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INDUSTRIAL PLANTS

Chapter twenty-six:

Piping – Fluid distribution plants – Sources of water supply

DOUBLE DEGREE MASTER IN

“PRODUCTION ENGINEERING AND MANAGEMENT”

SEAT OF PORDENONE

UNIVERSITY OF TRIESTE

Source of water supply

Mode of derivation

The sources of supply of water are:

- public aqueducts;
- surface water (sea, rivers, canals etc.);
- groundwater (ground water and artesian).

The choice of the power source depends on the requirements of the water and the chemical-physical characteristics, the depth of the groundwater and the relative abundance of water, by the proximity of aqueducts, rivers, the unit cost of the water etc.

In establishments where water consumption is relevant can be used if possible, to mixed solutions for industrial water.

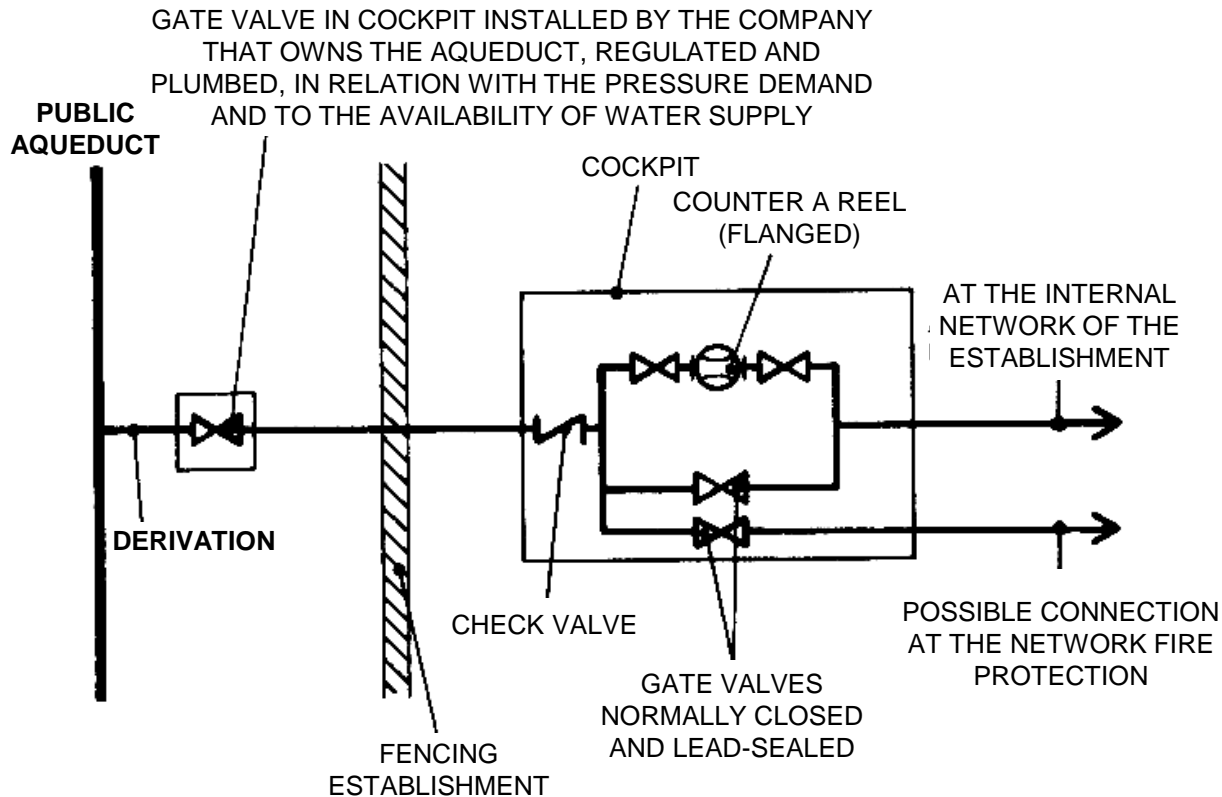
We want to emphasize that in Italy there are many laws that regulate the use of groundwater and the derivation and use of public waters, subject to regular license by the Ministry of Public Works for large derivations and the regions for small derivations.

Source of water supply

Mode of derivation

a) derivation from waterworks

Provision must be made a particular connection visible in the figure.

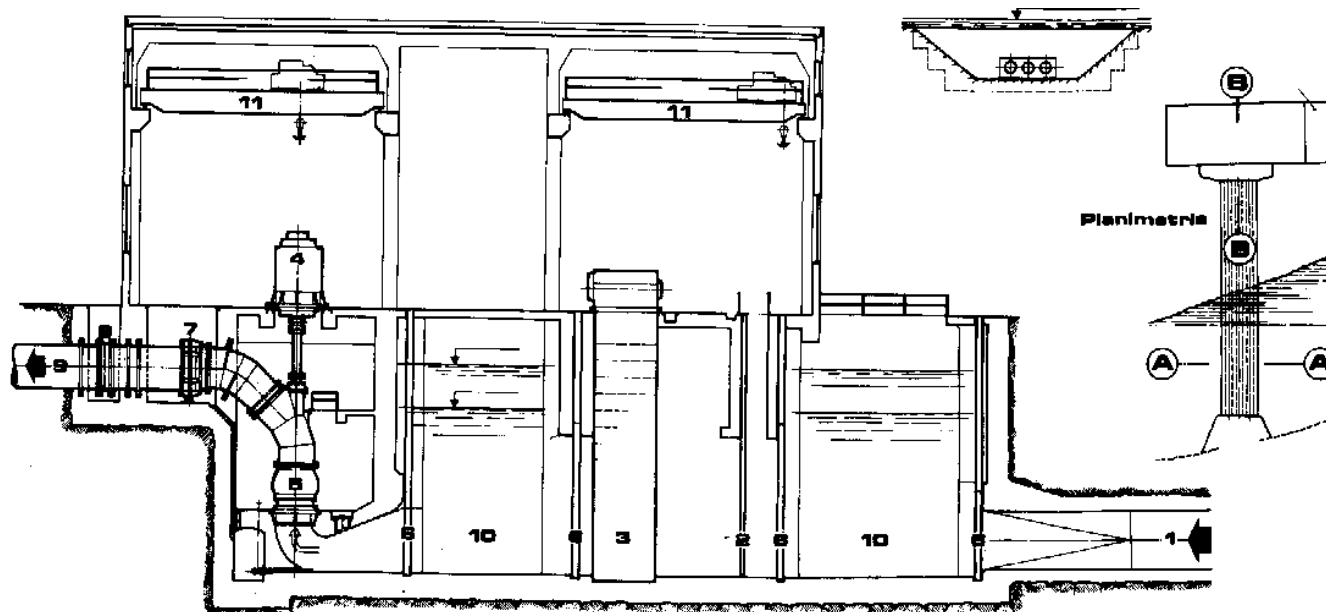


Source of water supply

Mode of derivation

b) derivation by surface water

The taking of sea water is via one or more lines that extend at an appropriate distance from shore (intake structures) and a pumping station located on the mainland.



1. Pipe of adduction – 2. Fixed grid – 3. Rotating grid – 4. Electric motor pump – 5. Pump – 6. Floodgate – 7. Throttle – 8. Expansion joint – 9. Delivery pipe – 10. Accumulation tub – 11. Overhead crane

Source of water supply

Mode of derivation

b) derivation by surface water

The withdrawal of water from the lakes are made to intake structures placed at distances from the seabed, such that you have:

- recalls appreciable of vegetation or turbidity;
- significant temperature excursions.

The work gripping is provided with openings arranged at different heights and adjustable, in anticipation of excursions of the level of water.

For drawing from fresh surface water, are present:

- the water level in correspondence with the derivations remains approximately constant over time (water extraction by means of a bypass channel and a gate to regulate the flow - channel scheme adjusted);
- the level undergoes considerable variations (is realized, in addition to the channel and gate, including a dam downstream of the junction, to ensure a certain level of consistency at the point of outlet).

Source of water supply

Mode of derivation

b) derivation by surface water

An example of derivation of water from a river are:

- damming of the river;
- floodgate fixed or mobile;
- channel of derivation (one has the larger cross-section at the entrance to facilitate the deposit of solid materials);
- spillway to download downstream of the dam the surplus of water derived;
- bottom outlet for the cleaning of the first section of the channel of derivation.

The channel is usually in concrete and can have different shapes (rectangular, trapezoidal, etc.).

The presence of suspended solids constrains the lower limit of speed that should not fall below 0.25 m/s to muddy waters and 0.5 m/s for sandy waters.

Source of water supply

Mode of derivation

c) captation from groundwater

Are groundwater a free surface resting on impermeable layers, which in the case of little depth is used in traditional wells (to groove) with concrete walls, while in the case of deep groundwater is used in bored wells.

The capture of water from aquifers is made for pumping.

Source of water supply

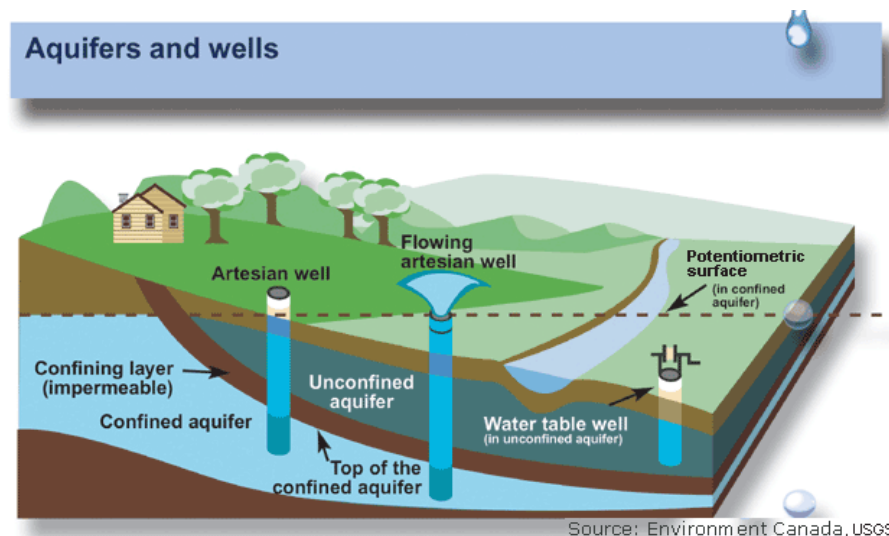
Mode of derivation

d) captaion from artesian aquifers

They are groundwater under pressure, as collected between impermeable layers, whose capture is via wells.

The water in the aquifer may be under pressure so as not to require any pumping system for its withdrawal.

In the case where the pressure is not such as to convey the water above the mouth of the well, it must provide a pumping system similar to that for the uptake of water from groundwater.



Source of water supply

Pits

The drilling of a pit involves the execution of the following operations:

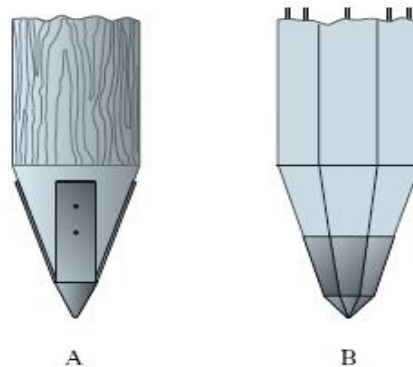
- crushing of the soil by means of a tool;
- removal of debris produced, which may be continuous (*wet perforations*) or discontinuous (*dry perforations*)

Source of water supply

Pits – Dry perforations

Pits Norton

They are made with steel tubes fitted with pile shoe and placed in the ground to hammer blows. These tubes are perforated to allow the passage of water, with a diameter between 2-3".



Reached the aquifer, the pumping of water is obtained by installing the top a suction pump or by a group of centrifugal pumps with horizontal axis arranged in the vicinity of the level of ground water.

The depth of the pits does not exceed 10 m, but can reach 25 to 30 m with diameters of 200 mm pits and using submersible pumps.

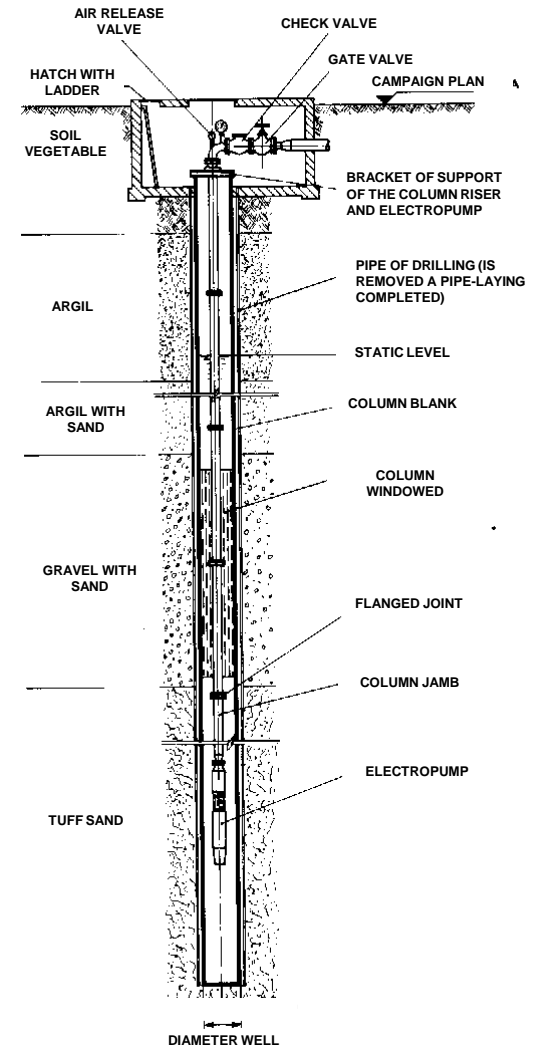
Source of water supply

Pits – Dry perforations

Pits at percussion

Are wells that are made with pipe of maneuver with diameters gradually decreasing introduced into the soil to a depth of aquifers, removing the material from the interior by means of probes or utensils in rotation.

Inside the tubes, fixed in the ground, is introduced into the column constituting the well (pipe-laying), blind in the stretch of the formations devoid of water and windowed in that where there are the aquifers, of a diameter less than the smallest column of drilling (200 - 700 mm). The columns of maneuver are extracted and, after a period of purging, the well is ready to operate. Water extraction is performed using electric submersible pumps.



Source of water supply

Pits – Dry perforations

Pits at percussion with windows in work

Is accomplished by the direct burying in soil of the column of coating and its subsequent windows in work in correspondence of aquifers.

The same tubes constitute the riser final maneuver of the well: once introduced inside the tubes are free from the material content, and this introduces a mechanical or hydraulic pipe cutter that performs, in correspondence of the aquifers, windows in shape and size suitable for relation to the characteristics of the material in the same layers.

This type of drilling causes minimum disruption to cross training, reduces the danger of landslides and allows you to exclude groundwater that is not interested. It does not have the advantages linked to the existence of siliceous gravel drainage blanket that was introduced around the riser final for other pits. They are used to maximum depths of 500 to 600 m.

Source of water supply

Pits – Dry perforations

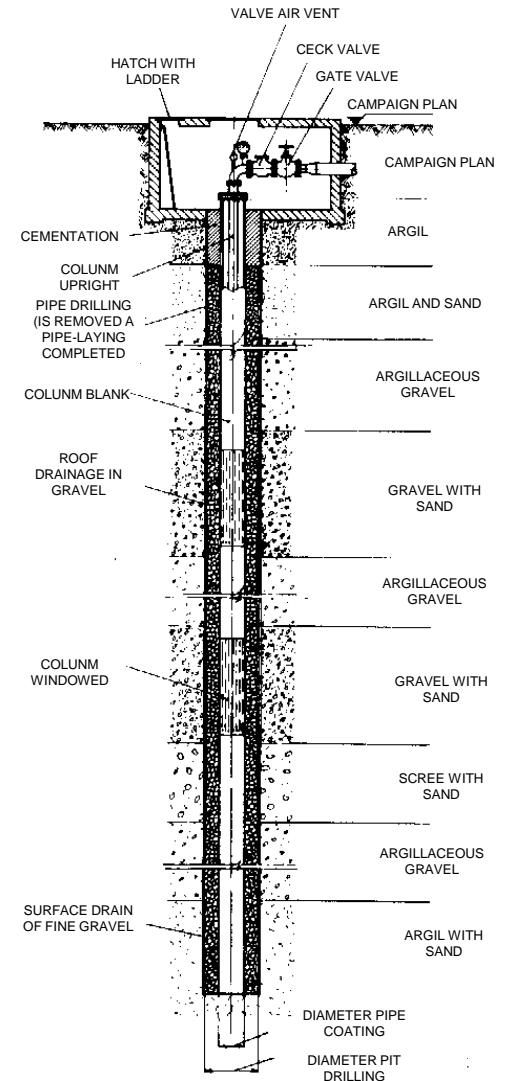
Artificial drainage pits

In the case of sandy soils, which do not allow a natural drainage of the water around the column windowed, and where it is required high flow rates, is used to this type of pit.

They are made sinking into soil the pipe to maneuver with decreasing diameters.

The removal of the material from inside is carried out with buckets or probes, depending on the nature of the subsoil.

Subsequently, shoves the column constituting the pit, windowed in correspondence of the aquifer, coaxial with the hole. Between the column and the tube is inserted of the siliceous gravel, ensures that the artificial drainage of water.



Source of water supply

Pits – Dry perforations

Pits at rays

In the case of ground water rich in water and not very deep, is used to this type of wells, which consist of a series of 10 - 12 filter tubes (200 mm), installed in correspondence of the aquifer, which converge into a pit of cement concrete in which are located the pump of the type submerged or at vertical axis.

The tubes with windows (galvanized or stainless steel, brass, plastic, etc. depending on the nature of the ground) reaches a length of several tens of meters.

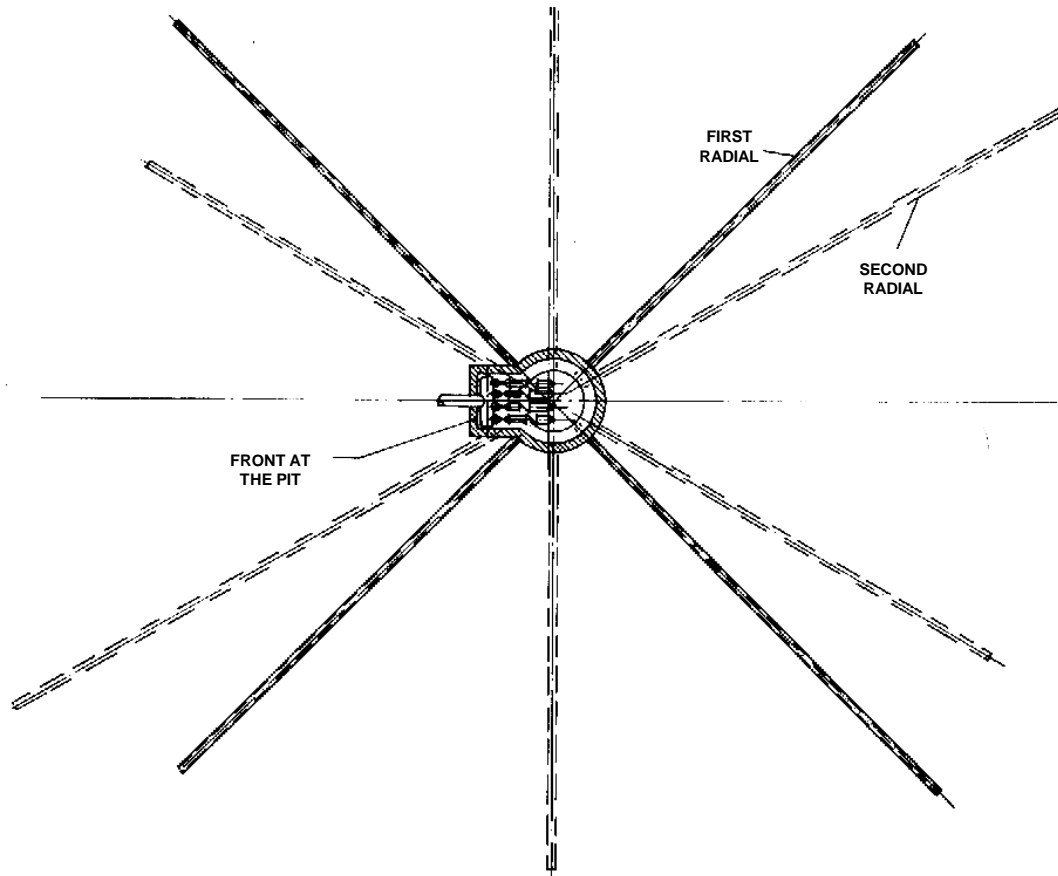
The pits reach a maximum depth of 30 to 35 m.

The water enters the aquifer in the horizontal pipes that end in windowed shutters controlled from the top of the well with auctions for maneuver. If you close all the shutters of the rays from above, you can empty the well collector and access to its bottom.

Source of water supply

Pits – Dry perforations

Pits at rays



Source of water supply

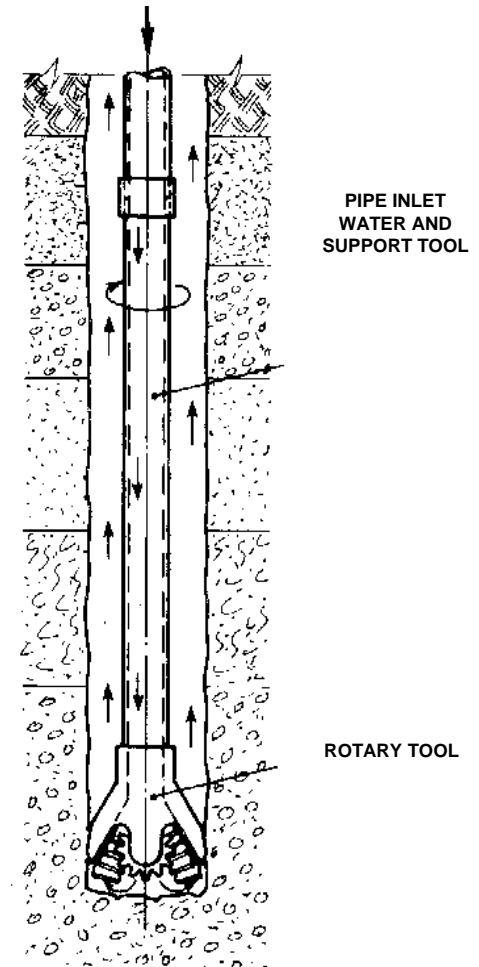
Wet perforations

A rotation and direct circulation

The perforation is effected by means of a tool which advances as a drill bit, shattering the material constituting the formations crossed.

The debris that are formed are transported to the ground level by a current of muddy water (to increase the viscosity and specific gravity of the fluid) introduced from above, under pressure, through the hollow rod which transmits the rotational movement of the drill tool (drilling rod).

Drilling holes with a diameter up to 500 to 600 mm with high feed rates.



Source of water supply

Wet perforations

A rotation and reverse circulation

The tool is still advancing along the rotating pipe that supports it.

The fluid circulation is poured from above into the annular space between the wall of the well and the drill rod, and goes back inside the latter. The return of the fluid circulation is ensured by a suction pump or an air compressor.

Normally with suction pumps can drill pits to depths ranging from 150 to 200 and can get to 1500 mm diameter pits.

If it has a compressor, this feeds the compressed air in the auction drilling, immediately above the tool. In this way it alleviates the column of water inside the tool holder pipe , in order to favor that the rising water upward poured outside of the tube. In this way you get higher rate of ascent that in the case to a suction pump.

Source of water supply

Wet perforations

A percussion and reverse circulation

The tool in the shape of the chisel percussion works (vertical reciprocating motion), while the water is fed from the ground level with reverse circulation. You can reach land in favor of the 600 m depth, although it has a well diameter gradually reduced, starting from 800 to 1200 mm and reaching the 400 to 800 mm.

You should always ensure a minimum flow of water to prevent cave-ins and a head of water of at least 2 to 3 m above the static level of groundwater, that will be absorbed by the ground and then will have to integrate.