25.03.2020
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WATER PROJECT

A new reservoir for Oslo in cooperation with Rambøll

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1. Introduction

During our outdoor education program at the University of South Eastern Norway we got the opportunity to work on a water project with Rambøll company. The collaboration between Rambøll and USN exists since 2019. They aim to educate us, so we can teach future generations about sustainable development by experiencing it ourselves. The head of the department of contaminated water and ecology of Rambøll, Tom Øyvind Jahren, is our contact person for the project. His department is responsible for ensuring biodiversity and handles projects that have an impact on water.

Rambøll is an engineering and management consultancy which was founded in 1945 in Denmark. Ramboll employs 16.500 people globally and has especially strong representation in the Nordics, UK, North America, Continental Europe, Middle East and Asia-Pacific. The mission of the company is to create sustainable societies where people and nature flourish. Rambølls vision is to be a globally leading consultancy delivering integrated and sustainable solutions, shaping today and tomorrow. Ramboll focuses on working towards achieving the SDGs through their projects, e.g. the depositing of snow in Sandvikselva, which was strongly and mainly connected to SDG 6, 14 and 13.

We were divided into three groups, each being responsible for one point of taking the sample. After visiting the creek and taking samples, we are visit the municipality to learn more about their water and sewage system in Oslo to get a better understanding of the need for this new water project. Throughout this day we are filming and taking notes, which will then be turned into a documentary about the project and a scientific report.

Interview with Tom Øyvind Jahren.

2. Place and dates

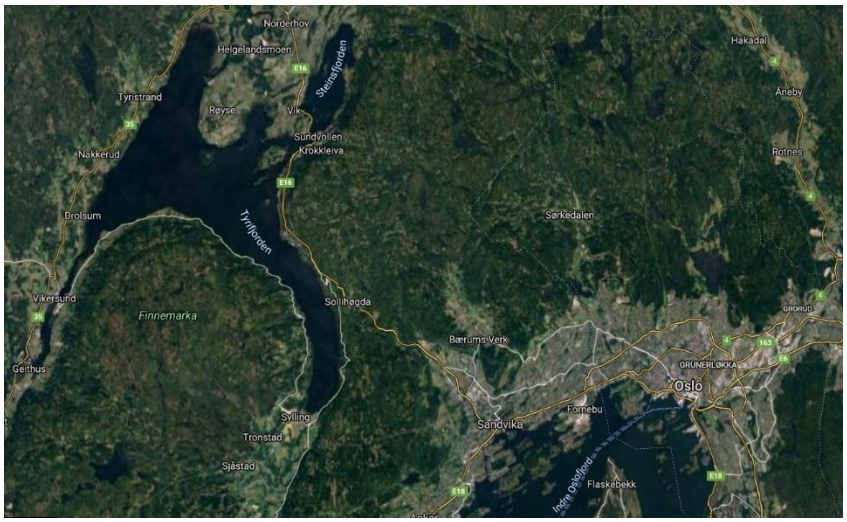
The first samples were taken on March 5th. Ramboll will continue to take samples approximately once a month at each monitoring point.

The samples are taken at three different points along a creek at Makrellbekken, which is a bit outside of Oslo.

3. Map

The place where the samples are taken at the creek at Makrellbekken.

Pictures of the Makrellbekken.



The old and new water reservoir of Oslo.

4. Purpose or fieldwork

The city of Oslo is mostly provided with water from lake Maridal and the surrounding rivers and waterbodies. Each person in Oslo uses about 160 litres of water a day. That are about 92 million m^3. “Maridalsvann” covers 90% of the water requirements. The other 10% come from the Elvåga lake. Although this freshwater network is adequate, the municipality of Oslo still decided to add another water resource. Not for the reason of the first one not being enough or polluted, but because of the safety of it. So, the goal is to have a new independent freshwater resource for the city, in case one of them gets polluted or, out of any other reason, unusable. For this they chose the Holsfjorden western of the city, which is way larger than the existing water resource. A new water treatment plant is going to be built in the west of Oslo as well, so the new resource has no problem connecting to the given network. To transport all the freshwater from the fjord to the city, there is going to be a new tunnel drilled through the mountain. The exact position of this tunnel is highly secret, since the municipality wants to achieve a high level of security around the new water system. This whole project is going to cost around 12 to 15 billion Norwegian crowns and the deadline is in the year of 2028. To monitor the water quality before, during and after the project Rambøll was brought in.

Since this is a long-term project, we are very lucky to be able to join it at the very start. The employees have already defined three spots for taking water samples. The first one upstream where the water is in its natural state. The second and third one further down the creek where possible contamination is possible. The water must be monitored in case of water being discharged to the creek due to the overflow of the sewage system. Water is used for cooling the drill during the construction work on the tunnel which connects the water reservoir with Oslo. This water will be led to the sewage system. However, should that overflow due to heavy

rain or sewage and the capacity of water cannot be cleaned, it will be led into some creeks in Oslo. Therefore, Rambøll is in charge of monitoring the water quality and ensuring a functioning ecosystem. Should the water quality be massively affected or the ecosystem endangered, the project can be stopped until a solution is found.


5. Field equipment

- Science log to note down temperature, PH, conductivity, colour, time, smell, comments
- Big plastic container to collect water
- Small brown glass container to measure mercury
- Glass bottle to measure oil
- Stickers to label each bottle
- Gloves (warm ones and one-way ones)
- Safety glasses
- Life jacket
- PH and temperature measurement item



6. Methods

This is a list what us and Rambøll tested for:

- Particles
- PH is the most important and interesting because it can have an effect on all other measures as well
- Nutrients

- Oil
- Temperature is not allowed to be affected by construction work because it has a huge impact on the ecosystem
- Mercury
- Smell
- Ammonium is affected by temperature; could come from the explosives that are used during the construction work
- Conductivity (how well water conducts electricity)

In order to measure our data correctly, we took a big plastic bottle with a wide opening and held it under flowing water at a spot which is easily accessible. For our own safety the one taking the sample must put on the life jacket with light reflection before sampling. As the water might be contaminated or polluted in some way, wearing protective gloves is also a must. Once the big plastic bottle was filled, we could start to take further steps in collecting our different data. Therefore, we transferred some water in a clear glass bottle and some in a smaller bottle with acid for further testing. After that we filled the plastic bottle up again for Rambøll to take it back to the laboratory. We also used a PH meter directly in the water for exceeding test results. Additionally, we filled up a smaller plastic bottle to take it back to our university. In the following chapters the exact methods and their results will be described and analysed.

7. Description of methods

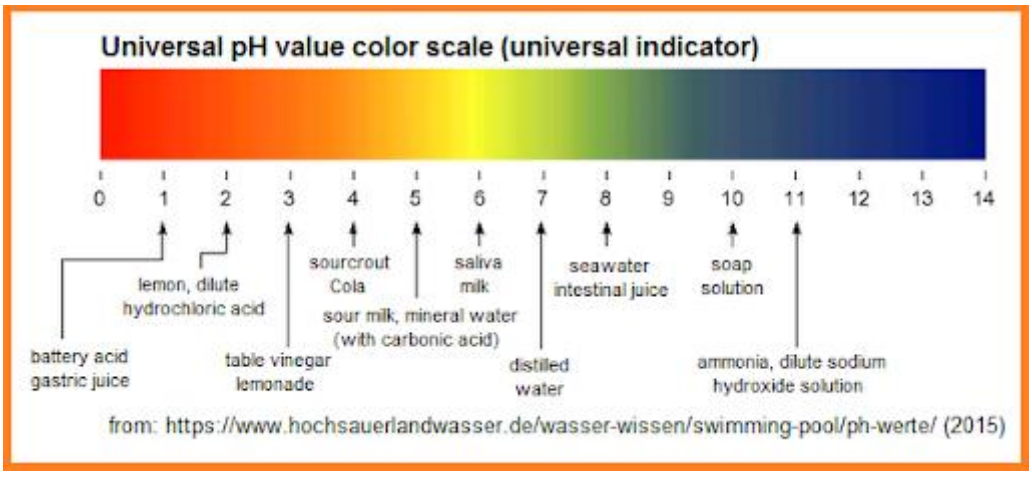
First and foremost, putting on the safety equipment is essential. In our case that was a reflective life jacket in case of falling in the water, a pair of protective gloves should the water already be contaminated. After putting on the safety equipment we started our field work. Before even starting the water sampling we observed the relative **height of the water** compared to the water line, which seemed medium at this time. The **smell** could be classified beforehand, by just smelling the air. To probe the water properly we had two bottles to sample with, one plastic bottle and a glass bottle. We took the bigger plastic bottle with a big opening into the water, since it is easier and faster that way to fill it up. Once it was full, we transferred the water into the see-through glass bottle. Thereby we could analyse the **colour** of the water, if there are **oils** and any **particles** in it. Additionally, we poured some water in a small brown glass bottle with some acid in it to test it for the amount of **mercury** in it. For the testing with acid we had to put on some safety glasses for our protection. Furthermore, we used a PH meter which could measure the **PH level** in the water, the **temperature** of it as well as the **conductivity**. The glass bottle filled with the stream water was sent to the lab of Rambøll to examine the amount of **nutrients**, **ammonium, metals** in the sample. All taken samples were brought back to Rambøll into the lab for further examination and we took one bottle back for testing it ourselves.

8. Results



	Group 1	Group 2	Group 3
PH field	8,2	8,2	9
PH campus	7 / 7 / 6,5	7 / 7 / 6,5	7 / 7 / 7,5
Connectivity	1065 mS/cm	1005 mS/cm	952 mS/cm
Temperature	4,2 °C	4,1 °C	4,2 °C
Colour	Medium grey	Medium grey	Medium grey
Smell	It´s smelling a bit like sewage	Smellier than (1)	Smellier than (1)

We wonder why the water is so alkaline. Usually the PH should be neutral (PH 7) or lower. Maybe because the machine wasn´t calibrated and therefore the results are wrong. Later on, it also could be a sign of overflow from the drilling. Since they will use explosives during the construction work, it might lead to stone particles (natro gaions particles) and minerals leaking in the streams. This can make the water more alkaline and explain the high PH, but the tunnel work has not started yet. The given minerals in the rocks of the river could also be a reason for the high PH-levels.



9. Discussion

In what ways may monitoring of water contribute towards reaching the sustainable development goal (clean water)?

- By monitoring water an imbalance can be discovered at an early age, so the water quality can be protected and restored
- As a long-term goal, the improvement of the water quality is easier achieved by monitoring the water
- Raising awareness towards efficiency of water usage
- It ensures universal access to save drinking water
- Individuals can report to the municipality if there are changes of the water quality

Our group.