



Report for water analysis in Aguas Agrias community, Granada, Nicaragua

1. Chain of custody or third party water testing

Table 1. Chain of custody

Description of the sample	
Date	Wednesday, July 13th, 2022
Time	8:53 am
Number of samples	2
Matrix	Water
Source origin	The first sample comes from a surface source, specifically from a river called Manares, and the second sample was taken from a house and comes from a well.
Sampling location	Aguas Agrias, Granada
Coordinates	River: 11° 46' 24.98" N y 85° 58' 24.73" O House: 11° 46' 47.07" N y 85° 58' 28.64" O
Total volume	1 liter o 1000 mL per sample, a total of 2 liters o 2 000 mL
Analysis information	
Measured parameters	Total coliforms pH, conductivity, salinity, total dissolved solids, temperature, etc.
Method of analysis	Neither of the two water samples showed noticeable turbidity.
Observations	In the Los Cocos community sample, no color or high turbidity can be observed with the naked eye; however, the community members do not dare to take it because they doubt its quality.

2. Results for Total Coliforms

Parameter	Value	Recommended values	Maximum permissible values according to CAPRE
Total coliforms NMP/100 mL of sample	4	Negative	≤ 4

Table 2. Water quality results for the Manares River, Aguas Agrias community.

Parameter	Value	Recommended values	Maximum permissible values according to CAPRE
Total coliforms NMP/100 mL of sample	500	Negative	≤ 4

Table 3. Water quality results for the Aguas Agrias community.

According to the Quality Standard for Human Consumption CAPRE (1994), the maximum admissible number of total coliforms should be ≤ 4 NMP/100 mL for point samples, where it should not be detected in 95% of the annual samples.

This standard mentions that in quality control analyses, the presence of total coliforms is determined and if a positive sample is detected, resampling is performed and the presence of fecal coliforms is investigated. If the resampling is negative, the positive sample is not taken into consideration for the annual quality assessment. If the resampling is positive, the activities of the sanitary surveillance program established in each country are intensified.

Given that the value for the river analysis is 4 NMP/100 mL, another analysis is recommended for the Manares River, as well as another series of analyses to demonstrate whether this water is fit for human consumption. Given that after

being known as "Aguas Agrias" it is assumed that there is a presence of sulfur, as well as other metalloids and heavy metals that can affect human health.

In the case of the water from the house sampled, it has a high content of total coliforms, 500 NMP/100 mL of sample, so it is assumed that this water should be analyzed for fecal coliforms to confirm or rule out the presence of this group of coliforms, which is the most harmful to health.

3. Results of physical-chemical analysis.

Parameter	Value	Maximum permissible values according to CAPRE
Total Dissolved Solids (mg/L)	332	1000
Salinity (ppt)	0,23	
pH	6,12	6,5 a 8,5
Conductivity (μ S/cm)	468	400

Table 4. Manares river sample

Table 5. House sample

Parameter	Value	Maximum permissible values according to CAPRE
Total Dissolved Solids (mg/L)	255	1000
Salinity (ppt)	0,18	
pH	7,47	6,5 a 8,5
Conductivity (μ S/cm)	360	400

Observing the results presented by the multiparametric tool, it can be noted that the condition changes in terms of quality. The pH in the river water is below the admissible levels for human consumption, that is, a pH considered acidic to be ingested. Also, the conductivity levels are above the maximum admissible levels.

It is assumed that in a water containing a low pH, heavy metals are more soluble, so this solubility will determine its toxicity, also, a low or acid pH can cause irritation to mucous membranes or internal organs including ulcers. It is therefore recommended that these waters be tested specifically for heavy metals and arsenic to measure their level of toxicity. Conductivity rises as its ionic content increases, which is related to the water-rock interaction in surface water, which can also be related to hardness, according to UNED (2011), which is sensitive to variations in dissolved solids, mainly mineral salts, which will depend on the geology.

A hardness analysis is recommended to define the magnitude of contamination by mineral compounds in the source and in the case of water with high hardness, the recommendation is a treatment to soften it (reduce the amount of salts). In the case of calcium or magnesium carbonate, it can be treated by heating it to boiling so that the carbonate and magnesium hydroxide precipitate, ending with filtration so that they disappear.

As for the analysis of the water sample from the house, it is below the maximum admissible levels, being suitable for human consumption by means of the parameters analyzed. It is also recommended to perform other types of analysis to rule out other contaminants and to assume that it is safe in its entirety.

Figure 1. Micro-localization map

Mapa de microlocalización: Toma de muestras de agua en Aguas Agrias, Granada

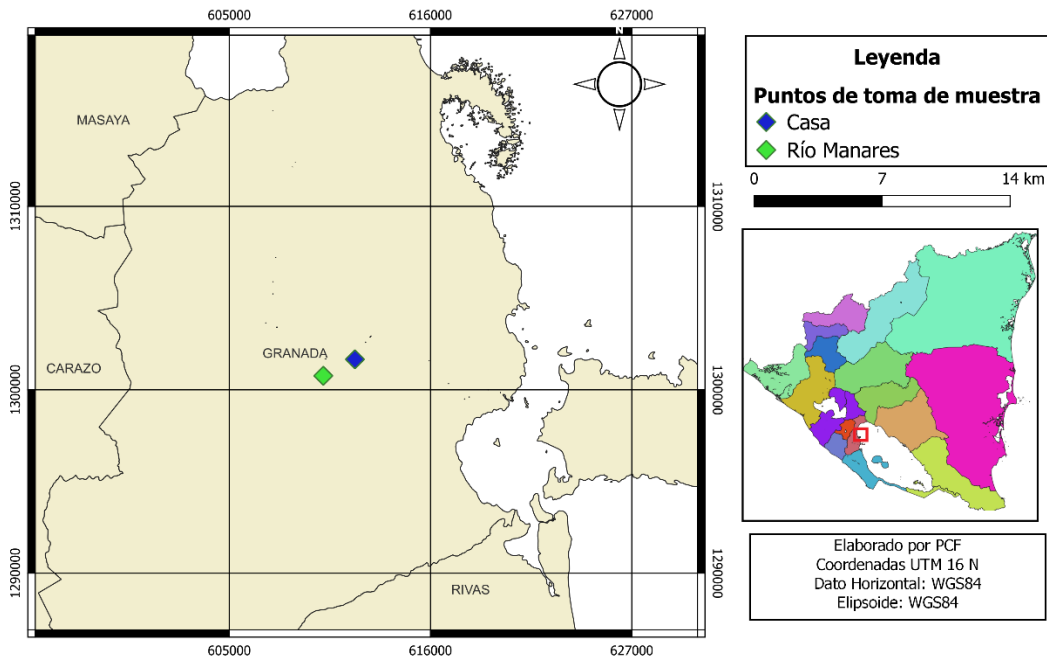


Figure 2. Presumptive analysis for total coliforms

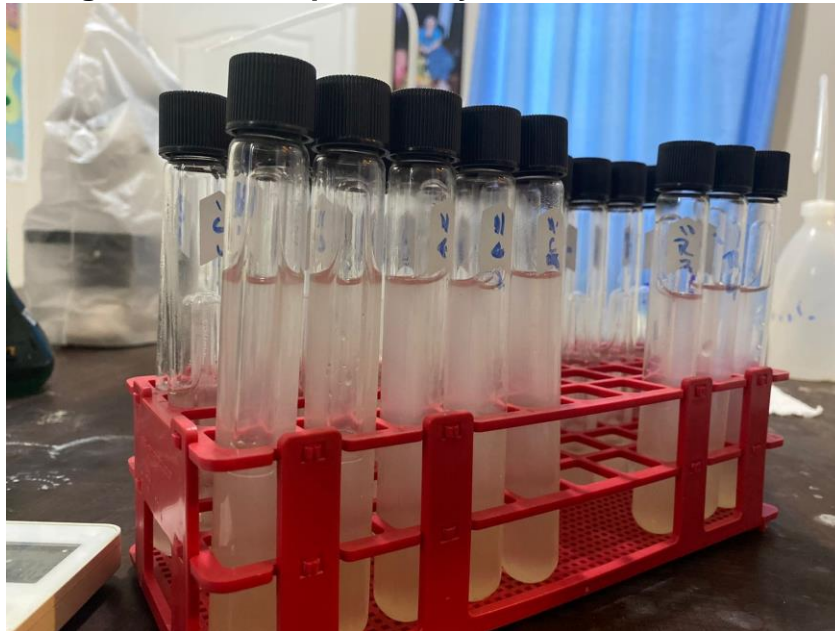
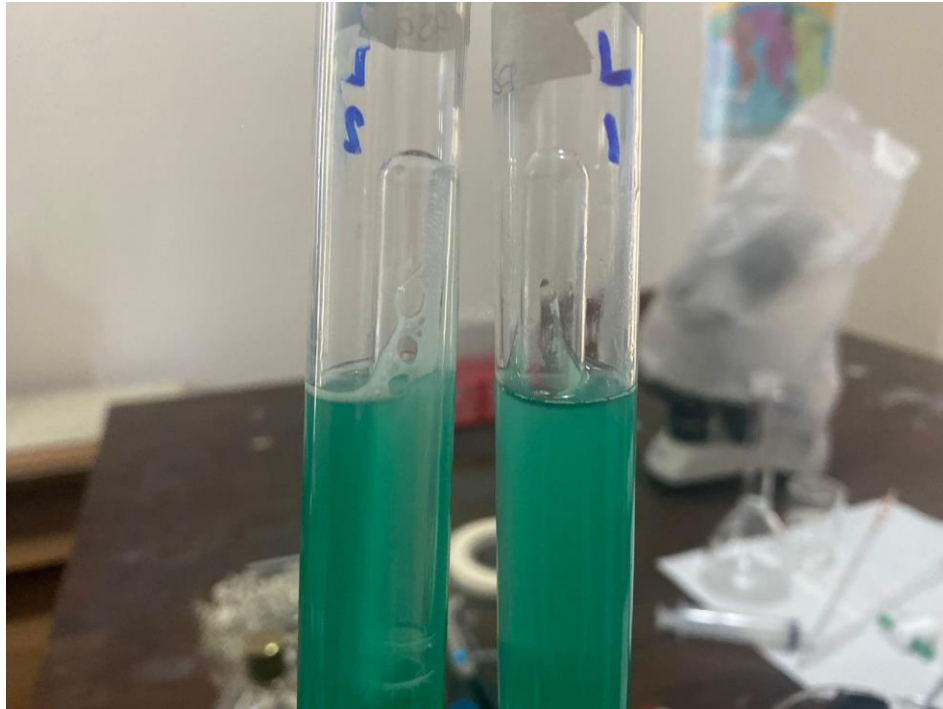


Figure 3. Confirmatory analysis for total coliform



4. Reference

Norma Regional CAPRE. (2014). *Normas de Calidad del Agua para Consumo Humano*.
https://www.rasnic.org/wp-content/uploads/2020/09/CAPRE_Normas_Regional-1.pdf

UNED. (2011). *Físico-química de las aguas superficiales de la Cuenca del río Rincón, Península de Osa, Costa Rica*.
<https://www.redalyc.org/pdf/5156/515651982004.pdf>