

Isbre Holding

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STATUS OF THE WELL DRILLING IN OSA, NORWAY, APRIL 29TH 2004

The well drilling in Osa started April 14th and was planned to be completed by May 1st . Due to some problems mentioned below we are delayed c. One week.

The work so far:

- 1: Drilling of one monitoring/investigation borehole between the municipality well field and Osa Vannesksports planned well field.
- 2: Drilling of one production well.

1 Investigation borehole

The investigation borehole was drilled to a depth of 33 m. Down to c. 18 m depth the soil (Sediments) consist of sand, gravel and stones. The water was encountered at c. 8,5 meter depth. I.e. from 8.5 to 18 m we find water-bearing strata (an aquifer). Of special interest is the type of bedrock found in these strata; a phyllite, which is the same bedrock as found in sediments in the municipality wells. From 18 to c. 26 m depth, the sediments consist of fine, sand, silt and some clay, that is, not water bearing strata. In these layers we found shells from marine shells. This illustrate so-called low permeable layers.

From 26 to c. 33 meter depth we find sand and gravel water bearing layers consisting of another bedrock type (gneiss). This bedrock type is the same as in the water bearing layers planned for use in Osa Vanneksports wells.

Thus, the drilling log illustrates two separate aquifers (water bearing strata). The upper aquifer is the same one as the municipality is using in their wells, and the lower is the same as planned for this project.

A monitoring well was installed in each of the aquifers. Last Thursday, the water level in the upper aquifer was 3 m higher than in the lower aquifer. This is an evidence for that these aquifers are separated and that the lower aquifer is recharged the upper one. The relatively low water level in the lower aquifer is a strong indication of a high permeability (a property to drain water).

Another possibility might be that the water feeding/recharge of the lower aquifer is low. Only pumping tests can give the answer on this. Regarding the possibility to get licence to abstract water, these observations are very positive because is demonstrate that the municipality is using one aquifer, and this project is using another one.

2 Production well

One of the production wells is installed. It was planned to be 33 m deep (into the lower aquifer), but due to a layer of big boulders, the well is 30,5 m deep.

It was apparently a very productive zone from c. 28-30,5 m depth, and we changed the design of the well a little bit in order to be able to use the deepest layer. The previous drilling indicated high permeability from 18 meters and down, the new drilling indicated a little bit lower permeability. Due to the layer of boulders, it is difficult to remove some of the outer casings. The well will be completed on Friday 30th of April, and the pump will be installed on Monday 3rd of May.

Another interesting observation last week was the big submarine spring in Salbuвика (in the fjord) which everybody in Osa is talking about. On low tide I could see this spring for the first time. This can be important in the discussion of what to call the water, spring water, artesian water etc.. It is my believe that the spring originate from the planed area for the new wells. By definition the water to be abstracted from the well may be called spring water if we can demonstrate a connection between the well field and the spring. On the other hand, the water already can be called artesian. As soon as the drilling operation is completed, the well/aquifer testing will start included water testing.

Regarding the discussion last week about the certification of the water, we might change the plans somewhat. I think we should go for long term pumping in order to get a Norwegian certification as well. The water source is already protected; some of the area is included in the municipality's protection plan on the downstream side, and Osa Mineral water protection on the upstream side. Only some minor changes will be needed.

As a conclusion we can say that the investigation drilling was very positive, but we have to perform pumping tests in order to understand the extent of the aquifer, the recharge and the real yield of the well.

Best regards

A handwritten signature in blue ink that reads "Oddmund Soldal". The script is cursive and fluid, with the first name "Oddmund" and the last name "Soldal" clearly distinguishable.

Oddmund Soldal
Hydrogeologist