Project:

Water Harvesting with Earthworks

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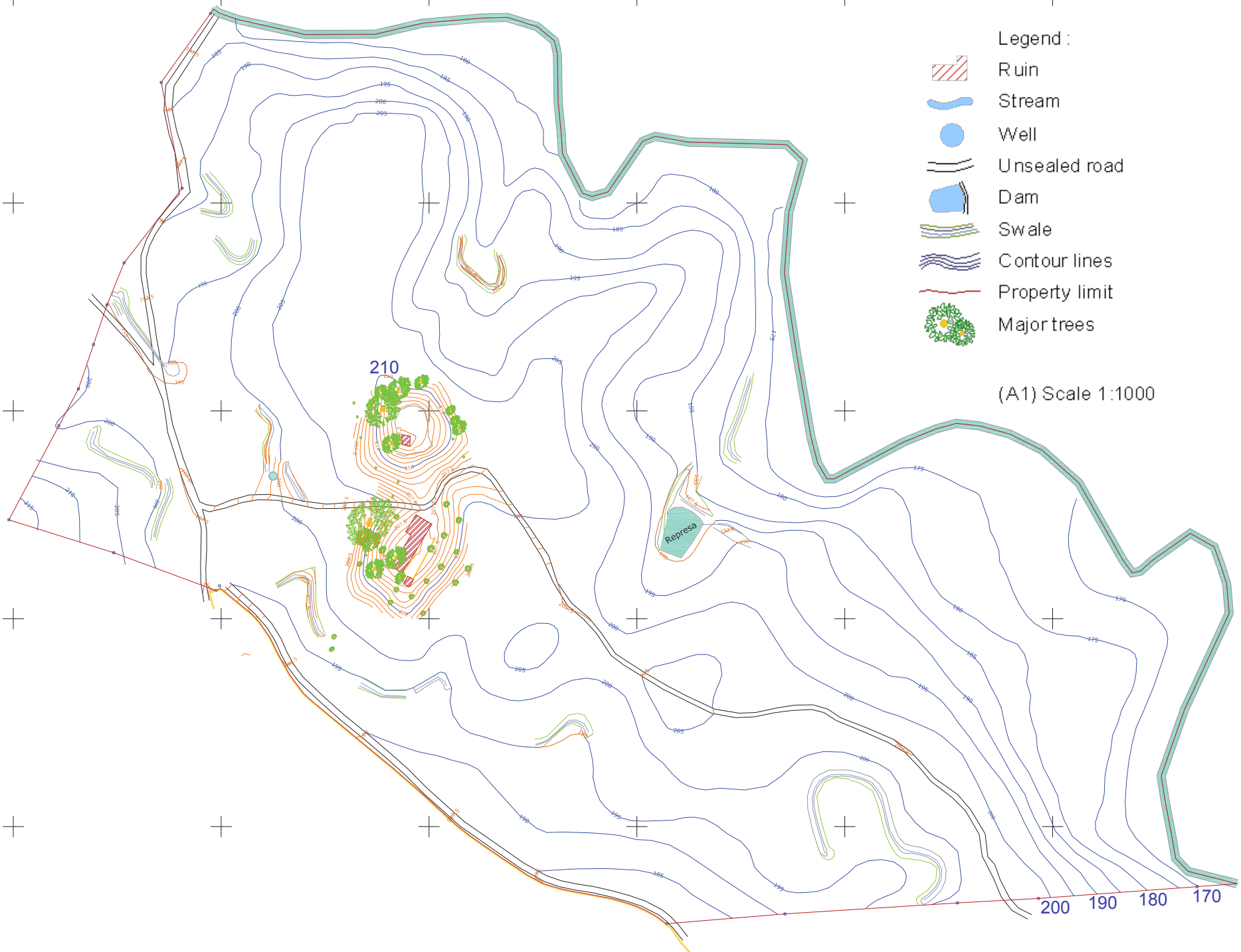
Monte da Ameira

Maps


Legend :
Ruin
Stream
Well
Unsealed road
Dam
Swale
Contour lines
Property limit
Major trees
(A1) Scale 1:1000
210
Represa
200
190
180
170


Monte Ameira
Represa
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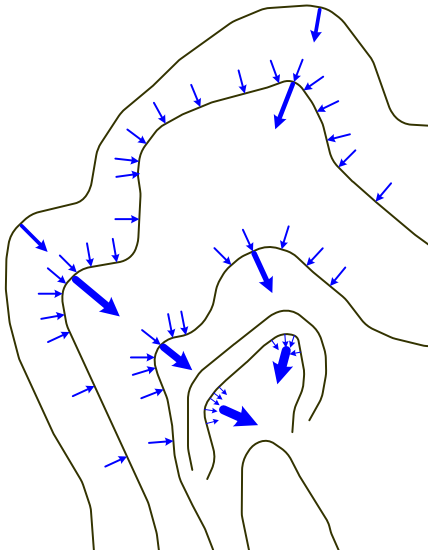
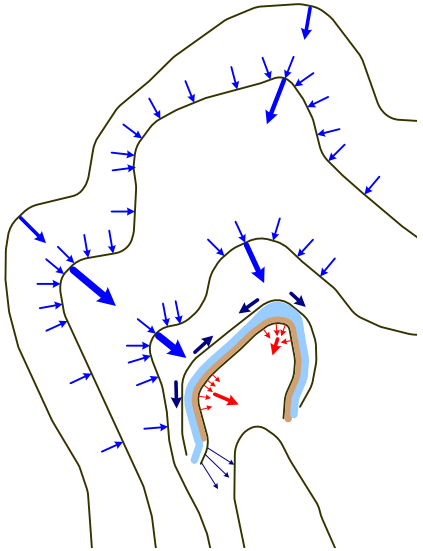
Specifications



Run-off water -no catchment *(before)*

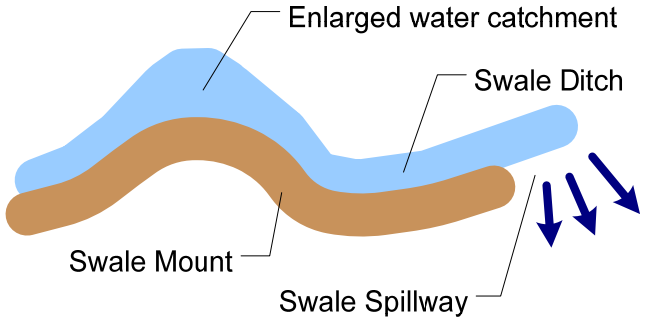
When looking from above, this valley has a large area where rain water is caught. The existing vegetation did not sufficiently slow down the run-off water. Water follows the easiest way, this is straight down *(see blue arrows)* which resulted in gullies in sensitive areas where the water flows strongest *(see large blue arrows)* and large quantities of the top soil have been washed off.



Run-off water catchment by swale *(after)*

To slow down the water a swale system is implemented. The position of the swale is determined by locating the keypoint of the slope/valley. This is the point where the slope (convex) decreases and becomes more outwards (concave) or even. This is visible by observation as gullies (erosion) settle and become puddles or pools, when dry visible by settlement. This keypoint is then followed on contour which is called the keyline. With a keyline approach the construction of the swale requires the least energy while maximising water catchment capacity.

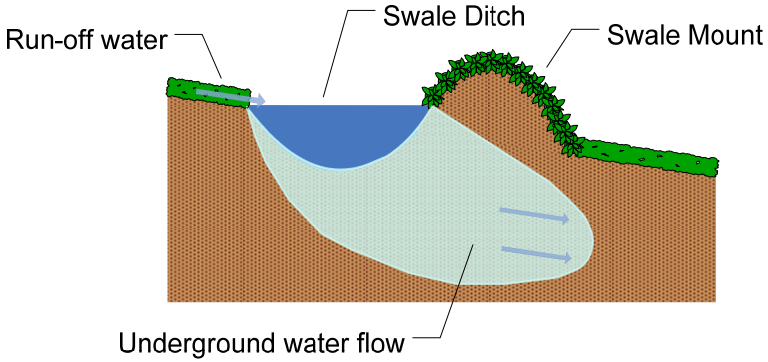
This way water is slowed down by spreading it evenly over the swale which would prior to the earthworks would run down and cause erosion *(see red arrows).*



Top-view swale

A swale is a ditch on contour. With other words, it is a ditch following the slope on water level. By doing this you will hold water from rain and/or runoff water. The mount (the dyke/wall) which is not compacted, unlike dam walls, gradually let's the water infiltrate the water downhill.

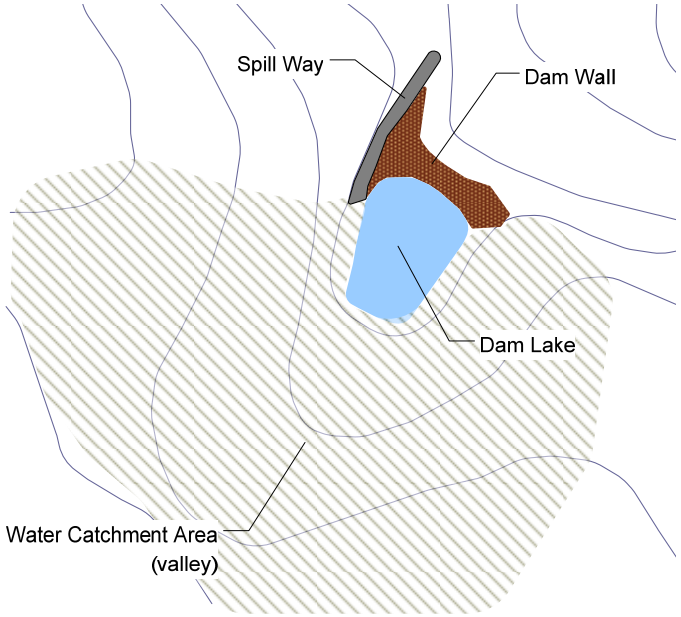
As the swale is on contour it diverts water from the valley where there is an excess of water and spreads it over the length of the swale. The overflow of water will be regulated by the spillway which is placed to an area where there is less water. The spillway is lower then the swale mount and its surface is the untouched ground. The amount of water the swale can capture determines the size of the spillway as it will spread the water evenly over the spillway area.



Cross-section swale

This way some of the water is held and slowly irrigated on the land below without any energy spend or any human interaction. With this you reduce the need of irrigation and increase fertility with more water present in the soil

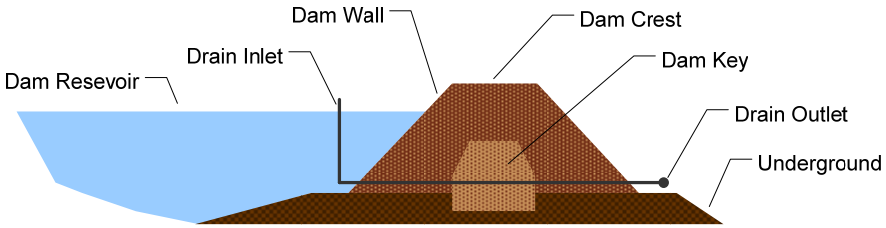
Vegetation can be grown on different spots of the swale, which each have different conditions, multiple microclimates are created. When there is less runoff water, soil erosion will decrease and organic matter or silts that do get washed away by heavy rainfall will be caught in the swale and can be used later.



Top-view dam

Looking from above on the dam it is visible that the dam is build on the point where the wall can be build with minimum effort with maximum water holding capacity.

A crucial element of the dam is the spill way. The spill way makes sure enough freeboard. This is calculated by the margin between top of the dam wall and maximum water level, to keep the dam wall safe. The spill way is wide enough and placed in a location where it causes the least erosion by the overflowing water. The spill way is carved out of bedrock which makes it of great strength.



Cross-section dam

The dam wall is build on top of a strong underground just above the bedrock. After taking of the topsoil of the whole area the crucial element dam key is excavated to create the base for a hard core of compacted soil with a high content of clay and moisture to ensure sealage. A drainage pipe is placed over the length of the dam to be able to manage the water level. Then the dam is constructed by moving the soil from the dam reservoir up onto the dam wall and compacting it with a bull-dozer.