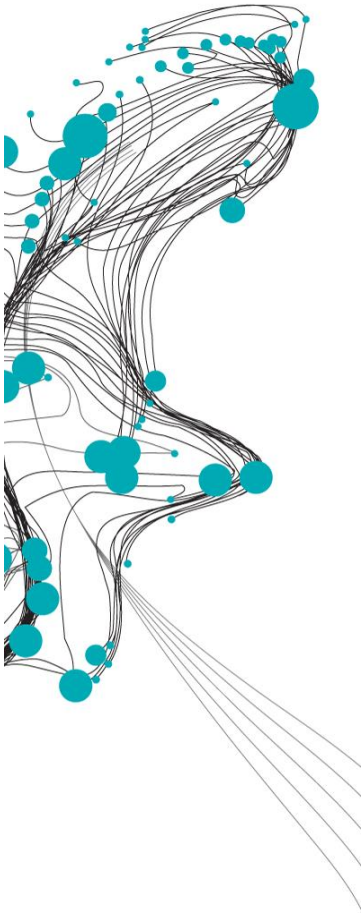
THE WATER FOOTPRINT OF GOLD PRODUCTION



Water is the most important resource on the planet and although it is considered a renewable one, it is limited to the amount of precipitation and freshwater available over specific time periods. Considering this, the water footprint (WF) assessment proves to be a helpful tool to prevent unsustainable uses of water and develop integrated water management practices. Although agriculture is the most water-consuming activity on earth, the mining industry is also a large water user that can have large effects on local water availability in the regions where it is executed. Besides, society's need for mined commodities continues and shows no signs of decreasing. Despite this, in comparison to agriculture, there hasn't been done nearly enough research regarding the water footprint of mining.

The scope of this research is on the gold mining industry, considering the extraction and beneficiation of the gold ore. The water footprint assessment method, introduced by Hoekstra, is used to evaluate the direct and indirect blue WF, and the direct grey WF, of 1 kg of refined gold, as well as assessing its environmental sustainability. The objective is to further our understanding of the water footprint in the production of gold. This is done with the following method consisting of 6 steps: First (1) is establishing the WFdirect,blue. This is followed by (2) calculating the WF of the electricity mix of different continents. Later (3) determining the energy-related blue WF (which, for the purpose of this research is equivalent to the WFindirect,blue). Afterwards, (4) the direct WFgrey is measured. And the final step (5) consists of assessing the environmental sustainability and resource efficiency regarding the WF of this industry, considering the water stress index (WSI) and the monthly water scarcity (WS).

This study concludes that the total yearly WF of gold production in 2017 is around 1.83×10^{12} m3 for both ore types. The global average WFs of 1 kg of refined gold has been estimated at 571x103 m^3 for non-refractory ore and 571x103 m^3 for refractory ore, where the contribution from the WFgrey is roughly 99.8% for both ore types. The grey WF is thus three orders of magnitude larger than the blue WF. The direct blue water footprint (independent of ore type) is 512 m^3, while the indirect for non-refractory and refractory is 382 m^3 and 610 m^3 respectively. Also, despite the WSI assessment showing that gold is generally not mined in water stressed countries, the monthly WS indicates that the majority is at risk of experiencing WS. This, along with the overwhelming results in terms of the overall WF and WFgrey, indicates that gold mining has the potential to make a large impact on local basins.

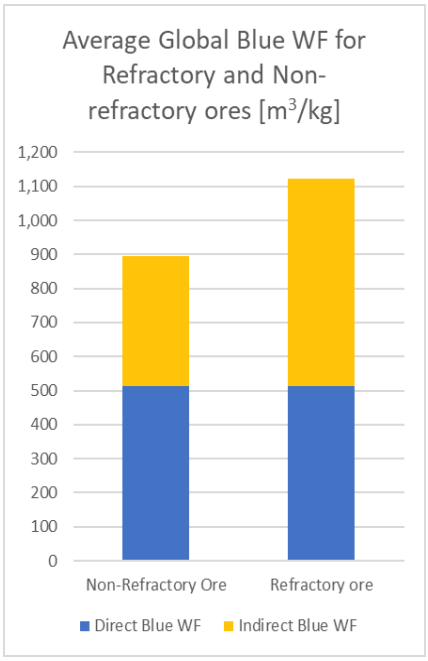


Figure 1: Average blue water footprint of gold production

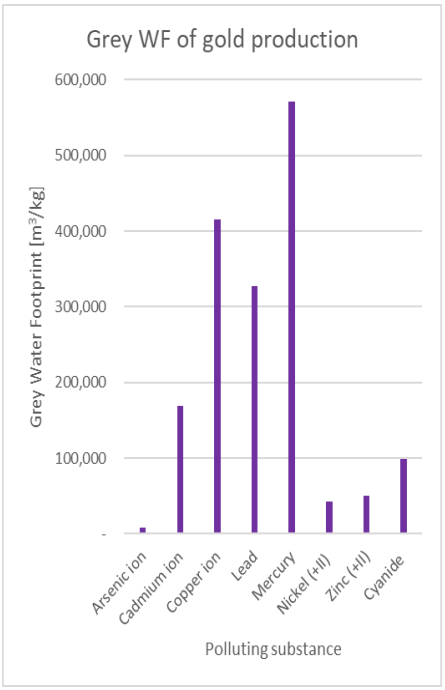


Figure 2: Average grey water footprint of gold production.

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