of waste waters has a priority and crops are secondary.

876. **Irrigation (Tưới):** Water application confined in time and space, enabling to meet the water requirements of a crop at a given time of its vegetative cycle or to bring the soil to the desired moisture level outside the vegetative cycle. The irrigation of a field includes one or more watering per season.
877. **Irrigation interval (Thời gian ngừng tưới):** Reckoning of time from the start of one irrigation to the start of the next on the same field. Frequency of irrigation is a very close notion which expresses the number of successive irrigations carried out in a given period of time.
878. **Irrigation dose (Mức tưới):** Volume of irrigation which is expressed either in m³/ha or, preferably, in mm or height of water.
879. **Ideal irrigation interval (Thời gian ngừng tưới thực tế):** Interval corresponding to the actual requirements of the crop without any shortage or excess of water brought by the works.
880. **Irrigation season (Vụ tưới):** The actual length of time in days between the dates of the first and last irrigations given to a crop during the irrigation season of this crop.
881. **Turn interval, or Frequency of turn (Tần số quay vòng tưới):** The number of days separating the start of two consecutive water applications for the same field intake the irrigator may, at his will, use the water of his turn for his own field or for another field.
882. **Fall irrigation (USA) (Tưới trong mùa thu (ở Mỹ)):** Watering carried out just after harvesting the summer crop to restore the soil to the desired moisture.
883. **Winter irrigation (USA) (Tưới trong mùa đông (ở Mỹ)):** Watering carried out before the crop growing period in order to increase the water reserve of the soil.
884. **Early irrigation (USA) (Tưới sớm (ở Mỹ)):** Watering carried out well in advance of planning if the moisture in the soil is not adequate to carry out the soil preparation work.
885. **Preliminary watering (Tưới chuẩn bị):** Watering meant to facilitate the sowing of summer or winter crops.
886. **First watering (Tưới lần đầu):** Watering meant to facilitate the raising of the seedlings.
887. **Run through (Tưới chảy toàn bộ):** A watering run rapidly over the entire area to wet the surface soil either to fight against frost-sensitive areas or to cool the plants at the time of a heat wave.
888. **Sub-irrigation (Tưới không đủ):** Insufficient irrigation with regard to the actual requirement either due to insufficient doses of water or due to an excessive irrigation interval or even due to an underestimation of the actual requirements.
889. **Overirrigation (Tưới quá mức):** Excessive irrigation with regard to the actual requirement either due to excessive doses of water or due to an insufficient irrigation interval or even due to an overestimation of the actual requirements (lesser evapotranspiration or excess of rains with respect to the normal). It causes either a

leaching of the soil if it is sufficiently drained or a waterlogging of the soil which is very harmful to the growth of the crop.

890. **Intake structure, diversion structure, or headworks** (*Công trình lấy nước, công trình chuyển nước hoặc công trình đầu mối*): All structures built upstream of the system in order to divert the variable flow required for its supply, generally from a stream or a supply channel. They may include barriers across a stream (closed weirs or barrages), control structures, intake structures or sediment exclusion works as well as other appurtenant works.
891. **Structures for transfer of supplies from one drainage area to another** (*Công trình chuyển nước tưới từ một lưu vực này sang lưu vực khác*): These structures may be built for increasing the supply of an irrigation system. They generally include an intake structure and a tunnel, which passes through the watershed, or a transition canal.
892. **Conveyance structures** (*Công trình vận chuyển nước*): Structures built to help provide general control and conveyance of the flow from the intake structures to the area to be irrigated.
893. **Delivery structures** (*Công trình chuyển nước*): 1- All the structures (canals or pipes and their appurtenant works such as intakes, distributors, drops, discharge structures, etc.) which ensure delivery of water to the irrigators of an irrigation area from the main canal. 2- Any system delivery water to users.

II.3.2. COLLECTIVE IRRIGATION SYSTEMS HỆ THỐNG TƯỚI TỔNG HỢP

II.3.2(a). DEFINITIONS - KHÁI NIỆM ĐỊNH NGHĨA

894. **Irrigation canals** (*Kênh tưới*): Canals meant primarily for conveying and delivering water from the headworks to the fields: they include the head races, primary, secondary, tertiary and quaternary canals.
895. **Navigation canal** (*Kênh giao thông thủy*): Canals primarily meant for transport by water.
896. **Power canals** (*Kênh thủy điện*): Canals primarily meant for supply to hydroelectric plants.
897. **Double purpose canal** (*Kênh hai mục tiêu*): Canal built and operated with a double purpose: navigation and irrigation, irrigation and domestic and industrial water supply, irrigation during drought season and drainage during wet season.
898. **Perennial canal** (*Kênh tưới quanh năm*): A canal meant to irrigate all the year around.
899. **Seasonal canal** (*Kênh tưới theo vụ*): A canal meant to irrigate during a part of the year or during a particular season.

900. **Inundation canal (Kênh ngập):** A canal the flow of which depends on the surface level of the water in the river above a certain limit. In Burma such a canal is known as "freshest canal".
901. **Link canal, carrier canal, or Feer canal (Kênh nối):** A canal meant to convey water from one source of supply or system to another, or to link two points of the same system.
902. **Contour canal (Kênh theo đường đồng mức):** A canal the alignment of which follows more or less the contour. It may have a single bank or two banks.
903. **Ridge canal (Kênh sống địa hình):** A canal the alignment of which follows the ridge of the terrain making irrigation on both sides possible.
904. **Side slope canal (Kênh trên mái dốc):** A canal aligned roughly at right angles to the contours and is neither on the ridge nor in the valley.
905. **Main canal, Main line, Pipe main, or Principle canal (Kênh chính, tuyến dẫn chính):** A canal receiving its supplies from the head race and from which laterals as well as distributaries eventually receive their supplies.
906. **Branch canal, Lateral, or Primary canal (Kênh nhánh):** Sub-division of the main canal from which tributaries get their supplies. Normally, neither the main canal nor the laterals have any field outlets. Laterals of large areas may be themselves subdivided into main laterals and sub-laterals.
907. **Distributaries, or Secondary canals (Kênh cấp hai):** Canals receiving their supplies from the main canal or laterals or their branches and supplying water to minors as well as certain outlets.
908. **Minors, Distributor minors, or Tertiary canals (Kênh cấp ba, kênh nội đồng):** Canals receiving their supplies from the distributors and supplying water to sub-minors as well as certain irrigation outlets.
909. **Sub-minors, or Quaternary canals (Kênh cấp bốn):** Canals receiving their supplies from minors and supplying water to individual irrigation outlets.
910. **Waste channels, or Tail escapes (Kênh dẫn nước thải):** Channels which are extensions of the distribution canal system conveying surplus or unused waters to an outlet such as a stream, a depression of the terrain or any other place where they can be diverted. By "wastage or escapage" is meant all the waters discharged through the outlet of the system or the waste channels after having been diverted into the irrigation system.
911. **Tail tank (Bể chứa cuối kênh):** A reservoir supply with water from a canal when the flow conveyed is in excess of the requirements. This situated near the tail of the canal supplies water to a separate irrigation system.
912. **Parallel canal, or Side canal (Kênh tưới song song, kênh tưới bên):** A canal built by the side of an important canal (main canal or lateral or a branch of the latter) in order to serve the lands running alongside. It is called "gannabla" in Egypt and "ditch canal" in Pakistan.

II.3.2(b). REGULATION AND OPERATION (OF COLLECTIVE IRRIGATION SYSTEM)-ĐIỀU TIẾT VÀ VẬN HÀNH (CỦA HỆ THỐNG TƯỚI TỔNG HỢP)

- 913. **Regulation of a collective irrigation system** (**Điều tiết của hệ thống tưới tổng hợp**): Control of the hydraulic phenomena likely to occur in a system for the sake of safety, water economy and equitable distribution among the irrigators.
- 914. **Operation of a collective irrigation system** (**Vận hành của hệ thống tưới tổng hợp**): Method or way of controlling or operating a collective irrigation system with the main objective of distributing, to all the farms or field of the area, the water which they should receive in a safe and economical manner.
- 915. **Water account** (**Hiệu quả kênh tưới**): Follow-up of the volumes of water actually delivered with regard to the theoretical volumes to the areas served by the various canals of a collective irrigation system.
- 916. **Available supply** (**Lượng cung cấp có thể**): 1- In a river or a canal, the discharge passing at a given moment. 2- In a reservoir, the volume of water stored above the sill of the lowest sluices or minimum authorized level. 3- At the head of a canal, the authorized fraction of the river discharge (or the water of a reservoir) which feeds all the lands served. 4- At other points of a canal: the discharge passing at a given moment.
- 917. **Average supply (of a canal)** (**Lượng cấp trung bình (của kênh dẫn)**): Quotient of the sum of the measured daily discharges at the head of a canal by the number of days of measurement.
- 918. **Supply utilized** (**Lượng cấp sử dụng**): Difference between the quantity of water which enters a canal and the sum of the quantities of water which escapes from it by infiltration or discharge.
- 919. **Water requirement** (**Lượng yêu cầu nước**): Total of the water requirement (in discharge or in volume) which are felt downstream of any point in the delivery system for instance at the head of a delivery branch or of an individual irrigation system.
- 920. **Period of shortage of water** (**Thời kỳ thiếu nước**): Part of the irrigation season during which the demand for water is more than the available supply (corresponding for instance to a period of low water of the stream which feeds the system).
- 921. **Restriction** (**Hạn chế cấp nước**): Reduction applied to the supply with regard to the demand for water during a period of shortage.
- 922. **Excess water** (**Thừa nước**): Quantity of water allotted to an irrigated area or sold to an irrigator in excess of the water right during a period of plenty of the water resource.
- 923. **Still pond regulation** (**Điều tiết hồ nước tĩnh**): Method of regulation of the headworks in which the undersluices in the pocket being closed, the canal is fed from a still volume of water.

924. **Open flow regulation, or Continuous scour regulation (Điều tiết dòng chảy hở):** Method of regulation of headworks in which the undersluices of the pocket being opened, the canal is fed from a still volume of water through which running water flow.
925. **Semi-still pond regulation, or Semi-open flow regulation (Điều tiết bán hở):** Method of regulation of headworks in which the gates are raised up to the level of the tunnel so that the sediment is discharged through the under sluices and the canal is fed with the relatively clear water from the upper layers of the pocket.
926. **Wedge system of regulation (Hệ thống điều tiết xen kẽ):** Method of regulation of headworks in which, on a rising river, the gate openings are increased from the flanks towards the center, and on a falling river, the gate openings are decreased from the center to the flanks.
927. **Double wedge regulation (Điều tiết xen kẽ kép):** Method of regulation of headworks of canals, long closures of which are not permissible and where the discharge is such that the ratio of velocities in the river and the pocket in unfavorable: openings of the gates close to the divide wall are more than those further away. If the barrage feeds canals from both the banks, the opennings should be minimum at the center, and increase gradually towards the divide walls located on each bank.
928. **Overload of a canal (Kênh quá tải):** Discharge in excess of the designed discharge.
929. **Time of response (Thời gian phản hồi):** During a change in flow in an irrigation system or in a part of this system, it will take some time to reach the new equilibrium at each point of the system. This time is called time of response at this point for the change in question.
930. **Sluggish system (Hệ thống chậm chạp):** A system with an unduly long time of response due to oscillatory phenomena.
931. **Travelling surges (Sóng dâng phóng xa):** During a change in the hydraulic conditions of operation of a system, there is a transition period (see time of response) during which a new equilibrium is reached by means of surges called travelling surges. In case of sudden shut down, these surgesassume a marked curvature and may take the shape of the travelling hydraulic jumps called "hydraulic bores".
932. **Closure (Đóng kênh):** Shutting off supplies in the entire or part of a canal system for various reasons: (i) Annual repair or maintenance works. (ii) Construction of new structures or strengthening of old ones. (iii) Preventing harmful silt deposits by infiltration during periods of flood. (iv) No demand in the area due to heavy rains or frost. (v) Closure od certain distribution canals in the case of rotational working. (vi) Emergency measures in case of breaches in the embankments, immediate danger to the hydraulic structures, search for drowned bodies. (vii) Any other exceptional cause.

933. **Annual closure or Period of unemployment (Đóng kênh hàng năm hay thời kỳ ngừng khai thác):** Closure of a system for carrying out annual maintenance or improvement works and/or due to fall in temperature preventing the crops from growing.
934. **Self-regulation (Tự điều tiết):** Systems of regulation involving practically no intervention for operating the system.
935. **Water-right (Quyền dùng nước):** A grant, permit, degree, appropriance or claim to the use of water for beneficial purpose, limited by the economical use and subject to other rights of older date of use. The same term may apply to the quantity of water per year to which each farmer within a proclaimed irrigation area is entitled.
936. **Block system (a term used in India in the States of Maharashtra and Gujarat) (Hệ thống khu tưới độc lập (hệ thống Block):** A system which consists of limiting water delivery to blocks (i.e. fixed areas) for a define period (generally six years) during which only certain crops are permitted.
937. **There are different kinds of blocks (Có các loại khu tưới khác nhau):** Sugar cane blocks, garden blocks, kharif blocks and rabi block. In sugar cane block, any crop may be grown in the monsoons and winter seasons subject to the provision that not more than one third area shall be under sugar cane, but during summer season only sugar cane is allowed.
938. **Night-storage irrigation system (Hệ thống tưới trữ nước trong đêm):** In this system practiced in Sudan, crop are not watered by night. The outlet pipes are closed at sunset but water continues to enter the tertiary canal, flow rate being the same as the one recorded during the day. At the downstream reaches of the tertiary canal a small flat crested brick weir is constructed. A steel pipe is also provided across the weir which is shut at dusk. As and when water crosses the first reach, its level rises until the discharge across the weir is equal to that feeding the canal, and the water starts filling the second reach. The same process is getting repeated sonsecutively in all the remaining reaches of the canal until the sunrise when the entire canal is converted into a series of water storages. Subsequently, when the outlet is opened, the discharge is almost twice the supply. In this operation, by sunset the stored water is emptied, and then the same process is getting repeated.
939. **Waterman, or Water bailiff (Cán bộ thủy lợi):** A term used for the person who, in Province, is in charge of operating the general gates of the distribution system of an irrigation area as well as the control of the proper functioning of the entire area in application of the directives and decisions of the managing body.
940. **Continuous-flow irrigation system (Hệ thống tưới mặt liên tục):** In this system, each irrigator receives, in the form of a continuous flow, the quantity of water to which he is entitled.
941. **Intermittent-flow irrigation system (Hệ thống tưới mặt gián đoạn):** In this system, each irrigator gets water only intermittently either by pre-established rotation of the basic flow (called module) or on demand i.e. according to the prior

demands by individuals or group of individuals of the quantities and at the times which appear to them most desirable, or finally in the most modern pressurized systems, in total free service. The first method implies observance of an annual time table of rotation which fixes for each irrigator the dates and timings of the various irrigation of the season, the second method requires the permanent revision of the programme of opening and closure of the gates of the system so as to optimize the use of water and determine the possibility of satisfying any particular demand (earlier demands having a priority), hence the obligation to resort to a computer aided programme management, and free service dispenses with all programmes but on the other hand, it applies only to delivery systems which are fully pressurized. It requires a certain oversizing, the larger the system the smaller being oversizing, as well as outlets, called terminals, equipped with meters and pressure regulation devices, and a limitation of the flow at a subscribed value.

942. **Rotation, Rotation System, or Rotational working (Hệ thống tưới luân phiên):** When the water supply or the delivery structure does not satisfy the demands in free service, resource has to be made to a method of delivery in which, during a certain period, only a part of the system receives its supply, the rest being closed for a short while, before another part is primed in its turn, and so on till the entire area is fully served. This is the method of delivery by the supply of each irrigator is fixed on actual data and the irrigators know the same before the commencement of the irrigation season, the time-table is called "watering turn". For each irrigator, there may be rotation of the watering dates either during the same irrigation season (with gradual shifting of the day and time), or from season to season, in order to equate the advantages and disadvantages among all the irrigators for the night irrigation.
943. **Demand delivery (Chuyển yêu cầu tưới):** Method of delivery in which each irrigator can, by giving prior notice (generally 48hrs.), ask for the supply of irrigation water in the desired quantity and on the desired date. This system is widely used in United States.
944. **Total demand (in discharge and in volume) (Tổng yêu cầu):** Sum of discharge (of volumes) requested by irrigators downstream of any point in a canal system, at the head of a transport or delivery canal or at the head of an individual field.
945. **Free service delivery (Dịch vụ cấp nước tự do):** Method of delivery where each user, up to a certain discharge, subscribed beforehand, and limited by a flow limiting device installed on the corresponding outlet of a terminal of a pressurized irrigation system can at any moment make use of the water. In France, this method is widely used in reserve irrigation areas where it is known under the usual but erroneous name of "irrigation demand".
946. **Regulation with upstream control (Điều tiết có kiểm soát ở thượng lưu):** Method of regulation in which the flow in a canal (or in a pipeline) at right angles to a gate, is controlled by the level of the water (or pressure) measured by a sensor placed in the immediate upstream of the gate.

947. **Regulation with downstream control (Điều tiết có kiểm soát ở hạ lưu):** Method of regulation in which the flow in a canal (or in a pipeline), at right angles to a gate, is controlled by the level of the water (or pressure) measured by a sensor placed in the immediate downstream of the gate. This flow can also control the preceding gate downstream.
948. **Joint regulation (Điều tiết nối):** Method of regulation in which the inflow in a reach of the canal depends on the flow conditions both on the upstream and downstream of this reach. The volume of water in the reach is kept fairly constant, as well as the level of water at a point situated approximately at the center of the reach. This method is called in France "System level".
949. **Regulation with volume control (Điều tiết có kiểm soát tổng lượng):** Method of regulation in which the volume of water in the reach may vary for technical reasons but remains under the control of the operator.
950. **Constant upstream level gate (Mức cống thượng lưu không đổi):** The level is kept constant upstream of the gate separating two successive reaches, with the result that in each reach, it is the downstream end or tail which is constant.
951. **Constant downstream level gate (Mức cống hạ lưu không đổi):** In this case it is the upstream end or head of each reach which has a constant level.
952. **Operation of a canal with constant volume (Vận hành kênh dẫn với tổng lượng nước không đổi):** Method of operation aimed at maintaining constant, under all conditions of steady flow, the volume of a canal reach situated between two gates.
953. **Operation of a canal with volume control (Vận hành kênh dẫn có kiểm soát tổng lượng):** Method of operation where the volume of a canal reach situated between two gates is controlled so as to take into account inflows and withdrawals (by drawing out or pumping) which are arable in time.
954. **Dynamic regulation (Điều tiết động):** A method of regulation using the downstream information, with an upstream pre - regulation. The operation of a gate does not depend only on one or more measurements of level but on an entire series of measurements, on the position of the other gates, on the water level in the reserves constituted in the upstream and downstream reaches because and - this is the essential characteristic of the method - all the reaches should contribute to meeting peak demands as well as in the absorption of the unutilized volumes whether they are provided or not. The canal system acts therefore as a single reservoir managed by a real time computer. The computer receives the various data indicated above checks them and interprets them for working out the orders to be given to the various gates, starting or stopping the pumps and finally controlling the various operations.
955. **"In and out" method (Phương pháp "vào và ra"):** It is a method of strengthening the embankments, used generally in the flow plains, which consists in constructing, parallel to the outside of the old embankments, additional embankments with connections between old and new embankments at calculated intervals. The two

series of partitions thus formed on each bank are connected to the canal by inlets at their upstream and by outlets enable to divert a part of the flow from the filled with silt-laden sediment.

- 956. **Modernization of a system (Hiện đại hóa hệ thống):** This operation consists in replacing certain structure by using a new improved technology, for instance replacing channels and ditches by underground pipes.
- 957. **Preventive maintenance (Duy tu bảo vệ):** Works undertaken before the peak period of the system or the period of high water to ensure the functioning of the canals, structures and embankments under conditions as good as original and fully efficient, or to overcome an accelerated degradation.
- 958. **Change of slope (of a canal) (Thay đổi độ dốc (của kênh dẫn)):** Altering the functioning levels of a canal or canal reach so as to either improve its functioning by gravity or preventing silting or scours.

II.3.3. INDIVIDUAL IRRIGATION SYSTEM HỆ THỐNG TƯỚI RIÊNG LẺ

- 959. **Techniques of irrigation to the field (Kỹ thuật tưới cho đồng ruộng):** Methods of applying irrigation water to field. There are numerous methods followed by agriculturists: they are classified, going from the general to the particular, into irrigation methods, systems, sub-systems and processes. The three main methods are surface irrigation, sprinkler irrigation and micro-irrigation. The first applies water by gravity, hence its earlier name of gravity irrigation and other two apply it by means of pipes under pressure and can be called under the combined name of pressure irrigation.

II.3.3(a). SURFACE IRRIGATION - TUỐI MẶT

II.3.3(a1). Methods of surface irrigation - Các phương pháp tưới mặt

- 960. **Surface irrigation (Tưới mặt):** A method of irrigation in which water is applied to the land by allowing it to flow by simple gravity, before infiltrating. It includes various systems depending upon the relative magnitude of the surface flooding phase and infiltration phase after accumulation (submersion).
- 961. **Flood irrigation (Tưới tràn):** A method of irrigation in which the surface flooding phase is reduced to the minimum: water is quickly taken towards one or more storage basins where it collects before infiltrating into the soil. In soils which are hardly permeable, the layer of water is important as well as the duration of infiltration, at the end of which the water that has soaked in is drawn off to enable crops to grow: the dose applied is generally large enough to be sufficient for feeding the crop during its vegetative cycle. In the case of more permeable and less deep soils, several waterings are required during the cultivation season.

962. **Submersion checks** (**Tưới khoanh vùng trữ nước**): Parts of horizontal or quasihorizontal fields surrounded by earth ridges where water is brought and remains till it is completely soaked in. They may be of retangular shape or follow the contour.
963. **Basin method of irrigation, or Irrigation by beds** (**Phương pháp tưới vũng**): A method of irrigating, orchards more particularly, by which each tree or a group of trees is surrounded by a border to form a small submersion check called basin of round or ring-like shape (to prevent the water from stagnating at the collar) and promotes in certain sensitive species (citrus fruit and fruits with stones particularly) the appearance of cryptogamic diseases. The water comes from generally direct from the supply ditch but may sometimes come from another basin.
964. **Flush irrigation** (**Tưới tràn**): A method of surface irrigation in which the surface flooding phase predominate: the surface of the field or each part of the field is therefore accurately controlled so that water flows gradually in a continuous sheet over the entire surface of the land (border strip irrigation) or over the entire length of the corrugations (corrugation irrigation) from a delivery canal situated at the head. The downstream part of the border strips or corrugations is either closed or open on an excess water discharge system called surface runoff. When there is no surface runoff, there is a risk of overirrigation which is avoided by following what is called in English the cut-back method, i.e. by reducing the inflow at the head before the water reaches the extremity of the border strips or corrugations.
965. **Wild flooding, or Free flooding** (**Tưới tràn tự do**): Surface flooding in which water is diverted to unlevelled lands and where it flows in a natural way. This is a method earlier used on mountains.
966. **Spathe irrigation** (**Tưới dâng**): A method of random irrigation using the flood waters of a normaly dry system. It includes the construction of earthen diversion banks across the bed and then canals leading to embanked fields where the water is ponded till total infiltration.
967. **Controlled flooding** (**Tưới tràn chủ động**): Unlike in free flooding, water is diverted to levelled lands and in a sequential manner in such a way as to deliver everywhere the desired dose: it includes flooding from ditches, border irrigation and corrugation irrigation.
968. **Border irrigation, or Border method** (**Tưới khoanh vùng hay phương pháp tưới khoanh vùng**): A sub-system of colected flood irrigation in which the land is divided into parallel border strips (referred to as "planches or calans" in French) demarcated between them by earth ridge. Water is successfully delivered into each strip from a head or fields ditch at its upper end. On the upstream of each strip is provided a flat zone, the level portion wherein the stream of water spreads evenly across the entire width of the border strips before the flow starts down the slope in the entire downstream portion. The "calans" of Crau (Province) differ from border strips by the fact that the land surface is not levelled as well as by the absence of ridges: it follows that the location and the flow of the head orifices have been

pragmatically determined by the experience of the irrigators so as to obtain a flow as a broad stream as uniform as possible on the natural prairies of this ancient Rhone delta.

- 969. **Corrugations, or Rills (Rãnh luống):** V- shape narrow furrows made by agricultural implements between rows of crops by a ridging machine.
- 970. **Flooding fro, ditches, or (contour ditch irrigation) (Tràn từ kênh tưới hoặc rãnh tưới theo đường đồng mức):** A sub-system of controlled irrigation in which water flows through openings in the downstream banks of ditches (which more or less follow the contours) or over these ditch banks as a sheet across fields. The delivery is controlled by the spacing between ditches as well as the size and site of opening on each ditch. This method was earlier widely used on mountain prairies.
- 971. **Corrugation irrigation (Tưới luống):** A sub-system of controlled flood irrigation in which the corrugations between rows of a crop are fed at the head by flows from a furrow long enough to wet laterally the ridges situated between the corrugations. In soils with a large natural slope, corrugations which have a small longitudinal slope appear to be parallel to the contour. When the soils are in addition highly permeable, corrugations called "herringbone" corrugations are used; cemented furrows approximately parallel to the contours and laid along the line of the highest slope start from the field channel and feed the corrugations connecting two adjacent furrows: by gradually decreasing the slope of the corrugation from the furrows, the discharges produced at both the ends of each corrugation meet near about its central portion.
- 972. **Furrow irrigation (Tưới rãnh):** A method similar to corrugation irrigation used in permeable soils, which consists in feeding narrow furrows very close to one another with small discharges so as to wet more easily the entire soil situated between two rows of crops (generally orchards). Furrows parallel to the rows are laid mechanically with an agricultural machine (drill plough).
- 973. **Run (Tuyến rãnh luống):** Length of a corrugation of a field subjected to corrugation irrigation.
- 974. **Length of run (Chiều dài tuyến rãnh luống):** The distance run by the water along a border strip or corrugation, from one head ditch to the next one or from one end to the other end of a field.
- 975. **Duration of irrigation (Thời gian tưới):** The period of time for which one irrigator is allowed the irrigating head, in the system od rotation deliveries.
- 976. **Secondary flow irrigation, or (with two discharges) (Tưới tự chảy thứ cấp hay tưới với hai lưu lượng):** A method of applying water to the border strips or corrugations in which, before the water reaches the end of the run, the head flow is set at a reduced rate to avoid an excess of water or a runoff, yet maintain soaking over the length of the run. This reduction is referred to as "cut back" in English. The initial flow is called "attack flow" and the final flow is called "maintenance flow".

977. **Primary flow irrigation (single discharge)** (**Tưới tư chảy sơ cấp** (tưới với một lưu lượng)): A method of applying water to the border strips or corrugations in which the flow is maintained constant during irrigation of a unit, whether the head flow is stopped or not before the water reaches the downstream end.
978. **Surface irrigation system with recycling of surface runoff** (**Hệ thống tưới mặt với việc tái sử dụng dòng chảy mặt**): A system in which the surface runoff water from the field is collected at the lower point for using it for irrigation, either by gravity fields at a lower level (sequence irrigation) or by pumping fields at a level higher (or even at the same level) than the collecting point. Waters recovered in a basin can be used manually or automatically, the recycling pump starting to function when the basin is full.
979. **Wave irrigation** (**Tưới theo đợt**): A variation of the secondary flow irrigation in which the flow variation is obtained by varying the frequency and/or the duration of the waves, which are intermittent supplies feeding the corrugations or border strips. This very flexible method can be applied to surface irrigation in order to reduce the flow at the end of the attack phase and/or to reduce the duration of this phase in difficult soils.
980. **Cablegation** (**Tưới bằng đường ống có dây kéo**): Automated equipment of a field under surface irrigation in which a single pipeline is used both conveying as well as delivering water to the corrugations or to the border strips from the highest extremity of a field. The quantity applied, through a corrugation or a border strip, is determined by the speed of advance of a piston placed inside the pipeline and pushed by the static pressure of water; the advance towards the downstream of the piston is slowed down by a cable connected to a drum the rotation of which is controlled manually or programmed for each field, hence the American name of "cablegation" for which the French name is "transirrigation". There are surface cablegations, which can be shifted every year, and underground cablegations laid permanently in perennial crops.
981. **Irrigation through buried drains, Irrigation - drainage, or Vallenhoove process** (**Tưới bằng đường ống tiêu**): In practically horizontal lands, drainage pipes can be used in summer for irrigation if they end into ditches the level of which can be controlled.
982. **Irrigation by nappe control, or Ramspol process** (**Tưới bằng cách kiểm soát lớp nước**): The drainage ditch network is dense enough to be able to control the general level of the nappe, in winter as well as in summer, by adjusting the level in the ditches by means of coffer dams. This process is being followed in the Wateringue (North of France).

II.3.3(a2). Distribution of water downstream of outlets in surface irrigation - Phân phối nước hạ lưu cống lấy nước trong tưới mặt

983. **Outlet area, or Turnout area** (called "chak" in some Indian and Pakistan states) (**Diện tích tưới của cống** (ở một số bang của Ấn Độ và Pakistan gọi là "Chak")): All the fields which depend on an outlet of the distribution network. It

- can belong to a single or more agriculturists. It can include, in addition, to the irrigated fields, either uncultivable lands or cultivable but waste lands which require a reclamation or irrigation.
984. **Water courses (Đường dẫn nước tưới):** Ditches, flumes or pipelines delivering their supplies from the outlet or turnout and feeding the sub-water courses, and exceptionally some fields.
985. **Sub-water courses (Đường dẫn nội đồng):** Ditches, flumes or pipelines delivering their supplies from a water course and feeding the fields through their upper portion.
986. **Tail drain, or Waste ditch (Kênh tiêu cuối nguồn):** A furrow or small ditch at the lower edge of an irrigated field for collecting surplus water for either removal or redistribution.
987. **Dual-purpose ditches (Kênh nội đồng tưới tiêu kết hợp):** Field ditches which, during the wet period of the year, are used for drainage, and during the dry season for irrigation. Example: ditches used for nappe control.
988. **Irrigator (Người sử dụng nước tưới):** One who applies water to land between crops in a field.
989. **Co-irrigator (Người cùng sử dụng nước tưới):** When several fields depend on the same outlet or turnout, their irrigators are called co-irrigators.
990. **Roster (Lịch tưới luân phiên):** List or timetable prepared for distribution of water among the co-irrigators of the same outlet area, and showing: (i) Order of turn; (ii) field number; (iii) name of co-irrigator; (iv) area of the fields; (v) theoretical duration of the turn, proportional to the area; (vi) any addition or reduction; (vii) the actual duration of the turn, called "waraband" or "osrabandi" in some Indian or Pakistan states.
991. **Fixed system (Hệ thống cố định):** A procedure of distribution between co-irrigators in which each individual irrigator receives water once in a week, on the same day and at the same time. Disadvantage: during a period of restriction, when there is rotational running of canals or outlets, one or more co-irrigators may miss their turn.
992. **Balance (Lượng nước đọng trong kênh):** When the last of a main or branch water source (canal, flume or pipeline) has completed his turn, the main or branch watercourse is closed off and the water that has been left between the point of close off and the field is called "balance" ("nikal" in India and Pakistan).
993. **Follow-on system (Thực hiện tưới theo hệ thống):** A procedure of distribution between co-irrigators in which the turn of each co-irrigator is calculated on the basis of hours of use of discharge. When one co-irrigator has finished, he hands over to the next one on the roster and so on. This order is observed even if there is rotational running of canal or outlets.
994. **Down the watercourse turn (Tưới dẫn xuống hạ lưu):** Procedure of allotting order of turns in a roster in which water is delivered upstream to downstream, first

to the right and then to the left. On reaching a branch watercourse, it proceeds down from upstream to downstream, and then it turns to the junction point and the process is repeated.

995. **Round the water course turn** (**Tưới vòng quanh**): A procedure of allotting order of turns in a roster in which water is equally distributed from upstream to downstream, first to the right and then to the left, but only on the main watercourse. On reaching the downstream of this watercourse, water is let into the branch watercourse starting with the one which is nearest to the tail and going upstream, the distribution on a single branch watercourse also taking place from upstream to downstream.
996. **Shovel cut** (**Xẻ rãnh**): Cut made by shovel or spade in a watercourse or in a field sub-lateral to divert the water into a canal, a sub-watercourse or a field.
997. **Field delivery point** (**Điểm cấp nước mặt ruộng**): The point on the watercourse or branch watercourse at which delivery of water to a co-irrigator or group of co-irrigators is given. The delivery structure can be a mere shovel cut or a proper distribution or division structure.
998. **Farm irrigation structures** (**Công trình tưới mặt ruộng**): Small structure and equipment which enable an irrigator to divert water from the watercourse and to convey it to various points in his field including control, regulation and measurement device.
999. **Check, or Stop** (**Cửa điều tiết**): A structure, permanent or temporary, placed in a particular ditch to change or check the flow so as to raise the water level upstream, and be able to divert the water into one or more watercourses or discharge it laterally through cuts or levees gates. The gate placed across is called check gate and the levee gates are called take-out gates.
1000. **Head gate** (**Cửa đầu mói**): A gate installed at the head of a diversion channel. It can also act as check gate.
1001. **Drop (ditch)** (**Dốc nước trên kênh**): A structure built to absorb the excess of the grade of the land with respect to the water line without producing an erosive velocity. When the drop acts also as check, it is called check drop.
1002. **Border gate** (**Cửa cống bờ vùng**): A small structure which enables to convey the water from one border or one submergence basin to another lower down the slope.
1003. **Agriculture division box, or Proportional distributor on the field** (**Hộp chia nước tưới**): A small structure enabling to divide water between two or more ditches. A Y-divider divides the flow into two ditches: the channel of approach must provide a parallel flow, without cross currents, with a horizontal transverse slope.
1004. **Spiles, or Furrow tubes** (**Ống rãnh tưới**): Portable tubes laid across ridges or above them to feed the corrugations. In the second case, they are called siphon tubes.
1005. **Temporary check dam, or Bag check** (**Đập điều tiết tạm thời hay bao điều tiết**): A strong piece of canvas or plastic used for obstructing the flow of water in a ditch for the purpose of taking out the water into another ditch or field.

1006. **Taphoon** (**Cửa diều tiết có thể di chuyển được**): A portable dam or stop on a frame or metal panel put across a ditch section by moving it downstream as the irrigation progresses.
1007. **Farm road crossing** (**Công trình giao thông trên kênh**): Culverts, siphons or bridges built on irrigation ditches to enable them to cross roads.
1008. **Stock guard** (**Lưới chắn rác**): Structure for protecting ditches under a farm road against solid debris and weeds as well as for preventing the stock from entering. It is mostly used on irrigated pastures.
1009. **Overflow stands** (**Trang thái tràn ống**): Pipes rising from a sloping pipeline. Excess water spills back into the pipeline.
1010. **Float valves** (**Van nổi**): Automatic valves which enable to control pressure head in a pipeline by shutting off the passage section when the pressure exceeds the specified limit.
1011. **Flow regulating boxes** (**Hộp điều tiết dòng chảy**): An apparatus installed on a main pipeline at the level of a diversion: the flow is controlled by means of valves.
1012. **Riser pipe** (**Đường ống đứng**): A pipe rising from the pipeline and fitted with a gate valve which enables to irrigate the land.
1013. **Alfalfa, or Orchard valves** (**Van An-pha**): Special valves attached to riser pipes to control their flow
1014. **Portable hydrants** (**Vòi xách tay**): Hydrants installed on the top of alfalfa valves to direct flow in a definite direction or to permit connection or portable pipes.
1015. **Distribution pot** (**Bình phân phôi**): A riser pipe which permits corrugation irrigation in orchards; the walls of the pot are provided with outlets which are equipped with slide gates which control the flow into the corrugations. An alfalfa valve on the riser enables to regulate the water level in the pot.

II.3.3(a3). Soil preparation in surface irrigation - Chuẩn bị đất cho tưới mặt

1016. **Soil preparation work** (**Công việc chuẩn bị đất**): All the works including: 1- The selection of a suitable layout, 2- The creation of irrigation canals and ditches and taking into account the layout of the fields, 3- The grading of the land, and formation of banks and subsidiary channels to facilitate the application of water.
1017. **Selection of irrigation parameters** (**Lựa chọn các thông số tưới**): Taking into account the pedological study, the nature of the planned crops and the climatological, study over the longest possible period of time, it will be necessary to determine the most suitable procedure of application of water to the fields, the frequency and dose of irrigation in average, wet and dry years, taking into account the rationalization of all agricultural procedures.
1018. **Topography** (**Địa hình**): The surface configuration of the land.
1019. **Clearing** (**Phát quang mặt đất**): Removing of vegetable cover, loose rock bits and other obstructing materials, prior to the preparation of the soils for irrigation.

1020. **Land forming (San lấp đất):** Modification, by mechanical means, of the land slope so as to make it compatible with the chosen of application of water to the fields. Levelling of the humps and filling of hollows should be done in such a way as to retain a minimum arable layer of earth and to optimize the volume of the cuttings and fills required.
1021. **Rolling land (Đất thoái):** Land having gradual, rounded undulations of its surface.
1022. **Upland (Đất cao):** Ground elevated above the lowland valleys.
1023. **Indicator plants (Thực vật chỉ báo):** The presence, in the wild state of certain species, can bring some indications about the organic content of a soil, its capacity of retention of its pH (calciphobes and calciphiles). Whereas the sagebush grows well in rich, wet and mildly alkaline soils, sarcobatus vermiculatus which is similar in appearance to it indicates the presence of a strongly alkaine soil.
1024. **Wind row (Vun gọn):** 1- A row of bushes rake up to dry before being destroyed by burning; 2- A row of useful crop material, after cut and raked up to cure before being baled or removed in bulk.
1025. **Railing (Phương pháp dùng máy kéo trên đường ray):** agricultural method of brush removal from a field using a tractor-drawn railway rail.
1026. **Grubbers (Máy đào củ):** Tractor implements or equipment used for digging roots.
1027. **Logged-off land (Đất trơ gốc):** Land cleared of trees but from which stumps are yet to be removed.
1028. **Char-pit method (Phương pháp đốt hố gốc cây):** A method of removal of stumps by burning. The bark around the stump is cleared, set on fire and covered with soil to limit the draft and converting the stump into charcoal.
1029. **Brush breaker, or Scrub breaker (Cày cây bụi):** A large powerful moldboard plough used for ploughing waste land overgrown with brush.
1030. **Flail (Thiết bị đập):** A hammer hinged to a rotary axle used to break or crush materials (stone, brushes). A brush beater consists of a series of flails connected to a horizontal rotary shaft which acts much as a hammer mill; it is driven by the power take-off of a powerful tractor and can be used over a stony and brushy land where mowers cannot be used.
1031. **Levelling, or Grading (San phẳng đất):** Work which consists in producing a level or uniformly sloping surface for crop growing. Levelling guided by revolving laser is being widely used because of its quantity (± 1 cm) and very low cost price on sufficiently extensive areas.
1032. **Spot grading (San lấp):** Removing humps or filling hollows without establishing, as the case of leveling or grading, a uniform grade in any direction.
1033. **Planing, Smoothing, or Floating (làm phẳng, nhẵn, bằng mặt đất):** The precision touch-up after levelling for correcting differential heaps of fill or the annual operation of eliminating small surface irregularities caused in a levelled field by farming operations.

1034. **Levelling equipment (Thiết bị san lấp):** Leveler, scraper, drag or any other device which enables to smoothen the soil surface.
1035. **Drag scapers, levelling drag scapers, or Blade scrapers (Máy cạo lưỡi ben):** Machine fitted with blade with adjustable level which enables to drage or push the earth during its operation.
1036. **Bulldozer (Máy ủi).**
1037. **Buck scraper (Máy cạo nhỏ):** A levelling machine for either dry or wet conditions pulled by animals or light tractor. The operator rides on the footboard and the position he takes - either forward or backward - and the angle at which he holds the cutting blade with the control lever regulate the cutting or spreading action of the blade.
1038. **Rollover, or Rotary scraper (Máy cạo rô-lô):** It has a carrying bowl which, unlike blade scrapers, carries rather than pushes the earth. Basically, it consists of a steel cylinder split longitudinally and with a cutting blade on one edge. The cylinder is fitted to a frame which is towed behind the tractor and can be so controlled that it will excavate, carry, dump and spread the earth.
1039. **Carrier scrapers (Máy cạo tự hành):** Scrapers mounted on wheel, which can dig ground material, haul and eject them into the carrying boul at high speed, and also dump and spread these materials in layers of desired thickness, hydraulic mechanism being used in digging, spreading and dumping operations.
1040. **Float, or smoother (Thiết bị làm nhẵn mặt):** A framework of planks or steel angles, plates ect. for drawing over the soil, to compact and smoothen its surface, to improve its condition or to break clods.
1041. **Cutting float (Máy cạo loại nhẹ):** A type of buck scraper, but mean for lighter work under dry conditions.
1042. **Mould board-type ditches (Thiết bị đào rãnh kiểu tấm bản đúc):** An equipment consisting of a cutting share and double mould boards attached to a heavy standard. It is carried or dragged on a wheeled frame on the rear of a tractor.
1043. **Ridger (Máy lên luống):** An implement for making small ridges anywhere in the field. In border irrigation, a drag (board drag) is used for making ridges at boundaries of fields.
1044. **Border disk (Thiết bị đắp bờ):** An instrument for making ridges in border irrigation: two gauges of disks are mounted on a toolbar so as to throw earth in and so build up a ridge. The inclination of the disks and their distance on the tool bar can be adjusted, which permits to obtain ridges of the desired height and width.
1045. **Corrugator, or land corrugator (Thiết bị tạo vũng):** An implement for preparing corrugation in corrugation irrigation.
1046. **Furrow opener (Thiết bị mở rãnh):** A small plough or share for opening corrugations for corrugation irrigation. A similar implement enables to smoothen and compact the corrugations in highly permeable soils to reduce seepage losses.

1047. **Disk-roller (Rô-lor đĩa):** An implement used to reduce seepage losses in paddy field. It is driven at a distance of 20 cm below land surface to produce compressed and less permeable layer at 50 cm depth, this layer being not disturbed by tillage implements. It is designed in such a way as to facilitate the incorporation of impermeable materials (clay, bentonite) just above the newly compressed layer.

II.3.3(b). SPRINKLER IRRIGATION - TUỐI PHUN

II.3.3(b1). Peculiarities of sprinkler irrigation - Đặc tính của tưới phun

1048. **Sprinkler irrigation (Tưới phun):** A method of irrigation under pressure in which water is sprinkled in the form of artificial rain through lines carrying distribution components: rotary sprinklers, diffusers with permanent water streams, perforated pipes. The length of the path of travel, by the water drops through the air, as compared to the other two methods causes: a great sensitivity to wind, which reduces the uniformity of the distribution; "air conditioning" effects on the crops used in anti-frost sprinkling or spraying, the sprinkling delaying the tripping of fruit trees.
1049. **Antifrost sprinkler method (Phương pháp tưới phun chống sương muối):** A method of frost control, whether it is due to radiation at night (frost without wind) or due to advection of cold air (frost with wind). It consists, in case of risk of frost, in covering the entire surface to be protected by a network of medium range sprinklers with an adequate rotational speed ($> 1\text{ rpm}$) and with a well distributed sprinkler intensity of the order of 4 mm/hr. The conversion of water into ice releases sufficient heat (80 cal/g of water) to maintain at 0° the temperature of the plants to be protected against frost.
1050. **"Débourement" delaying sprinkler method (Phương pháp tưới phun làm chậm quá trình sinh trưởng):** Very light and very frequent irrigation carried out at the end of winter during the hot hours of the day and permitting to cold down the micro-climate of an orchard with a view to delaying the vegetative cycle and avoiding the damages that a spring frost may cause on a more advanced vegetation.
1051. **Sprinkler intensity, or rain intensity (Cường độ tưới phun):** Intensity of the delivery of water by sprinkling expressed as the amount of water per unit of time (mm/hr). Its uniformity is expressed by a coefficient of uniformity (CU) of which there are several formulae for evaluation with the coefficient of uniformity of Christianson (CU.C) after the name of the American researcher who proposed it, being the oldest and the most widely used one.
- A quality sprinkling should be uniform (CU>80): Its sprinkler intensity should be adapted to the soil and remain at any point, less than the capacity of infiltration in order to avoid surface runoff and soil erosion that may follow.
1052. **Overtree sprinkler method (Phương pháp tưới phun trên tán cây):** Permanent sprinkler method used in orchards to distribute water over the top of leaves, mainly for frost control.

1053. **Undertree sprinkler method (Phương pháp tưới phun dưới tán cây):** Sprinkler method used in orchards with small sprayers with outstretched jet in order not to wet the leaves and avoid the wind effect on the distribution of water. These sprayers can be permanent, semi-permanent or portable.
1054. **Irrigation terminal (Họng nước tưới phun):** Collective irrigation systems under pressure supply water to the irrigated fields by means of special outlets called irrigation terminals and each one provided with one to four individual outlets. A terminal comprises a gate, and on each outlet, a pressure regulator, a flow limiting device and an adding meter. The flow limiting device regulates the discharge supplied by the outlet to the discharge subscribed by the irrigator.
1055. **Irrigation device (Thiết bị tưới phun):** In the system under pressure, it is the combination of two intervals expressed in meters, the first being the internal between distributors (sprinklers etc.) on each ramp; the second being the interval between two adjacent ramps.
e.g. in sprinkler irrigation, a 18×24 device corresponds to an interval of 18 m between sprayers of the same ramp, and of 24 m between ramps.

II.3.3(b2). Sprinkler Irrigation Methods - Các phương pháp tưới phun

1056. **Perforated pipe sprinkler irrigation (Tưới phun bằng đường ống có khoan lỗ):** A sprinkler method in which the nozzle-lines consists of portable and light-weight pipes the wall of which is perforated with several rows of small holes in such a way as to cause the water to be applied on both sides of the nozzle-lines.
1057. **Nozzle-line method, or Sprayline method (Phương pháp tuyến vòi):** A sprinkler method in which the nozzle-lines are provided with a single row of nozzles the diameter, spacing and pressure of which enable to obtain the most uniform possible distribution on a strip of land of given width, taking into account the possible blanketing between adjacent strips.
1058. **Portable nozzle-line method (Phương pháp tuyến vòi di động):** A sprinkler method in which nozzle-lines and nozzle-line holders are fully portable and should be manually shifted for each irrigation from one unit to the next one. Considerable improvement is possible by addition of waiting nozzle-lines, which enables to wait so that the land be dried, after irrigation before the shifting of the nozzle-lines.
1059. **Permanent nozzle-line method (Phương pháp tuyến vòi cố định):** A sprinkler method in which the nozzle-lines and nozzle-line holders are laid permanently overhead or underground. This method is quite suitable to perennial crops such as orchards.
1060. **Semi-portable, or Semi-permanent nozzle-line method (Phương pháp bán di động hay phương pháp tuyến vòi bán cố định):** It represents an entire range of sprinkler systems in which a part of the nozzle-lines, or even the nozzle-lines, remains permanently on the land during several waterings, or even throughout the irrigation season:

"Tricoffex" type system in which each sprinkler mounted on a float or on blocks, is connected to the nozzle-line by a hose of diameter 20 or 25 mm in reinforced plasticized PVC and protected against ultraviolet rays, of length 30 to 36 m, which enables, in a 12×12 arrangement for instance, to have five to six units per position of nozzle-line.

Total cover system (in portable nozzle-line of diameter 32 mm) in which each nozzle-line feeds only one sprinkler at a time. This sprinkler, generally fixed to an adaptor can be shifted from one position to the next position of the same nozzle-line by means of an automatic valve outlet, which cuts off the watering as soon as the sprinkler is disconnected, which permits to change positions without closing the outlet gate at the head of the system.

The system called integral cover system requires on the contrary no shifting of equipment, the positions being changed by opening and closing the gates placed at the head of the nozzle-line method only because the equipment should be done every year, which enables to shift the irrigated crop from one field to another.

1061. **Medium pressure sprinkler cover method (Phương pháp bao phủ tưới phun áp suất trung bình):** A sprinkler method in which water is sprinkled by means of rotating sprinklers laid out in a square, rectangle or triangle (arrangement called "in fives") on parallel nozzle-lines, at intervals ranging between 12 and 24 m, at an average pressure of 3 to 4 bars.
1062. **Raingun sprinkler method (Phương pháp tưới súng phun mưa):** A sprinkler method using heavy discharge and long range rotating sprinklers, requiring pressures higher than 5 to 7 bars and functioning in a fixed position. Widely used in an individual form on mountain prairies, rainguns can, in the plains, constitute high pressure sprinkler covers at interval of 90 to 100m. These systems are highly automated, with a central programmer which permits the individual control of the rainguns and this enables to easily split the units into sub-units.
1063. **Roll-move sprinkler lateral system (Hệ thống nhánh tưới phun lăn chuyển):** A sprinkler method in which the nozzle-line, which carries medium pressure sprinklers, is used as axle to the wheels which support it at regular intervals. Watering is done in a permanent shift and, between two waterings, the nozzle-line is manually moved to its new positions by rolling it fully.
1064. **Two-line sprinkler method, or Two-line method (Phương pháp tưới phun hai tuyén):** A sprinkler method in which the nozzle-line holder extends through the middle of the field and in which the two sections, after watering a plot, are broken and pulled, each one from the middle towards the extremity of the other half, the shifting taking place in such a way that the sections are then closed at extremities of the field, joined at its centre and connected by a hose at the following outlet of the nozzle-line.
1065. **Irrigation machine sprinkler method (Phương pháp tưới phun bằng máy tưới):** A sprinkler method using an irrigation machine which irrigates by successive

circular plots and in which the nozzle-line which rests in its central portion on a movable frame, carries on one of its arm sprinklers and at the end of other arm an irrigation hose. The nozzle-line pivots around a vertical axis, due to the reaction resulting from the orientation of a fixed jet in the direction opposite to the rotation.

1066. **Giant sprinkler method (Phương pháp tưới phun lớn):** A sprinkler method using an irrigation machine which irrigates by successive circular plots and in which the nozzle-line, which rests in its central portion on a movable frame, carries on one of its arm sprinklers and at the end of the other arm an irrigation hose. The nozzle-line pivots around a vertical axis, due to the reaction resulting from the orientation of a fixed jet in the direction opposite to the rotation.
1067. **Travelling gun sprinkler method (Phương pháp tưới phun bằng súng di chuyển):** A sprinkler method using an irrigation machine in which the sprinkler with a high discharge and at heavy pressure, mounted on a portable frame fed by a hose, waters, by adjustable sector of 1890 to 2400, and while moving backward, drawn either by a cable or by a flexible pipe or a PE pipe which winds itself on a rotating drum (enrouler or hose reel).
1068. **Centre pivot irrigation machine sprinkler method (Phương pháp tưới phun tự hành định vị trung tâm):** A sprinkler method using an irrigation machine, fully automatic, consisting of a nozzle-line rotating around one of its extremities by self-propelled towers with a hydraulic or electric motor. The water supplied to the pivot feeds the whole nozzle-line on which are provided rotating sprinklers or fixed diffusers (also called nozzles).
1069. **Lateral-move irrigation machine sprinkler method (Phương pháp tưới tự hành di chuyển bên):** A sprinkler method using an automatic irrigation machine, consisting of a nozzle-line fitted with rotating sprinklers or fixed diffusers, and divided into sections by self-propelled towers with an electric motor. This nozzle-line straight or slightly curved in shape, moves by translation in a direction perpendicular to its axis. It therefore irrigates a rectangular field. It is supplied with water at some points either by directly pumping from a ditch parallel to its movement or by successively connecting a flexible pipe to outlets fed by a pipeline under pressure.

II.3.3(b3). Equipment used in sprinkler irrigation. General terms - Thiết bị dùng trong tưới phun. Thuật ngữ chung

1070. **Head station, Head installation, or Head unit (Trạm đầu mối):** All the equipment installed upstream of an individual irrigation system under pressure, and which can fulfill several functions: starting and stopping the irrigation, regulating the pressure and the flow, accounting the water used, filtration, fertigation, programming of the waterings or even scheduling the irrigation, eventually unit wise accounting of the water and fertilizer monitoring the proper functioning of the various parts of the system stopping watering by sprinklers in case of very strong wind, etc. Among these functions, the simplest ones can be performed by the

irrigator himself. The most complex ones are more and more automated and can even necessitate the use of computers.

1071. **Automation (Tự động hóa).**
1072. **Filtration (Lọc):** A process or method which enables to separate the solid elements in water by interposition of a permeable medium (surface or volume) and to throw them outside the filter.
1073. **Piloting of irrigation (Thí điểm tưới):** All the methods which enable to determine in an optimum manner the date and quantum of each watering. The programming of the waterings also integrates the water, equipment and manpower availability to the irrigator.
1074. **Irrigation programmer (Máy tính dùng cho tưới tự động):** An apparatus automating the starting and the stopping of the waterings programmed by the starting and the stopping of the waterings programmed by the irrigator for each unit as well as injections of fertilizers within the irrigation sequences. Useful for the implementation of certain sprinkler methods, it is essential in micro-irrigation, taking into account the high frequency of the waterings.
1075. **Fertigation (Hoà lǎn phân bón):** Introduction into the irrigation water of fertilizing elements which enable to increase the crop yield; besides fertilizers, other chemical products can be added:
 - for improving the chemical properties of the water (e.g. lowering the pH) or of the soil (use of chelates to control certain chloroses of fruit trees);
 - for controlling certain crop diseases (insecticides, nematicide, systemic fungicides);
 - cleaning the network and removing from it calcareous deposits and furs (acid) or disinfecting it (Javel water) in order to avoid clogging resulting from the proliferation of certain micro-organisms.Fertigation is mostly used in micro-irrigation because it allows more efficient use of fertilizers (delivery water limited to the root zone) and also to prevent much more serious risks of clogging.
1076. **Irrigation cycle (Chu trình tưới):** Successive deliveries of water on all the units of a network in such a way as to achieve a given irrigation on the entire concerned field.
1077. **Commutation (of flow) (Chuyển đổi dòng tưới):** Transfer of the available flow from one unit to the next one.
1078. **Field equipment (Thiết bị ngoài trời):** All equipment, of various nature, which are necessary for the irrigation, under pressure, of a field.
1079. **Nominal pressure (Áp suất danh nghĩa):** Maximum service pressure at which some equipment should function.
1080. **Angle of departure of a rotating sprinkler (Góc xuất phát của bình phun quay tròn):** Angle which the axis of the range nozzle makes with the horizontal. During a light wind, a 23° angle ensures a maximum range. During a strong wind, a more

stretched jet (up to 7° or even 5°) enables to resist the wind better, and the closer the sprinkler head to the vegetation cover the better is the resistance.

1081. **Diffuser (fixed) (Bộ phát tán nước):** A sprinkler distributor in which the fixed jet, calibrates by a nozzle, bursts into fine droplets. It is less exacting under pressure than the rotating sprinkler intensity is much higher because its range is reduced and the drops always fall on the same global surface, which may be a full circle (360°), a semi-circle (180°) a quarter circle (90°), quarters of circle in opposition (twice 90°) etc.
1082. **Sprinkler (rotating) (Bình phun (quay tròn):** A sprinkler distributor, the jet of which can rotate around a vertical axis. The rotating part may be with gears driven by a turbine actuated by the discharge of the sprinkler. But the oldest and most widely used rotating part is the oscillating arm which is driven outside its equilibrium position when the jet coming out of the nozzle hits a slanting part (paddle) and which is brought back to its position of equilibrium under the effect of a torsional spring: the arm gives an impact on the head of the sprinkler which rotates by a certain angle. The repetition of the phenomenon creates regularly sprinklers used in agriculture is 360° (full circle sprinklers) but may be limited to a smaller angle (adjustable sector sprinklers) by means of a rotation reversal device. It is provided with one or more nozzles. In the case of a double nozzle, the bigger one called range nozzle throws the water in the farthest part of the sprinkler head. The smaller one applies water to the nearest part of the sprinkler head.
1083. **Giant rainer, raingun, or extra large rainer (Súng phun mưa):** A rotating sprinkler having at least one nozzle of diameter greater than 12.5 mm.
1084. **Nozzle (Vòi phun):** A component for calibrating the jet of a sprinkler or diffuser of a mouthpiece, generally screwed to the head of the apparatus. The nozzle of a sprinkler which can be cylindrical, conical or of any other shape, determines the flow of the jet and its method of bursting along its travel path. The equivalent diameter of a sprinkler nozzle is calculated from the discharge and pressure at the nozzle.
1085. **Distribution curve (of a sprinkler diffuser) (Đường phân phối (của bộ phát tán nước tưới phun):** The curve of heights of water recorded at a given time (generally expressed in mm/hr) by rain gauges installed along a radius of the wetted area with respect to their distance from the tested apparatus.
1086. **Rain gauge, Pluviometer (Thùng đo mưa):** Container used to collect the water thrown out by a sprinkler (or diffuser) during the distribution uniformity test, and/or range measurement test.
1087. **Range (of a sprinkler or diffuser) (Tầm phun của bình phun (bộ phát tán nước):** It is the maximum distance, measured under normal operation between the vertical axis of the apparatus and the point where the sprinkler intensity exceeds 0.25 mm/hr for an apparatus with a discharge less than 75 l/hr. and 0.13 mm/hr. for an apparatus with a discharge less than or equal to 75 l hr (points corresponding to a circular sector limit should be excluded).

1088. **Effective diameter of the irrigated area** (**Đường kính hiệu quả của diện tích tưới**): It is by definition equal to twice the range.
1089. **Minimum operating pressure (of a sprinkler or diffuser)** (**Áp suất làm việc tối thiểu của bình phun hay bộ phát tán nước**): The minimum pressure at which the apparatus should function.
1090. **Nominal discharge** (**Lưu lượng danh nghĩa**): Quantity of water delivered by a sprinkler or diffuser fitted with a specified nozzle during the unit of time, at the ambient temperature ($25 \pm 5^\circ\text{C}$) and at the test pressure indicated by the manufacturer in his technical literature.
1091. **Non self-regulating distributor** (**Bộ phận phun không tự điều chỉnh**): A sprinkler or diffuser the discharge of which varies with respect to the input pressure. A self-regulating distributor has on the contrary a discharge which is relatively constant within the pressure range indicated by the manufacturer.
1092. **Retractable sprinkler** (**Thiết bị tưới phun tự nâng lên hạ xuống**): A sprinkler designed in such a way that when the system is stopped, its head is below the surface of the ground. When put under pressure, it lifts up above the ground and the sprinkler starts functioning. When the pressure drops, at the end of the irrigation, it returns to its initial position.
1093. **Service pressure variation range** (**Phạm vi biến đổi áp suất phục vụ**): Range of pressure varying between the minimum working pressure P_{min} and the maximum working pressure P_{max} at which the sprinkler system should function.
1094. **Range of distributors of a pivot, or Frontal nozzle-line** (**Tầm của bộ phận phân phối trục quay hay tuyến vòi phía trước**): Distribution equipment which can be mounted on the outlets of a pivot or a frontal nozzle-line for the purpose of a definite use. This equipment may be sprinkler distributors (sprinklers and diffusers) but also pipelines, pressure regulators, flow limiting device etc.
1095. **Test pressure (of a sprinkler or diffuser)** (**Áp suất kiểm tra của bình phun hay bộ phát tán nước**): The pressure chosen in the service pressure variation range.
1096. **Peak of travel path (of a sprinkler or diffuser)** (**Đỉnh đường đi của nước tưới (của bình phun hay bộ phát tán nước)**): Maximum height of the travel path with respect to the nozzle when the apparatus is functioning in a vertical position at a given pressure.
1097. **Range of a pivot, or Frontal nozzle-line** (**Tầm của trục quay hay tuyến vòi phía trước**): Distance measured between the nozzle-line and the farthest point where the sprinkler intensity of only one distributor drops approximately to zero. This range should result from tests carried out without wind. In practice, one can content oneself with an estimate from the data observing a machine in actual operation.
1098. **Wind velocity** (**Tốc độ gió**): Mean velocity measured at the site during the distribution uniformity measurement test.

1099. **Christiansen uniformity coefficient (CU.C) (Hệ số đồng đều Christiansen):** Uniformity of application of water with a sprinkler expressed as a percentage, measured at a given pressure, interval and device, in accordance with the method proposed by Christiansen $CU.C = \Delta h/h$ (ratio to the mean of heights of water, of the mean, in absolute value, of the deviation to the mean).
1100. **End gun (Súng phun End):** Sprinkler mounted at the end of a pivot or a frontal nozzle-line in order to increase their range. It does not function permanently to be able to follow as best as possible the limits of the field (or of the unit).
1101. **Pressure test (of a pivot or frontal nozzle-line) (Kiểm tra áp suất (của trục quay hay tuyến vòi phía trước):** Measurement of the pressure at the first accessible outlet on the nozzle-line.
1102. **Effective radius of a pivot (Bán kính hiệu quả của trục quay):** Radius of the irrigated circular area which is by convention equal to the distance from the pivot to the last distributor of the nozzle-line plus 75% of the range of this distributor.
1103. **Effective length of a frontal nozzle-line (Chiều dài hiệu quả của tuyến vòi mặt trước):** Conventional length equal to the distance which separates the two sprinkler distributors which are farthest away from each other plus 75% of the range of these distributors, and minus the length of the nozzle-line overhanging an area not being used for agricultural production.
1104. **Electric point (Điểm đấu điện):** Electrically insulated part of the irrigation machine used for connecting the machine from the electric point of view.
1105. **Main electric cable (Cáp điện chính):** Cable connecting the electric point to the motor of the irrigation machine.
1106. **Subsidiary electric cable (Cáp điện phụ):** Cable feeding a component which is not involved in the movement of the movement of the irrigation machine.
1107. **Control cable (Cáp điều hành):** Electric cable feeding the control required for the movement of the irrigation machine.
1108. **Main control panel (Thanh điều hành chính):** Enclosure containing the main control as well as the other control is used for starting and stopping an irrigation machine.
1109. **Subsidiary pannels (Các thanh phụ trợ):** Protected enclosures of subsidiary controls such as relays, switches, transformers. They do not include the main control or the general switches.
1110. **Earthed (Tiếp địa):** Connected to the earth or to a conducting mass used as earth
1111. **Earth cable (Dây tiếp địa):** Cable connected internationally to the earth.
1112. **Earthing cable (Dây mát):** Cable used to earth the metal parts to an earth cable or to an earthing electrode.
1113. **Metal to metal assembly (Lắp ráp các bộ phận kim loại với nhau):** A reliable connection which enables to ensure the electrical continuity between metal parts which should be necessarily electrically connected. This assembly is done with bolts

and nuts the bearing surface of which have been thoroughly cleaned from paints or other foreign matter.

- 1114. **Weatherproff (from the electrical point of view) (Chống phong hoá (theo quan điểm về điện)):** Which can be subjected to the atmospheric conditions by the fact of its very construction or by the fact of a special protection without affecting its normal functioning.
- 1115. **Hose (Ống nối):** A flexible pipe which can be flattened, consisting of an inner tube covered with a reinforcement and then generally with an external protective layer.
- 1116. **Croquage:** Transverse folding making an acute angle at a point in a hose (flexible pipe or CE pipe) following an excessive bend or torsion, and resulting in a total or partial closure of the flow section and/or permanent deformation. (Rãnh nằm ngang tạo một góc chính xác tại một điểm ở ống nối (ống mềm hay ống CE) tiếp theo chỗ uốn cong hay xoắn và làm cho kín toàn bộ hay một phần mặt cắt ngang dòng chảy và/hoặc làm biến dạng cố định mặt cắt này).
- 1117. **Winding (Uốn cong):** Undulation of a hose caused by an elongation from the straight initial position on the ground.
- 1118. **Main line (Tuyến chính):** Pipeline of an irrigation system under pressure is going from the outlet to the sub-mains or to the distribution nozzle-lines.
- 1119. **Distribution nozzle-line (Tuyến vòi phân phối):** Pipeline of an irrigation system under pressure fitted with distributors for distributing the water which it is conveying.
- 1120. **End plug (Đầu lắp ống):** A cap at the end of a conduit, for conveying or delivering water, and which may be fitted with a flushing device.
- 1121. **Couplers (Ống cút):** Special parts which permit either to connect two pipes of same diameter (joints) or of different diameter (reducers) or to change the direction of a pipeline (reversible elbow) or even to divide it into several branches of equal diameter or not (Tees and Y). There are also valve tees in which the diverted pipeline is fitted with a valve.
- 1122. **Quick couplers (Ống cút thẳng):** Couplers used in portable sprinkler systems for the quick assembly or separation of pipes of same diameter.
- 1123. **Nominal diameter of a pipeline (in plastic or aluminium) (Đường kính danh nghĩa của đường ống (làm bằng chất dẻo hay nhôm):** Conventional designation approximately equal to the outside diameter.
- 1124. **Anti-corrosion tube (Ống chống gỉ):** A tube lined internally and externally with a layer of aluminium alloy, used as anode for the tube material and protecting it against corrosion.
- 1125. **Impact resistance factor (Hệ số chống tác động):** A parameter for evaluating the capacity of an aluminium tube to resist external loads or impacts without permanent deformation.

1126. **Pressure regulator (Bộ phận điều áp):** A valve in which the passage section widens or contracts automatically to maintain the output pressure close to a pre-determined value in spite of variations in pressure and/or discharge at the inlet of the apparatus. The value of the output pressure can be regulated externally or by replacing inside the regulator a thickness sprink or disk.
1127. **Declared pressure (Áp suất khai báo):** Pre-determined pressure declared by the manufacturer and corresponding to a reference velocity of 1 m/s.
1128. **Regulation range (Phạm vi điều chỉnh):** Range of pressure and/or discharges at the inlet of a pressure regulator in which the later should function (i.e. regulate).
1129. **Total regulation range (Phạm vi điều chỉnh tổng):** All regulated pressures which can be obtained with a pressure regulator using all possible adjustments of the outlet pressure (change of spring, addition or replacement of thickness discs).
1130. **Minimum service pressure (upstream of the pressure regulator) (Áp suất phục vụ tối thiểu ở thượng lưu bộ phận điều áp):** Lowest inlet pressure which allows the output pressure to be regulated with the precision specified in the standard.
1131. **Minimum discharge (Lưu lượng nhỏ nhất):** Lowest discharge at which the regulated pressure lies within the precision range specified in the standard.
1132. **Fixed pressure regulator (Bộ điều áp cố định hoặc không thể thay đổi):** Pressure regulator without any possibility of adjustment.
1133. **Multi-range pressure regulator (Bộ điều áp đa khoảng):** Pressure regulator in which it is possible to alter the outlet pressure by altering an internal part of the apparatus.
1134. **Regulation mechanics (Bộ điều chỉnh cơ học):** All the parts involved for widening or narrowing the passage section.
1135. **Precision level (Mức độ chính xác):** Deviation of the actual output pressure from the pressure specified by the manufacturer for a given adjustment.
1136. **Outlet valve (Van cửa ra):** Any type of valve installed at the head of an irrigation system under pressure and used for opening or closing it. It can be manual, hydraulic, volumetric etc.
1137. **Hydraulic valve (Van thủy lực):** A valve which opens or closes by applying or removing the hydraulic pressure of the system. Its shutter may be provided with a diaphragm or a piston. A minimum pressure is required for the closing mechanism to fully function.
1138. **Pivot valve (Van định vị):** Any valve which enables to operate a hydraulic valve.
1139. **Non-return valve (Van một chiều):** A valve which allows water circulation in only one direction, by preventing the reversal of the flow through the action of a no-return automatic mechanism. It opens under the effect of the flow and closes under the effect of the weight of the no-return mechanism or of a spring when the flow stops.

1140. **Valve body (Thân van):** Main part of a valve through which water flows, which contains the moving parts and which allows connection to the irrigation system.
1141. **Shutter (Cửa van):** Moving part of a valve which carries a disk, one face of which is provided with a seat which rests on the seat of the valve body as well as an annular joint which ensures the tightness of the valve when it is closed.
1142. **Closing mechanism (Bộ phận đóng):** All the moving parts of a valve which enable to open or close it.
1143. **Adjustment device (Thiết bị điều chỉnh):** A part which can be used for altering the magnitude of the movement of the closing mechanism, from full opening to full closure. Full opening is achieved either when the valve is fully opened or when the closing mechanism has reached the adjustment point fixed on the adjustment device.
1144. **Normally opened hydraulic valve (N.O) (Van thủy lực mở thông thường):** It remains open as long as the minimum pressure is not applied.
1145. **Normally closed hydraulic valve (N.C) (Van thủy lực đóng thông thường N.C):** It remains closed as long as the minimum pressure is not applied.
1146. **Straight valve or Slanting valve (Van thẳng hay van xiên):** A manual valve, generally spherical, the control axis of which is perpendicular (or slanting with respect to the inlet-outlet common axis).
1147. **Nominal pressure (Áp suất danh nghĩa):** Maximum service pressure at which the valve should function.
1148. **Hydraulic control tube (Ống kiểm soát thủy lực):** A plastic tube of small diameter which transmits the orders received or sent by a valve.
1149. **Hydraulic activation (Kích hoạt thủy lực):** It is single if it enables either to open or to close; it is double if it enables to open and to close.
1150. **Control rod (Cân điều khiển):** Threaded part of a manual valve shutter which enables to open or close it.
1151. **Opening torque (Mô-men xoắn khi mở):** Minimum torque which when applied continuously on the control rod allows for the full opening of a valve from fully closed initial position.
1152. **Valve pressure test (Kiểm tra áp suất van):** A test which enables to determine the pressure resistance of a complete valve.
1153. **Norminal diameter of a head installation (Đường kính danh nghĩa của một bộ phận đầu lắp):** Numerical designation equal to the smallest nominal diameter of the inlet and outlet pipelines.
1154. **Coefficient of discharge of a valve (Hệ số lưu lượng của van):** A parameter equal to the discharge of the valve (expressed in m³/hr) fully opened, by a loss of head of 1 bar.
1155. **Volumetric valve (Van khối):** A valve which enables to deliver predetermined volume of water, in a certain range of discharges, between the minimum discharge at which it should function with the specified tolerance and function without being

damaged, and in a certain range of pressures, between a minimum pressure and a maximum pressure. Its nominal discharge is the discharge at which it should function for 2000 hours under normal condition of service: it is used to characterize a given model. It requires a manual refitting in order to function once again. It can be mechanically (for small models) or hydraulically (for large models of diameter greater than 1.5 inch) closed. It can function individually or in sequence (it then enables the automatic commutation of the discharge between the various sets of a system, thereby completing a full irrigation circle).

1156. **Air valve (Van khí):** An automatically functioning valve which permits the one and/or the other of the following three functions:

Entry of air into the pipe while emptying the system,

release of air from the pipe while filling the system,

elimination of air pockets which get formed in the pipe during normal operation.

The low pressure air valve performs the first two functions and is provided with a large mouthpiece because it should ensure large airflows in an intermittent manner. The high pressure air valve performs the third function: its mouthpiece is small but can function at any moment when the system functions normally.

Some air valves, with double or triple action, combine the functions of the high and low pressure air valves, which are housed in the same apparatus, but function separately. Their minimum and maximum pressure are those at which their should function.

1157. **Coefficient of loss of head of an apparatus (K) (Hệ số tổn thất đầu nước của thiết bị (K):** Non-dimensional coefficient defined by the expression $K = 2\Delta H / \rho V^2$ in which ΔH is the loss of head, ρ is the specific gravity of the liquid, V is the reference velocity.

1158. **Float (Phao):** A part of an air valve, situated inside its body, of specific gravity less than 1, and which therefore floats on the surface of the water contained in it. When the water level rises it closes the mouthpiece through which air is released thereby preventing water from escaping.

II.4. HEADWORKS - CÔNG TRÌNH ĐẦU MỐI

II.4.1. DAMS, WEIRS AND BARRAGES

ĐẬP, ĐẬP DÂNG VÀ CÔNG TRÌNH NGĂN DÒNG

1159. **Headworks, Diversion work, or Diversion structure (Công trình đầu mối, công trình hướng dòng hoặc kết cấu dẫn dòng):** A collective term for all works (weir of diversion dams, head regulators, upstream and downstream river training works and their appurtenant structures) required at intakes of main or principal canals to divert and control river flows and to regulate water supplies into the main canal or canals.

1160. **Diversion ratio (Tỷ lệ hướng dòng):** The ratio of the flow diverted to the stream flow.
1161. **Regulator (Công trình điều tiết):** A structure built on canals at suitable points to control and regulate water supplies, and at head of canals to control, regulate and admit supplies from the parent canal or river.
1162. **Head regulator (Công trình điều tiết đầu nước):** A structure built at the intake end of an open channel to control the supplies of water and check trash and sediment entry into the channel.
1163. **Main head regulator (Công trình điều tiết chính):** A head regulator at the head of a diversion canal, often briefly referred to as a head regulator.
1164. **Overpour type regulator, Overshot type regulator, or Skimming type regulator (Công trình điều tiết tràn đỉnh hoặc điều tiết phần trên):** A regulator where the water passes from the parent channel to the offtaking channel by discharging over the crest of a wall, or over the top edge of a gate or flash- boards.
1165. **Undershot type regulator (Công trình điều tiết chảy đáy):** A regulator where the water passes from the parent channel to the offtaking channel below the gate opening formed (when raising the gates) between the sill of the gate opening and the lower edge of the gate.
1166. **Head of a canal (Đầu kênh):** The point where the supply is diverted into a canal from a reservoir, river, or parent canal.
1167. **Head gate structure (Kết cấu đầu cửa van):** 1- The portion of the head regulator which houses control gates. 2- Often used in the same sense as a head regulator.
1168. **Bay, or Embayment (Khoang hoặc khẩu độ):** One of the main divisions of a structure as the part of a weir, regulator or bridge between two piers. A local widening of a channel adjacent to an offtaking channel headwork.
1169. **Breast wall, Face wall, or Panel wall (Tường ngực, tường mặt hoặc tường panen):** When applied to irrigation practice, a wall, generally of masonry or concrete, provided immediately above the face of a submerged orifice, opening or sluice. Also referred to as "curtain wall".
1170. **Inlet (Cửa lấy nước):** 1- A surface connection to a closed drain. 2- A structure at the diversion end of a conduit. 3- The upstream end of any structure through which water may flow. 4- A cross drainage work consisting of an opening in a canal bank suitably protected, to admit upland drainage water into the canal. 5- A structure admitting water supplies from the source and leading them to the intake structure.
1171. **Intake (Công trình lấy nước):** A structure to control, regulate and admit water supplies either directly from the source or through an inlet built upstream.
1172. **Wing wall (Tường cánh):** Walls joining the abutments of a structure to an earth dike or the banks to provide a longer path of percolation around the end of the structure and or to improve flow conditions upstream and downstream of the controlling section.

1173. **Abutment (Mố trú).**
1174. **Wing levee, Afflux bund, or Afflux bank (Đê bối, đê quây):** An embankment or dike designed to prevent the outflanking of the abutment by flood waters passing round the end of the weir, extending out up to, but not across, the whole of the river flood plain.
1175. **Inlet wing wall, or Upstream wing wall (Tường cánh cửa vào hoặc tường cánh thượng lưu):** Wing wall connecting the abutments with the banks of the parent channel or the banks upstream of the structure.
1176. **Outlet wing wall, or Downstream wing wall (Tường cánh cửa ra hoặc tường cánh hạ lưu):** Wing wall connecting the abutments with the offtaking channel section downstream of the structure.
1177. **Flank wall (Tường bên):** The retaining wall in continuation of abutments both upstream and downstream.
1178. **Curtain wall, or Cutoff wall (Tường chống thấm hoặc tường chắn khay):** 1- A cross wall built under the floor of a hydraulic structure with the object of dividing the work into suitable compartments, or to provide cutoffs; also known as "cutoff wall". 2- A wall placed at the top of the inlet and extending into the water to ward off ice and drift, usually with coarse rack.
1179. **Toe wall (Tường chân):** A shallow wall constructed below the bed or floor level to provide footing for the sloped pitching or the face of an embankment.
1180. **Lining (Lớp lát).**
1181. **Operating platform (Sàn công tác):** A platform constructed on the top of piers to support the gate stand and operating mechanism.
1182. **Floor (Sàn):** A horizontal masonry or concrete slab with its upper surface at about the level of the gate seats in a movable weir from which piers rise.
1183. **Operating gear, or Lifting gear (Hộp số vận hành hoặc hộp số đóng mở cửa van):** Any mechanical device used for adjusting the position of the gates, wickets, shutters, etc., of a movable weir.
1184. **Gates (Cửa van):** For various types see sub-head V.4 "Gates and valves".
1185. **Wasteway (Đường xả):** The channel required to convey water discharged into it from a spillway, escape, or sluice, weir, etc.
1186. **Operation waste, or Escaped water (Nước tổn thất khi vận hành hoặc nước thất thoát):** The water wasted through spillways or otherwise discarded from an irrigation system after having been diverted into it; also referred to as "escaped water".
1187. **Undersluices, Sliding sluices, or Scouring sluices (Cống xả đáy, cống cửa van trượt hoặc cống xả cát):** 1- A portion of a weir or barrage, having its sill at a level lower than the remaining portion; provided (i) adjacent to the head regulator and or (ii) at the approximate location of the line of maximum surface velocity before the erection of the weir or barrage with a view to sluicing out detritus during periods of

high flows in the river. **2-** The term "**Undersluices**" is also used for "**Sliding sluices**" in main dams, where water is discharged at a level much below the reservoir level.

- 118. **Undersluices pocket, Pocket, or Scouring sluices pocket** (**Hố thượng lưu cống xả đáy** hoặc **hố thượng lưu cống xả cát**): The portion of river channel upstream of the undersluices bounded by the divide wall, inlet of the head regulator structure and the undersluices.
- 118. **Scouring sluice channel, or undersluices channel** (**Lòng dẫn của cống xả đáy** hoặc **lòng dẫn của cống xả cát**): The portion of a river channel leading water to the undersluices and away from it to join the river downstream of the weir or barrage.
- 1190. **Downstream undersluices channel** (**Lòng dẫn hạ lưu của cống xả đáy**): A portion of the river channel, which confines the erosive effects of the water, discharged through the sluice gates and again joins the river downstream.
- 1191. **Upstream undersluices channel, or Upstream scouring sluice channel** (**Kênh dẫn thượng lưu của cống xả đáy**): The portion of the river channel leading water to the undersluices and limited up to the sill of the undersluices. "Pocket" is only a part of the upstream undersluices channel.
- 1192. **Divide wall, Divide groyne, Division wall, or Dividing wall** (**Tường phân dòng, kè phân dòng**): A longitudinal wall or groyne separating the undersluices pocket section from the weir or barrage section.
- 1193. **Fishway, or Fish-pass** (**Đường cá đi**): A structure facilitating the migration of fish around a dam, weir or other obstructions in streams.
- 1194. **Fish screen** (**Lưới chắn cá**): A device intended to prevent the entrance of fishes into a conduit.
- 1195. **Log chute, or Logway** (**Đường chuyển gỗ**): A bypass around or through a dam or weir, etc., to pass logs and drift.
- 1196. **Lock** (**Âu thuyền**): A structure (open rectangular chamber) built in an open conduit in a reach having a considerable vertical drop in water levels to pass two-way traffic is raised or lowered by admitting or releasing water from the chamber to negotiate with the desired water level upstream or downstream.
- 1197. **Silt excluding devices** (**Thiết bị xả cát**): Devices and controls such as excluders, regulation and orientation of the head regulators, to exclude entry of coarse silt into the offtaking channels.
- 1198. **Weir** (**Đập dâng**): **1-** A low dam or wall across a stream to raise the upstream level. The entire flow passes over it. Termed "fixed-crest weir" or "ungated weir" when uncontrolled. **2-** A structure built across a stream or channel for the purpose of measuring flow. Sometimes described as "measuring weir" or "gauging weir". Type of weir include "broad crested weir", "sharp crested", "drowned weir", or "submerged weir", "free fall weir".

1199. **Anicut (Đập dâng Anicut ở Nam Ấn Độ):** In Southern India, a barrier across a stream for the purpose of diverting part or all of the water from a stream into a canal is called "anicut", while it is called weir in other parts of India and Pakistan. It may incidentally store water for emergencies.
1200. **Diversion weir (Đập dâng hướng dòng):** A low dam or wall across a stream for the purpose of diverting part or all the water from a stream into a canal.
1201. **Closed weir, Overflow diversion dam, Fixed crest weir, Blind weir, or Ungated weir (Đập dâng kín, đập hướng dòng tràn đỉnh, đập dâng đỉnh cố định, đập dâng mù hoặc đập dâng không cửa):** A diversion dam built as a complete obstruction across the river so that the entire stream passes over it. It may or may not be fitted with crest gates; when not fitted with crest gates, also called "fixed crest weir", or "blind weir", or "ungated weir".
1202. **Open weir, or Open diversion dam (Đập dâng mở hoặc đập hướng dòng mở):** A diversion weir across a river to produce least obstruction to the flow. It comprises undersluices and several other bays having falling shutters fitted on a permanent structure.
1203. **Barrage (Công trình ngăn sông):** 1- A barrier, provided with a series of gates, across the river to regulate water surface level and flow upstream and to divert water supplies into a canal; distinguished from a weir by its being gated over its entire length and may not have a rained sill. 2- In Australia, primarily used for a structure which prevents intrusion of salt water upstream in a tidal river.
1204. **Pick-up weir, Regulating weir, or Regulating pondage weir (Đập dâng dẫn dòng, đập dâng điều tiết hoặc đập dâng chứa nước):** A diversion weir built downstream of and as an adjunct to a dam.
1205. **Subsidiary weir (Đập dâng phụ trợ):** It is a structure constructed downstream of the main weir, on the apron to increase the tail water to ensure the formation of a hydraulic jump whenever the tail water level is lower than required for hydraulic jump formation.
1206. **Siphon weir (Đập dâng xi phông):** A weir operating on the siphon principle. The siphonic arrangement is usually fitted in gravity weirs.
1207. **Bar (Ngầm):** A weir in a torrential river, the crest of which is at or very close to the normal bed of the river.
1208. **Fixed buttress weir, Ambursen dam, or Ambursen weir (Đập dâng mó trụ cố định, đập Ambursen hoặc đập dâng Ambursen):** It is classified as open or closed Ambursen weir according to the absence or provision of downstream face slab.
1209. **Impermeable weir (Đập dâng không thấm):** A weir made up of impermeable material, such as rock, stone, brick masonry, concrete, steel, or timber. It can be of a fixed or movable type.
1210. **Impermeable fixed weir, or Solid fixed weir (Đập dâng cố định không thấm hoặc đập dâng cố định đặc):** A fixed weir whose water bearing surfaces are of

watertight construction. It may be built with timber, masonry, concrete (plain or reinforced), steel, or combinations thereof.

1211. **Timber weir (Đập dâng bằng gỗ):** It is a type of fixed weir, where timber baulks, timber piling or timber surfaces primarily make the body of the weir watertight.
1212. **Piles weir (Đập dâng cọc cù):** A semi-permeable weir in which the desired water raising is effected by driving piles.
1213. **Gravity weir, or Masonry weir (Đập dâng trọng lực hoặc đập dâng khối xây):** A watertight weir made up of stone or brick masonry or of concrete depending solely on its weight for stability. It may be of overall or slope-weir type.
1214. **Slope weir (Đập dâng mái nghiêng):** A weir with sloping surfaces extending from the crest, so that the water remains in contact with the weir surface all the way down and is guided by it as desired.
1215. **Glacis (Dốc thoái):** 1- A gentle slope. 2- The sloping surface of a weir or fall.
1216. **Solid slope masonry weir (Đập dâng khối xây mái nghiêng đặc):** An impermeable slope weir made up of rock, stone, brick masonry or concrete. It may or may not have falling shutter for headwater control.
1217. **Permeable weir (Đập dâng thấm nước):** A weir made of loose and permeable construction, such as loose rock, stones, timber, brushwood, or crib.
1218. **Rockfill weir (Đập dâng đá đỗ):** A permeable weir, whose body is formed by loose stones or boulders laid between intervening masonry walls or piles, terminating at the top surface of the weir. It can be constructed without any wall of concrete or masonry.
1219. **Crib weir (Đập dâng dàn):** A permeable weir formed by timber cribs. Cribs are constructed of round timbers in a block-house like fashion, sometimes with transverse walls. The timbers are joined together at their intersection with claps, nails, or bolts. The cribs are filled with gravel and stones.
1220. **Brushwood weir (Đập dâng bụi cây):** A permeable weir, whose body is formed by brushwood, round timber and gravel.
1221. **Falling crest weir, or Falling shutter weir (Đập dâng đỉnh đổ hoặc đập dâng cửa sập rơi):** A weir having falling shutters fitted along its crest which may be laid down to pass floods. Falling crest arrangement is installed in both permeable and impermeable weirs.
1222. **Movable weir, or Collapsible weir (Đập dâng có thể di chuyển được hoặc đập dâng có thể đổ):** 1- A general term used to denote all barriers that may be opened in whole or in part. The movable part may consist of gates, stoplogs, needles, wickets or any other device whereby the area of flow through or over the weir or dam may be controlled. 2- In Sudan, this term is used only for a special type of regulator consisting of a weir-shaped profile designed to give modular flow, which can be moved bodily up or down to regulate the discharge.
1223. **Bear trap weir (Đập dâng bẫy săp).**

- 1224. **Shutter weir (Đập dâng cửa sập):** A weir fitted with shutters.
- 1225. **Rolling weir (Đập dâng cửa quay):** A weir fitted with roller gates.
- 1226. **Segment gate weir (Đập dâng cửa cung):** A weir fitted with a gate.
- 1227. **Flap weir, Flash board weir, or Tilting gate weir (Đập dâng cửa lật, đập dâng cửa chớp lật hoặc đập dâng cửa nghiêng):** A type of movable weir in which a hinged leaf gate rotating about a horizontal axis is installed at the weir crest. Also called "flash board weir".
- 1228. **Inflatable weir (Đập dâng bơm hơi):** A weir constructed of neoprene reinforced with nylon and anchored to a concrete foundation. The weir inflates by water pressure and automatically deflates when the upstream water reaches a prescribed level.
- 1229. **Flash weir (Đập dâng tẩm chớp):** It is provided over a roller gate with the purpose of preventing overtopping of the gate by waves and to provide freeboard above the highest point of the gate. This extends upwards when the gate is in the closed position and is provided in the gates, which are not designed for passing ice or trash over the top.
- 1230. **Needle weir (Đập dâng mũi kim):** A movable weir in which headwater is controlled by needles.
- 1231. **Block outs (Các khoang chờ):** Temporary recesses provided in the civil structure to facilitate proper embedment of steel fixtures for gates, trestles, etc., and which are concreted after their fixing.
- 1232. **Weir head (Cột nước của đập dâng):** 1- The vertical height from the crest of a weir (apex of a V-notch weir) to the water surface in the forebay above the weir. It does not include the head due to velocity of approach. 2- The energy head of the water referred to the crest of the weir which does include the velocity head due to the velocity of approach.
- 1233. **Velocity of approach (Vận tốc tới gần).**
- 1234. **Designed maximum head across the weir (Cột nước lớn nhất qua đập dâng):** The maximum difference in elevation which may occur under any set of conditions, between the upstream and downstream water levels of a weir.
- 1235. **Concentration factor (Hệ số tập trung):** The factor by which the discharge per unit length of a barrage assuming uniform distribution is required to be multiplied to get the design discharge per unit length for designing its various elements.
- 1236. **Pond, or Pool level (Mực nước trước công trình):** The level of water immediately upstream of the barrage required to facilitate withdrawal into the canal or for any other purpose.
- 1237. **Afflux (Sự chảy dồn).**
- 1238. **Guide bund (Tường hướng dòng):** A training wall intended to lead water smoothly to, or away from, a barrage or weir.

1239. **Uplift (áp lực đẩy ngược):** The upward pressure in the pores of a body (interstitial pressure) or on the base of a structure.
1240. **Method of independent variables, or Khosla's method of determination of uplift pressures and exit gradients (Phương pháp biến độc lập hoặc phương pháp Khosla xác định áp lực đẩy ngược và gradiêng cửa ra):** It is an empirical method evolved by Khosla for determining uplift pressures with high accuracy under a weir founded on permeable soils. The complex foundation profile is broken up into a number of simple profiles, each of which is independently amenable to mathematical treatment.
1241. **Mutual interference of piles (Sự tác động qua lại giữa các cọc cù):** When two cutoffs or pile-lines are placed closely in the permeable soil below a hydraulic structure, a change is caused in the ultimate value of the uplift pressures due to overlapping effect of the streamlines, which is known as mutual interference or piles. It takes note of the depth of either cutoff, the distance between them and the floor length:
1242. **Waterway (Đường dẫn):** 1- A way or channel for water; a way of water; navigable width of channel. 2- Amount of opening for the passage of water, viz. Between piers or abutments.
1243. **Standard waterway, Theoretical waterway, or Normal waterway (Đường dẫn tiêu chuẩn, đường dẫn lý thuyết hay đường dẫn thông thường):** The width of waterway determined by engineering skill based on the study of physical laws governing the river training principles, such as Lacey's waterway.
1244. **Lacey's waterway, or Lacey's wetted perimeter (Đường dẫn Lacey hoặc chu vi ướt Lacey):** The wetted perimeter determined by Lacey's formula $P=1.47Q^{1/2}$ where: P = perimeter in metres, and Q = discharge in cubic metres per second (cumec). In case, where the width of the channel is considerably larger in comparison to the depth of water the computed perimeter is provided as width.
1245. **Clear waterway, or Effective waterway (Đường dẫn không có vật cản hoặc đường dẫn hiệu quả).**
1246. **Contracted waterway (Đường dẫn thu hẹp):** A waterway less than the standard waterway.
1247. **Contraction ratio (Tỷ lệ thu hẹp):** The ratio of the widths of the contracted waterway to the standard waterway. It is always less than unity.
1248. **Looseness factor (Hệ số nói lỏng):** When the ratio of width of waterway actually provided to that theoretically required is more than unity, the ratio is called the "looseness factor".
1249. **Exit gradient (Gradiêng ra):** The hydraulic gradient of the emerging streamlines at the end of an impervious apron.
1250. **Talus, Flexible apron, or Placed riprap (Talus, sân phủ mềm hoặc đá xếp):** A protection at the downstream end of a weir, fall, etc., consisting of blocks of concrete or masonry or stones.

1251. **Open-jointed floor (Bản đáy nối tiếp hở):** The floor with open joints to relieve the upward pressure on the floor.
1252. **Weep holes (Lỗ dò):** Openings left in retaining walls, aprons, linings, foundations, etc., to permit drainage reduce pressures, etc.
1253. **Roofing (Sự sinh mái):** The void spaces created locally between a hydraulic structure and its foundations due to settlement.
1254. **Surface curves (Đường cong bờ mặt):** 1- The longitudinal profile assumed by the surface of a stream of water flowing in an open conduit; the surface curve is the curve of equilibrium of all forces acting on the flowing water. 2- The hydraulic grade line.
1255. **Backwater curve (Đường cong nước vật).**
1256. **Drop-down curve (Đường cong nước đổ):** A particular form of the surface curve of a stream of water, which is convex upward. For example, a free falling nappe over a weir. The depth at all points is greater than Belenger's critical depth and less than the normal depth, and velocities increase downstream.
1257. **Nappe (Lớp nước đổ):** A sheet or curtain of water overflowing a weir, fall, etc. The nappe has an upper and a lower surface.
1258. **Caisson, or Pneumatic caisson (Giếng chìm hoặc thùng chìm):** A chamber, usually sunk by excavation within it, for the purpose of gaining access to the bed of a stream or other body of water. If the chamber is closed on top and the water excluded by air pressure, it is called "pneumatic caisson".
1259. **Dewatering (Tháo nước):** Lowering the water table to facilitate construction of the barrage/ substructure and for works to be done in fairly dry conditions and to prevent free flow of particles below the foundation.
1260. **Measuring weir, or Notched weir (Tràn đo hoặc tràn cát chữ V).**
1261. **Notch (Mặt cát chữ V):** The opening in a weir for the passage of water and measurement of discharge flowing over the weir.
1262. **Sharp- crested weir (Đập tràn thành mỏng).**
1263. **Rectangular weir (Tràn chữ nhật).**
1264. **Triangular weir, or V- notch weir (Tràn tam giác hoặc tràn chữ V).**
1265. **Trapezoidal weir (Tràn hình thang).**
1266. **Cipolletti weir (Tràn Cipolletti).**
1267. **Contracted weir (Tràn co hẹp).**
1268. **Contraction (Sự co hẹp).**
1269. **Bottom contraction (Co hẹp đáy).**
1270. **End contraction (Co hẹp phần cuối).**
1271. **Suppressed weir (Tràn co hẹp bên).**
1272. **Vertical drop weir, or Overfall weir (Tràn bậc thẳng đứng hoặc tràn qua đỉnh):** A weir, in which the water napped separates from the weir body at the crest.

1273. **Step weir, or Cascade weir (Tràn bậc hoặc tràn tầng):** A type of drop weir, in which the drop is broken into a number of smaller drops.
1274. **Free Overfall weir, Free weir, or Clear overflow weir (Tràn đổ tự do, tràn tự do hoặc tràn đổ không vật cản).**
1275. **Submerged weir (Tràn ngập).**
1276. **Broad-crested weir (Tràn đỉnh rộng).**
1277. **Side weir (Tràn bên):** A weir to which water flows approximately parallel to the crest.
1278. **Lateral flow weir (Tràn ngang).**
1279. **Ogee weir (Tràn Ogee (thực dụng)):** A weir having a crest with an ogee shape.
1280. **Irregular weir (Tràn không quy tắc):** A weir, the crest of which is irregular or zigzag in plan.
1281. **Oblique weir or Skew weir (Tràn xiên hoặc tràn chéo):** A weir the crest of which is inclined to the flow in plan.
1282. **Inclined crested weir (Tràn có đỉnh nghiêng):** A weir the crest of which is sloping from one side to the other.
1283. **Narrow-crested inclined weir (Tràn nghiêng đỉnh hẹp):** A weir formed by projecting an inclined wall (upstream or downstream) from the bed of the channel. Briefly, these are called "inclined weir".
1284. **Curved weir (Tràn cong):** A weir having a curved crest in plan.
1285. **Parabolic weir (Tràn parabol):** A measuring weir whose notch is bounded on the sides by parabolas .
1286. **Circular weir (Tràn tròn):** A measuring weir having a circular crest.
1287. **Weir with linear flow characteristics, or Proportional weir (Tràn có đặc trưng dòng chảy tuyến tính):** A weir, in which the rate of flow is simply proportional to the head over the weir, i.e. $Q = ha$ where Q = discharge, h = head over the weir, a = a constant depending on the weir dimensions and the sharpness of the weir plate. The shape is determined by the equation

$$x^2 z = \frac{a^2}{2\pi^2 g} = \text{Constant}$$

Where: x denotes the half-width at a height z above the weir crest.

1288. **Poebing weir (Đập dâng Poebing):** A weir formed by inserting a semi-circular disc in a rectangular channel, having its width greater than the diameter of the disc.
1289. **Approximate exponential weir (Đập dâng xấp xỉ hàm mũ):** A Poebing weir in which the diameter of the disc is equal to the channel width.
1290. **Exponential weir (Đập dâng hàm mũ):** A weir, the opening outlines of which are defined by exponential curves of the form $x = C_1 e^{C_2 z}$ in which x = the half-width of the weir opening at a depth z below the free surface of a stream.

$$C_1 = \frac{Q_{\max}}{\sqrt{2\pi g}} \left(\frac{E_q}{e_h} \right)^{2/3} \quad \text{and} \quad C_2 = \frac{E_q}{e_h}$$

where: Q_{\max} = maximum rate of flow, E_q = relative error of flow indications, e_h = indication error of the head over the weir. The flow characteristic for the weir is also an exponential curve.

1291. **Hansen weir (Đập dâng Hansen):** It is a rectangular suppressed laboratory weir, used by V.W. Hansen in 1892 for his experiments. The head over the weir is measured at a distance of 1.100 mm from the upstream face of the weir.
1292. **Poncelet rectangular weir (Đập dâng chữ nhật Poncelet):** It is a laboratory rectangular weir with double end contractions.
1293. **Pfarr weir (Đập dâng Pfarr):** It is of Poncelet weir type used by Prof. Pfarr for his investigations, in which the flume width was 600 mm; and the crest length 200 mm. The height of the weir crest above the bed was 330 mm and the head was measured at a distance of 2300 mm from the upstream face of the weir.

II.4.2. HIGH DAMS OR DAMS - RESERVOIRS ĐẬP CAO HOẶC ĐẬP - HỒ CHÚA

II.4.2(a). GENERAL TERMS - THUẬT NGỮ CHUNG

1294. **Canyon, or Canon (Lũng sông):** A deep valley with high steep slopes, generally with a stream at the bottom. Canyons are characteristic of regions where, owing to aridity or to great slope, the downward cutting of the stream greatly exceeds weathering. The width at the top is generally several miles and at the bottom about that of the stream. Distinguished by its great size and rugged steep slopes.
1295. **Valley (Thung lũng):** An elongated depression, usually with an outlet between bluffs or between ranges of hills or mountains.
1296. **Thalweg (Đường đáy thung lũng).**
1297. **Gorge (Hẻm núi):** 1- A small-canyon. 2- A narrow passage between mountains. 3- A ravine
1298. **Gorge portion (Phần hẻm núi):** The river portion of the dam site.
1299. **Ravine (Khe núi):** A deep narrow gorge or mountain cleft. It is larger than a gully and smaller than a canyon and usually worn down by running water.
1300. **River valley (Lũng sông):** It is a depression made by a stream and by the various processes which precede and accompany the development of the stream.
1301. **Structural valley (Thung lũng cấu tạo):** It is relatively a long and narrow depression produced by movements of the surface. Thus a downfold produces a synclinal valley, while a rift valley is caused by down faulting. The valley floor is the low flat land, bordering the channel of a stream.

1302. **Dam (Đập):** 1- A barrier, usually on an important scale, across a watercourse, for the purpose of impounding water or creating a reservoir (i) to raise water level, (ii) to divert water therefrom into a conduit or channel, (iii) to create a hydraulic head which can be used to generate power, (iv) to improve river navigability by means of regulated releases of stored water, and (v) to retain debris. 2- To provide a dam; to obstruct the flow.
1303. **Compound weir (Đập dâng kết hợp):** A flow measuring structure consisting of a combination of a triangular notch and one or more rectangular weir. Used to measure stream flow over a wide range of dry weather and flood conditions.

II.4.2(b). TYPES OF DAMS - CÁC LOẠI ĐẬP

1304. **Masonry dam (Đập xây):** A dam composed of one or more of the following materials: bricks or stone masonry or concrete (plain, reinforced, prestressed).
1305. **Masonry-cum-earth dam (Đập đất-dá xây):** A dam comprising a portion of earth and masonry along its length (length of spillway portion being excluded).
1306. **Framed dam (Đập có khung):** A barrier generally built of timber or steel, framed to form a water face, supported by struts.
1307. **Timber dam (Đập gỗ):** A framed dam in which the material used is timber.
1308. **Steel dam (Đập thép):** A dam built or steel deck supported on inclined steel struts. There are two general types of this dam: (i) direct struttled steel dam in which the load is transferred from the deck to the foundations through the inclined struts: (ii) cantilevered steel dam - it consists of variations of the direct struttled type, in which the section of the bent supporting the upper part of the deck is formed into a cantilever truss.
1309. **Direct struttled type steel dam (Đập thép loại thanh chống trực tiếp).**
1310. **Cantilevered type steel dam (Đập thép loại công xôn).**
1311. **Gravity dam, Solid gravity dam, Curved gravity dam, or Gravity arch dam (Đập trọng lực, đập trọng lực đặc, đập trọng lực cong hoặc đập vòm trọng lực):** It is customary to confine the term "gravity dam" to solid masonry or concrete dams and which resist their imposed loading by the weight of the structures themselves. However, if the dam is sufficiently curved upstream in plan for its entire length, a portion of the imposed loading may be carried by arch action; such dams are called "gravity arch dams".
1312. **Straight gravity dam (Đập trọng lực thẳng):** A gravity dam straight in plan.
1313. **Buttress dam (Đập trụ chống):** A dam usually of reinforced concrete, consisting of upstream face or deck and buttresses. The water bearing members (upstream face or deck) are supported upon the buttresses and span between them. The load is transferred to the foundations through the buttresses.
1314. **Buttress (Trụ chống):** A masonry or concrete pier built normal to a wall or face and on the opposite side of the retained material to resist the pressure transmitted by the wall or face.

1315. **Single wall buttress (Trụ chống tường đơn):** A buttress of solid section. It may have (a) uniform thick section, (b) (i) thin section reinforced by stiffeners for lateral stability, (ii) thin section reinforced by struts between the adjacent buttresses for lateral stability.
1316. **Double wall buttress, or Hollow buttress (Trụ chống tường kép hoặc trụ chống rỗng):** A buttress made of thin concrete section duly stiffened in between by stiffeners.
1317. **Flat slab buttress dam, Flat deck dam, Deck dam, Slab and buttress dam, Fixed slab buttress dam, Fixed deck dam, Free deck dam, or Cantilever buttress dam (Đập bản chống, đập tấm phẳng, đập tấm, đập trụ chống và tấm bản, đập trụ chống tấm bản cố định, đập tấm phẳng cố định, đập tấm phẳng tự do hoặc đập trụ chống công xôn):** A dam usually of reinforced concrete, consisting, essentially, of slabs supported by transverse buttresses. The load is taken by the slabs and transferred to the foundations through the buttresses. The slab may be (i) integrally cast with the buttresses, (ii) freely supported at the buttresses, or (iii) cantilevered from the buttresses.
- The dams are accordingly named as (i) fixed slab buttress dam, or fixed deck dam, (ii) free deck dam, (iii) cantilever buttress dam.
1318. **Amburseen dam (Đập Amburseen):** (originated by Swedish engineer Nils Amburseen).
1319. **Truss buttress dam (Đập thanh chống):** A type of deck dam in which the massive buttresses are replaced by reinforced concrete trusses to support the deck slab.
1320. **Columnar buttress dam (Đập trụ chống dạng cột):** A type of deck dam in which the massive buttresses are replaced by a series of inclined columns.
1321. **Multiple arch-butress dam (Đập trụ chống vòm nhiều nhịp):** A type of buttress dam, consisting of a series of arch barrel segments, supported by buttresses. The load is transferred by the several arches to the foundations through the buttresses.
1322. **Deckless buttress dam, Massive head buttress dam (Đập trụ chống không tấm bản, đập trụ chống đầu to):** A type of buttress dam in which the face slab is replaced by flaring the upstream edges of the buttresses to span the distance between buttress walls. The flaring portion of the buttress (head) may be of various geometrical shapes, viz. (i) massive head, (ii) round head or mushroom head, (iii) diamond head. The buttress dams comprising types of head classified above are named accordingly.
1323. **Round head buttress dam, or Mushroom head buttress (Đập trụ chống đầu tròn hoặc đập đầu hình nấm).**
1324. **Diamond dome buttress dam (Đập trụ chống đầu hình thoi).**
1325. **Multiple dome buttress dam (Đập trụ chống đầu vòm nhiều nhịp):** A modification of a multiple arch dam, in which there is a large dome-shaped structure space the distance between the buttresses.

1326. **Cupola dam (Đập vòm bát úp):** It is a type of buttress dam in which the upstream face is of cupola shape.
1327. **Hollow dam (Đập rỗng):** A modification of buttress dam in which the buttresses are grouped or joined together leaving hollow spaces in between, such as Dixence dam (Switzerland).
1328. **Conoidal dam (Đập dạng hình nêm):** A dam which can be considered as being formed by the juxtaposition of a certain number of blocks, of which the geometrical definition is as follows: The upstream face is a plane slightly inclined to the vertical, the downstream face is a conoidal surface generated by straight lines-which, where they touch the horizontal at the crest, are orthogonal there to and repose over a directrix drawn in a horizontal plane.
1329. **Prestressed dam (Đập ứng lực trước):** A dam comprising concrete which, by post-tensioning with high tensile steel bars or wires, increase the initial compressive stress in the upstream portion of the dam allowing for thinner cross section than those for gravity dams. The post-tensioning bars or wires are arranged in groups, and located in holes or shafts, and are anchored into the foundations (shaft anchorage).
1330. **Arch dam, Arched dam, or Massive arch dam (Đập vòm, đập cong hình vòm hoặc đập vòm khối lớn):** An arch dam is a solid concrete or masonry dam, curved upstream in plan, which, in addition to resisting part of the pressure of the reservoir by its own weight, obtains a large measure of stability by transmitting the remainder of the water pressure or load by an arch action into the canyon walls or other abutments.
1331. **Constant radius arch dam, Constant centre arch dam, or Constant centre dam (Đập vòm bán kính không đổi, đập vòm tâm không đổi hoặc đập tâm không đổi):** An arch dam the arch centres of which for the upstream face, the downstream face and the centre line are all coincident with the axis centre at all elevations.
1332. **Constant angle arch dam (Đập vòm góc không đổi):** It is a type of an arch dam in which all the arch rings have a constant value of central angle.
1333. **Variable radius arch dam, or Variable centre dam (Đập vòm bán kính thay đổi hoặc đập tâm thay đổi):** It is a type of an arch dam in which neither the radius nor the central angle is constant. This dam is a compromise between the constant radius and the constant angle arch dams.
1334. **Arch dam in series (Đập vòm xếp theo dãy):** A series of arch dams placed one behind the other in descending height, the space between successive arches is filled with water to the level of the crest of the lower arch; by this means, the pressure on each arch would be limited to that due to the difference in height of two successive arches; consequently, the arches would be of constant thickness. This effects economy in material. It has been of academic interest only.
1335. **Earth dam, or Embankment dam (Đập đất hoặc đập đắp):** A barrier of earth, clay, sand or sand and gravel, or a combination of the earth and rock.

1336. **Borrow area (Vùng mỏ đất):** An area forming a source of construction materials required for an earth dam.
1337. **Fill (Bãi thải):** Man-made deposits of natural soils and waste materials.
1338. **Random fill (Đập đất không quy luật):** A zone in an embankment in which material of properties is not very uniform, and can be dumped and compacted to give satisfactory densities.
1339. **Hydraulic fill dam (Đập đất đắp theo phương pháp thủy lực):** An earthfill dam in which the fill is excavated, transported and placed by hydraulic method; generally the fines are washed towards the centre for greater imperviousness.
1340. **Semi-hydraulic fill dam (Đập đất đắp bán thủy lực):** An earth dam in the construction of which the materials are transported on to the dam and dumped within the section of the dam by some other means than water, but some of the material is moved to its final position in the dam by the action of water.
1341. **Hydraulic sluicing (Vận chuyển bằng thủy lực):** The process of moving materials by water.
1342. **Rolled-fill dam, or Rolled-earthfill dam (Đập đất đầm lăn):** An earthfill dam which is constructed in successive mechanically compacted layers.
1343. **Homogeneous earth dam (Đập đất đồng nhất):** An earth dam composed of a single type of material, except for the protective material on the exposed faces.
1344. **Modified homogeneous earth dam (Đập đất đồng nhất biến tướng):** An earth dam, in which small amounts of pervious material selected to control the action of seepage are carefully placed on an otherwise homogeneous dam.
1345. **Composite earth dam, Multiple-zoned earth dam, or Zoned earth dam (Đập đất đắp hỗn hợp, đập đất nhiều vùng vật liệu hoặc đập đất phân vùng):** A rolled-fill dam consisting essentially of an inner or enclosed impervious section supported by two or more outer sections of a relatively pervious material.
1346. **Diaphragm (Màng ngăn):** A thin wall or membrane of some impervious material running lengthwise within a dam constructed of pervious material, concrete, or other material, and may occupy a position within an embankment or on the exposed surface.
1347. **Envelope type junctions (Nối tiếp loại vỏ bọc):** A junction between masonry (or concrete) and earth-work, where earthwork envelopes the masonry.
1348. **Settlement allowance (Giới hạn lún cho phép):** It is the allowance or increase made in the height of an earth dam to compensate for the anticipated post-construction settlement.
1349. **Camber (Sự vòng lén):** A cross fall given to the surface of the top of the dam to drain off water quickly.
1350. **Rockfill dam (Đập đá đổ):** A dam composed of loose rock usually dumped in place, often with the upstream part constructed of hand placed, or derrick placed

rock and faced with rolled earth or with an impervious surface of concrete, timber, or steel.

1351. **Core-wall type rockfill dam (Đập đá đỗ tường lõi):** A rockfill dam in which a core wall of steel, concrete (plain or reinforced) or compacted earth is placed in the centre, and loose rockfill is dumped on both sides.
1352. **Composite type rockfill dam, or Earth-and-rockfill dam (Đập đá đỗ hỗn hợp hoặc đập đất đá hỗn hợp):** A type of rockfill dam consisting of water tight earth on the upstream side and rockfill on the downstream side.
1353. **Coffer dam (Đê quai):** A temporary dam used to exclude water from a work site during construction.
1354. **Overflow dam, or Overfall dam (Đập tràn đỉnh):** A dam designed to carry discharge over its crest.
1355. **Non-overflow dam (Đập không tràn đỉnh):** 1- A dam which does not have spillway section along its length. 2- The part of the dam not designed to be overtopped.
1356. **Solid dam, or Blind dam (Đập đặc hoặc đập mù):** A dam or part of it without having sluice openings.
1357. **Sluice dam (Đập cống):** A dam having sluice openings.
1358. **Limpet dam, or Leech dam (Khoang áp tường âu):** A small open caisson designed to fit against a dockwall which requires repairs. It is lowered into the water by a crane and then water is pumped out to provide access for repair work.
1359. **Closer (Vật chặn dòng):** A sheet pile special cut or fabricated to close a coffer dam in cases when a standard pile will not fit the space.

II.4.3. RESERVOIRS - HỒ CHÚA

1360. **Reservoir, Tank, or Pool (Hồ chứa, bể chứa hoặc đầm):** A pond, lake, or basin either natural or artificial, for the storage, regulation and control of water. Small reservoirs are called tanks in India, Ceylon, etc, and dams in some other countries.
1361. **Auxiliary reservoir (Hồ phụ trợ):** A reservoir which supplements the storage of a main reservoir.
1362. **Balancing tank, Balancing reservoir, Equilising reservoir, or Compensating reservoir (Bể chứa cân bằng, hồ chứa cân bằng, hồ chứa hoặc hồ chứa bù):** A reservoir subsidiary to the main reservoir for storing excess river water which is utilized during periods of short supply.
1363. **Conservation reservoir, or Conservation storage reservoir (Hồ trữ):** A reservoir, impounding water for useful purposes, such as municipal supply, power, irrigation and recreation.

1364. **Flood control reservoir, or Single-purpose flood control reservoir (Hồ chứa phòng lũ hoặc hồ chứa một mục đích phòng lũ):** A reservoir operating on the principle that it will never be used except for the temporary storage of flood waters which are subsequently released as rapidly as channel conditions would permit.
1365. **Retarding basin (Bể trữ).**
1366. **Retarding reservoir or Detention reservoir (Hồ trữ hoặc hồ chứa chậm lũ).**
1367. **Reservoir basin (Lưu vực hồ chứa):** The drainage basin feeding the reservoir.
1368. **Safe yield of reservoir basin, or Safe yield of catchment (Dòng chảy an toàn của lưu vực hồ chứa hoặc dòng chảy an toàn của lưu vực):** It is the annual runoff flowing from the basin into the reservoir that can be depended upon for utilization.
1369. **Surface area of reservoir, or Maximum water surface area (Diện tích bề mặt của hồ chứa hoặc diện tích mặt nước lớn nhất):** The water surface area of a reservoir at total capacity.
1370. **Water surface (Mặt nước):** The water surface area of a reservoir at a particular reservoir elevation.
1371. **Flowage line (Đường dòng chảy):** A contour or line around a reservoir pond, lake or along a stream, corresponding to some definite water level (maximum, mean, low, spillway, crest, etc) generally used in connection with the acquisition of rights to flood lands for storage purposes.
1372. **Rim (reservoir) (Bờ hồ chứa):** The intersection line of the top surface of the reservoir with the valley surface.
1373. **Desilting strip (Dải đất tháo bùn cát):** A strip of land, located above a reservoir, stock tank, pond or cultivated fields, and used for deposition of silt and debries carried by flowing water. The strip contains a vegetal cover of sufficient density to retard flow of runoff water with deposition of suspended material.
1374. **Delta (Đồng bằng, tam giác châu thổ):** 1- The sediment deposit at the confluence of the upstream end of the reservoir and the main feeding stream; also similar deposits at the joining points of the tributaries and the reservoir. 2- This term also applies to the alluvial tract formed by the deposit of the sediment carried down by rivers near their outfall into the sea or ocean.
1375. **Storage (Sự tích nước, dung tích của hồ chứa).**
1376. **Dead storage capacity, or Dead storage (Dung tích trữ chết hoặc dung tích chết):** The storage volume of a reservoir measured below the invert level of the lowest outlet and the minimum operating level.
1377. **Active storage (Dung tích hoạt động):** The volume of the reservoir that is available for use either for power generation, irrigation, flood control or other purposes. Active storage excludes flood surcharge. It is the reservoir capacity less inactive storage. The terms useful storage or usable storage or working storage are sometimes used instead of active storage but are not recommended.

1378. **Inactive storage (Dung tích không hoạt động):** The storage volume of a reservoir measured between the invert level of the lowest outlet and the minimum operating level.
1379. **Live storage (Dung tích hữu ích):** The sum of active and inactive storage volume. When there is no active storage e.g. in some irrigation reservoirs, live storage and active storage describe the same storage which is generally termed as "live storage".
1380. **Conservation storage (Dung tích trữ):** Storage impounded for later release, as required for some useful purposes, such as municipal supply, power generation or irrigation.
1381. **Flood control storage (Dung tích phòng lũ):** Storage capacity provided for in the reservoir to absorb or retain floods is usually released as rapidly as downstream channel capacities permit.
1382. **Flood storage (Dung tích chứa lũ):** The part of the active storage used specifically for flood control, "Flood storage" should not be confused with "flood surcharge".
1383. **Surcharge (Dung tích chứa lũ tạm):** This is the storage capacity used to protect the structure against floods greater in magnitude than the capacity of the regular outlet works and control spillways. This storage capacity is in addition to conservation storage in the case of irrigation structures, and is in addition to the flood control storage space in a multiple-purpose structure. This surcharge storage space is available only for temporary uncontrolled flood storage but is not counted in the reservoir capacity.
1384. **Flood surcharge, or Surcharge (Dung tích chứa lũ tạm thời hoặc dung tích tạm thời):** The volume or space in a reservoir between the retention water level and the maximum water level. Flood surcharge can not be retained in the reservoir but will flow over the spillway until the retention water level is reached.
1385. **Carry-over storage (Dung tích phân trên):** Storage collected during surplus years for making up deficiencies in dry or lean years.
1386. **Seasonal storage (Tích nước theo mùa):** 1- Storing of water during high inflow season and supplying it during low inflows. 2- It also refers to the quantities of seasonal storage.
1387. **Annual storage (Dung tích chứa năm):** 1- The difference of storage in a reservoir at the beginning and end of year of reservoir operations. 2- The difference between the maximum and minimum volumes in storage in a reservoir over a year of reservoir operation.
1388. **Storage increment (reservoir) (Dung tích gia tăng của hồ chứa):** Difference between the inflow and outflow in the reservoir.
1389. **Storage cycle (Chu trình tích nước):** A period at the beginning and the end of which the reservoir contents are the same. The period may vary from a few hours to years depending upon inflow and outflow rates.

1390. **Reservoir capacity, Gross capacity reservoir, Gross storage, or Storage capacity** (**Năng lực hồ chứa, năng lực tổng cộng của hồ chứa, dung tích tổng cộng** hoặc **Năng lực chứa**): The gross capacity of a reservoir from the river bed upto the retention water level. It includes active, inactive and dead storages.
1391. **Bank storage, or Ground storage** (**Tích nước trong bờ hoặc tích nước ngầm**): Water that has infiltrated from a reservoir into the surrounding land where it remains in storage until the water level in the reservoir is lowered.
1392. **Capacity curve** (**Đường cong dung tích hồ**): The graph of the volume of reservoir, tank, etc, as a function of elevations. The capacity of a reservoir can only be defined with reference to some definite elevations.
1393. **Peak stage (reservoir)** (**Giai đoạn đỉnh của hồ chứa**): Stage reached during floods in a reservoir when the flood inflow has passed its peak and its rate has declined to a figure equal to the rate of outflow.
1394. **Peak inflow** (**Dòng chảy đỉnh lũ**): The rate of inflow during floods when the reservoir gains in storage at the fastest rate.
1395. **Maximum water level** (**Mực nước cao nhất**): The maximum water level, including flood surcharge, which the dam has been designed to withstand.
1396. **Retention water level, Top water level, Normal top water level, Full supply level, or Normal water lever** (**Mực nước duy trì, mực nước đỉnh, mực nước đỉnh bình thường, mực nước cấp nước đầy hoặc mực nước bình thường**): For a reservoir with a fixed overflow sill, it is the lowest crest level of that sill. For a reservoir, the outflow from which is controlled wholly or partly by movable gates, siphons or by other means. It is the maximum level at the dam to which water may rise under normal operating conditions, exclusive of any provision for flood surcharge.
1397. **Exceptional water level, or Abnormal water level** (**Mực nước ngoại lệ hoặc mực nước bất thường**): Maximum or minimum level attained in a reservoir during a flood or drought of greater intensity than normally experienced or provided for in design.
1398. **Minimum riservoir level, or Maximum draw down level** (**Mực nước hồ nhỏ nhất hoặc mực nước rút xuống tối đa**): The lowest level to which a reservoir surface may be lowered keeping in view the requirements of head for the water to be released downstream for hydropower generation, or to be drawn for irrigation and other needs.
1399. **Minimum operating level** (**Mực nước vận hành nhỏ nhất**): The lowest level to which the reservoir is drawn down under normal operating conditions. The lower limit of active storage.
1400. **Dead storage level** (**Mực nước chết**): Level in a reservoir corresponding to dead storage.

1401. **Normal water surface elevation, Normal water level, Conservation water level, Storage level, Normal pool level, or Conservation storage level** (Cao trình mực nước dâng bình thường, mực nước dâng bình thường, mực nước trữ, mực nước hồ bình thường hoặc mực nước tích nước duy trì): The reservoir water surface level corresponding to conservation storage.
1402. **Fetch (Đà gió):** The distance over which the wind can act on a body of water. It is generally, defined as the maximum distance from the windward shore to the structure.
1403. **Seiche (Triều già):** A slow aperiodic up and down movement of the water surface of a reservoir or lake, probably due to unequal atmospheric pressure, or wind.
1404. **Drawdown (Rút nước):** Lowering of the water surface of the reservoir to any level.
1405. **Sudden drawdown (Rút nước đột ngột):** A sudden substantial lowering of the water level in the reservoir.
1406. **Density currents (Dòng cùng tỷ trọng):** A gravity flow of a fluid through, under, or over a fluid of approximately equal density.
1407. **Underflow density currents (Dòng tỷ trọng chảy dưới):** The density currents flowing under another fluid.
1408. **Interflow density currents (Dòng tỷ trọng lân dòng):** The density currents which flow through another fluid.
1409. **Overflow density currents (Dòng tỷ trọng chảy trên):** Density currents which overflow another fluid.
1410. **Turbidity currents (Dòng đục):** A class of density currents associated with the suspension of sediment in flowing water, and usually involving the deposition of sediment in reservoirs.
1411. **Underflowing turbidity currents (Dòng đục chảy dưới):** It is the common type of density currents, which move down the bottom of a reservoir, lake or deep channel due to the greater density of the turbid water resulting from the inclusion of suspended sediment.
1412. **Underflow turbidity currents-plunging type (Loại nhún chìm dòng đục dưới):** In this case, the turbid water flowing into a reservoir plunges directly under the clear water in the take. The formation of this type is indicated by the collection of flowing drift on the surface and the sharp line of separation of the muddy and the clear water.
1413. **Underflow turbidity currents-settling type (Loại lắng dòng đục dưới):** In this case, the inflowing muddy water does not dive under the clear water, but pushes it downstream and forms a considerable body of muddy water, in which the sediment slowly settles to the bottom, which later on flows down into the reservoir as in the form of underflow turbidity currents. The existence of these currents is indirectly inferred from the deep deposits of fine material in the streambed near the upper ends of some large reservoirs.

1414. **Interflow turbidity currents (Dòng đục chảy lắn):** Turbidity currents flowing between the lighter water and heavier water, viz. Water in a reservoir at the surface is warmer and lighter and at the bottom is colder and heavier. This difference in densities of water will induce interflow turbidity currents in the reach where the colder bottom water has a greater density than the inflowing water.
1415. **Overflow turbidity currents (Dòng đục chảy trên):** Turbidity currents formed by the inflowing turbid water having lesser density than the water in the reservoir. This case occurs when the turbid water of a river enters the salt water (heavier) of the ocean.
1416. **Foreset bed (Bãi bồi đáy láng trước):** The deposition of sediment by the turbidity currents above the reservoir water level. It consists of coarse and fine material (coarse silt and sand).
1417. **Topset bed (Bãi bồi láng đỉnh):** The deposition of sediment by the turbidity currents below the reservoir water level and near the reach where the inflowing water enters into the reservoir. It consists of coarse and fine material (coarse silt and sand).
1418. **Bottom set bed (Bãi bồi láng đáy):** The deposition of sediment by the turbidity currents in the bottom of the reservoir. It consists of fine materials (silt and sand).
1419. **Trap efficiency (Hiệu suất tích bùn cát):** The proportion of incoming sediment load deposited in the lake or reservoir, in per cent.

II.4.4. DIMENSIONS AND COMPONENTS KÍCH THƯỚC CÁC HẠNG MỤC CÔNG TRÌNH

1420. **Length of dam, or Crest length (Chiều dài đập hoặc chiều dài đỉnh đập):** The extent of the barrier in a dam and the integral features constructed between excavated abutments. The length is measured along the axis of the dam at the elevation of the top of the main body of the dam or of the roadway surface exclusive of any abutment spillway. If the spillway lies wholly within the dam and not in any area especially excavated for the spillway, the length should be the length along the axis extended through the spillway to the abutment contacts.
1421. **Structural height of dam, Lowest point of foundation, or Maximum height of dam (Chiều cao kết cấu đập, điểm thấp nhất của nền hoặc Chiều cao tối đa của đập):** 1- Distance between the lowest point in the foundation and top of the dam. The structural height of an earth dam is the vertical distance between the top of the embankment and the lowest point in the excavated foundation area, including the main cutoff trench, if any but excluding small trenches or narrow back filled areas whose width is less than 10 metres. The top elevation does not include the crown of any roadway across the dam. 2- The structural height of a masonry dam is the vertical distance between the top of the dam and the lowest point of the excavated

foundation area, whose width is less than 10 metres. The top of the dam is the crown of the roadway, if a roadway crosses the dam, otherwise it is the level of the walkway.

- 1422. **Hydraulic height (Chiều cao thủy lực):** Distance between the lowest point of the original stream bed at the axis of the dam and the highest controlled water level.
- 1423. **Maximum base width (Chiều rộng đáy lớn nhất):** Horizontal distance between the outer points of the heel and toe of the cross section of a dam or spillway.
- 1424. **Top width (Chiều rộng đỉnh):** Width at the crest of dam.
- 1425. **Volume (dam) (Khối lượng (đập)):** Space occupied by all materials in the dam. The volume of a dam includes the main fill, the riprap and the impervious blanket.
- 1426. **Dam axis, Axis of dam, or Axis (Trục đập, trục của đập hoặc trục):** 1- In case of gravity, buttress and arch dams, it is the horizontal trace of the upstream edge of the top of the structural zone or top arch. 2- In case of earth and rockfill dams, it is the horizontal trace through the centre of the top width.
- 1427. **Top of the dam, or Crest level of the dam (Đỉnh đập hoặc cao trình đỉnh của đập):** In masonry dams it is the level of the crown of the roadway if a roadway crosses the dam, or the level of the walkway if there is no roadway. In earth dams, it is the level the top of the embankment.
- 1428. **Crown (Đỉnh):** The highest part of the curved surface of a road. Cross-section without superelevation.
- 1429. **Crest (Đỉnh):** 1- The top of a dam dike, spillway, or weir: frequently restricted to the overflow portion. 2- The summit of a wave; peak of a flood.
- 1430. **Walkway (Đường dành cho người đi bộ):** A passageway for pedestrians.
- 1431. **Profile (Mặt cắt dọc):** A profile is a developed elevation of the intersection of the dam with the original ground surface, rock surface, limit of excavation, or any other surface along a designed line, such as the axis or the upstream or downstream toe. Profiles are commonly classified as U - shaped or V- shaped, with variation between these two classifications.
- 1432. **Canyon- shape factor (Hệ số dạng thung lũng):** It is the ratio of the perimeter of the foundations and abutments of a dam measured along its axis and the maximum height of the dam.
- 1433. **Arch abutment (Mố trụ vòm):** The abutment of an arch element is the surface, at either end of arch, which contacts the rock of the canyon wall. Arch loads are transferred through the arch abutments to the canyon walls.
- 1434. **Arch centre line (Đường tâm vòm):** An arch centre line is the locus of all median points of the thickness of an arch section.
- 1435. **Line of arch centres (Đường tâm vòm):** The line of arch centres is a line passing through the arch centres in plan or profile. Arch centres are located so that they will be on smooth profile curves in a vertical plane. In the case of a constant-centre type of arch dam, a single vertical line will be the locus of the arch centres. For variable

centre dams, separate profile curves will be the loci of the arch centres for the upstream face, the centre line, and the downstream face. In the case of symmetrical layouts, the vertical plane through the arch centres will generally intersect the dam at the place of maximum deflection.

1436. **Arch element (Phản tử vòm):** An arch element, or arch, is a portion of a dam bounded by two horizontal planes at a distance of one unit apart.
1437. **Arch section (Mặt cắt vòm):** A section representative of an arch dam as it would appear if cut by a horizontal plane.
1438. **Cantilever section (Mặt cắt công xôn):** It is a vertical section taken normal to the axis, usually oriented with the reservoir on the left.
1439. **Cantilever elements (Phản tử công xôn):** The cantilever element, or cantilever, is that portion of a dam, which is contained within two vertical radial planes spaced a unit distance apart at the axis. Cantilevers of arch dams, other than one of the constant-centre type, have warped sides owing to the fact that the arch centre line radii are not the same at all elevations. The crown cantilever is located at the point of maximum depth.
1440. **Central angle of arch dam (Góc tâm của đập vòm):** The central angle of an arch is the angle bounded by lines radiating from the arch centre to points of intersection of the arch centre line with the abutment.
1441. **Fillet (Đường gờ):** A fillet is an increase in the thickness of a dam at and near the abutments of the arches or the base of the cantilevers. Fillets are usually placed at the downstream face, but may also be used at the upstream edge of the base of the maximum cantilevers.
1442. **Bedrock (ledge) (Đá gốc):** Rock of relatively great thickness and extent in its native location.
1443. **Foundations:** That part of a structure which serves exclusively to transmit the weight of the structure on to the natural ground. In dams, it is understood to mean both the valley floor and the dam abutments.
1444. **Footing (Chân móng):** Portion of the foundation of a structure that transmits loads directly to the soil.
1445. **Freeboard (Chiều cao an toàn):** The vertical distance between a stated water level and the top of a dam. Thus net freeboard, dry freeboard or flood freeboard is the vertical distance between the maximum water level and the top of the dam.
1446. **Gross freeboard or Total freeboard (Chiều cao an toàn tổng cộng):** is the vertical distance between the retention water level and the top of dam.
1447. **Valley floor (Nền thung lũng):** Bottom of the canyon.
1448. **Cutoff collars (Tường chắn khay chống thấm):** In all closed conduit layouts, seepage of water along the contact plane of the outlet conduit and the dam embankment is minimized by the construction of projecting fins or cutoff collars

around the exterior circumference of the conduit, particularly through the upstream and the central portion of the impervious section of the dam.

- 1449. **Pile (Cọc cù):** A long, straight, stiff structural elements, usually of circular or square cross section, which is driven, or otherwise introduced into the soil, usually for the purpose of providing vertical or lateral support.
- 1450. **Sheet piling (Đóng cù thành tấm):** A diaphragm made up of meshing or interlocking members of wood, steel, concrete, etc., driven individually to form an obstruction to percolation, to prevent movement of material, for coffer dams, stabilization of foundations, etc.
- 1451. **Heel line, or Upstream toe line (Đường chân đập hoặc đường chân thượng lưu):** The line joining the upstream slope or face of a dam with the valley floor or the upstream blanket.
- 1452. **Heel, or Upstream toe (Chân đập hoặc chân thượng lưu):** The line joining the upstream slope or face of a dam with the valley floor or the upstream blanket.
- 1453. **Downstream toe line (Đường chân hạ lưu):** Line joining the downstream slope or face of a dam with ground surface or downstream river bed.
- 1454. **Downstream toe (Chân hạ lưu):** Junction of the downstream slope or face of a dam with the ground surface or downstream river bed.
- 1455. **Apron (Sàn phủ):** A floor or lining of concrete, timber, etc., to protect between a surface from erosion, such as the pavement below chutes, spillways, or the toe of dam.
- 1456. **Gallery (Hành lang):** A formed opening or passage left in a structure after its completion; it may run either transversely or longitudinally, and may be either horizontal or on a slope.
- 1457. **Foundation gallery (Hành lang nền móng):** A gallery providing drainage for water percolating from the upstream face or seeping through the foundations in a dam, generally, extending the length of the dam near the rock surface, conforming in elevation to the transverse profile of the canyon; in plan it is near and parallel to the axis of the dam. It is from this gallery that the holes for the main grout curtain are drilled and grouted, and also from the foundation, drain holes are drilled.
- 1458. **Drainage gallery (Hành lang tiêu nước):** A supplementary gallery, which when used, is located further downstream of the foundation gallery for the purpose of drilling and draining the downstream portion of the dam.
- 1459. **Gate galleries (Hành lang cửa van):** Galleries, made in dams, to provide access to and from for, the mechanical equipment required for the operation of gates in outlet conduits, power penstocks, or spillway crests.
- 1460. **Grouting galleries (Hành lang khoan phun):** Galleries, provided in dams, to locate the supply, return and vent headers of the grout piping system; also the piping system for artificial cooling of the blocks terminates in these galleries.

1461. **Inspection galleries (Hành lang kiểm tra):** Galleries, made in a dam, to provide access to the interior of the mass in order to inspect the structure and study the structural behavior of the dam after completion. Foundation, drainage, gate and grouting galleries also serve as inspection galleries.
1462. **Access gallery, Adit, or Entrance gallery (Hành lang vào).**
1463. **Shafts (Tháp, giếng):** Vertical openings provided in the dam at suitable places for various purposes, such as for location of headers of artificial cooling systems, accommodation for measuring devices, for connecting galleries by stairway, for elevator movement and for hoisting equipment.
1464. **Plumb-line shaft, or Collimator shaft (Tháp trực thẳng đứng hoặc tháp chuẩn):** A shaft located near the maximum section of a dam in order to make observations of the movements of the dam with respect to the base.
1465. **Stilling well shaft, or Gauge well (Tháp giếng tĩnh hoặc giếng đo mức nước hồ):** A special shaft, sometime included in the design of a dam, open to the reservoir below the minimum reservoir level and containing a floating mechanism to record reservoir fluctuations.
1466. **Foundation tunnels (Tuy nến nền đập):** Tunnels driven in the rock below the base of a dam and also into the abutments at a higher elevation for grouting; in order to provide access to foundation grouting operations. They also provide a means of access to the foundation for any future treatment in case unsatisfactory subsurface conditions develop after the structure is completed and the reservoir filled. In addition, foundation tunnels are used to measure movements of the foundations, consequent to variations in reservoir water loading, variation in foundation loading, and variation due to seismic forces.
1467. **Grout (Vữa):** 1- A fluid or fluid mixture that can be poured or injected easily. 2- To fill the joints, hollows, cracks, seams, faults, shattered zones or fracture zones, etc., with grout.
1468. **Grouting (Phút vữa):** 1- Process of pouring or injecting grout. 2- Present participle of the verb grout.
1469. **Stage grouting, or Successive grouting (Phút vữa giai đoạn hoặc phút vữa kế tiếp):** Grouting consisting of drilling a hole to a limited depth or to the intersection with an open seam, grouting to that depth, cleaning out the hole after the grout has taken its initial set, and then drilling and grouting the next stage. This process repeated, using higher pressures for each succeeding stage until the final depth is reached. This process is also known as down-stage grouting. It may be performed with or without the use of packers.
1470. **Upstage Grouting (Phút giai đoạn lên):** Grouting consisting of drilling a hole to its final depth and grouting the lowest high-pressure zone by extending the grout pipe to the top of this zone. A flexible seal or packer between the end of the grout pipe and the wall of the hole prevents the grout from rising. After grouting this zone, the grout pipe is raised so that the seal is at the top of the next zone, which is

grouted using a somewhat lower pressure. The process is repeated until all the zones have been grouted.

1471. **Packer grouting (Phút vữa tùng đoạn):** The use of expandable implements to isolate sections of a grout hole and thereby enabling the application of grout to a portion of the hole only.
1472. **Curtain grouting (Phút vữa màng):** It consists of forming an approximately vertical grout curtain of moderate thickness below an adjoining a hydraulic structure to reduce the passage of water to a required degree.
1473. **Tubes a Manchettes grouting (Khoan phút kiểu ống Manchettes):** It is a process of grouting through a tube with a smooth interior and which has perforations at an interval of 30-40 cm covered by rubber sleeves. The tube is sealed into the ground by plastic grout sheath. The rubber membrane acts as a one-way wall allowing the grout under pressure to escape into the ground hole. When grouting is stopped, the rubber membrane sits tightly on the mouth of the same hole a number of times as is required in case of alluvium grouting and permits grouting any layer in the sequence as may be decided.
1474. **Grout curtain (Màng phút):** A diaphragm or curtain in which the permeability of the foundation is reduced by the grouting process.
1475. **Area grouting, Consolidation grouting, or Blanket grouting (Sự phút vữa theo vùng, sự phút vữa già cố hoặc sự phút vữa tạo thảm):** Grouting to be done in an area to stop water passage through the disintegrated rock and also to increase the bearing strength of the strata. It is comparatively shallow and low pressure grouting.
1476. **Zone grouting (Khoan phút khu vực):** A process of construction of a grout curtain whereby a whole section of the curtain is stage drilled and grouted to a limited depth before any holes are drilled and grouted beyond that depth.
1477. **Circuit grouting (Khoan phút vòng quanh):** The grouting process where a tube or pipe is placed down the centre of the grout hole (to the bottom) and grout is circulated, under pressure down the tube and upwards around the outside of the tube to the surface.
1478. **Contraction joint grouting (Phút vữa khớp nối co hẹp):** Grouting process whereby contraction joints of a concrete structure are filled by using pipes, grouts, wells etc.
1479. **Contact grouting (Phút vữa tiếp xúc):** The grouting process whereby contact between a structure and a vertical or nearby vertical rock face is grouted.
1480. **Dental treatment (Xử lý chân răng):** The operation of filling localized pockets of weathered rock, potholes, faults or other foundation flaws extending below the general foundation surface and being of small size or of difficult access. Grout and/or concrete are used. Access is obtained by large calyx holes shafts or trenches.
1481. **Slush grouting (Phút vữa sét):** The operation of filling surface irregularities and open fractures with grout.

1482. **Lugeon coefficient (Hệ số Lugeon):** An arbitrary factor derived for a foundation by means of water testing. In conjunction with a grouting programme, it enables assessment of the necessity or otherwise for the grouting and provides a standard whereby some types of grouting in progress can be examined to determine the adequacy or otherwise of the work to date. Water is pumped into test holes at 10 kg per cm². The recommended stage length for the test is 5 metres. Absorption of water by the foundation at the rate of 1 liter per minute per linear metre is arbitrarily designated as a Lugeon coefficient of 1.
1483. **Chemical grouting (Phút hoá chất):** A process by which chemicals are injected under pressure into a pervious medium to make it watertight by formation of gels.
1484. **Bentonite grouting (Phút vữa bentonit):** A process in which bentonite, with or without other ingredients, in the form of suspension, is injected under pressure into a pervious medium to make it watertight.
1485. **Alluvium grouting (Phút tầng bồi tích):** Grouting of transported pervious media, such as sand, gravel, shingle, with clay, cement, bentonite and/or chemicals mixed in different proportions.
1486. **Levy-type facing, or Hollow facing (Lớp lát mặt kiểu Levy hoặc lớp lát mặt rỗng):** The upstream facing of a masonry dam with a series of watertight arches.
1487. **Supporting mass (Khối tựa):** The portion of the body of a dam supporting the Levy-type facing.
1488. **Drainage wells (Giếng tiêu nước):** Openings between the watertight arches and the supporting mass in a dam with Levy-type facing.
1489. **Insulating wall (Tường cách ly):** A thin wall of reinforced concrete provided along the downstream face of a dam and at a little distance from it with a view to protecting it from frost damage in cold countries.
1490. **Cutoff buttress (Mố trụ chắn khay):** Cross walls projecting into the embankment from spillway abutments, power-house walls, or other concrete walls extending through the structure in an upstream and downstream direction.
1491. **Joint drains, Vertical drains, or Vertical wells (Tiêu nước tiếp giáp, tiêu nước đứng hoặc giếng tiêu nước đứng):** Vertical drains provided in construction joints as a precaution against development of excessive pressure in the joints during the construction period and against seepage of reservoir water through the joints during the operating period.
1492. **Joint (Khớp nối):** A break between two pours of concrete done at some interval of time; or a small open space forming a complete plane of separation between components of the structure with relation to transmission of stresses.
1493. **Contraction joint (Khớp nối co ngót):** A joint provided in a concrete structure to prevent unsightly cracking caused due to drying, shrinkage, thermal expansion and contraction.

1494. **Expansion joint (Khớp nối dàn nở):** A joint provided in exposed members between fixed points to permit longitudinal expansion and contraction when changes in temperature occur, and to permit vertical movement where differential settlement is anticipated.
1495. **Foundation joint (Khớp nối nền móng):** The joint along the plane of contact between the masonry and the foundation.
1496. **Construction joint (Khớp nối xây dựng):** These are breaks in the continuous pouring of concrete required to prevent haphazard cracking of the structure. These are classed into (i) horizontal joints, (ii) transverse joints and (iii) longitudinal joints.
1497. **Horizontal joint, or Construction lift (Khớp nối theo phương ngang hoặc phàn lấp xây dựng):** A joint introduced between the lifts to provide sufficient cooling between pours.
1498. **Lift (Lớp bê tông):** The height, which is poured continuously at a time and over which other lift is poured after sufficient time is allowed for the pour to cool.
1499. **Longitudinal joint, or Longitudinal contraction joint (Khớp nối theo phương dọc hoặc khớp nối co hẹp theo phương dọc):** 1- A joint in the longitudinal direction of the dam or parallel with the axis of the dam and offset at the transverse joints to form longitudinal row of staggered columns. 2- Joint parallel to the lines of principal stress.
1500. **Transverse joint, or Transverse contraction joint (Khớp nối ngang hoặc khớp nối co hẹp ngang):** A joint provided normal to the axis of the dam and extending entirely through the structure dividing it (structure) into separate blocks, with a view to preventing haphazard transverse cracking due to contraction of concrete.
1501. **Key ways, or Offsets (Đường khoá hoặc đường gờ):** Indentations or projections of some geometrical shape built on, or formed into, poured surface to provide a degree of integral action with subsequent structural addition.
1502. **Waterstops (Vật cách nước):** Devices provided to prevent or retard the flow of water through the leaks or joints.
1503. **Groutstop (Vật ngăn vữa):** A type of waterstop to confine the extent of grouting used to seal joints.
1504. **Transverse joint seals, or Sealing strips (Vật kín nước của khớp nối ngang hoặc dải kín nước):** Devices provided in the transverse joint to prevent leakage of water from the reservoir. These seals are of copper, rubber, etc.
1505. **Block, or Monolith (Khối đập):** The portion of a dam between two transverse joints constructed normal to the axis.
1506. **Hearting (Lõi đập):** The portion of the main body of a dam not affected by atmosphere.
1507. **Main body (Thân đập chính):** The structural parts of a dam above foundation.

1508. **Zone (Vùng):** 1- In masonry dams, it refers to a vertical portion between two horizontal lines of its cross section assumed for stress analysis. 2- In earth dams, different material types are placed in zones.
1509. **Overhang (Định chia):** 1- The portion of the spillway crest of the dam projecting upstream for efficient water discharge. 2- In an arch dam, the portions projecting beyond the width of the top arch.
1510. **Sluice (Cống):** 1- A conduit for carrying water at high velocity which can, if desired, be closed by a sluice gate. 2- An opening in a structure for passing debris. 3- To cause water to flow at high velocities for wastage, for purposes of excavation, ejecting debris, etc.
1511. **Cavitation (Xâm thực).**
1512. **Pitting (Rỗ):** The roughening or formation of pockets on surfaces due to cavitation or erosive action of the water.
1513. **Gate chamber of sluice well (Buồng van cửa tháp cống):** A structure located within the abutment main body of the dam or the dam embankment within which the regulating gates or emergency gates are installed. The lower portion of the chamber provides an anchorage for the gates and liner, while the upper portion furnishes a working space for the removal of the gate leaf and other parts for repair, and for the installation of the necessary control mechanisms. The gate chamber is usually located upstream of the axis of the dam.
1514. **River sluices, Waste outlets, or Dewatering outlets (Cống sông, cửa xả hoặc cửa tháo cạn hồ):** Sluices provided near the river bed to empty the reservoir or to discharge muddy water during floods and also to serve as an auxiliary spillway.
1515. **Sluicing outlets (Cửa xả cát):** Outlets in the body of the dam, used for sluicing out settled material from the reservoir.
1516. **Service outlet (Cửa lấy nước):** Outlets provided in the body of the dam through which water is drawn off for actual use. These are provided with trash racks.
1517. **Towers (Tháp):** Vertical shafts provided for the purpose of lifting or lowering materials to the galleries or for accommodating the staircases which lead to the galleries at different levels or for accommodation outlet pipes, control and service equipment.
1518. **Elevator towers (Tháp thang máy):** Towers containing electric lifts.
1519. **Hoisting chamber (Khoang tời):** A chamber built at the top of a dam to house remote control hoisting mechanism.
1520. **Control house (Nhà điều khiển):** A structure usually built at the top of the shaft and employed as a means of access to the gate chamber. The house usually shelters the remote control mechanism, a hoist, generator set, ventilating system, heater, gate-height indicator, etc.
1521. **Core wall, Membrane, or Core (Tường lõi, màng chống thấm hoặc lõi):** A wall of masonry, sheet piling, or compacted puddled clay built inside an earth dam or a levee to reduce percolation .

1522. **Diaphragm wall (Tường ngăn):** A comparatively thin core wall built of masonry or sheet piles or concrete or a combination thereof.
1523. **Transition filter (Lớp lọc chuyển tiếp):** A component of an earth dam section (with core) consisting of an intermediate grade of material placed between the core and the shells to function like a filter, preventing lateral movement of fines from the core .
1524. **Transition section (Bộ phận chuyển tiếp):** It is the part of the section of an earth dam occupied by the transition filters.
1525. **Shell, Upstream shell, Upstream fill, Downstream shell, Downstream fill, or Shoulder (Khối gia tải, khối gia tải thượng lưu, lọc thượng lưu, khối gia tải hạ lưu, lọc hạ lưu hoặc vai đập):** A component of an earth dam constructed of pervious or semi-pervious materials upstream and downstream of the core or membrane. The upstream portion is called "upstream shell" and the downstream portion "downstream shell".
1526. **Riprap (Đá lát):** Broken stone placed on earth surfaces, and large stones against a fill of small rocks, etc., placed on the upstream slopes of embankment for protection against the action of water; particularly against wave wash.
1527. **Revetment (Kè):** Material, such as rock, concrete blocks or mattresses, placed on the bottom or banks of a river to prevent or minimize erosion.
1528. **Blanket (Sân phủ):** A cover of one type (pervious or impervious) material by a layer of another type of material.
1529. **Impervious blanket (Sân phủ không thấm):** Blanket, when the coveting material is impervious.
1530. **Upstream blanket, or Riverside blanket (Sân phủ thượng lưu hoặc sân phủ bờ sông):** An impervious blanket constructed on the upstream of an earth dam or on the river side of a levee (then also called "riverside blanket") where the substratum is pervious, to control seepage by increasing the resistance to seepage entry into the pervious sub-stratum, thereby decreasing both seepage flow and excess pressure on the downstream side of the earth dam or landward side of the levee.
1531. **Natural blanket (Sân phủ tự nhiên):** A cover of naturally occurring soil acting as a blanket. The natural blanket is generally less permeable.
1532. **Horizontal drainage blanket, Pervious blanket, or Drainage filter (Thảm tiêu nước ngang, thảm thấm hoặc lớp lọc tiêu nước):** A blanket of pervious material constructed at the foundation from the impervious zone to the landside in a levee or downstream side of an earth dam, to permit the discharge of seepage and to minimize the possibility of piping failure, either of the blowout or subsurface erosion type.
1533. **Blanketing (Sự hình thành thảm phủ).**
1534. **Cutoff wall, or Cutoff (Tường chắn khay hoặc chắn khay):** A wall, collar, or other structure, intended to reduce percolation of water along otherwise smooth surfaces, or through a porous strata. It is provided in or on the foundations.

1535. **Positive cutoff, or Complete cutoff** (**Tường chắn khay chủ động** hoặc **tường chắn khay hoàn chỉnh**): A cutoff extending down to or into the bed rock surface, or to or into impermeable subsurface stratum.
1536. **Partial cutoff** (**Chắn khay một phần**): A cutoff extending into the underlying stratum, but not reaching an impervious subsurface stratum.
1537. **Perforated cutoff, or Semi-impervious cutoff** (**Chắn khay có đặc lỗ** hoặc **chắn khay nửa không thấm**): A cutoff made up of non-watertight material, as steel sheet piles, usually provided on the downstream side to help decrease pressures.
1538. **Stoped cutoff** (**Chắn khay chặn dòng**): Cutoff constructed by utilizing underground mining methods for excavation, then backfilling the excavation with concrete or other selected material.
1539. **Stub concrete cutoff, or Short concrete cutoff** (**Chắn khay bê tông cùt** hoặc **chắn khay bê tông ngắn**): Cutoff employed in conjunction with level rock foundations or with deep soil trenches cutoff where a good seal of earth on rock is difficult to obtain. Its purpose is to increase the path of seepage and to prevent leakage along the rock-soil contact surface.
1540. **Cutoff trench** (**Dải chắn khay**): An excavation in the base of a dam or other structure and filled with relatively impervious material to reduce percolation.
1541. **Key wall** (**Tường khoá**): A cutoff wall extending from the cutoff trench into the bedrock or the impervious subsurface stratum.
1542. **Filter:** One or more layers of porous material so arranged as to prevent movement of soil particles due to flowing water.
1543. **Inverted filter, or Protective filter** (**Tầng lọc ngược** hoặc **tầng lọc bảo vệ**): A layer or layers of pervious or semipervious material to provide drainage and prevent movement of soil particles due to flowing water.
1544. **Trench drain** (**Dải tiêu nước**): A drain provided in the foundations of a dam to intercept seepage. When placed immediately after a cutoff, it relieves any pressure that might develop from possible ineffectiveness of the cutoff.
1545. **Chimney drain** (**Tiêu nước ống khói**): A vertical thin drain of uniform or graded material placed inside the embankment at the downstream of the hearting zone to deal with seepage that gets past the hearting of an earth dam.
1546. **Rock toe** (**Chân đá**): The downstream toe of a high earth dam or other structure constructed of rock materials.
1547. **Drain well, Relief well, or Pressure relief well** (**Giếng tiêu nước** hoặc **giếng giảm áp**): A deep cylindrical drain located in the foundations of a dam or downstream of it to relieve the seepage pressures in pervious strata too deep to be reached by trench drain, and to drain localized concentrations of seepage, where a continuous trench of pervious blanket is not warranted; they are also employed to correct developed bed seepage conditions.

- 1548. **Longitudinal drain (Tiêu nước dọc):** It is a drain along the length of the dam generally located inside the embankment at the downstream toe of the hearting to drain away the seepage water collected by the filter drain.
- 1549. **Toe drain (Vật tiêu nước chân):** A drain constructed at the downstream toe of an earth dam to collect and drain away the seepage through the dam.
- 1550. **Sod (Vàng cỏ).**
- 1551. **Piezometer (Óng đo áp).**
- 1552. **Settlement gauge (Thiết bị đo lún):** A device to measure the internal settlements within the embankments and foundations of an earth dam.
- 1553. **Settlement block (Thót đo lún):** A device to measure at the surface, cumulative settlement and horizontal deflections of an earth dam.
- 1554. **Water intake test (Thí nghiệm ép nước):** A test conducted in the field to detect the presence and extent of crevices, cracks, fissured and voids in the foundations by observing the loss of water at different pressures in a bore hole.
- 1555. **Coefficient of permeability (Hệ số thấm).**

II.4.5. DESIGN AND THEORY - LÝ THUYẾT VÀ THIẾT KẾ

- 1556. **Gravity method (two-dimensional method of analysis) (Phương pháp trọng lực (phương pháp phân tích hai chiều)):** A method of stress analysis of gravity dams assuming the structure of the dam to be composed of vertical cantilever elements which act independently of each other and in which the vertical stress varies linearly.
- 1557. **Slab analogy method (Phương pháp tấm tương tự):** A two-dimensional method of studying the non-linear distribution of stresses in a dam by considering the analogy between the stresses in a two-dimensional elastic body and the deflections of an unloaded slab of the same shape bent by forces and couples applied round its edges.
- 1558. **Lattice analogy method (Phương pháp phân tích mạng lưới):** A three-dimensional method of analysing stresses in a dam by considering it a frame consisting of diagonally braced squares.
- 1559. **Trial load method (Phương pháp tải trọng thử):** A three-dimensional method of dam analysis in which the dam is assumed to be made up of two or more systems of elements; for arch dams - vertical cantilever elements and horizontal arch elements; and for gravity dams - vertical cantilever element, horizontal beam elements and a twisted structure system of vertical and horizontal elements. Each system occupies the whole dam structure and the loading is assumed to be divided between them in such a manner that the computed deflection for any point in the dam, considered as point in the other system will be identical with its computed deflections. The

division of loading which will cause coincident deflections at all points, is found by a succession of trials.

1560. **Amplified trial load method (Phương pháp tải trọng thử cân bằng chuyển vị):** For arch dams it is based on the assumption that the water load is divided between the arch and cantilever elements, that the division may or may not be constant from abutment to abutment for each horizontal element, and that the true decision of load is the one which causes equal arch and cantilever deflections in all arches and cantilevers instead of at the crown cantilever only. Further, it assumes that the distribution of load must be such that it should be able to cause equal arch and cantilever deflections in all directions; that is in tangential and rotational directions as well as in radial directions. To accomplish the preceding agreement, it is necessary to introduce internal, self - balancing trial load patterns on the arches and cantilevers.
1561. **Abridged trial load method, or Simplified trial load method (Phương pháp tải trọng thử cân bằng rút gọn hoặc phương pháp tải trọng thử cân bằng giản đơn):** For arch dams it is used for preliminary design work by making use of tables and curves for determining deflections of arches. Modified assumptions are made with regard to the foundation in this analysis which neglect (i) differences in elasticity of rock and concrete, (ii) the angle which the plane of the abutment makes with a vertical plane, and (iii) certain secondary effects.
1562. **Trial load twist method (for gravity dams) (Phương pháp xoắn tải trọng thử (cho đập trọng lực)):** It is based on the assumption that the water load is divided between a structural system made up of vertical and horizontal elements, each system occupying the entire volume of the dam. For ungrouted joints, there are two systems, the cantilever structure and the twisted structure, and for grouted joints there are three systems, the cantilever structure, the twisted structure and the beam structure. The division of load must be such that it causes equal deflection of each structure in all directions.
1563. **Finite element method (Phương pháp phần tử hữu hạn):** In this method a continuous system is represented as an assemblage of finite flat elements interconnected at a finite number of nodal points. The analysis of this idealised structure is then carried out by standard method of structural analysis by determining the stiffnesses of individual elements and then superposing them to obtain the total stiffness. Simultaneous equations based on the forces and displacements at nodal points can be framed and solved. A high speed computer is usually required to carry out computations. Both two and three dimensional models are used.
1564. **Cylinder theory or Thin cylinder theory (Lý thuyết vỏ trụ hoặc lý thuyết vỏ trụ mỏng):** A method used for the preliminary design of arch dams assuming the arch to be part of an unrestrained thin cylinder.

1565. **Elastic arch method (Phương pháp vòm đàn hồi):** A theory of arch analysis in which the dam is divided into horizontal arch rings, which are assumed independent of each other. It is possible to take into account various deformations caused due to elasticity, temperature change and shrinkage, abutment yielding and variable loads and arch forms.
1566. **Arch and crown cantilever method (Phương pháp côngxon đỉnh và vòm):** A preliminary method of analysis of arch dams, in which the distribution of load between arch and cantilever elements is assumed by adjustments of the deflections of the crown of each arch and the main cantilever section. It is then assumed that the load distribution found at this point is applicable to the entire structure and that the water loads are uniform throughout the lengths of the horizontal arch elements.
1567. **Cracked cantilever analysis (Phân tích côngxon bị nứt):** In thin arch dams, applied radial loads tend to produce tension in the cantilevers. Since ordinary concrete usually is not assumed to have a tensile strength more than a specified value (say, 20 kg/cm²), when this specified value of stress is exceeded, all the cantilevers in tension may be assumed to be cracked to the point of zero stress, so that the uncracked sections are entirely in compression.
1568. **Unit column method (for buttress dam) (Phương pháp cột đơn vị (đối với đập trụ chống):** It is a method of designing a buttress advanced by Herman Shorer. It is assumed that the buttress comprises a series of hypothetical curved struts which transmit the water load to the foundations by uniform axial compression without interaction between struts. The axes of the curved struts are analogous to trajectories of first principle stress in a monolithic buttress of identical shape and loading.
1569. **Bligh's creep theory (Lý thuyết đường thám Bligh):** The premise of this theory is that the resistance to percolation along the "line of creep", the line of contact of the dam and cutoff with the foundations may be less than directly through the foundation materials on account of the difficulty of securing an intimate contact and that the hydraulic gradient is constant throughout the creep length.
1570. **Creep line, or Line of creep (Đường viền thám):** It is the line of contact of the base of a hydraulic structure founded on a permeable soil and the cutoffs with the foundations.
1571. **Creep (Tù biến):** 1- The gradual permanent deformation of matter, either in solid or particle form, under stress which is not reversed when the stress is removed. 2- Gradual deformation of concrete under stress. 3- Permanent extension caused under high stresses in hard drawn steel. 4 - A slow, natural movement of loose material on hill sides.
1572. **Creep length (Chiều dài trượt):** The length measured along the line of creep.
1573. **Horizontal creep (Trượt ngang):** 1- The creep in the horizontal direction. 2 - The distance measured along the horizontal creep. 3- According to "Lane" the creep along a slope flatter than 45° is also treated as a horizontal creep.

1574. **Vertical creep (Trượt đứng):** 1- The creep in the vertical direction. 2- The distance measured along the vertical creep. 3- According to "Lane" the creep along a slope of 45° or greater than 45° is also treated as a vertical creep.
1575. **Lane's weighted creep theory (Lý thuyết đường viền đổi trọng):** The premise of this theory is that the horizontal contacts with the foundation and slopes flatter than 45°, being less liable to have intimate contact, are given only one - third the weightage of steeper (45° and greater than 45°) and vertical contacts while calculating the creep length. The creep length obtained by the above procedure is called Lane's weighted creep length. The hydraulic gradient is assumed constant along the Lane's weighted creep length.
1576. **Weighted creep length (Chiều dài đường viền trượt đổi trọng):** Creep length calculated on the basis of different weightage given to horizontal and vertical creeps according to practical considerations. Generally horizontal contact with the base, being less liable to have intimate contact with the base due to less resistance to percolation, are given lesser weightages.
1577. **Creep rate, or Creep ratio (Tỷ lệ trượt hoặc hệ số trượt):** The ratio of creep length to the difference in water levels at upstream and downstream of a hydraulic structure (effective head).
1578. **Weighted creep ratio:** The ratio of weighted creep length to the difference in water level at the upstream and downstream of a hydraulic structure (effective head).
1579. **Sliding factor (Hệ số trượt):** The ratio of the net horizontal forces acting on the structure above the plane under consideration to the net vertical load acting on the plane (shear strength of the material neglected).

$$(\sum H / \sum V) < f$$

where:

ΣH = summation of horizontal forces.

ΣV = summation of vertical forces.

f = coefficient of friction.

Safe value of the sliding factor is assumed approximately between 0.6 and 0.75.

1580. **Shear friction factor (SFF) (Hệ số ma sát cắt (SFF)):** An index of safety of a masonry structure against sliding, considering both the shear and frictional resistance offered at a joint.

$$SFF = \frac{f \sum V + y \cdot S_a \cdot A}{\sum H}$$

where:

f = coefficient of friction of the material on each side of the joint.

ΣV = summation of vertical forces,

y = the ratio of the average to the maximum shearing stress on the joint.

S_a = unit shearing strength of the material.

A = area of the joint at the section.

ΣH = summation of horizontal forces above the joint.

The safe value of this factor is considered to lie approximately over 4.

1581. **Earthquake factor (Hệ số động đất):** The percentage of gravity acceleration for which a structure is required to be designed.
1582. **Overturning (Lật):** In masonry structures, this condition may be attained when the horizontal forces are so great in comparison to the vertical forces that they cause the resultants of all forces acting on the structure above any horizontal place, including uplift, to pass outside the limits of the structure.
1583. **Swedish slip circle method, or Slip circle method (Phương pháp cung trượt Thụy Điển hoặc phương pháp cung trượt):** A method used to analyse the stability of an earth dam or rockfill structure in which failure is assumed to take place along the cylindrical surface in the form of a rotational slide.
1584. **Slip circle or Swedish break (Cung trượt hoặc Cung trượt Thụy Điển):** An idealized cylindrical surface through an earth or rockfill structure along which a slide failure or slip would take place.
1585. **Composite surface of failure (Mặt phá hoại hỗn hợp):** A surface failure which in cross section is not circular but is composed of one or more arcs of a circle (with or without straight). Stability along the surface involves a considerable horizontal movement and hence cannot be investigated by the Swedish slip circle method which presupposes only rotational movement. The stability is worked out by considering the equilibrium of a horizontally moving mass under the action of external driving and resisting forces and frictional resistance afforded by the horizontal plane.
1586. **Critical circle, or Critical surface (Cung trượt giới hạn hoặc bề mặt giới hạn):** The sliding surface assumed in a theoretical analysis of a soil mass for which the factor of safety is a minimum.
1587. **Rotational slide (Trượt quay):** The failure of a soil mass along the slip circle path with the mass rotating about the centre of the slip circle.
1588. **Factor of safety (Hệ số an toàn):** An index of stability of a structure with respect to its sudden failure.
1589. **Stability factor (stability number) (Ns) (Hệ số ổn định (số ổn định) (Ns):** A pure number used in the analysis of the stability of a homogeneous soil embankment defined by the following equation:

$$N_s = \frac{H_c Y_c}{C}$$

Where:

H_c = critical height of the sloped bank.

Y_e = the effective unit weight of the soil.

C = the cohesion of the soil.

Note: Taylor's stability number is the reciprocal of Terzaghi's stability factor.

1590. **Flow-net or Flow pattern (Mạng dòng chảy hoặc mô hình dòng chảy):** A graphical representation of flow lines and equipotential lines used in the study of seepage problems.
1591. **Flow line (Đường dòng):** The path that a water particle follows in its course of seepage under laminar flow conditions.
1592. **Equipotential lines (Đường đẳng thế):** A line in an equipotential surface.
1593. **Flow channel (Lòng dẫn lưu lượng):** A channel between any two adjacent flow lines, which conveys a fixed part of the total discharge.
1594. **Potential drop (Bậc năng lượng):** The difference between any two adjacent equipotential lines.
1595. **Transformed flow-net (Mạng dòng chảy biến đổi):** A flow-net whose boundaries have been properly modified (transformed) so that a net consisting of curvilinear squares can be constructed to represent flow conditions in an anisotropic porous medium.
1596. **Transverse isotropy (Đẳng hướng ngang):** The orientation of the particles of sediment in a direction more or less parallel to the horizontal planes.
1597. **Seepage (Thấm).**
1598. **Infiltration (Ngấm (thấm lậu)).**
1599. **Percolation (Thấm thấu).**
1600. **Line of seepage, or Phreatic surface (Đường thấm hoặc Bề mặt giếng):** The surface separating the saturated ground through which seepage occurs, from the unsaturated ground above it.
1601. **Seepage force (Lực thấm):** The force transmitted to the soil grains by seepage.
1602. **Unit seepage force (Lực thấm đơn vị):** The measure of seepage force and is equivalent to the product of the hydraulic gradient and the weight of water (or other liquid).
1603. **Seepage velocity (Vận tốc thấm):** The rate of discharge of seepage water through a porous medium per unit area of void space perpendicular to the direction of flow.
1604. **Discharge velocity (Vận tốc lưu lượng):** Rate of discharge of water through a porous medium per unit of total area perpendicular to the direction of flow.
1605. **Elastic state of equilibrium, or Elastic equilibrium (Trạng thái cân bằng đàn hồi hoặc cân bằng đàn hồi):** State of stress within a soil mass when the internal resistance of the mass is not fully mobilized.
1606. **Floatation gradient (Gradiêng tách dài):** The hydraulic gradient at which soil particles get dislocated and are liable to be washed out.

1607. **Plastic equilibrium (Cân bằng dẻo):** State of stress within a soil mass or a portion thereof, which has been deformed to such an extent that its ultimate shearing resistance is mobilized.
1608. **Active state of plastic equilibrium (Trạng thái chủ động của cân bằng dẻo):** Plastic equilibrium obtained by an expansion of a mass.
1609. **Passive state of plastic deformation (Trạng thái chủ động của biến dạng dẻo):** The deformation obtained by an expansion of a mass.
1610. **Plastic flow, or Plastic deformation (Dòng chảy dẻo hoặc biến dạng dẻo):** The deformation of a plastic material beyond the point of recovery, accompanied by continuing deformation with no further increase in stress.
1611. **Progressive failure (Sự phá hoại dần):** Failure in which the ultimate shearing resistance is progressively mobilized along the failure surface.
1612. **Quick condition (quicksand) (Điều kiện chảy (cát chảy)): Condition in which water is flowing upward with sufficient velocity to reduce significantly the bearing capacity of the soil through a decrease in intergranular pressure.**
1613. **Shear failure, or Failure by rupture (Sự phá hoại cắt hoặc sự phá hoại do đứt gãy):** Failure in which movement caused by shearing stresses in a soil mass is of sufficient magnitude to destroy or seriously endanger a structure.
1614. **General shear failure (Sự phá hoại cắt tổng thể):** Failure in which the ultimate strength of the soil is mobilized along the entire potential surface of sliding before the structure supported by the soil is impaired by excessive movement.
1615. **Local shear failure (Sự phá hoại cắt cục bộ):** Failure in which the ultimate shearing strength of the soil is mobilized only locally along the potential surface of sliding at the time; the structure supported by the soil is impaired by excessive movement.
1616. **Flow failure (Sự phá hoại dòng):** Failure in which a soil mass moves over relatively long distances in a fluid like manner.
1617. **Flow slide (Trượt dòng):** The failure of a sloped bank of soil in which the movement of the soil mass does not take place along a well defined surface of sliding.
1618. **Hydrostatic pressure (Áp lực thủy tĩnh):** The pressure in a liquid under static conditions. The product of the weight of the liquid per unit volume and the difference in elevation between the given point and the free water surface.
1619. **Excess hydrostatic pressure, or Hydrostatic excess pressure (Áp lực thủy tĩnh vượt trội):** The pressure that exists in pore water in excess of the hydrostatic pressure.
1620. **Earth pressure (Áp lực đất):** The pressure or force exerted by soil on any boundary.
1621. **Active earth pressure (Áp lực đất chủ động):** The minimum value of earth pressure. This condition exists when a soil mass is permitted to yield sufficiently to cause its internal shearing resistance along a potential failure surface to be completely mobilized.

1622. **Passive earth pressure (Áp lực đất bị động):** The maximum value of earth pressure. This condition exists when a soil mass is compressed sufficiently to cause its internal shearing resistance along a potential failure surface to be completely mobilized.
1623. **Pore pressure, Pore water pressure, or Neutral stress (Áp lực lỗ rỗng, áp lực nước lỗ rỗng hoặc ứng suất trung hòa):** The pressure in the fluid within the voids of the soil.
1624. **Ice pressure (Áp lực băng):** Pressure produced by ice due to its thermal expansion and by wind drag. Its value is generally taken from empirical curves developed from field and laboratory tests.
1625. **Silt pressure, or Silt load (Áp lực bùn cát hoặc tải trọng bùn cát):** Pressure exerted by saturated silt deposited against upstream side of a water retaining structure. The horizontal component V of silt load as given by Rankine's formula neglecting friction, is:

$$V_s = (W_s h^3 / 2) [(1 - \sin \Phi) / (1 + \sin \Phi)]$$

where: W_s = submerged weight of deposited material

h = depth of material

Φ = angle of internal friction.

1626. **Effective stress, Effective pressure, or Intergranular pressure (Ứng suất hiệu quả, áp lực hiệu quả hoặc áp lực giữa các hạt):** The average normal force per unit area transmitted from grain to grain of a soil mass. It is the stress that is effective in mobilizing internal friction.
1627. **Critical hydraulic gradient (Gradiêng thủy lực tối hạn):** Hydraulic gradient at which the intergranular pressure in a mass of cohesionless soil is reduced to zero by the upward flow of water.
1628. **Effective force (Lực chủ động):** The force transmitted through a soil mass by intergranular pressure.
1629. **Total stress (Tổng ứng suất):** The total force per unit area acting within a mass of soil. It is the sum of the neutral and effective stresses.
1630. **Allowable bearing value, or Allowable soil pressure (Giá trị chịu tải cho phép hoặc áp lực đất cho phép):** The maximum pressure that can be permitted on foundation soil, giving consideration to all pertinent factors, with adequate safety against rupture of the soil mass or movement of the foundation of such magnitude that the structure is impaired.
1631. **Ultimate bearing capacity (Giá trị chịu tải cơ bản):** The average load per unit of area required to produce failure by rupture of a supporting soil mass.
1632. **Coefficient of earth pressure (Hệ số áp lực đất):** The principal stress ratio at a point in a soil mass.
1633. **Coefficient of active earth pressure (Hệ số áp lực đất chủ động):** The minimum ratio of (i) the minor principal stress to (ii) the major principal stress. This is

applicable where the soil mass is in its natural state without having been permitted to yield or without having been compressed.

1634. **Coefficient of compressibility, or Coefficient of compression (Hệ số khả năng nén hoặc Hệ số nén):** The secant slope for a given pressure increment of the pressure - void ratio curve. Where a stress - strain curve is used from a one - dimensional consolidation test, the slope of this curve is equal to:

$$M_v = \frac{a_v}{1+e}$$

where :

M_v = coefficient of volume compressibility

e = void ratio

a_v = coefficient of compressibility.

1635. **Coefficient of consolidation (Hệ số cố kết):** A coefficient utilized in the theory of consolidation, containing the physical constants of a soil affecting its rate of volume change.

$$C_v = \frac{k(1+e)}{a_v y_w}$$

where: k = coefficient of permeability (LT^{-1}), e = void ratio (D), a_v = coefficient of compressibility ($L^2 F^1$), y_w = unit weight of water (FL^{-3}).

Note: In the literature published prior to 1935 the coefficient of consolidation, usually designated c , was defined by the equation.

$$c = \frac{k}{a_v \cdot y_w (1+e)}$$

This original definition of the coefficient of consolidation may be found in some more recent papers and care should be taken to avoid confusion.

1636. **Coefficient of passive earth pressure (Hệ số áp lực đất bị động):** The maximum ratio of (i) the major principal stress and (ii) the minor principal stress. This is applicable where the soil has been compressed sufficiently to develop an upper limiting value of the major principal stress.
1637. **Coefficient of internal friction (Hệ số ma sát trong):** The tangent of the angle of internal friction.
1638. **Internal friction (Ma sát trong):** In soils, the portion of the shearing strength of a soil indicated by the term $p \tan f$ in Coulomb's equation $s = c + p \tan f$. It is usually considered to be due to the interlocking of the soil grain and the resistance to sliding between the grains.
1639. **Angle of internal friction (Góc ma sát trong):** Angle between the abscissa and tangent of the curve representing the relationship of shearing resistance to normal stress acting within a soil.
1640. **Angle of external friction, or Angle of wall friction (Góc ma sát ngoài hoặc góc ma sát của tường):** Angle between the abscissa and the tangent of the curve

representing the relationship of shearing resistance to normal stress acting between soil and the surface of another material.

1641. **Angle of repose (Góc nghỉ):** Angle between the horizontal and the maximum slope that a soil assumes through natural process. For dry granular soils the effect of the height of slope is negligible; for cohesive soils the effect of height of slope is so great that the angle of repose is meaningless.
1642. **Skin friction (Ma sát bề mặt).**
1643. **Wall friction (Ma sát tường):** Frictional resistance mobilized between a wall and the soil in contact with the wall.
1644. **Compaction (Sự nén chặt):** The densification of a soil by means of mechanical manipulation.
1645. **Consolidation (Sự cát két):** The gradual reduction in volume of a soil mass resulting from an increase in compressive stress.
1646. **Dilatancy (Sự trương nở):** The expansion of cohesionless soils when subject to shearing deformation.
1647. **Shear stress, Shearing stress, or Tangential stress (Úng suất cắt hoặc úng suất tiếp tuyến):** The stress component tangential to a given plane.
1648. **Shear strength (Cường độ chịu cắt):** The maximum resistance of a soil to shearing stresses.
1649. **Compressive strength, or Unconfined compressive strength (Cường độ chịu nén hoặc cường độ chịu nén tự do):** The load per unit area at which an unconfined prismatic or cylindrical specimen of soil will fail in a simple compression test.
1650. **Triaxial shear test, or Triaxial compression test (Thí nghiệm cắt ba trục hoặc thí nghiệm nén ba trục):** A test in which a cylindrical specimen of soil encased in an impervious membrane is subjected load confining pressure and then loaded axially to failure.
1651. **Consolidated drained test, or Slow test (Thí nghiệm tiêu nước cố kết hoặc Thí nghiệm chậm):** A soil test in which essentially complete consolidation under the confining pressure is followed by an additional axial (or shearing) stress applied in such a manner that even a fully saturated soil of low permeability can adapt itself completely (fully consolidate) to the changes in stress due to the additional axial (or shearing) stress.
1652. **Consolidated undrained test, or Consolidated quick test (Thí nghiệm cố kết không tiêu nước hoặc thí nghiệm cố kết nhanh):** A test in which complete consolidation under the vertical load (in a direct shear test) or under the confining pressure (in a Triaxial test) is followed by a shear at constant water content.
1653. **Unconsolidated undrained test, or Quick test (Thí nghiệm không tiêu nước không cố kết hoặc thí nghiệm nhanh):** A soil test in which time is not allowed for consolidation and the water content of the test specimen remains practically unchanged during the application of the confining pressure and the additional axial (or shearing force).

1654. **Soil classification systems (Hệ thống phân loại đất):** System of classification of soils based on recognition of the type and predominance of the constituents of soil considering grain size, gradation, plasticity and compressibility. Amongst the widely used soil classification systems are Unified Soil Classification System, USDA system and AASHO system of USA. Other countries also have their systems.
1655. **Dry unit weight, or Unit dry weight (Trọng lượng đơn vị khô hoặc trọng lượng khô đơn vị):** The weight of soil solids per unit of total volume of soil mass.
1656. **Effective unit weight (Trọng lượng đơn vị hiệu quả):** That unit weight of a soil which, when multiplied by the height of the overlying column of soil, yields the effective pressure due to the weight of the overburden.
1657. **Maximum unit weight (Trọng lượng đơn vị lớn nhất):** The dry unit weight defined by the peak of a compaction curve.
1658. **Saturated unit weight (Trọng lượng đơn vị bão hòa):** The wet unit weight of a soil mass when saturated.
1659. **Submerged unit weight, or Buoyant unit weight (Trọng lượng đơn vị ngập hoặc trọng lượng đơn vị Buyant):** The weight of the solids in air minus the weight of water displaced by the solids per unit of volume of soil mass; the saturated unit weight minus the unit weight of water.
1660. **Wet unit weight, or Mass unit weight (Trọng lượng đơn vị ướt hoặc trọng lượng đơn vị khối):** The weight (solids plus water) per unit of total volume of soil mass, irrespective of the degree of saturation.
1661. **Zero air voids unit weight (Trọng lượng đơn vị có độ rỗng không khí bằng không):** The weight of solids per unit volume of a saturated soil mass.
1662. **Arching (Neo):** The transfer of stress from a yielding part of a soil mass to adjoining less yielding or restrained parts of the mass.
1663. **Undisturbed sample (Mẫu nguyên dạng):** A soil sample that has been obtained by methods in which every precaution has been taken to minimize disturbance to the sample.
1664. **Heave (Sự trồi đất):** Upward movement of soil caused by expansion or displacement resulting from phenomena, such as moisture absorption, removal of overburden, driving of piles and frost action.
1665. **Piping, or Mechanical piping (Mạch lùng hoặc mạch lùng cơ học).**
1666. **External piping (Mạch lùng ngoài):** The piping which can be countered by inverted filters.
1667. **Internal piping (Mạch lùng trong):** A piping which displacement of separate particles of the ground takes place within the ground pores (in the foundation layer's thickness).
1668. **Local piping (Mạch lùng cục bộ):** A piping in which movement of a certain mass of ground takes place due, mainly, to the influence of seepage forces.

II.5. APPURTEANT WORKS CÁC CÔNG TRÌNH PHỤ TRỢ

- 1669. **Tunnel, or Temporary diversion tunnel (Tuy nén hoặc tuy nén dẫn dòng tạm thời):** A passageway constructed underground, through high ground or mountains open at both ends so as to provide a path for a road, rail - road, canal, water, sewer, drain, etc. Tunnels on irrigation projects (i) carry supplies of irrigation water through locations of high terrain that obstruct desirable canal routes, (ii) import supplies of irrigation water from adjacent drainage basins, (iii) provide temporary conduits for diversion of stream flows during the construction of dams and are called temporary diversion tunnels, and (iv) provide permanent conduits for spillway and outlet discharges at reservoirs after the dams are completed.
- 1670. **Pressure tunnel (Tuy nén áp lực):** A tunnel in which the water is under pressure, flows, full, and wets its entire perimeter as in pipes.
- 1671. **Free level tunnel, or Free flow tunnel (Tuy nén chảy tự do):** A tunnel in which water flows with a free water surface at atmospheric pressure.
- 1672. **Tunnel portal (Đầu tuy nén):** The structure built at the inlet (or entrance) and outlet (or exit) of the tunnel to support rock load, water - load, etc.
- 1673. **Tunnel portal transitions (Phần chuyển tiếp đầu tuy nén):** Structural arrangement at the inlets and outlets of tunnels. At the inlet, this arrangement changes the shape of the flow area from the approaching channel section to the normal tunnel section and at the outlet from the normal tunnel section to the exit channel section.
- 1674. **Cut-and-cover section (Đoạn đào và lấp kín mái):** A closed section of a waterway that is formed by first excavating an open channel in the ground and then roofing it over so that material may not slide into it (as opposed to a tunnel).
- 1675. **Adit (Đường vào):** Additional access tunnels provided to reach inside of a main tunnel for construction, repair and maintenance purposes. It may also apply to an access tunnel within concrete structures, such as dams and spillways.
- 1676. **Shaft (Tháp):** A pit or well sunk from the ground surface to a tunnel or gallery for the purpose of furnishing ventilation or for facilitating the work by increasing the number of points from which it may be carried on.
- 1677. **Overflow shaft (Tháp tràn):** Shafts in long pressure tunnels constructed to limit internal pressures and to serve as air vents for inlets during filling or emptying.
- 1678. **Pressure shaft (Đường hầm áp lực):** A tunnel designed to take up high pressure.
- 1679. **Rigid pressure shaft (Đường ống áp lực cứng):** A pressure shaft lined with sheet steel.
- 1680. **Flexible pressure shaft (Đường ống áp lực mềm):** A pressure shaft, the shell of which is made out of flexible corrugated steel sheets.

1681. **Lining (Lớp lót):**
1682. **Gunite (Vữa phun):** Gunite is a proportional combination of sand and Portland cement which is mixed and pneumatically conveyed in a dry state to a nozzle where water is added immediately prior to expulsion. Used as a watertight membrane.
1683. **Power conduit (Ống dẫn nước đến nhà máy thủy điện):** A conduit which conducts water from intake to the power house or surge tank if there be any.
1684. **Conduit (Ống dẫn nước):** It is a device for conveying water under an embankment, under pressure or at atmospheric pressure.
1685. **Power channel (Kênh dẫn năng lượng):** A channel constructed to carry water for power generation.
1686. **Bypass head regulator (Công trình điều tiết đầu nước bằng tràn qua):** It is an escape regulator provided upstream of the intake in a power plant to control level in the forebay. Sometimes automatic gates are installed at the bypass head.
1687. **Bypass channel (Kênh dẫn vòng):** A channel below the bypass head, which leads the escaped water again to the parent channel downstream of the power plant.
1688. **Forebay (Bể điều áp):** 1- A reservoir or pond at the head of a penstock or pipeline.
2- The water immediately upstream of any structure.
1689. **Race (Kênh dẫn vào hoặc ra):** The channel that leads water to or from a water wheel or water turbine, such as head race tail race.
1690. **Headrace (Kênh dẫn thượng lưu):** A channel leading water to a water wheel or water turbine; a forebay.
1691. **Tail race, or After-bay (Kênh dẫn hạ lưu hoặc Miền hạ lưu):** A channel conducting water away from a water wheel or water turbine.
1692. **Trash rack, or Rack (Lưới chắn rác):** A grid or screen composed of parallel bars to catch floating debris.
1693. **Coarse rack (Lưới chắn rác thô):** Trash rack to prevent large drift, such as cakes of ice, roots, trees and timber from being drawn into the conduit, usually kept vertical.
1694. **Fine rack (Lưới chắn rác tinh):** Trash rack to protect the machine and apparatus through which water flows. The clear opening between bars is made narrower than the narrowest part of the water passages of the machine to prevent clogging by material which passes the rack.
1695. **Raking (Cào rác):** Cleaning of the trash racks.
1696. **Hydroelectric power house, Power house building, or Power house superstructure (Nhà máy thủy điện, phần nhà máy hoặc kết cấu phần trên của nhà máy thủy điện):** A building housing and protecting the generating and control equipment.
1697. **Water turbine (Tuốc bin nước):** A rotating prime mover driven by water under pressure, often used for driving an electric generator.

1698. **Prime mover (Nguồn động lực):** A machine which converts fuel or other natural energy into mechanical power, such as an internal combustion engine, steam engine, water wheel, water turbine or steam turbine or windmill.
1699. **Spiral casing, or Scroll casing (Buồng xoắn tuốc bin):** The fixed circumferential casing of a reaction turbine of gradually contracting cross section, so designed as to impart to the incoming water an initial whirl component and to feed the water uniformly to the turbine runner.
1700. **Turbine setting (Sự bố trí tuốc bin):** The level at which the distributor or runner of the turbine is set with reference to the minimum tail water level.
1701. **Open pit setting (Bố trí tuốc bin trong hố hở):** A turbine setting in which the turbine is installed in an open pit, horizontally or vertically, and the turbine shaft passes from the pit into the machine room, if necessary, by means of a stuffing box. The turbine is always under water.
1702. **Vertical concrete spiral cased setting (Bố trí buồng xoắn bê tông theo phương đứng):** A turbine setting in which the turbine is installed in the vertical position and the water is guided by a spiral casing.
1703. **Siphon - pit setting (Bố trí tuốc bin trong xi phông):** A type of turbine setting used when the head is insufficient to provide a permanent water seal to the turbine. The water passes through the turbine under siphonic action.
1704. **Cased turbine (Tuốc bin lồng):** A turbine in which the water is conducted to it through pipelines, usually in case of high heads and in special cases, as in limited space for smaller heads also.
1705. **Draft tube, or Draught tube (Ống xả):** An expanding tube connecting the outlet passages of a turbine runner with the tail water.
1706. **Penstock (Ống áp lực):** A closed conduit for supplying water under pressure to water wheel or turbine.
1707. **Anchorage, Anchor block, or Anchor pier (Mố neo hoặc trụ neo):** A structure built to hold down penstocks in position at the points where the direction of the axis changes and also at some regular intervals.
1708. **Terminal anchors (Mố đầu cuối):** Anchors built at the outer ends of the penstocks and the upstream and downstream ends of the penstock and outlet headers.
1709. **Penstock piers, Penstock support, or Support piers (Mố trụ ống áp lực, mố đỡ ống áp lực hoặc trụ đỡ):** Intermediate supports for penstocks installed above the ground or in open tunnels, between the anchorages and designed to support normal component of the dead load of pipe and contained water and to resist longitudinal forces resulting from temperature changes. They are also designed for earthquake forces in areas subject to seismic disturbances, and further for lateral wind loads, if necessary.
1710. **Rocker support (Gối đỡ chống rung):** It is a support for penstock pipe and consists of rocker bents or frames supported at the bottom on concrete piers and

attached at the top to ring girders or stiffener rings around the pipe. The rockers move to and fro when the pipe moves.

1711. **Rocker (Khớp rung):** A casting used in supports which allows expansion by a rocking motion of the casting.
1712. **Thrust blocks (Khối tựa):** Supports built on either side of the branch connections to resist unbalanced forces at the penstock connection and thus to maintain alignment of outlet headers.
1713. **Cradle, or Cradle bridge (Giá đỡ hoặc cầu đỡ):** A footing structure shaped to fit the conduit if supports. Support for outlet headers having a function similar to that of thrust blocks. In addition to the weight of the pipe and stresses due to hydrostatic pressure and temperature variations, the cradles are subjected to outward thrust due to the reaction of the deflected water column.
1714. **Water hammer (Nước va):** The phenomena of oscillations in the pressure of water in a closed conduit, resulting from checking the flow; momentary pressure, greatly in excess, of the normal static pressure may be produced in this manner.
1715. **Elementary surge tank, or Simple surge tank (Tháp diều áp cơ bản hoặc tháp diều áp đơn giản):** It consists of a shaft as close to the turbine gates as possible so as to reduce penstock length and protect maximum lengths of the pipeline.
1716. **Conduit regulator, Surge tank, or Surge chamber (Kết cấu diều tiết ống, Bể diều áp hoặc buồng diều áp):** A tank with a free water surface provided at the transition from tunnel or pipeline to penstock to protect the tunnel or pipeline from excessive changes in pressure, rise in pressure in particular and which expeditiously maintains equilibrium in the system by storing or furnishing water required for the above purpose.
Note: Strictly speaking, "surge tank" or "surge chamber" is that vertical portion of the conduit regulator, which maintains free water surface, but in general usage, "surge tank" or surge chamber" is referred to as a "conduit regulator".
1717. **Multiple surge tanks (Bể diều áp kép):** More than one surge tank fitted at the transition of the pipeline to a penstock to obtain the same effect with less total area of the tanks.
1718. **Throttled surge tank, or Restricted orifice surge tank (Bể diều áp thất cổ chai hoặc bể diều áp lỗ giới hạn):** A type of surge tank in which inlet to the surge tank is narrowed with a view to speeding up pressure change (due to greater head at the inlet) and quickening damping of oscillations.
1719. **Differential surge tank (Bể diều áp lệch):** A type of throttled surge tank with an addition of a riser either in the centre or in the side.
1720. **Surge shaft with expansion chamber (Tháp diều áp có buồng mở rộng):** A kind of surge tank, in which an expansion chamber is provided at the junction of the surge tank and the pipeline to speed up the pressure change at that point.

1721. **Outlet works** (**Công trình lấy nước**): A collective term for all components of the means system provided at a dam for releasing water from a reservoir at a controlled rate. The term includes such items as the trash barrier, the conduits, the emergency and regulating gates or valves, the gate chamber or valve houses, and the stilling basin. The term excludes spillways.
1722. **Valve chamber, or Valve house** (**Buồng van hoặc nhà van**): A structure, housing the regulating valves, control mechanisms for operation of valves, equipment required to remove parts for repair, etc.
1723. **Inlet control, or Inlet structure** (**Không ché cửa vào hoặc kết cấu cửa vào**): A structure built at the upstream end of the outlet conduit of the outlet works and housing the regulating or emergency gates usually combined with the trash rack structure.
1724. **Intake structure, or Intake** (**Công trình lấy nước hoặc Cửa lấy nước**): A structure placed in a surface-water source to permit the withdrawal of water from this source.
1725. **Intake tower** (**Tháp lấy nước**): A structure used to draw water from lakes, reservoirs or rivers, in which there is a wide fluctuation in water level, or the desire to draw water at the most desirable depth, or both.
1726. **Movable intake, or Floating intake** (**Cửa lấy nước di động hoặc Cửa lấy nước nổi**): An intake built in stream with sloping banks and wide variation in surface elevation. As the river level changes, the discharge pipe on the intake is disconnected and the pump is run to the edge of the water on the track. The discharge pipe is then reconnected at the appropriate level.
1727. **Submerged intake** (**Cửa lấy nước chìm**): An intake structure constructed entirely under water.
1728. **Intake ports** (**Lỗ lấy nước**): The openings in the intake well (tower) which admit water into the tower from the source of water.
1729. **Wet intake tower** (**Tháp lấy nước ướt**): An intake tower which is filled with water to the level of the source of supply.
1730. **Dry intake tower** (**Tháp lấy nước khô**): An intake tower which has no water inside it other than in the intake pipe. Water is admitted through the ports connected to the intake pipes which convey it from the tower under pressure. The interior of the tower is accessible for inspection and operation.

II.5.1. SURPLUSING WORKS OR SURPLUS DISPOSAL WORKS CÔNG TRÌNH XẢ HOẶC TRỮ NƯỚC THÙA

1731. **Surplusing works** (**Công trình xả nước thừa**): Services or hydraulic structures and works to lead away surplus water (not required to be stored in the reservoir) safely

to the river lower down or to a natural escape or escapes. The surplus water may be carried out through or over the dam or the side ridges.

- 1732. **Spillway (Tràn):** 1- A passage for spilling surplus water; a wasteway. 2- A surplusing work over the dam or upstream of the dam in the side ridge, in form of an open or closed conduit.
- 1733. **Main spillway (Tràn chính):** The spillway which is designed to pass the spillway design flood and which usually comes into operation. The main spillway may be assisted by an emergency spillway in passing the design flood.
- 1734. **Spillway design flood (Lũ thiết kế tràn):** 1- The flood which, after a thorough study of the hydrology of the drainage area, has been decided to be carried past the dam, without failure of that structure during a stipulated time period. 2- The flood used in the design of a dam for sizing the spillway and for determining the flood storage or the flood subcharge during a determined time period.
- 1735. **Service spillway (Tràn phụ vận hành hồ):** Any spillway that may be utilized, whenever desired, without significant damage to the structure or downstream channel. As a general rule, service spillways have paved channels and, if necessary, to reduce velocities of outflow to non-eroding velocities, appropriate stilling basins.
- 1736. **Limited-service spillway (Tràn vận hành hạn chế):** Any spillway that may be utilized infrequently for operation of the reservoir without incurring excessive damage to the spillway structure by erosion or to downstream areas from deposition of eroded material. Some extraordinary maintenance expenditures at relatively infrequent intervals would be accepted in order to reduce initial project construction costs, but not to the extent of imposing significantly adverse limitations on the optimum utilization of the controlled storage capacity of the reservoir under normal operating conditions.
- 1737. **Emergency spillway, or Auxiliary spillway (Tràn sự cố hoặc tràn phụ trợ):** An excavated or natural channel, usually sited some distance from a dam, provided to permit the release of extraordinary flood flows or flood discharge beyond the capacity of the service spillway. Control is seldom furnished and a low embankment of earth may be used to allow the water surface of the reservoir to rise above the crest of the emergency spillway. If continued inflow causes overtopping of the embankment plug, it is intended that the plug shall wash away, releasing the excess water without endangering the main dam.
- 1738. **Fuse plug, or Breaching section (Tràn tự vỡ):** A term sometimes used to designate an "automatic spillway", especially when a low dike is built across a low saddle in the rim of the reservoir basin 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.
- 1739. **Automatic spillway (Tràn tự động):** A spillway which operates through the rise of water in the reservoir or canal, generally by lowering the spillway crest or increasing the area of the outlet.

1740. **Controlled spillway, or Gated spillway** (**Tràn có khống chế hoặc tràn có cửa**): A spillway having any type of control, i.e. crest control or crest gate at the crest to control the reservoir water surface.
1741. **Uncontrolled spillway, or Ungated spillway** (**Tràn tự do hoặc tràn không cửa**): A spillway, the crest of which permits water to discharge, whenever the reservoir surface is higher than the crest.
1742. **Overflow spillway, Overfall spillway, or Ogee type spillway** (**Tràn tự do, công trình tràn qua đỉnh hoặc tràn loại Ogee**): It is section of a dam designed to permit water to pass over its crest, widely used on gravity, arch, buttress and hollow dams.
1743. **Ogee** (**Đáy tràn Ogee**): A reversed curve, shaped like an elongated letter "S". The downstream faces of overflow dams are often made in this shape.
1744. **Rollway, or Overflow section** (**Đường tràn hoặc bộ phận tràn**): The overflow portion of a dam; an overflow spillway.
1745. **Separate spillway** (**Đáy tràn riêng biệt**): A spillway built as an appurtenant work and not as a section of the dam.
1746. **Circular drop inlet spillway, Shaft spillway, Morning glory spillway, or Glory hole spillway** (**Tràn cửa vào tròn, có bậc, tràn trụ đứng hoặc tràn hình hoa muồng, và tràn giếng**): Spillway consisting of entrance structures shaped like a vertical flared funnel with its top as the lip of the spillway, with central vertical or inclined shaft that carries discharge downward to tunnels leading to a river channel below the dams.
1747. **Glory hole** (**Hoa muồng**): The vertical part of the shaft of a glory hole spillway.
1748. **Standard-crested morning glory spillway** (**Đáy tràn hoa muồng đỉnh tiêu chuẩn**): A circular spillway, having its shape at the top confirming to the "standard crest". The water begins its free fall immediately upon leaving the crest .
1749. **Flat- crested morning glory spillway** (**Đáy tràn hoa muồng đỉnh phẳng**): A circular spillway composed of three parts: (i) sloping weir section, (ii) free falling section, and (iii) the vertical shaft section. The water is caused to approach the crest of the free falling section, on a flat slope before beginning its free fall.
1750. **Crotch** (**Điểm đáy**): It is the point in the vertical pipe where annular flow turns into a solid jet flow.
1751. **Trough spillway, or Chute spillway** (**Máng tràn**): A spillway isolated from the dam, having its crest normal to its centre line and having an open discharge channel to the river in an excavated trench which is usually paved with concrete in whole or in part. The crest or spillway proper is usually of an insignificant height or actually flat.
1752. **Chute** (**Dốc tràn**).
1753. **Side channel spillway, or Lateral flow spillway** (**Tràn bên hoặc tràn ngang**): A type of spillway, in which the flow after passing over a weir or ogee crest is carried away by a channel running essentially parallel to the spillway crest.

1754. **Plug (Nút):** A sealing of concrete or other materials to prevent flow.
1755. **Stepped spillway, or Cascade spillway (Tràn bậc hoặc tràn dốc):** A spillway having a series of steps on the face of the spillway for dissipation of energy by contact with successive steps.
1756. **Box-inlet drop spillway (Đập tràn bậc có cửa vào hình hộp):** A rectangular box open both at the top and at the downstream end; an outlet structure is attached to the open end of the box inlet.
1757. **Spillway elements, or Spillway components (Các bộ phận của tràn):** Parts of a spillway which convey, control, carry away discharge, destroy excess energy and finally lead water to an outlet channel and comprising all or some of the following: (i) entrance channel, (ii) control structure, (iii) discharge carrier, (iv) energy dissipator, (v) spillway outlet channel.
1758. **Entrance channel (Kênh dẫn vào):** A channel which conveys water from the reservoir to the control structure of a spillway.
1759. **Control structure (Kết cấu không chế):** A stage-discharge regulating device of the spillway. It may be of any form, viz, weir, side channel, glory spillway, orifice, tube, pipe or a channel.
1760. **Normal control structure (Kết cấu không chế thẳng góc):** A control structure in which water approach is normal to its crest and passes through the structure with no general change in direction in the form of open channel or shaft or tunnel. The normal control structure is essentially a weir.
1761. **Discharge carries, or Face of the spillway (Bộ phận dẫn lưu lượng hoặc mặt tràn):** It is that portion of a spillway which extends from the control structure to the energy dissipator or to the downstream end of the spillway.
1762. **By-wash, By-channel, or Natural escape (Đập tràn bên, kênh dẫn vòng hoặc xả tự nhiên):** It is a type of spillway or escape channel for a small reservoir which passes flood waters around a dam rather than over a dam.
1763. **Spillway outlet channel (Kênh dẫn ra của tràn):** A channel connecting the stilling basin or the downstream end of the spillway either to the parent channel or another drainage.
1764. **Siphon spillway (Tràn xi phông):** A spillway operating on the siphon principle.
1765. **Siphon, or Syphon (Xi phông):** A closed conduit (duet) a part of which rises above the hydraulic grade line. As this upper part is subjected to subatmospheric pressure the siphon must first be primed by exhausting air from it.
1766. **High head siphon (Xi phông đầu nước cao):** A siphon acting under a difference in water level of more than the barometric height of the water column, i.e. 10.33 metres.
1767. **Low head siphon (Xi phông đầu nước thấp):** A siphon acting under a difference in water level of less than the barometric height of the water column, i.e. less than 10.33 metres.

1768. **Saddle siphon, or Hood siphon (Xi phông yên ngựa hoặc xi phông thuận):** A siphon having its duct formed of a U-shaped hood. The inlet lip of the hood is submerged below the full reservoir level and that of the outlet lip terminates in a water seal formed by various devices. The siphons are, sometimes, named according to the water seal provided.
1769. **Siphon duct, or Siphon barrel (Thân xi phông hoặc khoang xi phông):** It is the annular space between the dam (body wall) and the hood.
1770. **Hood, or Cowl (Mũ hoặc chụp):** It is a U-shaped body or structure made of reinforced concrete and used over the body wall to form a siphon duct.
1771. **Inlet, or Mouth (Cửa lấy nước hoặc miệng xi phông):** 1- The normal distance between the entrance lip of the hood and the body wall. 2- The section between the entrance lip of hood and the body wall through which water enters the siphon.
1772. **Entrance lip of hood, Upper lip of hood, or Upstream lip of hood (Mép cửa vào của mũ, mép trên của mũ):** The upstream edge of the hood which has to remain submerged below the full reservoir level for siphonic action to begin.
1773. **Upper limb, or Upper leg (Bờ trên hoặc nhánh trên):** The portion of the hood from the inlet lip to the crown.
1774. **Crown (Đỉnh):** The highest ridge of the hood.
1775. **Throat (Họng):** The vertical distance between the highest point of the crest of the dam (body wall) and the tower surface of the hood.
1776. **Lower limb, or Lower leg (Bờ dưới hoặc nhánh dưới):** The portion of the hood between the crown and the exit lip.
1777. **Exit lip of hood, Downstream lip of hood, or Lower lip of hood (Mép ra của mũ, mép hạ lưu hoặc mép thấp của mũ):** The downstream edge of the lower limb.
1778. **Water seal (Vật chắn nước):** A device using water for effectively shutting off air or gas entry into a chamber. This device is often used in siphons. There are a number of such devices, viz. (i) cup basin type water seal, (ii) tilted outlet type, (iii) obstruction weir type, (iv) baby siphon type or maramsilli baby siphon type, (v) auxiliary siphon type (vi) overfall weir or priming weir type, (vii) mechanically induced type, (viii) Tudel or stepped or offset or Joggle type, (ix) clear overfall type, (x) baffle type.
1779. **Cup basin type water seal (Vật chắn bằng nước loại bể cốc):** A water seal made effective by dipping the lower limb of the hood into a cup like basin provided on the downstream end.
1780. **Tilted outlet type water seal (Vật chắn nước loại cửa ra nghiêng):** A water seal made effective by an improvised tilted outlet pipe on the downstream end.
1781. **Obstruction weir type water seal (Vật chắn nước loại đập dâng cản):** A water seal provided by a low weir (subsidiary dam) constructed downstream of the body wall (dam).

1782. **Baby siphon type water seal, or Maramsilli baby siphon type water seal (Vật chắn nước loại xi phông con):** In this case, water seal is provided by a baby which, being at a lower level, gets primed earlier and its issuing jet seals the downstream end of the siphon duct. A siphon employing this device is called a "Maramsilli baby siphon".
1783. **Baby siphon, or Maramsilli baby siphon (Xi phông con hoặc xi phông con Maramsilli):** The smaller siphon operating at a lower level than the main siphon in the Maramsilli baby siphon. Sometimes, the baby siphon is also referred to a "Maramsilli baby siphon".
1784. **Auxiliary siphon type water seal (Vật chắn nước bằng xi phông phụ trợ):** A water seal made effective by the provision of a baby siphon placed either in front or by the side of the main siphon. The two siphons are connected through a pipe conduit.
1785. **Overfall weir type water seal, or Priming weir type water seal (Vật chắn nước bằng tràn đỉnh hoặc loại đập dâng mới):** A water seal made effective by the mingling of two overflowing opposite nappes in the duct near the crest of the body wall (dam). A small receptacle to admit water from the reservoir for the above purpose is located opposite the crest.
1786. **Mechanically induce water seal (Vật chắn nước cơ học):** Water seal obtained by mechanical means, such as (i) by installing an air pump to suck out air from siphon, (ii) by installing a flexible steel plate at the crest and projecting into the siphon duct.
1787. **Tudel type water seal, Stepped type water seal, Offset type water seal, or Joggle type water seal (Vật chắn nước loại Tudel, có bậc khuỷu hoặc Joggle):** Water seal obtained by providing a step or a series of steps at the rear of the body wall to throw water on the inner surface of the lower limb.
1788. **Clear overfall type water seal (Vật chắn nước loại tràn đỉnh không cản):** A water seal obtained by rounding off the crest of the body wall and keeping the lower siphon duct vertical.
1789. **Baffle type water seal (Vật chắn nước loại bệ phản):** A water seal made effective by constructing a baffle or step in the outlet invert.
1790. **Battery of siphons (Dãy xi phông):** A number of siphons installed close to each other.
1791. **Volute siphon (Xi phông dạng xoắn ốc):** A siphon consisting of a battery pipe (barrel), the vertical portion of which is usually funnel shaped at the top. Volutes are placed on the funnel or outside the vertical pipe near its top due to which it owes its name. The funnel is covered by a dome placed at some distance. The dome is supported by a cylindrical drum resting on pillars leaving an annular space around the funnel.
1792. **Volutes, Internal volutes, or External volutes (Các xoắn ốc trong hoặc ngoài):** Curved vanes or projections placed on (i) the inner sloping surface of the funnel of

the siphon (**internal volutes**) or (ii) on the outside vertical pipe near its tip (**external volutes**) to induce spiral motion to the water entering the vertical pipe (barrel).

1793. **Priming (Mồi):** In case of siphons, it is the operation of exhausting air from the siphon.
1794. **Priming time (Thời gian mồi):**
1795. **Volute priming (Mồi xoắn):** The priming effected by the action of volutes in a volute siphon by the way of imparting spiral motion to the entering water.
1796. **Primer (Vật mồi):** A priming device.
1797. **Priming depth (Chiều sâu mồi):** The depth of water above the crest of a siphon or the lip of volute channel or pipe attained during priming time.
1798. **Priming siphon (Xi phông mồi):** A siphon device, usually of smaller capacity, installed with a main siphon or battery of siphons to reduce priming depth in the latter.
1799. **Deprimer (Thiết bị phá chân không):** A device which breaks the priming in a siphon by admitting air through its inlet end located at the full reservoir level or a little below this.

II.5.2. ENERGY DISSIPATION DEVICES - THIẾT BỊ TIÊU NĂNG

1800. **Stilling basin, Tumble way, Hydraulic energy dissipator, Water-stilling device, or Energy dissipating device (Bể tiêu năng, đốc tiêu năng, vật tiêu năng, thiết bị làm lảng nước, thiết bị tiêu năng):** A structure below a spillway, chute or drop in which all or part of the energy dissipation occurs and in which kinetic energy is converted into turbulent energy.
1801. **Water cushion, Stilling pool, or Cistern (Đèm nước, bể lảng hoặc bể chứa):** A pool of water maintained to take their impact of water overflowing a dam, chute, drop, or other spillway structure.
1802. **Hydraulic jump basin, or Hydraulic jump dissipator (Bể nước nhảy thủy lực hoặc tiêu năng bằng nước nhảy thủy lực):** A stilling basin in which energy is dissipated by the hydraulic jump principle.
1803. **Free jet stilling basin, or Free jet basin (Bể tiêu năng bằng dòng phun tự do):** A stilling basin where the water jet emerging from an outlet discharges above the tail water level in the air and then plunges into the basin, dissipating energy largely by turbulence.
1804. **Free jet chute, Free jet parabolic drop, or Parabolic chute (Đốc nước phun tự do, bậc nước parabol phun tự do hoặc đốc parabol):** A chute having the profile of a free jet (parabolic) provided in cases where the centre line of the jet is above the stream bed elevation.

1805. **Free jet chute basin** (**Bể tiêu năng cho tràn dốc phun tự do**): A stilling basin in which the flow enters through a free jet chute, and energy is destroyed by the hydraulic jump principle.
1806. **Jet diffusion basin, or Jet diffusion stilling basin** (**Bể khuếch tán năng lượng dòng phun**): A stilling basin where the energy is dissipated by the jet diffusion principle, to reduce the length of the basin normally required by the hydraulic jump.
1807. **Submerged jet diffusion stilling basin** (**Bể tiêu năng khuếch tán dòng phun ngập**): A stilling basin in which the entering jet is completely submerged below the tail water level and its energy is dissipated by the jet diffusion principle.
1808. **Hump stilling basin, or Hump basin** (**Bể tiêu năng sóng trâu**): When the centre line of a jet emerging from an outlet is below the stream bed elevation, but not too far to be completely submerged by the tail water, a hump in the stilling basin floor may be provided to spread the jet and permit the formation of a stable hydraulic jump. The stilling basin in this case is called a "hump stilling basin", or "hump basin".
1809. **Impact stilling basin, or Impact basin** (**Bể tiêu năng va đập**): A type of stilling basin initiated by the need for relatively smaller basins to provide energy dissipation independent of tail water variations or any tail water at all.
1810. **Roller type stilling basin** (**Bể tiêu năng nước cuộn**): A stilling basin having an end sill above which surface roller and below which ground rollers form energy dissipation; the tail water depth being usually greater than that required for hydraulic jump.
1811. **Bhavani stilling basin** (**Bể tiêu năng Bhavani**): A type of stilling basin developed for lower Bhavani Dam (India) with depressed apron having T-shaped floor blocks.
1812. **SAF basin** (**Bể SAF**): Stilling basins designed by Saint Anthony Falls Hydraulic Laboratory, USA, for drainage structures. They have an end sill and a row each of chute blocks and floor blocks.
1813. **Energy-reducing action, or Energy dissipation action** (**Hoạt động tiêu năng**): A phenomenon, such as hydraulic jump, jet diffusion, ski-jump, which dissipates energy mainly by turbulence. Energy dissipation actions are accordingly named as hydraulic jump action (method or principle), jet diffusions principle or ski-jump principle.
1814. **Hydraulic jump** (**Nước nhảy thủy lực**): The sudden and usually turbulent passage of water from low level below critical depth to high level above critical depth during which the velocity passes from supercritical to subcritical state. It represents the limiting condition of the surface curve where it tends to become perpendicular to the streambed.
1815. **Standing wave** (**Sóng đứng**): 1- A wave formed on the surface of a body of water when a stream enters such a body at a high velocity. The energy of the entering stream is dissipated by turbulence and by maintaining the water dissipated by turbulence and by maintaining the water comprising the wave at the higher

elevation above the normal surface of the body of water. 2- A sudden rises in the water surface, generally fixed in position, such as a hydraulic jump; a standing wave may exist, however, where the hydraulic jump is not involved. 3- A type of wave in which the surface of the water oscillates vertically between fixed nodes without progressing. The points of maximum vertical rise and fall are antinodes, or loops. It may be the result of two equal progressive waves travelling through each other, but in opposite directions.

- 1816. **Diffusion (Sự khuếch tán):** It is molecular and molar mixing of a fluid.
- 1817. **Jet diffusion (Sự khuếch tán dòng phun):** A method of energy dissipation, used in the case of high velocity jets. It is accomplished by directing the water jets from an outlet sharply towards the bottom, rather than over the tail water surface.
- 1818. **Deflector hood (Mũi làm lệch dòng):** A curved deflector, used in jet diffusion method, to prevent the jet from being torn apart by induced eddies until it is well submerged.
- 1819. **Fine grain turbulence (Độ rói hạt nhỏ):** Small energy-dissipating eddies, such as created by jet diffusion.
- 1820. **Ski-jump (Nước nhảy trượt):** An action occurring when a high velocity jet is thrown into air from a spillway. It is attacked by air and jets are disintegrated due to (i) internal turbulence (ii) shearing action of the air surrounding it, and (iii) the surface tension and fall down in the shape of cascades and droplets.
- 1821. **Ski-jump Bucket, or Ski-jump dissipator (Mũi hắt nước nhảy trượt hoặc kết cấu tiêu năng các tia nước tự phá):** A bucket which enables the high velocity jet of water to be thrown.
- 1822. **Jet (Tia dòng):** The stream of water issuing at high velocity from an orifice or nozzle or similar opening.
- 1823. **Free jet (Tia dòng phun tự do):** A jet having atmospheric pressure along its surface.
- 1824. **Hollow jet, or Annular jet (Tia dòng rỗng hoặc tia dòng bán nguyệt):** A jet having an annular cross section, with little or no flying spray, and the centre core, composed of air, is ventilated.
- 1825. **Solid jet (Tia dòng đặc):** A jet having no annular space or cavities.
- 1826. **Partially submerged jet, or Partially drowned jet (Tia dòng bán ngập hoặc tia dòng chìm một phần):** A jet whose central line is below the tail water level, but not too far below to cause the jet to be drowned out by the tail water during operation.
- 1827. **Submerged jet, or Drowned jet (Tia dòng ngập):** A jet completely drowned under water.
- 1828. **Bucket type energy dissipator (Mũi hắt tiêu năng):** A type of energy dissipator in which a bucket is used in place of a sloping apron or stilling basin. Applicable in case of spillways below which the stream bed is composed of rock.

1829. **Solid roller bucket dissipator (Mũi hắt tiêu năng tạo dòng cuộn đặc):** A bucket type energy dissipator which consists a bucket-like apron with a concave, circular profile of considerable radius and a lip which deflects the high-velocity flow away from the stream bed and upward forming elliptical hydraulic rollers, viz. submerged rollers in the bucket, and ground rollers downstream of the bucket. Energy dissipation is accomplished by the interaction of the submerged roller in the bucket and the high turbulence created on the water surface above and below the bucket. Suitable when the tail water depth is moderately in excess of that required for the formation of a hydraulic jump.
1830. **Slotted roller bucket dissipator (Mô tiêu năng dạng mũi hắt tạo dòng cuộn):** A bucket type energy dissipator in which the lip wall is made up of alternate teeth and slots and below which a sloping apron is provided. This construction of the bucket materially reduces the intensity of the surface boil and ground rollers.
1831. **Bucket (Mũi hắt):** 1- A curved surface at the toe of an overflow dam designed to deflect the water horizontally; the transition curve between the overflow face and the apron of a dam. 2- A curved vane or blade on the rim of an impulse water wheel that receives the impact of the water from the nozzle.
1832. **Invert wall, or Bucket lip wall (Tường ngược hoặc tường mép mũi hắt):** The upturned portion of the invert having a lip.
1833. **Bucket lip (Mép mũi hắt):** The top surface of the invert wall.
1834. **Height of bucket lip (Chiều cao của mép mũi hắt):** The distance from the lowest concave surface in the bucket to the top of the lip.
1835. **Bucket invert, or Bucket arch (Đáy mũi hắt hoặc vòm mũi hắt):** The concave surface of the bucket.
1836. **Bucket invert elevation (Cao trình đáy mũi hắt):** The elevation of the lowest concave surface in the bucket invert.
1837. **Dentated bucket lip (Mép răng cưa của mũi hắt):** A bucket lip having protruding teeth over its length.
1838. **Bucket teeth (Chân răng của mũi hắt):** The protruding parts between the two slots of the slotted bucket.
1839. **Bucket apron (Sân sau của mũi hắt):** Apron laid downstream of the teeth of the bucket.
1840. **Trajectory bucket, or Flip bucket dissipator (Mũi hắt nhẹ):** A type of energy dissipator, employed in cases where the tail water depth is less than that required for the formation of a hydraulic jump by throwing water away from the teeth of the dam in the form of a projectile.
1841. **Kreuter dissipator, or Kreuter brake (Vật tiêu năng kiểu Kreuter):** An energy dissipator used for pipe flows. The water flows out of the pipe radially in the form of a disc. Hydraulic rollers form on and under the disc. Dissipating the energy of the water to such an extent that it flows quietly over the edges of the basin and

- safety joints the tail race. It is of two types: (i) top inlet type in which the flow from the pipe falls down on the disc and (ii) in the bottom inlet type, the flow shoots upward on the disc.
1842. **Contra-jet energy dissipator, or Interacting jet dissipator (Vật tiêu năng bằng các tia dòng đối nhau):** In this type of dissipator, jets of water form two openings or nozzles are directed against each other in a basin. In the plane of contact of the colliding jets in the form of a disc, and induces the formation of hydraulic rollers.
1843. **Schoklitsch dissipator (Vật tiêu nước kiểu Schoklitsch):** An energy dissipator designed by Prof. Schoklitsch for spillways and drops. In this case, a slightly battered drop is provided at the downstream end of the bucket and a sill is provided at the end of the stilling pool. The dimensions of different parts are determined by curves given by Prof. Schoklitsch.
1844. **Pfeiffer energy dissipator (Vật tiêu năng Pfeiffer):** It consists of a stilling pool without end sill. Water is also drawn from the reservoir through gate valves provided at the bottom of the dam and is admitted to the apron through openings from below.
1845. **Stilling basin appurtenances (Cấu trúc phụ trợ của bể tiêu năng):** Structure such as blocks, end sills, baffles, installed in the stilling basin to help improve its performance by increasing turbulence and obtaining the desired flow conditions downstream.
1846. **Blocks, Baffle piers, Friction blocks, Control blocks, or Floor blocks (Các mố, trụ cản, mố ma sát, mố khống chế):** Obstructions set in the path of high velocity water, such as piers, on the apron of an overflow dam, weir or drop, to dissipate energy, prevent scour downstream and also to control the position of a hydraulic jump.
1847. **Staggering of blocks (Phân bố các mố tiêu năng):** It is the method of placing blocks in two rows in such a manner that the blocks of the second row face the spaces between the blocks of the first row.
1848. **Chute Blocks (Mố tiêu năng của dốc nước):** Blocks provided at the entrance of the stilling basin to stabilize the formation of hydraulic jump, to increase effective depth, to break up flow into a number of water jets, to create turbulence and to lift the jets off the floor to reduce the basin length.
1849. **Diffusion blocks (Mố phân tán):** Blocks constructed on an upturned apron in case of varying tail water level to help increase diffusion activity and reduce velocity. These blocks are of special design.
1850. **Upturned apron (Tấm lát lồi):** Any apron sloping upwards in the direction of flow.
1851. **Arrows (Mố hình mũi tên):** V- Type blocks kept with their vertex on upstream side in the path of flow.
1852. **Dent, Dental, or Tooth (Răng):** A tooth-like projection on an apron, or other surface, to deflect or break the force of flowing water; a form of baffle.

1853. **Deflector, or Triangular end sill (Mố lái dòng hoặc nguồng cuối hình tam giác):** A sloped continuous wall provided at the end of a rigid apron to deflect the high velocity stream near the bed and to form ground rollers downstream of it to bank up bed material against it and thus protecting the apron from being undermined.
1854. **Jet deflector (Mố lái tia dòng):** A sector shaped block with a sloping arris which cuts the high velocity jet emerging from an outlet for the purpose of flaring out the jet laterally into a fan-shaped sheet.
1855. **Spillway spitter (Vật phân dòng tràn):** A horizontal block fixed on the downstream face of the spillway to split the stream.
1856. **Spillway bucket spitter (Vật phân dòng tràn dạng mũi hất):** A bucket type projection along the downstream face of the spillway to dissipate energy.
1857. **Tunnel spillway bucket, or Tunnel deflector (Mũi hất của tràn tuy nén hoặc mố lái dòng tuy nén):** A device to deflect and spread the high velocity flow high into the air and permit the dissipation of energy at a safe distance downstream from the tunnel outlet.
1858. **Baffle wall, or Baffle (Tường phản áp):** A cross wall, set of vanes or guides, a grid, grating, or similar device placed in a conduit to check eddy currents below them, and to effect a more uniform distribution of velocities and to dissipate energy.
1859. **End sill, or End baffle (Nguồng cuối bể, tấm phản áp cuối bể):** A vertical, stepped, sloped or dentated wall constructed at the downstream end of a stilling basin. It is rectangular, triangular, trapezoidal, Hornsby, Schoklitsch, Smetana and Rehbock type.
1860. **Rectangular end sill (Nguồng cuối hình chữ nhật).**
1861. **Trapezoidal end sill (Nguồng cuối hình thang).**
1862. **Hornsby end sill (Nguồng cuối Hornsby).**
1863. **Schoklitsch end sill (Nguồng cuối Schoklitsch).**
1864. **Smetana end sill (Nguồng cuối Smetana).**
1865. **Rehbock dentated end sill (Nguồng chân răng Rehbock).**
1866. **Splitter wall, Divider wall, or Vanes (Tường phân dòng hoặc thiết bị hướng dòng):** Longitudinal walls provided in open channels or basin expansions, for recovery of head and equalization of outlet velocity or reduction in expansion length.
1867. **Dentated sill (Nguồng có chân răng):** A notched sill at the end of an apron to check the force of flowing water and thus reduce erosion below the apron. The sill also reduces bed velocity.
1868. **Spillway training wall (Tường lái dòng của tràn):** Walls built at the sides of the face of the spillway with the top set at an elevation so that maximum tail water for the design discharge will be contained within the spillway portion with sufficient freeboard considering spray and air entrainment.

1869. **Stilling basin training wall** (**Tường bên của bể tiêu năng**): Walls built at the two sides of the stilling basin with the top set at an elevation so that maximum tail water for the design discharge will be contained within the stilling basin with sufficient freeboard considering the spray and air entrainment of the turbulent water.
1870. **Bucket training wall** (**Tường bên của mũi hắt**): Walls built at the sides of the bucket with top set at an elevation so that maximum tail water for the design discharge will be contained within the bucket portion with sufficient freeboard considering spray and air entrainment.
1871. (**Đường cong xác định mực nước hạ lưu hoặc đường cong lưu lượng hạ lưu**): A curve showing between the discharge and the corresponding tail water stage.
1872. **Jump height curve** (**Đường cong xác định chiều cao nước nhảy**): A curve showing relationship between discharge intensity and the subcritical conjugate depth determined for hydraulic jump formation.
1873. **Hydraulic rollers, Circular roller, Elliptical roller, Vertical roller, Horizontal roller, Inclined roller, Submerged roller, or Surface roller** (**Các cuộn nước thủy lực, xoáy cuộn hình tròn, xoáy cuộn elíp, xoáy cuộn đứng, xoáy cộn ngang, xoáy cuộn nghiêng, xoáy cuộn ngập hoặc xoáy cuộn mặt**): Flow having circular or elliptical motion round a vertical, horizontal or inclined axis and giving appearance of a roller. The roller formation may occur within or at the surface of the stream. According to their shapes, they are named as circular or elliptical rollers. According to the direction of the axis they are designated as vertical, horizontal or inclined rollers, and according to the location they are called submerged or surface rollers.
1874. **Jet trajectory** (**Quỹ đạo tia dòng**): The profile of the free jet.
1875. **Ground roller** (**Xoáy cuộn đáy**): A reverse flow in the form of rollers in an upstream direction along the streambed usually formed downstream of the end sills, deflectors and lip walls.
1876. **Plunge pool, or Plunge basin** (**Bể tiêu năng tia cắm**): A natural or sometimes artificially create pool which dissipates the energy of free falling water. The basin is located at a safe distance downstream of the structure from which water is being released.

II.5.3. GATES AND VALVES - CỦA VAN VÀ VAN

1877. **Over-pour, or Over-shot run** (**Dòng chảy tràn qua cửa**): Condition where water spills over the gate.
1878. **Orifice run, or Under-shot run** (**Chảy qua lỗ hoặc chảy qua cửa van**): Condition where water discharges through the space between the sill and the bottom of the gate or between upper and lower gates.

1879. **Hydraulic gate, or Gate (Cửa van hoặc van):** A device consisting of a structure made of wood, metal or other material, for controlling the flow of water through a passageway or an opening in a structure.
1880. **Gate seal (Vật cách nước cho cửa van):** Leakage preventing material or device provided at the sides and bottom of the gates, at the top also where the gate is submerged under water.
1881. **Open channel gate (Cửa trên kênh hở):** A gate which closes a channel or opening having a wetted perimeter consisting of two sides and a sill, the surface of the retained water being about level with top of the gate and free to atmosphere.
1882. **Submerged-face gate, or Culvert gate (Cửa ngập hoặc cửa cống luôn):** A gate which closes and opening having a wetted perimeter consisting of all four sides, the free surface of the retained surface being above the top of the gate opening.
1883. **Crest control devices (Thiết bị khống chế đỉnh):** This term is used to include those types of controlling devices which raise or lower the effective crest level, thus regulating the volume of flow over their top surfaces or edges. These devices, generally, make use of the headwater pressure to raise or lower the damming structure and utilize relatively small differences in elevation of headwater to automatically regulate discharge, viz. flashboards, drum gates, bear trap shutters, tilling gates.
1884. **Crest gates (Cửa đỉnh):** Gates mounted upon a crest for the purpose of maintaining and controlling the level of the upstream.
1885. **Sill (Ngưỡng).**
1886. **Counterweight tifting (Thiết bị nâng đối trọng):** The weight of the gate is balanced by counterweights so that the operating machinery has only the frictional resistance to overcome.
1887. **Hinged gates, or Swing gates (Cửa bản lề hoặc cửa lật):** Gates, operation of which depends upon fixed or movable hinges, they are also, sometimes, referred to as "swing gates".
1888. **Fixed hinged gates (Cửa bản lề cố định):** Hinged gates in which the hinges remain fixed in position and the shutting surfaces are either directly connected with the hinges (lifting gates, shutters), or they themselves are not hinged, but are connected with hinges through supporting frames (radial gates, drum gates). In the former case, the gates are called "hinged leaf gates".
1889. **Hinged-Leaf gates (Cửa phẳng có bản lề):** Gate consisting of a rigid flat leaf hinged operation at bearing along the lower (upstream) edge.
1890. **Movable-hinged gate (Cửa bản lề di động):** A hinged gate in which, during operation the hinge may move bodily up and down, e.g. Sidney gate.
1891. **Flashboard, or Stop plank (Ván chớp hoặc tấm ngăn):** A plank, or slab, generally held horizontally by end girders or by other supports, in a slit, on the crest of a dam, regularly check structure, or in a spillway to control the water level; a stop plank.

1892. **Temporary flashboards (Ván chớp tạm thời):** Flashboards loosely inserted into sockets set in the crest of a dam, weir gate, which may either be removed before high water is anticipated or are washed away when the headwater surface reaches elevation above the top of the flashboards.
1893. **Stop logs, Baulks, Planks, Regulation planks, or Kurries (Phai chắn):** Logs, planks, cut timber, steel or concrete slabs or beam, fitting the grooves, made into the faces of two opposite walls or piers, to close an opening to a passage of water. In case where regulation is effected by such devices, they are called "regulation planks" (logs, kurries, baulks).
1894. **Needle (Kim):** 1- A timber set on a stream bed or weir crest or regulating gate to close an opening for the control of water; it may be either vertical or incline; a form of a stop plank. 2- A closing member as in needle valves.
1895. **Shutter (Cửa sập):** A gate consisting of a panel or leaf rotating about a horizontal axis used for control of water over crests. Size of a shutter is limited by that which can be raised against a modest head of water by manual labour; usually applied to falling shutters.
1896. **Semi-Automatic Shutters, Self-Tipping Shutters, Falling Shutters, Falling Crests, or Permanent flash boards (Cửa sập bán tự động, cửa sập tự lật, cửa sập thả rơi, đinh rơi hoặc ván chớp cố định):** The shutters which fall automatically when the normal headwater level is exceeded and are raised again manually.
1897. **Ashford shutter (Cửa sập Ashford):** A type of falling shutter in which a strut (on the downstream) is used to support the shutter, which can be released by a lever. There is a separate strut for each shutter which itself revolves round the hinge at the bottom. The whole shutter system falls automatically if one lever is released. This is accomplished by slightly projecting the lever beyond the end of the shutter and providing a hinge in the middle of the lever.
1898. **Bengal shutter (Cửa sập Bengal):** A type of falling shutter which consists of two leaves hinged at the same place. The upper one is shorter and is supported by a chain. The lower leaf is of full height and in its raised position rests against a strut. When the shutter is to be raised, water is admitted below the upstream leaf in the recess made for that purpose. It then rises. The downstream leaf is lifted manually or mechanically and secured to the strut. The upstream leaf automatically falls down, when the downstream leaf has been raised. The upstream leaf helps in raising the downstream leaf.
1899. **Fouracres shutter (Cửa sập Fouracres):** A type of falling shutter consisting of two leaves, the upstream and the downstream. The former is fitted with six telescopic struts which, when water is admitted below the leaf, enables it to rise gradually. The latter (downstream) has seven tension bars hinged to it. It is raised by tackle and held by tension bars after the upstream gate has been raised. The

- upstream leaf is then lowered and the pond is maintained against the downstream leaf only.
1900. **Automatic shutter** (*Cửa sập tự động*): A shutter which maintains a required headwater level with all discharges.
 1901. **Counterweight shutter** (*Cửa sập có đối trọng*): It is an automatic shutter which maintains the required head water level by a counterweight system and which may be placed over or under the shutter. The shutters are accordingly designated as "over counterweight shutter" and "under counterweight shutter".
 1902. **Over-counterweight shutter** (*Cửa sập đối trọng trên*).
 1903. **Under-counterweight shutter** (*Cửa sập đối trọng dưới*).
 1904. **Hydraulic shutter** (*Cửa sập thủy lực*): An inclined shutter supported by a plunger, which has a roller at the top. The plunger is worked by a hydraulic ram. The roller slides along the shutter and operates the shutter.
 1905. **Bear trap shutter (gate)** (*Cửa sập ổ đỡ (cửa van)*): A type of automatic shutter consisting essentially of two leaves, hinged and sealed at the base. The two leaves also have a sliding hinge or seal at their junction. Operation is effected by the pressure under the gate by an adjustable weir or by the setting of inlet and outlet valves in a control chamber in the abutments or piers. Also called " bear trap weir".
 1906. **European bear trap shutter (gate)** (*Cửa sập có ổ đỡ kiểu châu Âu (cửa van)*): A bear trap shutter in which a vertical lip is added to the upstream leaf, which carries rollers bearing on the downstream leaf. The downstream leaf is curved at the upper end.
 1907. **American bear trap shutter (gate)** (*Cửa sập ổ đỡ kiểu Mỹ (cửa van)*): A type of shutter gate with many variations having provision to reduce friction between the leaves to avoid track accumulation and to allow raising the gate with a small differential head.
 1908. **Tilting gate, Hinged-leaf gate, or Automatic flap gate** (*Cửa mái nhà, cửa phẳng lắp bản lề hoặc cửa lật tự động*): A gate having a rigid flat leaf, inclined downward, hinged at bearing along its lower (upstream) edge and operating automatically to maintain a water level by means of a mechanical hoist or counterweight arrangement.
 1909. **Whiting's gate, or Whiting's self-acting waste weir gate** (*Cửa Whiting hoặc cửa dâng đập dâng tự vận hành Whiting*): A tilting type gate which is hinged at the base and is counterbalanced by Whiting's system.
 1910. **Whiting's counterbalancing system** (*Hệ cân bằng đối trọng Whiting*): The counterweight is housed in a chamber which has a large inlet pipe with its mouth just below the full reservoir level and a small exit pipe kept constantly open. The outflow is less than the inflow and hence buoyancy is exerted over the counterweight, which helps in its automatic operation.

1911. **Walton's rising sill gate (Cửa có nguồng nâng Walton):** It is essentially tilting gate hinged at the base with an additional hinged flap at the downstream end. It is used to admit water into canals when silt is present and it is claimed that by causing a standing wave to form downstream, a given discharge can be obtained under a smaller head than with conventional types of canal head gates and consequently less silt is admitted into the canal.
1912. **Bascule gate (Cửa nâng):** This gate is constructed by the S. Morgan Smith Company of the United States and is essentially a hinged flashboard. A gate leaf is attached to a torsion cylinder, which extends beyond the full gate length into gate-operating chambers in the piers. Hydraulic (oil) cylinders located in the operating chambers turn the torsion cylinder through an angle of about 90° to raise or lower the gate.
1913. **Drum gate (Cửa trống):** A hollow steel plate movable barrier having the cross section of a sector of a circle hinged at the apex. The cylindrical face effects a water seal with the edge of a recess into which the gate may be lowered. The gate is raised and held up by the pressure of water admitted to the recess from the forebay. It is lowered by closing the inlet port to the recess and draining the water from it.
1914. **Wicket (Cửa phu):** The upper leaf of a drum gate.
1915. **Counter wicket (Cửa phu dưới):** The lower leaf of a drum gate.
1916. **Stickney gate (Cửa Stickney):** A forerunner of the drum gate. It has two perpendicular leaves with lengths so proportioned that the pressure of water on the lower leaf supports the gate against the headwater acting on the upper leaf. As the upstream water level rises, the pressure on the upper leaf increase much more than on the lower, causing it to tilt and pass the water. When the level falls, the gate is restored to its closed position.
1917. **Automatics spillway gate (Cửa tràn tự động):** A gate which responds to flood levels without manual control.
1918. **Vertical lift gate (Cửa kéo thẳng đứng):** A general term used to designate all rectangular gates operating vertically in grooves in their own plane.
1919. **Slide gate (Cửa trượt):** A gate which can be raised or lowered by sliding in vertical guides. A sluice gate in which the gate is sealed at the sides by being pressed against the guide grooves by the water pressure and the bottom by being pressed by the bottom of the gate coming in contact with the bottom of the frame; i.e. with the sill member.
1920. **Double gates (Cửa đúp):** Sluice gates used in tiers to effect any type of operation, i.e. complete closure, raising over free water surface; overshot run, undershot run or any combination of them or flow between upper and lower gates.
1921. **Bulkhead gate (Cửa ngăn):** A hydraulic gate of which the operating member moves in the guides provided in the sides of the conduit to engage with the sealing element. This gate is subjected to relatively high heads and is operated under

balanced pressures only and is usually operated by gantry cranes, with or without the help of gate-lifting devices, as intake bulkhead gate, draft to be bulkhead gate.

1922. **Intake bulkhead gate (Cửa ngăn cống lấy nước):** A bulkhead gate located at the upstream end of a river outlet, conduit or a penstock.
1923. **Draft-tube bulkhead gate (Cửa ngăn ống xả):** A bulkhead gate used to permit dewatering of the draft tubes or inspection and repair of turbine parts and draft tubes and is placed over the draft-tube portal under no-flow conditions, although there may be considerable tailrace turbulence at the time.
1924. **Fixed axle gate, Fixed wheel gate, Fixed roller gate or Fixed wheel gate (Cửa van trục cố định, cửa van bánh xe cố định hoặc cửa van trục quay cố định):** A sluice gate consisting primarily of a skin plate mounted on beams that are supported by vertical girders at the gate sides. Wheels or rollers are attached to the girders which transmit water load on the gate to tracks attached to the piers or abutments. The fixed position of the wheels or rollers with respect to the gate gives the name to this type of a gate.
1925. **Truck-mounted gate (Cửa van gắn trên thanh ray):** A type of fixed wheel gate, used where unusually long and relatively shallow gate is needed, particularly in rivers where large drift or heavy ice may be encountered during floods. In such gates, the effects of deflection under water load and of variations from level in operation are more pronounced than in gates of more usual proportions. The truck mounting provides for the necessary flexibility and is particularly adaptable to a rugged type construction.
1926. **Surface type fixed-wheel gate (Cửa van bánh xe cố định bê mặt):** Fixed wheel gate having a height not less than the water head upstream and installed at crests of spillways, etc.
1927. **Tunnel type fixed-wheel gate (Cửa van bánh xe cố định loại tuy nến):** Fixed wheel gate operated in a vertical shaft above a tunnel with heads at any practical height above the gate height and stauching on the upstream side of the gate.
1928. **Submerged type fixed-wheel gate, or Face type fixed-wheel gate (Cửa van bánh xe cố định loại ngập hoặc cửa van bánh xe cố định loại mặt):** Fixed-wheel gate having a height less than the operating heads, such as at the face of a dam or intake structure and stauching on the downstream side of the gate.
1929. **Roller train (Bộ truyền động lăn):** It is composed of horizontal cylindrical rollers held by shafts usually into continuous vertical bars on each side.
1930. **Stoney gate, or Free roller gate (Cửa van Stoney hoặc cửa van trục lăn tự do):** A gate in which roller trains are introduced between bearing surfaces in the gates and on the frames attached to the piers or abutments. The roller travel at half the speed of the gate to the frame. Axle friction is eliminated and only roller friction is developed.
1931. **Caterpillar gate (Cửa van dây xích kéo):** A type of a free roller gate in which the roller trains are arranged as continuous chains. The rollers are connected by links

and the assembly travels round a continuous track which is framed into the end of the gate.

1932. **Broome gate (Cửa van Broome):** A type of gate in which the roller paths are in a planer relatively inclined to the sealing faces thus allowing the gate to move downstream on to its seat it reaches in closed position.
1933. **Skin plate (Tấm mặt cửa van):** That part of a metal gate which takes the water load and transfers it to the supporting gate structure.
1934. **Coaster gate (Cửa van Coaster):** It is a name used to identify a roller-mounted, high-head structural steel gate. A Coaster gate consists primarily of a skin plate supported by horizontal beams which, in turn, are supported by vertical girders at the sides. Continuous roller trains are mounted around the vertical girders and transmit the load to tracks in the face of the structure used for closing off flow through penstocks and outlet conduits under usually high heads or far large sizes, where fixed wheel gates would be impractical due to the necessarily greater frictional resistance.
1935. **Tractor gate (Cửa van loại có máy kéo):** A gate in which gate leaf assembly is suspended on the steel cables attached to the hoist above. The roller carriages carry and support each side of the gate leaf through interposed inclined roller trains in a manner similar to the usual paradox gate. The arrangement is such that the gate leaf, cross head, and attached roller carriages with their wedge roller trains all travel as a single entity during the period when they are being lowered from the top of the dam until the leaf comes opposite to the inlet opening and vice versa. Used as a high head intake gate.
1936. **Reinold's gate (Cửa cửa Reinold):** It is a vertical lifting, fixed roller gate, operated by Whiting's counterweight system. Named after its designer.
1937. **Visvesvaraya gates (Cửa Visvesvarays):** It is a system of vertical lifting and fixed-roller gates operated by Whiting's counterweight system. In addition to the above, (i) better sealing in closed position is provided by tapering the bearing surfaces of the gates and the sluice frame in opposite direction and (ii) better control is provided by tagging a group of gates on to a single counter-balance mechanism. To reduce capacity of counterweight some of the gates in a group may be lowered below the crest while the remaining may be raised above high flood level. Water to the weight chamber is admitted through several sluice valves located at different elevations. Named after its designer.
1938. **Radial gate, or Tainter gate (Cửa cung hoặc cửa Tainter):** A pivoted or hinged gate, the face of which is usually a circular arc with the centre of curvature at the pivot. Tainter gate is another named for radial gates in the honour of its inventor Burnham Tainter.
1939. **Hook type Tainter gate, or Hook gate (Cửa cung loại móc hoặc cửa móc):** It has two leaves and often in vertical as well as radial position. The upper leaf is of hook type, light, and rolls over the shield of the lower leaf, when discharge has to be

- passed over the gate. It has the advantage of passing considerable discharge over the gate without lifting the heavy bottom leaf.
1940. **Sidney gate (Cửa Sidney):** It is a movable hinged radial gate. It can also be raised bodily by raising the pivots along the roller guides.
1941. **High pressure outlet (Cửa xả áp lực cao):** An outlet may be considered as such when it controls and regulates the release of water for various conservation purpose from dams, reservoirs and conduits under heads in excess of 25 metres and when the discharge is not less than 4 cubic metres per second when operating at maximum capacity.
1942. **AMIL gate, AVIO gate, or AVIS gate (Cửa van AMIL, AVIO hoặc AVIS):** A type of radial gate designed to automatically maintain the water surface at a predetermined constant level. These gates essentially consist of a gate leaf, a float and a counterweight fixed on a frame which pivots around a horizontal axis. The movable part is balanced by a counterweight placed so that the centre of gravity of the whole structure has a well-defined position and, therefore, the gate is in equilibrium when the water surface to be controlled is on a level with the axis of articulation, i.e., at a constant level. This type of a gate includes two forms: (i) the AMIL gates (for constant upstream water level) and (ii) the AVIO or AVIS gates (for constant downstream water level). In the former, the float and the leaf are on the same side with respect to the axis of articulation, and in the latter, the float and the leaf are on opposite sides with respect to the axis of articulation.
1943. **High pressure gates (Cửa van chịu áp lực cao):** High pressure gates are used in outlet works of dams. They are generally installed in tandem, with the upstream gate serving as an emergency gate and the downstream gate as a regulating gate. They are often used as emergency gates in combination with needle valves and hollow jet valves. The gates may be operated as emergency gates under heads up to 75 metres and as regulating gates under heads up to 55 metres. The gate is fitted with air inlets.
1944. **High pressure gate frame, or High pressure gate casting (Khung cửa chịu áp lực cao hoặc khuôn cửa chịu áp lực cao):** It is a hollow casting of iron or steel of a desired cross section having appreciable longitudinal length to form water passage upon upstream and downstream sides of the gate leaf.
1945. **Seal bars, or Leaf seal bars (Các thanh chống dò rỉ hoặc các thanh chống dò cánh cửa van):** Metallic bars mounted on the gate leaf, usually on downstream face to transfer water pressure to the seal bars.
1946. **Seal bars, or Supporting seat bars (Thanh chống dò hoặc các thanh bổ trợ):** Metallic bars attached in the recess of gate frame to act as a mating surface to seal bars and to transfer water pressure to the gate frame and finally to the surrounding concrete structure.
1947. **Standard high pressure gate (Cửa van chịu áp lực cao tiêu chuẩn):** A sliding type rectangular or square high pressure gate. The gate leaf is received, supported

and guided in its opening and closing movements in a vertical slot or recess formed by two water tight gate frames, bolted together. The gate leaf is mounted with bronze seal bars (of a different composition) attached to the downstream sides of the slot walls. The slot recesses in the gate frames are continued upward in the envelope or bonnet castings, whose lower flanges are bolted to a flange formed on the top of the gate frame. During open position, the gate leaf is received in the bonnet. The bonnet cover converges into a circular flange upon which a hydraulic hoist cylinder is bolted, which operates the gate using oil as a medium.

- 1948. **Emergency gate (Cửa van sự cố):** A shut-off gate usually provided in penstocks for conduit service, in addition to a regulating valve or gate. It is so located and so controlled that its closure under emergency unbalanced conditions will stop all flow through the conduit and is assured for any except, extremely improbable, combinations of circumstances.
- 1949. **Guard gate (Cửa dự phòng):** A gate provided at the upstream end of the sluice to shut out the flow for inspection and repairs of the lining and of the regulating gate or valve lower down.
- 1950. **High head radial gate (Cửa van cung chịu cột nước cao):** A radial gate employed for flow control in submerged openings or sluiceways. The limits of the operating head on this gate are governed by practical limitations of spouting velocity and other hydraulic behaviour, which have not been fully explored.
- 1951. **Ring follower gate (Cửa van khuyên tròn):** A sliding leaf type high pressure gate for circular penstocks and is primarily used as emergency gate upstream of a regulating valve or service gate. The gate is followed up by an extended circular ring (a leaf having circular hole) of a diameter equal to the internal diameter of the conduit, which forms the unobstructed water passage when the leaf is in the open position. The operating mechanism is usually a hydraulic cylinder and piston connected to the leaf by a stream passing through a packing in the valve body. It is operated either in a fully open or fully closed position.
- 1952. **Gate hanger (Thiết bị treo cửa van):** A device to hold the gate open.
- 1953. **Semi-automatic gate hanger (Thiết bị treo cửa van bán tự động):** A gate hanger which can hold the gate leaf in the open position only, used with emergency high pressure gates ahead of another high pressure gate.
- 1954. **Hydraulic gate hanger (Thiết bị treo cửa van thủy lực):** A gate hanger actuated by hydraulic pressure.
- 1955. **Paradox gate (Cửa van Paradox):** A high pressure service gate used as a companion to the ring follower gate for opening or closing off flow under heads up to and in excess of 180 meters.
- 1956. **Ring seal gate (Cửa van có vật kín nước hình khuyên):** It is a high pressure gate and an improvement over the paradox gate. It is similar to a paradox gate in that it is operated by an electric motor hoist with twins systems and has a ring follower beneath the leaf. It differs from the paradox gate in that the hoist systems, instead of

extending vertically above the gear cases, are turned downward into the bonnet below and that the endless roller trains are shortened and support the leaf only, whereas the ring follower portion is carried by four wheels. For the same size, the height and weight of this size is less than the paradox gate.

1957. **Jet flow gate (Cửa van dòng phun):** A high pressure gate used as a regulating gate either at the discharge end of, or at any intermediate point in, a conduit. It consists of a leaf gate mounted on wheels and operated by means of a motor, gear reduction unit, and a pair of threaded systems or hydraulic cylinder hoist. A jet is created by the provision of a nozzle ahead of the gate such that the issuing jet skips over the gate slot without touching the downstream edge of the slot.
1958. **Bypass valve, or Filling valve (Van dẫn vòng giảm áp):** A subsidiary gate installed downstream of the main gate to facilitate reduction in the capacity of the hoist by filling the intervening section of the conduit which tends to equalize water pressure on the two sides of the main gate and thereby the differential pressure acting on the main gate.
1959. **Circular type gates (Cửa van tròn):** Gates installed along circular openings. The whole gate body, circular in plan, moves as one unit, viz. ring gates, cylinder gates.
1960. **Cylinder gate (Cửa van xylanh):** It is essentially a hollow cylinder open both at the top and the bottom placed in the waterway.
1961. **Ring gate (Cửa vòng):** It is a hollow, annular drum, seated within a hydraulic chamber. The upper surface of the chamber, in conjunction with the upper surface of the lowered ring gate, forms the spillway crest. The gate is raised or lowered as one complete unit by its own buoyancy in water introduced under control from the reservoir into the chamber.
1962. **Rolling gate, or Rolling weir (Cửa lăn hoặc đập lăn):** A hollow cylindrical gate with spur gears at each end meshing with an inclined rack anchored to a recess in the end pier or wall. It is raised or lowered by being rolled on the rack. It may close at a greater depth than its diameter by means of shields or aprons attached to the cylinder.
1963. **Apron, or Shield (Tấm đế hoặc tấm vỏ):** 1 - A steel structure extending along the length of the cylinder in a roller gate at its bottom or top to effect seal of the water level when the gate is at the lowest point of its travel. 2 - The water bearing surfaces of roller and radial gates
1964. **Standard roller gate (Cửa lăn tiêu chuẩn):** A roller gate attached with the bottom shield (apron) to effect sealing. The shield rests on the crest when the gate is at the lowest point of its travel. The water does not flow over the cylinder.
1965. **Submersible roller gate (Cửa lăn chìm):** It is of a standard roller gate type but differing in its operation. In this case, the bottom shield (apron) goes below the crest level and water flows over the cylinder and submerges it.

1966. **Small roller with shields roller gate (Cửa lăn có tấm đáy và bánh xe nhỏ):** A roller gate in which the hollow cylinder is of smaller dimensions; over its upstream face, a sector of bigger dimensions (making upper and lower shields) is attached.
1967. **Sector gate (Cửa van hình quạt):** A Tainter gate except that it has hinges along its length, whereas the Tainter gate is hinged only by its two arms.
1968. **Greisser gate (Cửa Greisser):** A type of roller gate in which the roller wheel and the face are both sectors instead of complete circles. The face is not concentric with the wheel but is concentric with the point of contact between the wheel and the rail when the gate is nearly closed. It may also be conceived as a Tainter gate rolling upward on segment circumscribed upon the pin and the top of the face and of which the upper arms forms the chord. Named after its designer.
1969. **Head gate (Cửa đầu mối):** The control works, or the gate itself at the entrance to a conduit.
1970. **Overpour gate, Ice gate, Ice shutter, Ice wicket, or Ice flap (Cửa tràn đỉnh, cửa băng hoặc cửa chặn băng):** A gate of smaller height provided at the top of the lift or roller gates or panel wall to pass ice or floating drift without damaging the structure of the main gate. It may be named according to its particular use viz. ice gate, drift gate.
1971. **Drift gate (Cửa xả vật nổi).**
1972. **Fish belly flap (Cánh cửa van hình bụng cá):** A hollow flap (gate leaf), the lower plating of which simulates the belly of a fish. This form has an excellent resistance to torsion stress.
1973. **Fish belly flap gate (Cửa van hình bụng cá).**
1974. **Bifurcation gate (Cửa phân nhánh):** A gate in a structure which divides the flow between two conduits.
1975. **Flap valve, or flap gate (Van luôi gà hoặc cửa van luôi gà):** 1 - A flap used at the outlet end of the pump-discharge pipes in order to prevent a return flow from the discharge line or discharge bay, when the pump is stopped. 2 - A hinged flap fitted on the lift gate or roller gate used for the disposal of trash (ice and drift) or the precise regulation of water level. 3 - A type of gate often used on flood protection schemes especially on tidal stretches. It is designed to open when the upstream level is slightly in excess of the downstream water level, allowing water to follow downstream. If, however, the downstream water level should rise say, due to tidal influence, it closes and prevents reserve flow from downstream to upstream. The gate is normally designed to withstand the maximum possible downstream head when in a closed position, with no head on the upstream side.
1976. **Mitering gate (Cửa chữ nhân):** It consists of a pair of hinged symmetrical leaves abutting against each other in the centre with vertical faces, and open against a so-called mitre sill, and at the top about a neck journal. Frequently used in locks.

1977. **Tumble gates (Cửa sập):** A single leaf gate which turns about a horizontal axis on the floor of the gate bay. In the lowered position, it lies on the floor of the gate bay and in the raised position, it remains slightly inclined upstream; used in locks.
1978. **Radial lock gate (Cửa cung âu thuyền):** A radial gate used in a lock. It is required to be raised high enough to provide necessary clearance to the passing traffic.
1979. **Lock (Âu thuyền).**
1980. **Flood gate (Cửa phòng chống lũ):** Gates having their top edge at a higher level than that of the highest flood stage to check the flood water to enter the structure behind, viz. used in a river.
- Note:** Gates which are opened to release flood are also described as "flood gates".
1981. **Hydraulic valve, or Regulating valve (Van thủy lực hoặc van áp lực):** In general, a valve to regulate or control flow in conduits, pipelines and penstocks. It is of such construction that the closing member operates and remains within the water passage.
1982. **Needle valve (Van kim):** The term "needle valve" is usually applied to a valve having a circular orifice which is closed by a conical plunger closing in the direction of the flow. It is used for regulating purposes, which necessitates operation of the valve for long periods of time at any opening from fully closed to fully open.
1983. **Ensign valve (Van Ensign):** It is the earliest regulating valve designed by O.H. Ensign of Bureau of Reclamation (U.S.A), first installed in 1909. The entire valve is submerged in the reservoir with the needle moved by the reservoir water pressure by controlling the pressure in an interior chamber. Because of this form and lateral admission of water, this valve is placed at the intake end of the conduit and consequently is not protected by a guard gate. Susceptible to cavitation.
1984. **Motor-operated needle valve (Van kim vận hành bằng mô tơ):** A needle valve in which the position of the needle is controlled by a motor-operated rod.
1985. **Balanced needle valve (Van kim cân bằng):** An improved design valve without Bull Ring or the annular external ring about the needle. The needle is moved by water pressure from the outlet conduit, which acts on the interior chambers in the valve. The movement is controlled by a hand wheel installed above the valve, with the motion transmitted through shafting and gearing to a positioning device inside the valve.
1986. **Internal differential needle valve (Van kim chênh lệch trọng):** An improved type of balanced needle valve. In the design of these valves, the interior is divided into three tandem aligned pressure chambers formed by fixed diaphragms inside the needle, supported by a heavy diaphragm tube concentric with the axis of the valve with the rear end terminating in a flange bolted to the upstream conical end of the needle receiving cylinder formed integrally with the valve body. The rear end of the needle is closed off by a hemispherical head, provided with a bushed hub which rides upon the diaphragm tube as the needle and its attached head moves back and

forth in opening and closing the valve. The exterior cylindrical surface of the needle is telescopically mounted in an enclosing cylinder which is supported by radial ribs extending through the water passage from the wall of the exterior shell. Pressure introduction in the first and the last chambers which are interconnected, leads to closing, and pressure releasing from these and introducing in the central chambers produces a force upon the inner face of hemispherical needle head, which lead to opening of the valve.

Because of the external bull ring, previously employed to secure opening movement of the needle, was replaced by the enhanced area of the annular interior surface of the needle head, these valves derive the name of internal differential needle valves.

1987. **Paradox control (Khống chế Paradox):** It is an automatic mechanical follow-up valve, which control water pressure to ensure positive positioning of a needle (closing member). This control is arranged to cause the needle (closing member) to follow the movement of the control device (stand hand wheel) and to automatically maintain the needle (closing member) in the position set by the control device (stand hand wheel). A position indicator is provided in the control stand to give the operator the exact needle position.

This control system makes it possible to move hydraulically the needle through out the extreme ranges of travel without requiring the presence of water in the conduits. It also makes the routine inspection and scale-removal operations much easier to perform.

1988. **Interior differential needle valve (Van kim chênh lệch bên trong):** It is an improvement in mechanical design over the internal differential needle valve. The needle, in this case, telescopes over a member fixed to the valve body known as the body extension. The extension diameter of the needle body forms the inner boundary of the annular water passage through the valve. The changed construction and rearrangement of the parts in this valve results in the first chamber (upstream) becoming a complete chamber (downstream), the central chamber being provided in the body extension and the last chamber downstream being changed from a complete chamber to the annular chamber owing to the diaphragm tube being fastened to the needle.

1989. **Tube valve (Van ống):** It is further involved design of the needle valve. The water passages are similar to the internal differential valve except that the downstream end of the needle is omitted. A tube or hollow cylinder similar to that of the cylinder gate, instead of a needle, comprises the moving part of the valve. This is actuated by a hydraulic cylinder and piston and a pressure pump or by a screw with an electric motor, or by manual control.

1990. **Hollow jet valve (Van phun tia rỗng):** This valve is essentially a needle valve with the needle, or closure member, pointing upstream. The nozzle is eliminated allowing the water to discharge from the bell shaped body in a tubular or hollow jet, the outside diameter of which does not change regardless of the valve opening.

This valve is, primarily, used in outlet works and is located on the downstream end of the outlet pipes. The water discharged may be closely regulated over the entire opening range of the above.

1991. **Inline tube valve (Van ống trùng tâm):** Tube valves used in the central conduit. These are longer and have nozzles at 30° which are susceptible to cavitation at partial discharges.
1992. **Free discharge tube valves (Van ống xả tự do):** Tube valves used at the downstream ends of conduits, are shorter and have nozzles at 45°. The issuing jet is unstable at lower discharges.
1993. **Howell-bunger valve (Van Howell-bunger):** A valve having two telescopic cylinders with a streamline dispersing cone secured to the inner cylinder by radial webs. The apex and axis of this cone are coincidental with the centreline of the conduit and valve body, and its apex faces upstream. The outer cylinder closes the sideway opening between the cone and the inner cylinder when it is slid in position. In its open position, the water is discharged on the sides of the cylinder in the form of highly diverging nappe hollow inside, in the shape of the surface of a cone.
1994. **Butterfly valve (Van bướm):** It is essential consists of a cylindrical or conical body with a circular leaf mounted on a transverse shaft which is carried out in two bearings, diametrically opposite each other, in the valve body. An external operating mechanism rotates the leaf 90° to move it from a fully closed to a fully opened position. Used in penstocks as a service or emergency gate and is usually placed immediately upstream from the turbine case and also as a shut-off regulating valve in outlet.
1995. **Shut-off devices (Thiết bị chặn dòng chảy):** Devices built into pipelines at places to permit shutting off the flow when necessary.
1996. **Bypass mechanism (Kết cấu dẫn vòng):** A device fitted in a high pressure pipe to fill the pipe below the valve to equalize pressures on both sides of the valve without opening the valve.
1997. **Ball valve, or Rotary valve (Van bi hoặc van xoay):** A device to close a pipe by rotating a sphere in which there is a hole having a diameter equal to that of the pipe, e.g. used at the entrance to a turbine casing.
1998. **Gate valve (Van cửa):** It is a shut-off device used in a pipe. The pipe is closed with a wedgeshaped plug or gate, which can be moved up and down perpendicular to the pipe axis.
1999. **Air valve (Van không khí).**
2000. **Blow off (Cửa thông dòng):** A controlled outlet on a pipeline used to discharge water or detritus.

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Chịu trách nhiệm xuất bản

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