FACT SHEET

Infiltration Wells

Introduction

This sheet presents the use of infiltration wells to improve surface drainage and reduce erosion problems in fields. The information it contains makes it possible to size and install appropriate structures in simple cases.

Source : Jacques Goulet (MAPAQ)

Source : Georges Lamarre (MAPAQ)

Definition

Infiltration wells (also called interception wells) are structures that allow surface runoff to drain through underground piping. Unlike inlet wells and drainage wells, however, infiltration wells do not have a direct water inlet at ground level: rather, they increase the ground's infiltration capacity through the installation of porous materials and, in most cases, a coiled drain between the soil surface and the underground piping (Figure 1). In some cases, this arrangement makes it possible to work the soil above the infiltration wells. Rocks, coarse wood chips or straw can be used as filtering material. Wells made of straw are constructed like permeable trenches and do not have a coiled drain, which can limit their infiltration capacity (Figure 2).

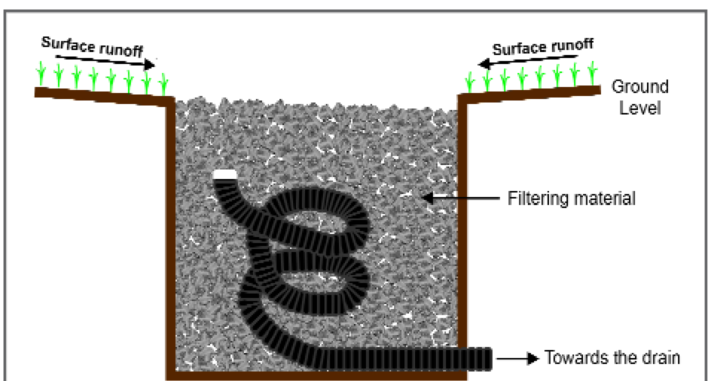

Figure 1: Infiltration well with coiled drain (rocks or wood chips)

The choice of material used to backfill the well affects the durability of the structures. Rock is the most durable material, but it is also the most costly. Straw is the most economical material, but it decomposes quickly: under certain conditions, more than half of the material can decompose within five years. Because of their higher carbon/nitrogen ratio and the nature of their fibres (rich in lignin), wood chips decompose much more slowly than straw. Furthermore, wood chips do not cost as much as rock. Wood chips are therefore an attractive material, but their availability varies greatly by region.

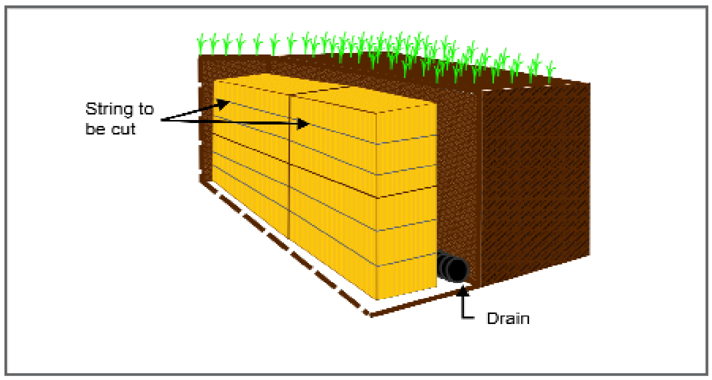

Figure 2: Infiltration well made with straw bales

Coarse wood chips are an economical and relatively durable backfilling material. The chips must be sufficiently large to allow water to infiltrate fairly rapidly. Branches and logs can also be used, but excessively fine wood chips or sawdust is not recommended.

Source : Jacques Goulet (MAPAQ)

Wood chips

When can infiltration wells be useful?

• Poor drainage of small, circular depressions

The maximum area of depressions that can be drained by an infiltration well is approximately 0.5 ha. If necessary, several wells can be installed in the same depression to ensure sufficient drainage.

• Localized resurgence of subsurface runoff or unconfined groundwater

Infiltration wells increase the efficiency of interceptor drains in low-permeability soils.

WARNING

Infiltration wells, permeable trenches and inlet wells are preferred means of draining areas between fields and watercourses. Surface runoff drained using these structures is less filtered than water that enters drains after filtering through the soil profile or that runs through abundant vegetation cover. This lower level of filtration increases the risk of surface water contamination by soil particles, nutrients (phosphorus, nitrogen, etc.), pesticides and agricultural microorganisms. Consequently, these structures must be used wisely and, when they are installed, be accompanied by preventive measures, such as balanced fertilization, limited pesticide use and, ideally, the creation around the structures of a buffer zone where the soil is not worked and no fertilizers or pesticides are applied.

How to determine where to place infiltration wells

Infiltration wells used to drain depressions must be installed at the lowest point of the depressions. Levelling work can be done to concentrate the surface runoff at the bottom of the depressions and thereby facilitate drainage.

In cases of subsurface runoff or unconfined groundwater resurgence, it is important to identify the cause of the resurgence, which depends on the morphology of the land and can sometimes be located several metres upstream from the point where the water breaches the surface of the soil. The infiltration well should be located so as to prevent water from rising to the surface rather than simply holding and draining the water at the resurgence point.

It is important that infiltration wells not be installed in areas where water drainage is rapid. Since infiltration wells have a low infiltration capacity, the drainage rate will be insufficient and will not make it possible to reduce the risk of erosion.

How to size infiltration wells

Since infiltration wells are used in simple cases where flow is limited, a drain measuring 10 cm (4 inches) in diameter is almost always used for the coiled pipes and the piping. As mentioned previously, several wells can be installed in the same depression to ensure sufficient drainage.

How to construct an infiltration well

First, the land must be surveyed to precisely determine the best location for the infiltration well, as well as the length and slope of the drainage pipes to be installed.

• Piping

Infiltration wells are generally connected to an existing drainage system when such a system exists and when it has sufficient capacity to drain the water from the wells to be installed. This arrangement reduces the scope and cost of the installation work. The existing drain is cut as close as possible to install a T-connection, then a new section of piping is directed towards the location selected for the infiltration well, with the desired slope maintained (minimum slope: 0.1%). A wrapped pipe is used if the soil type requires it. If the planned layout does not require the installation of a new drain, the work can be done with a backhoe.

If it is not possible to connect an infiltration well to existing piping, a drain and drain outlet must be installed to drain the surface runoff into the closest outflow. The drain slope will follow the general slope of the land, without being under 0.1%. A hydraulic shovel, mini-excavator or mole plough is usually used for the work. In all cases, the excavation slope should be controlled with a laser guidance system. The procedure is the same as the one described in the "Inlet and Drainage Wells" sheet.

• Rock or wood-chip infiltration wells

A hole measuring 1 to 1.5 m in diameter and approximately 1 m deep is excavated at the location selected for the infiltration well.

If the well is constructed with rock in sandy or loamy soil, the bottom and sides of the excavation can be covered with a geotextile membrane (of the Texel 7609 or 7612 type). This membrane will prevent lateral clogging by the rock and is attached to the drain with drainage adhesive tape where the drain crosses it. The membrane is cut 30 cm below the surface of the soil if the soil is to be tilled above the well once installation is complete. Otherwise, the membrane can extend up to the soil surface. Note that no geotextile membrane is used in wood-chip wells.

The excavation is progressively backfilled with the desired material. The drain is coiled in the porous material as it is placed in the hole. In wells made of rock, it is recommended that backfilling begin with clean 56-mm rock, although finer stone (such as 19-mm stone) can also be used.
The drain is cut at the desired height, and a cap is placed at the end. If the soil is to be tilled above the wells after the work is complete, the coiled piping must stop at least 30 cm below the ground surface so that the piping is not damaged by tilling equipment. The backfilling of the rock well is completed with materials that will not damage the tilling equipment (coarse soil if available, coarse sand, wood chips or clean 19-mm stone). Laying a geotextile membrane between these two zones is not recommended, because it would quickly be clogged by the silt contained in the surface runoff (Figure 3). Wood-chip wells are generally fully backfilled with wood chips (Figure 4).

Where the erosion rate is high and the risk of clogging is significant, it is preferable that the soil above the infiltration well not be tilled. A minimum radius of 3 m around the well is therefore grassed over to filter the soil particles and create a buffer zone between the tilled soil and the infiltration well. The well can also be covered with rock (e.g. clean 100-mm rock) to finalize the installation.

• Infiltration wells made with straw bales

The procedure for installing wells made of straw bales is described in the "Permeable Trenches" sheet.

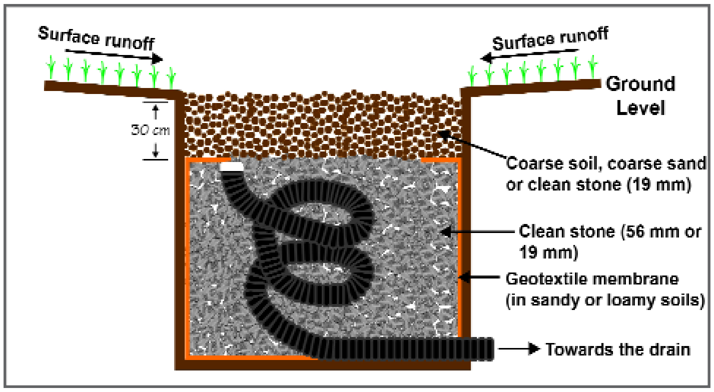

Figure 3: Infiltration wells with rock—tilled soil

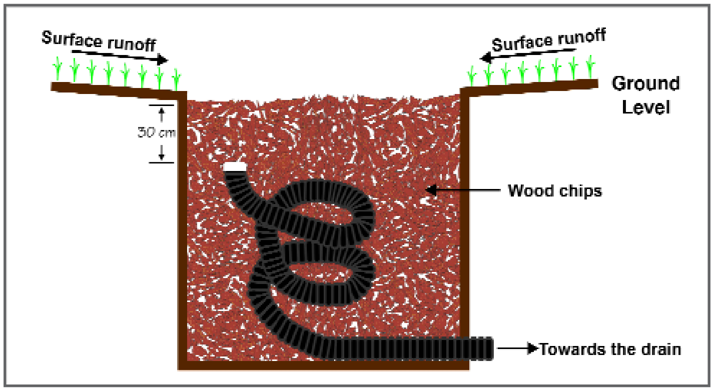

Figure 4: Infiltration wells with wood chips—tilled soil

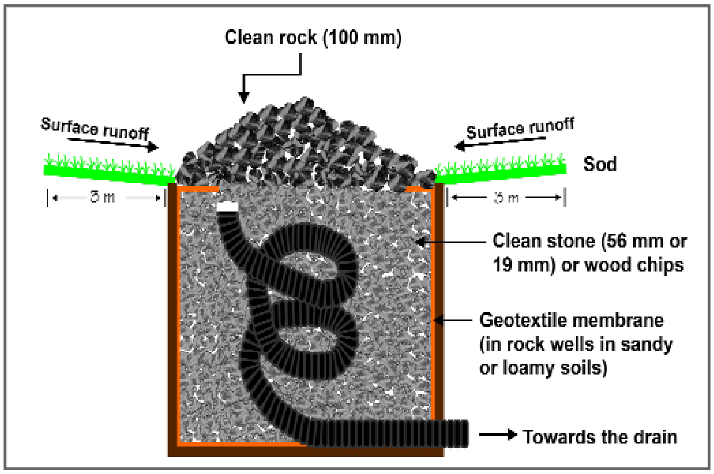

Figure 5: Infiltration well with rock or wood chips—soil not tilled

Maintenance

Generally, it is recommended that minimum tillage practices be adopted to maximize the lifespan of the well. If a well gets clogged, the first 30 cm of the porous material is replaced to improve the infiltration capacity.

Organic filtering materials decompose gradually over time. Because of better oxygenation conditions near the ground surface, decomposition is faster in the upper part of the well. In wood-chip wells, it is generally necessary to add more wood chips every 10 years to compensate for subsidence caused by the decomposition of the material in place. Given its lower carbon/nitrogen ratio and high cellulose content, straw decomposes much faster and must be replaced more frequently. Coarse sand can also be used to replace decomposed material in both cases.

Lastly, infiltration wells and separate drain outlets must be inspected frequently to evaluate the condition of the structures as well as their efficiency in improving surface drainage and reducing erosion problems.

Source : Jacques Goulet (MAPAQ)

Condition of the backfilling material after 6 years
Left: Wood chips: slow decomposition Right: Straw: quick decomposition

References

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