

## 2. Water intake structures - Водозабірні споруди

### Surface water source - поверхневі

river, lake, reservoir, sea

#### 11.1 River water intake

Groundwater is the preferred source, but the most convenient source of water for small communities is frequently a natural stream or river close by. The two most important criteria in judging the suitability of the surface water source are the **quality of the water** and the **reliability of the flow**.

Whenever practicable a river intake should be sited

- where there is adequate flow;
- at a level that allows gravity supply to minimize pumping costs;
- upstream of densely populated and farming areas to reduce silt inflow;
- upstream of cattle watering places, washing places and sewer outlets (to eliminate pollution of the water);
- upstream of bridges (to reduce velocity/turbulence).

Intake designs aim to avoid **clogging** and **scouring** and to ensure the stability of the structure even under **flood** conditions. Where the river transports no boulders or rolling stones.

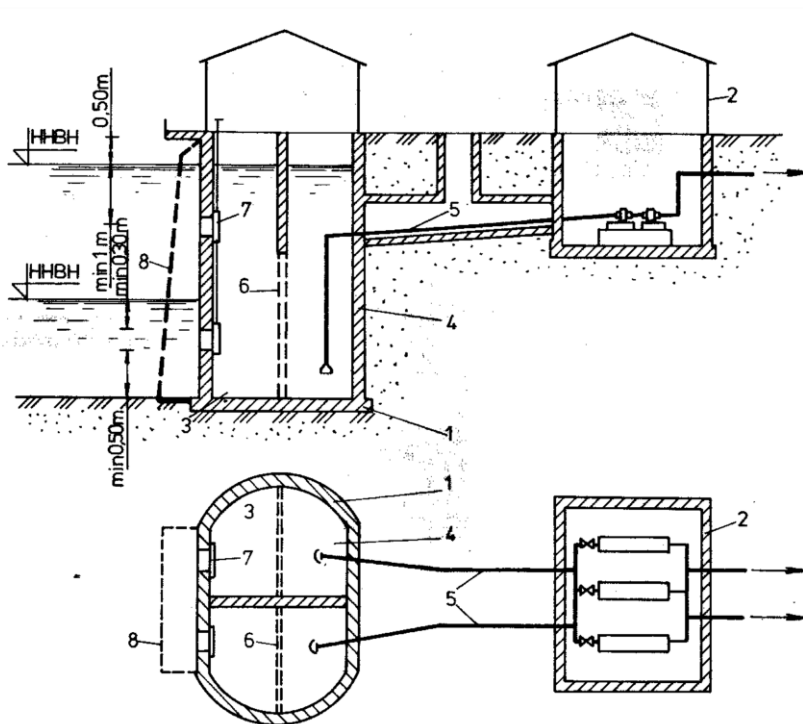
The intake structure must always include one or more **baffles or screens** to keep out debris and floating matter such as tree trunks and branches.

To reduce the drawing in of silt and suspended matter, the velocity of flow through the intake should be low, preferably less than 0.1 m/s. To make use of the natural current to help cleaning of screens, the following tips are suggested:

- The screen axis must be parallel to the current flow
- Dead-end approach channels should be avoided as they collect debris
- Adequate water cover must be provided all around the screen.

береговой водозабор – bank`s water intake

## Bank's Water Intakes Structures

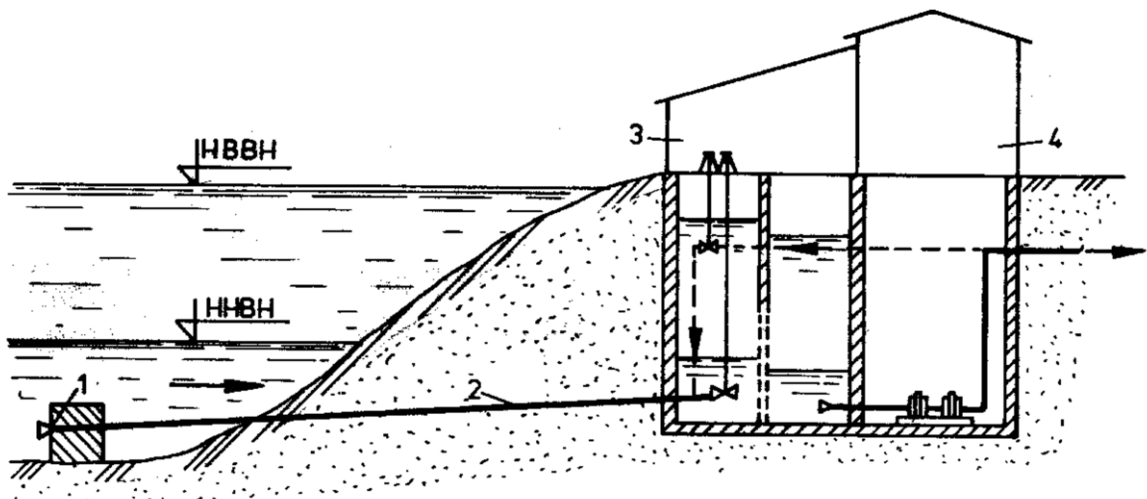


### Separate type (scheme)

- 1 - receiving well
- 2 - pumping station
- 3 - receiving chamber
- 4 - storage (suction) chamber
- 5 - suction pipes
- 6 - mesh screen
- 7 - inlets
- 8 - bar rack

русловой водозабор – stream's water intake,

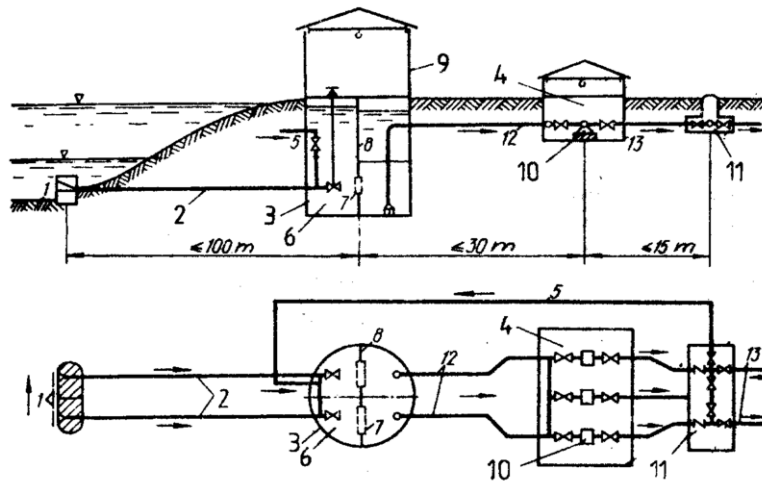
## Stream's Water Intakes Structures



### Combined type (scheme)

- 1 - water intake head
- 2 - gravity feeding pipe
- 3 - receiving well (with two chambers)
- 4 - pumping station

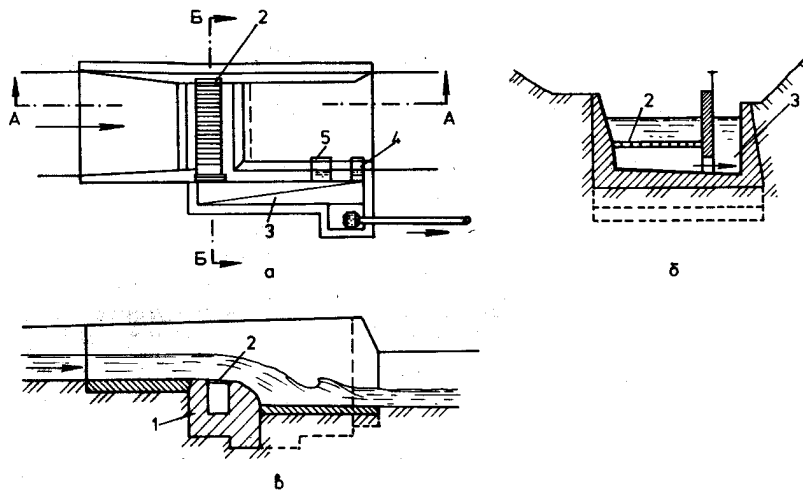
## Stream's Water Intakes Structures



### Separate type (scheme)

- 1 - water intake head
- 2 - gravity feeding pipe
- 3 - intake well
- 4 - pumping station
- 5 - back-washing pipe
- 6 - receiving chamber
- 7 - orifices with racks
- 8 - separation wall
- 9 - service office
- 10 - pumps
- 11 - distribution chamber
- 12 - suction pipes
- 13 - pressurised pipes

### Bottom intake



a - plane

1 - dam

4 - drain outlet

6 - cross section B - B

2 - bar rack

5 - weir

b - cross section A - A

3 - grit chamber

### Fish protection structures

Generally we categorize fish barriers into **behavioral** and **mechanical barriers**. Behavioral barriers can often be relatively easily and inexpensively installed into existing water intake structures. However, they only work truly efficiently when fish are offered alternative paths or territories. Furthermore,

behavioral barriers always function selectively, meaning that not all fish types and sizes respond and can be completely redirected. Despite this, when used correctly behavioral barriers, including the use of electrical impulses as a repellent and fish immobilization systems, can reduce fish losses by between 80-90%. They require careful planning and are tailor-made to suit the individual case.

Mechanical barriers reliably prevent fish from swimming into structures (using passive mechanical barriers such as static screens) or collect fish as they are swimming in and gently return them back to the water of origin (using active mechanical barriers such as moving screens). As long as these barriers are set up correctly, loss of fish can be almost completely avoided no matter what type and size of fish involved. However, mechanical barriers are usually more complex than behavioral barriers and often also require construction measures at existing water intake plants.

**Electrical Fish Repelling System** helps ensure that nearly all fish larger than 8-10 cm are kept away from the plant water intake. This technology produces short electrical impulses. Fish feel the effect of the impulses and swim away from them. The system is installed in the area of the water intake, and makes turning off into the inlet channel unattractive.

### **Acoustic Screens**

The most widely used behavioral system, acoustic barriers are suitable for deflecting migrating fish, resident coarse fish, estuarine and marine fish.

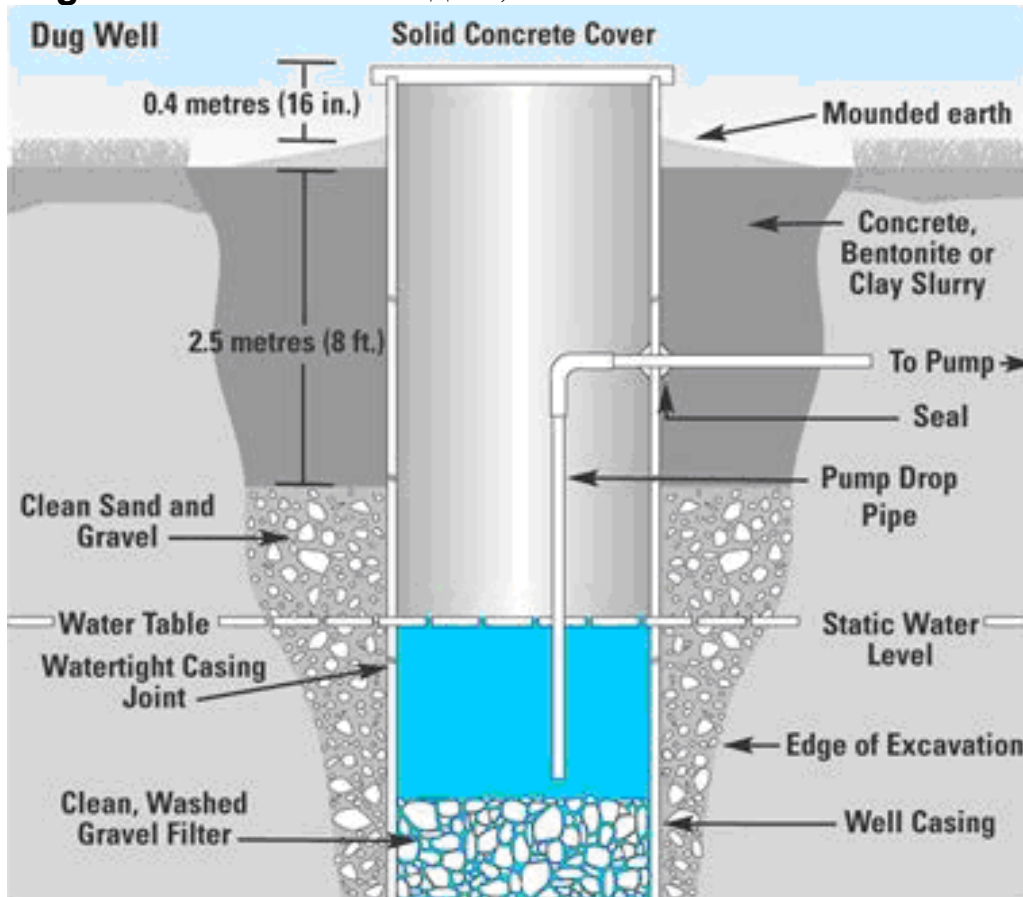
### **Intense Modulated Light**

Used in conjunction with other systems, this is suitable for deflecting fish that are less sensitive to sound, such as eels.

### **Bubble Curtains**

Bubble curtains are suitable for guiding fish to a point downstream. A curtain of bubbles are produced by a submerged, perforated tube, through which compressed air is released. The wall of bubbles that is released is used to guide approaching fish into a bywash. Bubble curtains are most effective when combined with other deterrent systems, such as sound or light screens.

## Dug well – шахтний колодязь;



Solid Concrete Cover – тверде бетонне покриття

Mounded earth – земляний насип

Concrete, Bentonite or Clay Slurry – бетонний, бентонітовий або глиняний замок

Pump – насос

Watertight Casing Joint – водонепроникна корпус

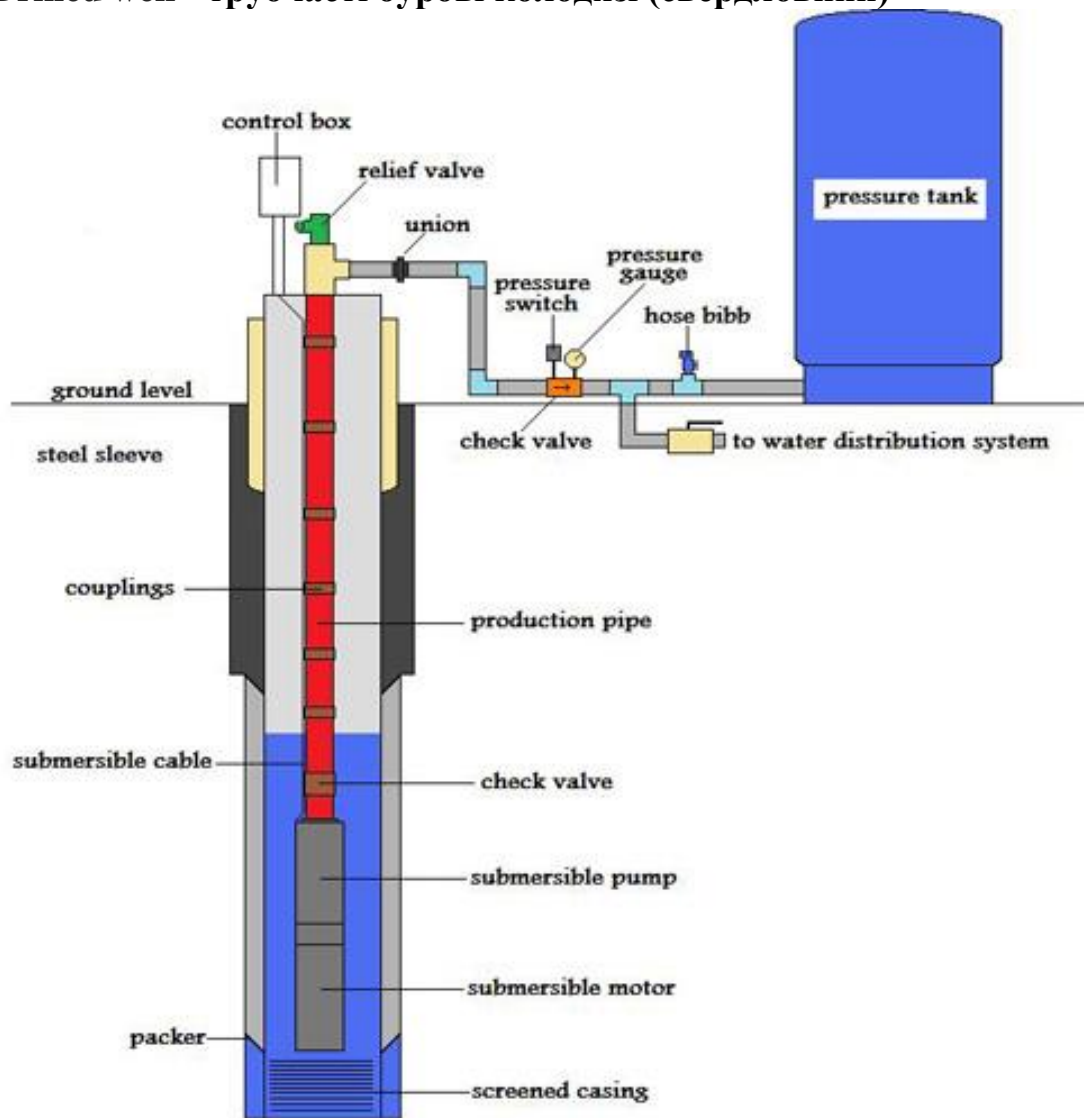
Static Water Level – статичний рівень води

Edge of Excavation – край котловану

Clean, washed gravel filter – чистий, промитий гравійний фільтр

Well casing – корпус колодязя

## Drilled well - трубчасті бурові колодязі (свердловини)



Control box – контрольна панель

Relief valve -вантуз

Union - з'єднання

Pressure switch – реле тиску

Pressure gauge - манометр

Hose bibb - заглушка для шлангу

Check valve- зворотній клапан

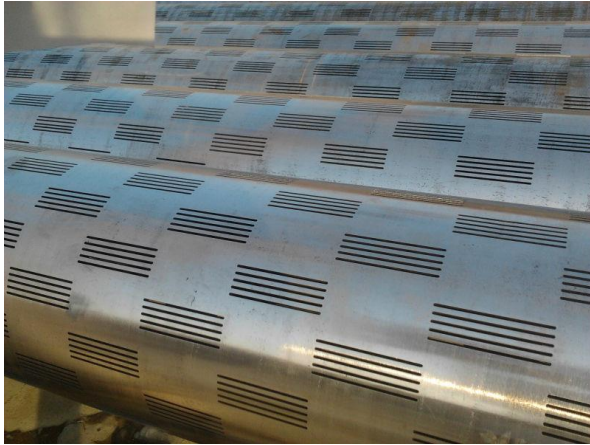
Steel sleeve- обсадна труба

Submersible cable – занурений кабель

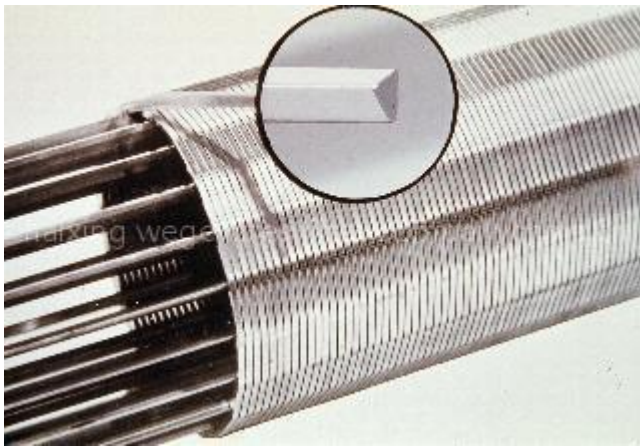
Screen casing - фільтр

## **Screen casing**

### **Slots – щілини**



## **Wire Wrap – дотова обмотка**



## **Bridge Slot – мост структура**



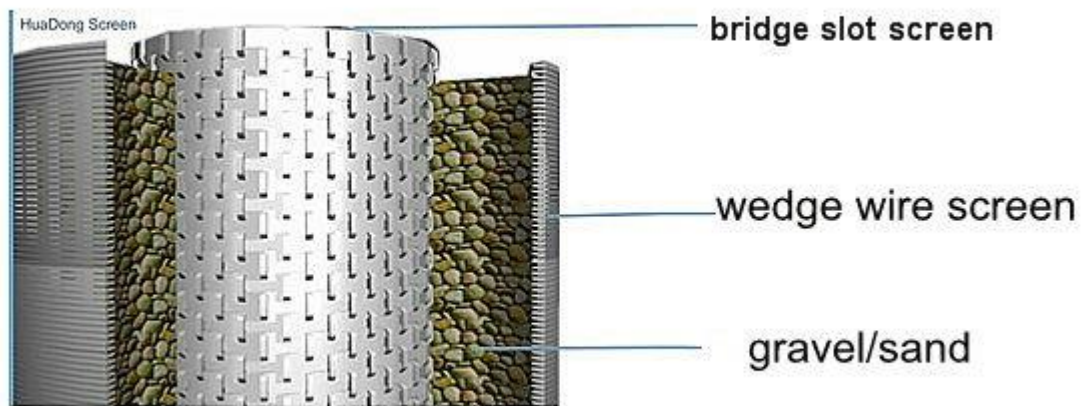
**Shutter Screen - жалюзеві**



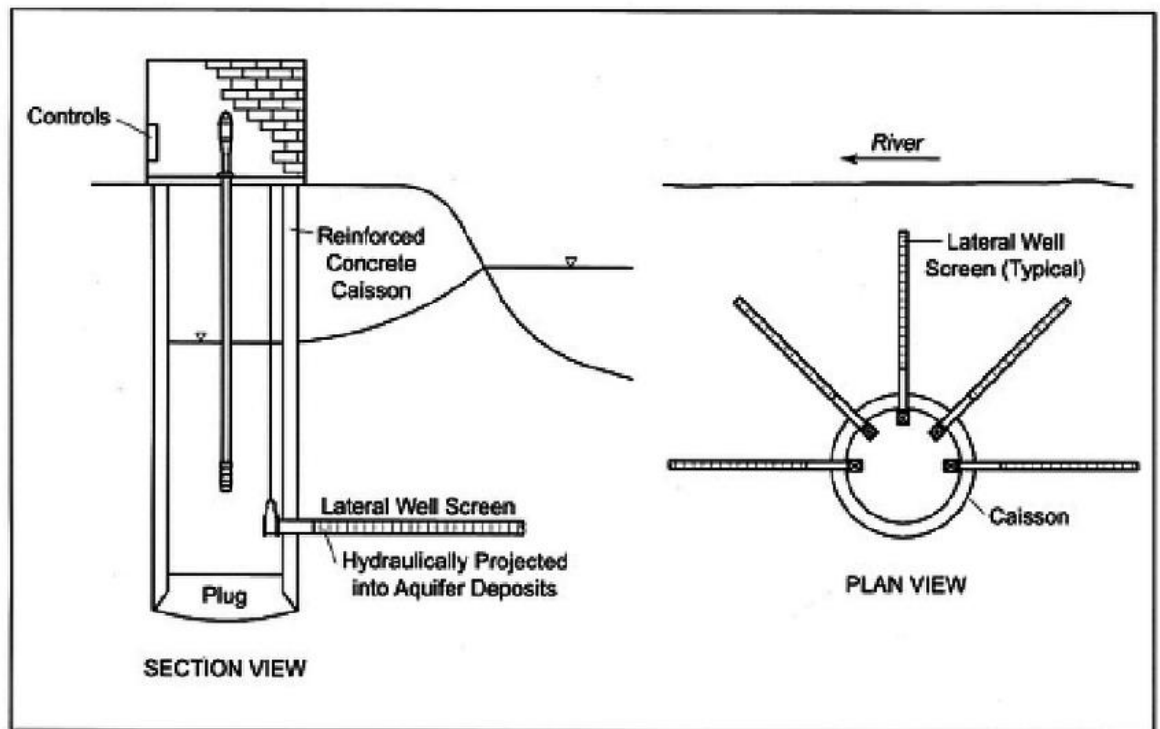
**Strainers screen - сітчастий**



gravel pack



**Horizontal Collector Well** - горизонтальні водозабори (променеві водозабори)



Lateral Well Screen – бічний фільтр

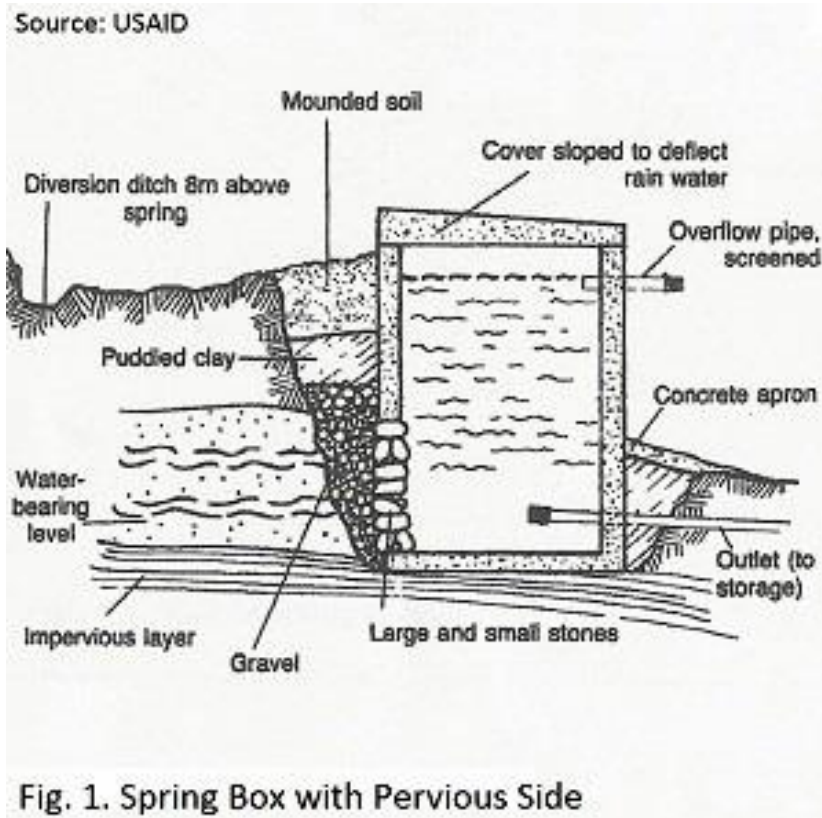
Reinforced Concrete caisson - Залізобетонний стакан

Controls- управління

Plug – пробка, суцільне дно

Hydraulically Projected into Aquifer Deposits – Гідравлічно запроектовано в водоносний шар

## Springwater collection – каптажи



Mounted soil – нагромаджена земля

Diversion ditch 8m above spring – відвідна траншея 8 м над джерелом

Puddled clay – замішена глина

Water bearing level – підпертий рівень води

Impervious layer – непроникний шар

Gravel - гравій

Large and small stones – велике і мале каміння

Outlet - випуск

Concrete apron – бетонний фартух

Overflow pipe screened – переливна труба з фільтром

Cover sloped to deflect rain water – похиле покриття для відбивання дощу

Video <https://www.youtube.com/watch?v=tGWQXCJghaM>

### Horizontal Collector Well

Leonardo da Vinci once said water is the driving force of all nature.

Water Resources is the **horizontal or radial collector well**. Collector wells are high-capacity water supply systems installed in unconsolidated aquifers commonly near rivers or streams. Collectors consist of a central **reinforced concrete caisson** which serves as a **wet well** for the **storage** of **raw water** brought into the well through an array of **lateral screens** which extend horizontally from

the bottom of the caisson into the surrounding aquifer. The well is completed with pumping equipment and a **well housed** in order to pump the water to the surface and into the **distribution system**. Due to their large amount of screen collector wells typically produce large volumes of water often as much as several traditional **vertical wells**. Other advantages of the collector wells system include concentration of pumping operations requiring minimal **land acquisition** and **ancillary costs**, natural filtration of source water and the **attenuation of particulates** and contaminants as water is drawn through the aquifer to the well. Lower entrance velocities through the lateral screens leading to lower **operating costs** and less **maintenance**. **Gravel packing** select filter media is placed around the lateral screens as the **outer projection pipe** is removed. This results in a uniform envelope of **coarse grained material** being evenly distributed around the circumference of the lateral screen. Gravel packing allows the slot size of the lateral screens to be maximized even in **fine formations** and increases the effective diameter of the laterals. Another advancement in collector well technology employed by BCI includes the installation of small diameter **precast caissons**. When property is limited or aesthetics are an issue precast caissons installed by BCI can provide large volumes of water from a smaller footprint. Caisson lifts can be excavated and sunk in a matter of hours not days and strict tolerances can be observed because the sections are constructed in the factory instead of cast in place on-site.

horizontal or radial collector well – горизонтальний (променевий)  
водозабор

reinforced concrete caisson – залізобетонний стакан

wet well – мокрий колодязь

storage – збереження

raw water – неочищена вода

lateral screens – бічні фільтри (екрани)

well housed – павільйон

vertical wells – вертикальні свердловини

land acquisition – відведення (придбання) землі

ancillary costs – супутні витрати

attenuation of particulates – зменшення твердих частинок

maintenance – технічне обслуговування

operating costs – вартість експлуатації

Gravel packing – гравійна обсіпка

outer projection pipe – зовнішня обсадна труба

coarse grained material – грубозернистий матеріал

*fine formations* – дрібні утворення

*precast caissons* – збірний кессон (стакан)

*place on-site* – на місці