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A food loss and waste water footprint calculation tool for organisations in the UAE



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FOREWORD

Water is a shared resource that supports our communities and ecosystems and is vital to our food and drink system. Climate change and associated extreme weather events have led to an increase in both drought and flooding and freshwater quality continues to be put at risk largely driven by the agri-food sector. We also know that food loss and waste (FLW) is a global issue that has significant impacts on the natural environment, in particular water scarcity and degradation of various water resources. Today, 25% of freshwater resources used for agricultural production are to irrigate food that ends in the wastebin. This is at a time when the freshwater resources planetary boundary for both blue and green water has entered into the critical zone of uncertainty.

It has long been suggested that ‘what gets measured gets managed’. Measuring the water footprint of the food that we produce as well as the food we import and subsequently waste is a crucial step to understanding this vital issue, and more importantly, empowering us to do something about it.

Through our experience with international partners, we know that guidance and support must be adapted to the specific context and geography in which we’re working. This is why WRAP, Thriving Solutions and City, University of London have joined forces to create a Water Footprint Tool for food loss and waste in the United Arab Emirates (UAE); a country that is acutely aware of the climate and water impacts of FLW. The UAE’s commitment to the transformation of its food system and tackling FLW is evident in its ambitious FLW reduction targets in its Strategy and its Nationally Determined Contribution, coupled with the launching of the national FLW initiative ne’ma. At COP28 the UAE put food systems transformation high on its agenda via the [Declaration on Sustainable Agriculture, Resilient Food Systems and Climate Action](#).

Measuring the water footprint of FLW in the UAE will, we believe, empower individuals, organisations, and governments to make informed decisions, re-evaluate supply chains, and champion sustainable water management that resonates with the UAE’s vision for a greener, more sustainable future.

This tool lays the foundation for guidance to organisations and governments in the UAE who are seeking to measure and tackle the water footprint associated with their FLW. If you haven’t already, now is the time to commit and play your part.

We look forward to working with businesses, governments and other organisations in the UAE and the Arab region, as together we can accelerate progress on reducing the water footprint of our food and drink system and ensure that no good food goes in the bin.

BACKGROUND

1.0 The food loss and waste challenge

Food loss and waste (FLW) can be defined as the decrease in quantity or quality of food along the food supply chain, from production to consumption¹. FLW has significant impacts on the environment, including the depletion of natural resources such as water, land, and biodiversity, and the emission of greenhouse gases (GHGs) that contribute to climate change. This report focuses on the connection between FLW and water footprint, which is a measure of the amount and quality of water used to produce goods and services.

According to the Food and Agriculture Organization of the United Nations (FAO), the global volume of FLW is estimated at 1.6 billion tonnes of primary product equivalents, with a global cost of \$750 billion annually². The global blue water footprint for the agricultural production of food wastage is about 250 km³; 3.6 times the blue water footprint of total USA consumption³.

UNEP estimates that 44% of food is lost or wasted in the Middle East region and the highest portion of waste (34%) is wasted at the consumption stage⁴. This is a region with an unfavorable natural resource base for agricultural production which is expected to worsen with climate change. The region imports a large percentage of its food at a considerable economic cost and is currently experiencing an increase in malnutrition including hunger.

In the United Arab Emirates (UAE), more than 90% of food is imported, and the food produced locally uses precious water resources⁵. Comparable to the other Arab regions food waste is very high and is estimated to be around 133 kilograms/ per person/ per year with the majority of that waste occurring in households⁶.

In 2022, the Ministry of Climate Change and Environment, Emirates Foundation, and the Abu Dhabi Crown Prince Court, launched ne'ma, the National FLW Initiative⁷. ne'ma seeks to align the

actions of government, private sector, NGOs, and communities to cut FLW across the whole value chain⁸. Its goal is to deliver on the UAE's target to reduce FLW by 50% by 2030. This ambitious target is officially communicated in the UAE's Nationally Determined Contributions (NDC) to the Paris Agreement.

1 The United Nations Food and Agriculture Organization (FAO) differentiates between food waste and food loss whereby Food loss is “The decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, food service providers and consumers”, and Food waste is “The decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers and consumers.”

2 FAO, “Food Wastage Footprint. Impacts on Natural Resources. Summary Report” (Food and Agriculture Organization of the United Nations (FAO) 2013)

3 FAO, “Food Wastage Footprint. Impacts on Natural Resources. Summary Report” (Food and Agriculture Organization of the United Nations (FAO) 2013)

4 [United Nations Environment Programme \(2021\). The State of Food Waste in West Asia.](#)

5 UAE MOCCA (2023) [“A Guide to Food Security in the UAE” Ministry of Climate Change & Environment Dubai, United Arab Emirates”](#)

6 [Forbes, H., and Qusted, T. \(2021\). FoodWaste Index - Level 1.](#)

7 [ne'ma | National Food Loss and Waste Initiative \(nema.ae\)](#)

8 “ne'ma | National Food Loss and Waste Initiative” <https://www.nema.ae/>

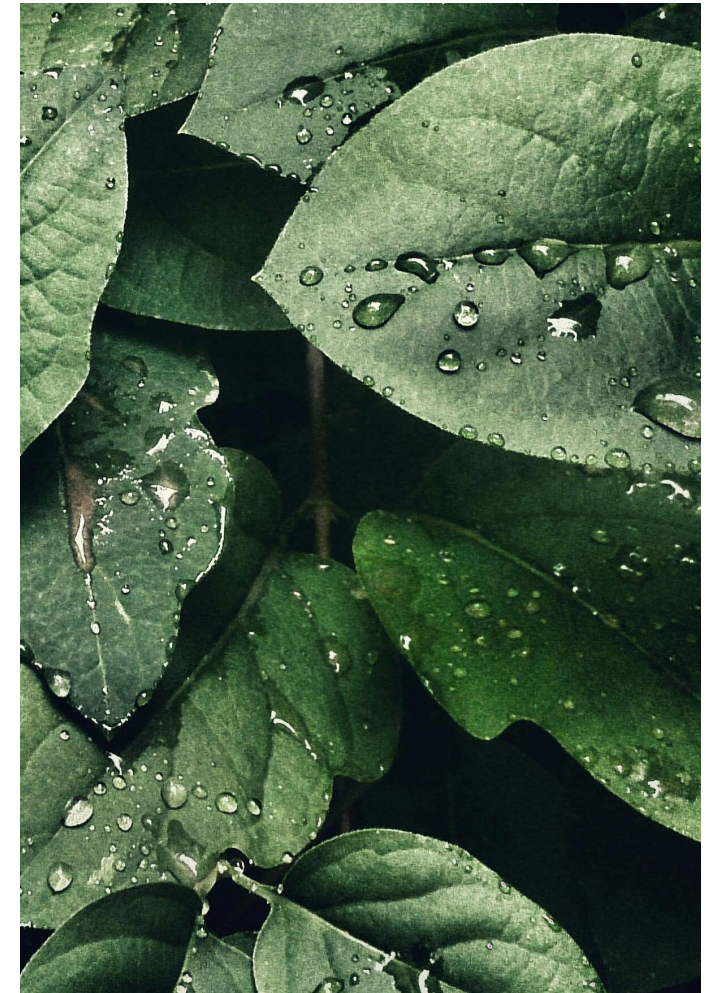
BACKGROUND

Today, we see an increasing drive by the private sector to join the climate action movement and reduce their greenhouse gases. This is observed by the increased number of companies undertaking GHG inventories. The private sector has also developed an increased recognition of the water footprint of FLW, however, quantification has not been as widespread as those measuring the GHG emissions associated with FLW. This is in part due to limited availability of water footprint tools and resources to support organisations to quantify the water impact of FLW.

The Food Loss and Waste Accounting and Reporting Standard, also known simply as the FLW Standard, provides a common language and clear requirements for companies that are seeking to quantify and report their FLW. The FLW Standard requires companies to quantify and report their FLW in weight while recognizing the value of also quantifying and reporting FLW in alternative units of measure that are relevant to the company.

The FLW Standard has issued 'Connecting Food Loss and Waste to Greenhouse Gas Emissions: Guidance for Companies' which is a valuable tool to support companies in the food system undertaking a GHG inventory as it provides step-by-step instructions that helps companies understand, connect, calculate, describe and communicate the scale and relevance of their FLW in GHG emissions.

Companies measuring their FLW and pursuing initiatives to manage it will also benefit by being able to estimate the GHG emissions associated with their FLW. It also enables companies to track reductions in GHG emissions associated with reductions in FLW.



2.0 Differences between greenhouse gas (ghg) emissions and water footprints

Greenhouse gas emissions (GHGE) are the gases that trap heat in the atmosphere and contribute to global warming and climate change. GHGE can be measured in terms of carbon dioxide equivalent (CO₂e), which is a unit that expresses the impact of different greenhouse gases in relation to carbon dioxide. GHGE can be calculated for different stages of the food system, such as production, processing, transportation, storage, consumption, and waste.

Water footprint is a measure of the amount of water consumed and polluted during the production of a good or service. Water footprints can be divided into two main types: blue and green. Blue water footprint refers to the use of surface or groundwater sources, such as irrigation. Green water footprint refers to the use of rainwater and soil moisture, such as rainfall. A water footprint can also be calculated for different stages of the food system and can be expressed in terms of litres (L) or cubic meters (m³) of water per unit of product.

The differences between GHGE and water footprints are mainly related to the sources and impacts of the environmental resources. GHGE are mainly derived from the combustion of fossil fuels and the emission of biogenic methane and nitrous oxide from agricultural activities. GHGE have a global impact, as they affect the atmospheric concentration of greenhouse gases and the radiative forcing of the Earth. Water footprints are mainly derived from the withdrawal and contamination of freshwater resources, such as rivers, lakes, and aquifers. Water footprints have a local or regional impact, as they affect the availability and quality of water for human and ecological use.

The geography of production matters for both GHGE and water footprints, as different regions have different climatic conditions, soil types, water availability, and energy sources. For example, producing rice in a humid and rainy area may have a lower blue water footprint but a higher green water footprint and higher GHGE than producing rice in a dry and sunny area. Similarly, producing beef in a grass-fed system may have a lower GHGE but a higher water footprint than producing beef in a feedlot system.

The importance of GHGE and water footprints for environmental impact assessments is that they provide a way to quantify and compare the environmental effects of different products, processes, and scenarios. Environmental impact assessments can help companies to identify the hotspots and trade-offs of their activities, to set targets and indicators for improvement, and to communicate their environmental performance to stakeholders and consumers. By using GHGE and water footprints, companies can also align their strategies with the global and national goals for mitigating climate change and ensuring water security.

3.0 Food loss and waste and the sustainable management of water

The UN Sustainable Development Goals (SDGs) aim to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains by 2030 (SDG 12.3)⁹. Achieving this target would also contribute to other SDGs related to water, such as ensuring availability and sustainable management of water and sanitation for all (SDG 6), protecting and restoring water-related ecosystems (SDG 6.6), and increasing water-use efficiency across all sectors (SDG 6.4).

To reduce FLW and to sustainably manage water resources, various complimentary actions are needed at different levels of the food system, from producers to consumers. Some examples of possible actions are:

- Improving agricultural practices and technologies
- Enhancing storage and transportation infrastructure
- Adopting better packaging and labelling standards raising awareness and education among consumers
- Promoting circular economy models such as reuse and recycling of food waste
- Supporting policy interventions and incentives that encourage FLW reduction¹⁰.

By taking these complimentary actions to reduce FLW, we can not only save water resources for other uses or for future generations, but also improve food security, nutrition, health, livelihoods, and environmental quality for ourselves and future generations.

The type and origin of food, as well as the stage of the supply chain where the loss or waste occurs, can alter the amount of water used in the production and processing of the food¹¹. This means that when food is lost or wasted, these sourcing factors can mean different amounts of water are lost or wasted. For example, cereals require lower amounts of water inputs than meat or dairy products; and food produced in arid regions requires more additional water than food produced in humid regions, and so have higher water footprints. When these high-water foods are wasted, the water that was used in their production is wasted¹².

⁹ [12.3 Food Loss & Waste | SDG 12 Hub](#) accessed December 18, 2023

¹⁰ EU Platform on Food Losses and Food Waste., [Key Recommendations for Action](#)* (EU Platform on Food Losses and Food Waste 2019)

¹¹ World Bank, "Addressing Food Loss and Waste: A Global Problem with Local Solutions" (World Bank, Washington, DC 2020)

¹² Marston LT and others, "Reducing Water Scarcity by Reducing Food Loss and Waste" (2021) 5 Frontiers in Sustainable Food Systems

4.0 What is a water footprint?

A water footprint is a method of accounting for water use. It helps people compare the different purposes that our limited freshwater resources are used for. Previous comparisons made with water footprints have included the direct and indirect water use of specific processes, products, companies, or industrial sectors. Typically, water footprints include water consumption and pollution throughout the full production cycle from the supply chain to the end-user¹³.

The global standard on water footprint assessment was developed by the Water Footprint Network (WFN). Under the WFN definition, a water footprint consists of three sub-components that measure different sorts of water use: blue water, green water, and grey water.

¹³ A good introduction to the water footprint concept is provided by the Water Footprint Network see <https://www.waterfootprint.org/water-footprint-2/what-is-a-water-footprint/> Likewise, see FAO, “Food Wastage Footprint. Impacts on Natural Resources. Summary Report” (Food and Agriculture Organization of the United Nations (FAO) 2013) for Water Footprint use to measure Food Loss and Waste

Blue water in agriculture is the consumptive use of irrigation water taken from ground or surface water. It is either evaporated, incorporated into a product, or taken from one body of water and returned to another, or returned at a different time.

Green water is the rainwater directly used and evaporated by non-irrigated agriculture, pastures, and forests. It is particularly relevant for agricultural, horticultural and forestry products.

Grey water is the freshwater needed to assimilate pollutants in order to reach quality standards. It therefore accounts for the direct and indirect release of pollutants into freshwater sources. Due to the unpredictability of grey water sources, this tool only accounts for green and blue water.



5.0 How to use this publication and tool

This publication and accompanying tool support people across the food supply chain, particularly those calculating water footprint and setting science-based targets, to:

- Better understand and connect FLW reductions with their efforts to reduce systems-wide water use.
- Calculate and communicate the environmental benefits of FLW reductions.
- Link those benefits to their science-based water use reduction targets.

This tool is designed so that an organisation can easily navigate to those sections that are most relevant for the organisation's particular situation.

This document contains guidance and recommendations about:

How to calculate the water associated with FLW. Section 6.0 provides the basic steps and calculations for estimating the blue and green water footprints associated with FLW and/or its reduction. This includes identifying the FLW-associated blue and green water footprints from the food supply chain and from FLW destinations.

How to communicate about the water footprint benefits of FLW reductions. Organisations are increasingly stating their interest in fighting water scarcity and pollution by reducing FLW, sometimes to help achieve sustainable water management targets. This is particularly important for the UAE which is severely water scarce. Its renewable freshwater resources are at 16 cubic meters (m³) per capita¹⁴ and available water resources that utilise desalination are at 525 cubic meters (m³) per capita¹⁵. Sections 7.0 and 8.0 provide recommendations for government (7.0) or food businesses and other stakeholders (8.0) in the UAE seeking to communicate about the contribution of FLW to water footprint reduction efforts.



¹⁴ World Bank. (n.a). [Renewable internal freshwater resources per capita \(cubic meters\)](#).

¹⁵ World Bank. (n.a). [Renewable internal freshwater resources per capita \(cubic meters\)](#).

6.0 The UAE water footprint tool

The following sections summarise the structure of the tool including the geographic regions and food groups (section 6.1), a description of who can use the tool (section 6.2), the data required by the user (section 6.3), and a step-by-step guide on how to use the tool (section 6.4). Further details on the methodology and underlying data in the tool are provided in the Annex 1.

6.1 Regions and food groups in the tool

This tool provides the capacity to calculate the blue and green water footprints for 27 food groups for both purchased food and food waste. Foods can be grown in the UAE or imported from one of nine other regions. The regions and food groups covered in the tool are summarized in Table 1.

6.2 Who can use the tool?

A government or policy maker in the UAE could use this tool to calculate the water footprint of food purchased, eaten, wasted, or redistributed for a city, region, or country. Governments can also

calculate the water footprint of locally produced food and the water footprint of imported food separately.

Food businesses can use this tool to calculate the water footprint of food purchased, eaten, wasted, or redistributed by their business.

6.3 What data do I need?

If the user has data on the weight of food waste

To use the tool for the purpose of a water footprint assessment for a city, region, country, or business the user would need to have food production and/or purchase data (or other dietary data related to food produced, purchased, or consumed) and the amount of imports vs domestically produced foods. The weight of this food can then be allocated to the 27 food groups to estimate blue or green water footprints for food purchased. Likewise, if a government user has measured the weight of FLW in their city, region, or country¹⁶ the volumes of food wasted and redistributed can be input into the tool (separated by the various waste treatment

or redistribution destinations). This can then be used to calculate blue or green water footprints related to this waste for a city, region, or country.

If the user has no data on the weight of food waste

If the user does not have specific weight of food waste, an established food loss and waste ratio to purchase, consumption or production can be used as a proxy to calculate a weight of food wasted¹⁷. This weight can then be either sorted to the 27 food groups for a more accurate blue or green water footprint calculation, or all of the weight assigned to the “Mixed waste category” for a general blue or green water footprint calculation.

¹⁶ Destinations can include Anaerobic digestion / codigestion; Composting / aerobic processes; Incineration / controlled combustion; Land application; Landfill; Sewer / wastewater treatment; and Redistribution. See World Resources Institute, “Food Loss and Waste Accounting and Reporting Standard” (WRI 2016)

¹⁷ See section 7.2 and “INFERENCE BY CALCULATION” in Hanson, C., Lipinski, B., Robertson, K., Dias, D., Gavilan, I., Gréverath, P., Ritter, S., Fonseca, J., VanOtterdijk, R., Timmermans, T. and Lomax, J., 2016. Food loss and waste accounting and reporting standard.

Table 1. Geographic regions and food groups covered in the tool

Regions		Food groups		Food groups (continued)	
1.	UEA	1.	Alcoholic beverages	21.	Olive Oil
2.	North Africa	2.	Beans and pulses	22.	Rice
3.	Rest of Africa	3.	Beef	23.	Roots and Tubers
4.	West Asia	4.	Bottled water**	24.	Soft drinks**
5.	Rest of Asia	5.	Butter & Cream	25.	Sugar
6.	Europe*	6.	Cakes, Biscuits & Desserts**	26.	Tea
7.	North America	7.	Camel	27.	Vegetables
8.	Latin America	8.	Cheese **	Additional categories for Waste Input Sheets	
9.	Oceania	9.	Chicken & Poultry		
10.	Rest of the world	10.	Coffee		
		11.	Dates	28.	Mixed Waste
		12.	Eggs	29.	Redistribution
		13.	Fish and seafood**		
		14.	Fruit		
		15.	Fruit juices**		
		16.	Grains, Breads & Pasta ex. Rice		
		17.	Lamb		
		18.	Meat - other (inc. pork)		
		19.	Milk & Yoghurts		
		20.	Oils (other)		

* Europe includes countries of the European Union – rest of the countries in Europe were excluded.

** Data sourced from wider literature. Please see Data Sources and assumptions section for more information.

6.4 Step-by-step guidance on how to use the tool

This part provides the basic steps and calculations for estimating the blue and green water footprints associated with FLW and/or its reduction using this tool.

Note:

Be careful with the units: purchases should be in kilograms (kg) or litres (L). In-country partners should work with the organisation, for example, a hotel to get their purchase ledger which might be in units or monetary units and will need to be pre-converted to kg through price/kg or weight/unit.

Front sheet summary

This sheet provides a summary of calculations performed in the tool. As shown in Figure 1, this sheet provides a summary of calculations performed in the tool including:

- Total weight (kg) of food purchased
- Green and blue water footprints of food purchased (L)
- The amount of wasted food (kg)
- Green and blue water footprints of wasted food (L)
- Amount of redistributed food (kg)
- Green and blue water footprints of redistributed food (L)

Summary Sheet

FOOD PURCHASE	
Total amount of food purchased (kg)	792,524
Total embodied green water in purchased food (L)	7,328,698,479
Total embodied blue water in purchased food (L)	1,129,786,224

FOOD WASTE	
Total amount of food waste (kg)	202,996
Total embodied green water in food waste (L)	1,178,930,604
Total embodied blue water in food waste (L)	273,182,935
Amount of food redistributed (kg)	1,890
Green water saved by redistribution (L)	64,035,850
Blue water saved by redistribution (L)	8,927,185

This publication and the accompanying "Water Footprint tool for food loss and waste in the United Arab Emirates" have been launched as part of the Arab Friends of Champions 12.3, a collaborative network for industry, governments and NGOs in the Arab region working to reduce food loss and waste.

For this publication, we are grateful for the generous financial support of the United Kingdom Government.

This publication represents the views of the authors alone. It does not necessarily represent the views of partners or funders.

We thank Dr Martin Bruckner for advice on using the FABIO tool.

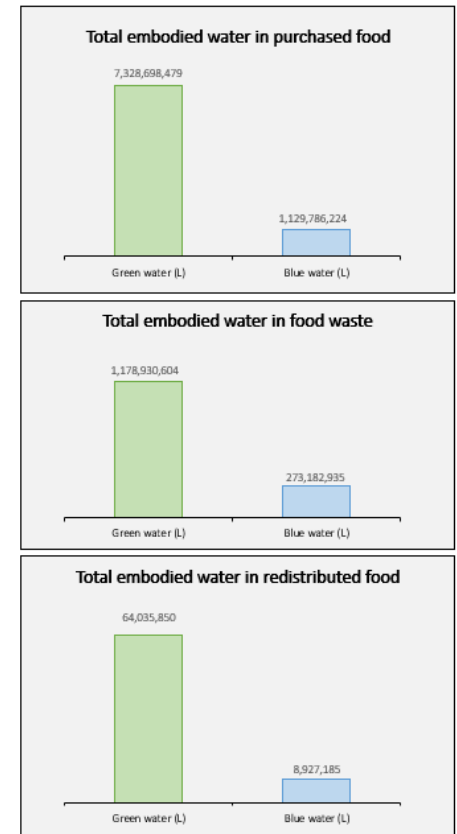
This tool is designed to be used with "A food loss and waste water footprint calculation tool for organisations in the UAE: guidance document".

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The food loss and waste water footprint calculation tool for organisations in the UAE is an excel file (.xlsx), that has multiple sheets. This section summarises the content of each sheet and how to use it.

Figure 1. The 'Front sheet summary' includes summary data and graphs for green and blue water footprints of purchased food, food waste, and redistributed food.

6.4 Step-by-step guidance on how to use the tool

Food Purchase - Input sheet

This sheet has two components:

- Rows 7 to Row 33: A summary table of all food purchased per month (kg), split into 27 Food categories.
- Row 38 onwards: A data entry section where you enter purchased food products (Item names, Column A), classify them into one of 27 Food categories (Column C), and input the Origin of purchased item (Column E), as best as possible. You can then add the monthly purchases in kg for up to 1 year (Column G to R). Column S provides a TOTAL weight (in kg) of the purchased item over the year. To add new products, add new Item names (Column A), and classify them into their correspondent Food category (Column C), including the Origin of the purchased item (Column E).

If your item changes purchase country origin, please add a new item as a new row, as this will be considered a new item for the purposes of water footprint calculations.

Figure 2. The ‘Food Purchased – Input sheet’ allows the user to input the total amount of food purchased (in kg) per month and assign the food category and origin of purchase.

Item names	Food category	Origin of purchased item	Purchases in kg		
			January	February	March
Sirloin steak	Beef	UAE	70	180	
Coca-Cola 500 ml bottle	Alcoholic beverages	Africa	20,000	22,000	20,000
Potatoes	Beans and pulses		300	300	
Beer	Beef		4,050	4,300	4,050
Chicken		Asia	1,356	1,252	1,356
Fruit	Bottled water		4,860	5,160	4,860
Coffee	Butter & Cream	the World	1,627	1,502	1,627
Oil	Cakes, Biscuits & Desserts		5,832	6,192	5,832
Cheese	Camel	America	300	300	
Fish - local	Cheese		1,506	1,252	1,506
Canned tuna	Chicken & Poultry		500	500	
Bread	Coffee		4,050	4,300	4,050
Rice	Dates		1,356	1,252	1,356
Vegetable	Eggs		4,860	5,160	4,860
Yams and cassavas			1,627	1,502	1,627
Tea			200	200	
Wine			300	500	
dates			400	450	
Sugar			1,356	1,252	1,356
Milk	Milk & Yoghurts	UAE	3,500	3,650	3,500

Figure 3. Dropdown option for Food Category on the 'Food Purchased – Input sheet'.

Item names	Food category	Origin of purchased item	Purchases in kg		
			January	February	March
Sirloin steak	Beef	UAE	70	180	
Coca-Cola 500 ml bottle	Soft drinks	UAE	20,000	22,000	20,000
Potatoes	Roots and Tubers		300	300	
Beer	Alcoholic beverages	North Africa	4,050	4,300	4,050
Chicken	Chicken & Poultry	Africa	1,356	1,252	1,356
Fruit	Fruit	West Asia	4,860	5,160	4,860
Coffee	Coffee	Asia	1,627	1,502	1,627
Oil	Oils (other)		5,832	6,192	5,832
Cheese	Cheese		300	300	
Fish - local	Fish and seafood	Europe	1,506	1,252	1,506
Canned tuna	Fish and seafood	North America	500	500	
Bread	Grains, Breads & Pasta ex. Rice		4,050	4,300	4,050
Rice	Rice	Latin America	1,356	1,252	1,356
Vegetable	Vegetables	Oceania	4,860	5,160	4,860
Yams and cassavas	Roots and Tubers		1,627	1,502	1,627
Tea	Tea	Rest of the World	200	200	
Wine	Alcoholic beverages	Europe	300	500	
dates	Dates	UAE	400	450	

Figure 4. Dropdown option for Origin of purchased item on the 'Food Purchased – Input sheet'.

6.4 Step-by-step guidance on how to use the tool

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		GREEN WATER FOOTPRINT EMBODIED IN FOOD [litres]															
2																	
3		Purchase															
4		Alcoholic beverages	12,306,876	13,325,712	13,171,364	13,017,016	12,862,668	13,449,259	14,182,499	13,742,555	14,402,471	14,739,761	15,077,051	15,414,342	165,691,572		
5		Beans and pulses	85,245	20,029	40,058	0	505,424	1,956,480	110,867	0	0	0	0	0	2,718,103		
6		Beef	4,793,597	12,326,393	4,108,798	6,847,996	6,847,996	6,847,996	6,847,996	6,847,996	6,505,596	6,163,196	5,820,797	5,478,397	79,436,753		
7		Bottled water	0	0	0	0	0	0	0	0	0	0	0	0	0		
8		Butter & Cream	83,058	0	0	0	0	0	0	0	0	0	0	0	83,058		
9		Cakes, Biscuits & Desserts	11,223,373	16,835,060	14,964,498	11,223,373	16,835,060	14,964,498	11,223,373	16,835,060	14,964,498	11,223,373	16,835,060	14,964,498	172,091,726		
10		Camel	99,312	0	0	0	0	0	0	0	0	0	0	0	99,312		
11		Cheese	4,150,988	4,150,988	4,427,720	4,150,988	4,150,988	4,150,988	4,150,988	4,150,988	4,150,988	4,150,988	4,150,988	4,150,988	50,088,584		
12		Chicken & Poultry	9,971,602	9,206,818	8,442,035	7,677,251	6,912,467	8,089,058	9,265,648	10,442,238	11,618,828	9,971,602	9,206,818	8,442,035	109,246,401		
13		Coffee	63,419,982	58,555,913	53,691,843	48,827,774	43,963,704	51,446,888	58,930,072	66,413,255	73,896,439	63,419,982	58,555,913	53,691,843	694,813,608		
14		Dates	1,648,813	1,854,915	2,061,017	2,267,118	2,473,220	2,473,220	2,473,220	2,473,220	2,308,339	2,143,457	1,978,576	1,813,695	25,968,810		
15		Eggs	0	0	0	0	0	0	0	0	0	0	0	0	0		
16		Fish and seafood	15,700,962	13,712,904	12,898,896	12,084,888	11,270,880	12,523,200	13,775,520	15,027,840	16,280,160	14,526,912	13,712,904	12,898,896	164,413,962		
17		Fruit	8,525,268	9,051,519	8,735,769	8,420,018	8,104,267	8,525,268	9,051,519	8,735,769	8,420,018	8,104,267	7,788,517	7,472,766	100,934,964		
18		Fruit juices	3,658,905	3,980,889	3,955,277	5,164,545	2,967,372	3,982,718	3,132,023	4,968,793	3,658,905	3,980,889	3,955,277	2,958,225	46,363,819		
19		Grains, Breads & Pasta ex. Rice	6,664,360	7,075,740	6,828,912	6,582,084	6,335,256	6,664,360	7,075,740	6,828,912	6,582,084	6,335,256	6,088,428	5,841,599	78,902,731		
20		Lamb	186,912	0	0	0	0	0	0	0	0	0	0	0	186,912		
21		Meat - other (inc. pork)	2,910,431	2,772,576	2,388,017	2,250,162	1,914,944	2,240,892	2,566,840	2,892,788	3,218,736	2,762,409	2,550,543	2,338,676	30,807,014		
22		Milk & Yoghurts	9,386,068	9,788,328	9,117,895	9,162,590	9,028,503	8,894,417	8,760,330	8,626,243	8,492,157	8,358,070	8,223,983	8,089,897	105,928,481		
23		Oils (other)	387,141,447	411,039,068	396,700,495	382,361,923	368,023,351	387,141,447	411,039,068	396,700,495	382,361,923	368,023,351	353,684,779	339,346,207	4,583,563,555		
24		Olive Oil	0	0	0	0	0	0	0	0	0	0	0	0	0		
25		Rice	2,012,656	1,858,293	1,703,930	1,549,567	1,395,204	1,632,685	1,870,167	2,107,649	2,345,130	2,012,656	1,858,293	1,703,930	22,050,159		
26		Roots and Tubers	2,043,135	1,985,632	2,014,354	1,870,625	1,813,122	1,901,588	1,990,055	2,078,521	2,166,988	2,043,135	1,985,632	1,928,128	23,820,914		
27		Soft drinks	4,485,006	4,933,507	4,485,006	4,485,006	4,485,006	4,485,006	4,485,006	4,485,006	4,485,006	4,485,006	4,485,006	4,485,006	54,268,572		
28		Sugar	1,618,818	1,494,661	1,370,504	1,246,347	1,122,190	1,313,201	1,504,212	1,695,223	1,886,234	1,618,818	1,494,661	1,618,818	17,983,687		
29		Tea	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	7,315,007	87,780,090		
30		Vegetables	65,959,559	222,033	67,209,475	65,597,739	63,114,343	66,755,555	70,936,206	67,294,994	64,732,659	62,305,185	59,877,710	57,450,235	711,455,693		
31																	
32																	
33		TOTAL GREEN WATER FOOTPRINT EMBODIED IN FOOD	625,391,381	591,505,983	625,630,868	602,102,018	581,440,973	616,753,731	650,686,356	649,662,553	639,792,166	603,683,321	584,645,941	557,403,188	7,328,698,479		

The “Food Purchased - Green WF” and “Food Purchased - Blue WF” sheets

These two sheets provide a summary of the total green or blue water footprint embodied in the 27 Food categories (Row 4 to 30), expressed as litres, for the data recorded on the *Food Purchases - Input* sheet. The water footprint on a monthly (Column E to P) and yearly (Total Year 1, Column Q) basis for each food item is provided. Row 33 displays the Total water footprint embodied in food, expressed as litres, for each month (Column E to P) and for the year (Column Q).

Figure 5. The ‘Food Purchased – Green WF’ sheet shows the green water footprint embodied in food by month and food category. There is an identical sheet for the blue water footprint called ‘Food Purchased Blue WF’.

6.4 Step-by-step guidance on how to use the tool

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	
1	Food waste inventory																					
2	Instructions																					
3	1. Be careful with the units: Food waste should be in kg or litre.																					
4	2. Please make sure to ALWAYS select one option from the dropdown menu for "Food item wasted" (Column C39 downwards), "Origin of wasted item" (column E39 downwards) and "Destination waste was sent to" (column G39 downwards) otherwise the tool will not be able to calculate the water footprint.																					
5	Assumptions																					
6	Food category																					
7	Amount wasted (kg)	amount of food waste (kg)		amount redistributed (kg)		Data collection Year 1																
8	Alcoholic beverages	0	202,396		1,830	January	February	March	April	May	June	July	August	September	October	November	December					
9	Beer and pulsed	0																				
10	Beer	370				10	20	30	100	100	100	100	100	95	90	85	80					
11	Bottled water	0																				
12	Butter & Cream	0																				
13	Cakes, Biscuits & Desserts	0																				
14	Canell	0																				
15	Cheese	0																				
16	Chicken & Poultry	14856				1,356	1,252	1,448	1,044	940	1,100	1,260	1,420	1,580	1,356	1,252	1,148					
17	Coffee	0																				
18	Dates	0																				
19	Eggs	0																				
20	Fish and seafood	0																				
21	Fruit	380				100	80	80	80	80	80	80	80	80	80	80	80					
22	Fruit juices	0																				
23	Grains, Breads & Pastas etc.	0																				
24	Lamb	0																				
25	Meat - other (inc. pork)	0																				
26	Milk & Yogurts	0																				
27	Oil (other)	0																				
28	Olive Oil	0																				
29	Rice	0																				
30	Roots and Tubers	3820				300	300	320	300	300	300	300	300	300	300	300	300					
31	Soft drinks	0																				
32	Sugar	0																				
33	Tea	0				20	20	20	20	20	20	20	20	20	20	20	20					
34	Vegetables	240				200	200	160	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000					
35	Mixed waste	180500				180	100	110	180	180	180	180	180	175	170	165	160					
36	Redistribution	1830																				
37																						
38																						
39	Item names	Food item wasted	Origin of wasted item		Destination waste was sent to	Waste in kg	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL	YEAR		
40	Sirloin steak	Beef	UAE		Redistribution	10	20	30	100	100	100	100	100	95	90	85	80		180,500	180,500	916	
41	Mixed waste	Mixed waste	North Africa		Composting / aerobic processes	200	200	100	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000		3,620	3,620	16,500	
42	Potatoes	Roots and Tubers	Africa		Composting / aerobic processes	300	300	320	300	300	300	300	300	300	300	300	300		2,400	2,400	10,500	
43	Vegetables	Vegetables	UAE		Anaerobic digestion / codigestion	1,356	1,252	1,448	1,044	940	1,100	1,260	1,420	1,580	1,356	1,252	1,148		14,816	14,816	68,400	
44	Chicken	Chicken & Poultry	UAE		Landfill	100	80	80	80	80	80	80	80	80	80	80	80		800	800	3,600	
45	Fruit	Fruit	West Asia		Redistribution	20	20	20	20	20	20	20	20	20	20	20	20					
46	Green tea	Tea	West Asia		Landfill																	
47																						
48																						
49																						
50																						
51																						
52																						

Figure 6. The ‘Food Waste – Input sheet’ allows the user to input the total amount of food waste (in kg)

36							
37							
38	Item names	Food item wasted	Origin of wasted item	Destination waste was sent to	Waste in kg		
39	Sirloin steak	Beef	UAE	Redistribution	January	February	March
40	Mixed waste	Mixed waste	North Africa		10	20	
41	Potatoes	Roots and Tubers	Africa	Anaerobic digestion / codigestion		200	10
42	Vegetables	Vegetables	UAE	Composting / aerobic processes		300	30
43	Chicken	Chicken & Poultry	UAE	Incineration / controlled combustion		20	
44	Fruit	Fruit	West Asia	Land application		1,252	1,148
45	Green tea	Tea	West Asia	Landfill		80	
46				Sewer / wastewater treatment			
47				Redistribution			
48							
49							
50							
51							
52							

...

Food Purchased - Input sheet

Food Purchased - Green WF

Food Purchased - BLU

Figure 7. Dropdown option for Destination waste was sent to on the ‘Food Waste – Input sheet’.

Food Waste - Input sheet

This sheet has two components:

- Rows 7 to Row 35: A summary table of the weight of all food waste generated per month (kg), split into the 27 Food categories (Row 7 to 33) as well as additional categories for: Mixed waste (Row 34) and Redistribution (Row 35).
- Row 38 onwards: A data entry section. First, enter the food item (Item names, Column A); then classify the Food item wasted into one of the 27 Food category (Column C) or as Mixed waste, and input the Origin of the wasted item (Column E), as best as possible. Finally, enter the destination of the waste (Destination waste was sent to, Column G) choosing one of the destinations options as per the Food Loss and Waste Measurement Protocol¹⁸. You can add the monthly waste generated in kg for up to 1 year (Column I to T). Column U provides a TOTAL weight (in kg) of food waste generated over the year for that specific item.

To add new products, add a new item in Item names (Column A) and classify it into the 27 Food category or mixed waste in Food item wasted (Column C); then enter the Origin of wasted item (Column E), and the destination of the waste (Destination waste was sent to, Column G).

If your wasted item changes the country of origin, please add a new item as a new row, as this will be considered a new item for the purposes of water footprint calculations.

18 Destinations can include Anaerobic digestion / co-digestion; Composting / aerobic processes; Incineration / controlled combustion; Land application; Landfill; Sewer / wastewater treatment; and Redistribution. See World Resources Institute, "Food Loss and Waste Accounting and Reporting Standard" (WRI 2016)



The “Food Waste - Green WF” and “Food Waste - Blue WF” sheets

These two sheets provide a summary of the total green or blue water footprint embodied in the Wasted Item (Column C), classified in the 27 Food categories or Mixed waste or Redistribution (Row 4 to 32), expressed as litres for the data recorded on the Food Waste - Input sheet. Water footprint on a monthly (Column E to P) and yearly (Column Q) basis of each wasted item are provided. Row 34 displays the Total water footprint embodied in food waste, expressed as litres, for each month (Column E to P) and for the year (Column Q).

Appendix- Notes on water values

This sheet shows the summary data of the blue and green water footprint Litres per kg purchased or wasted food (L/kg purchased or wasted food) for 27 food groups and 10 regions. This also contains notes on the data assumptions made which are also provided in Annex 1 of this document.

BLUE WATER FOOTPRINT EMBODIED IN FOOD WASTE [litres]													Data collection year 1							Total Year 1	
	January	February	March	April	May	June	July	August	September	October	November	December									
Wasted Item	litres	litres	litres	litres	litres	litres	litres	litres	litres	litres	litres	litres									
Alcoholic beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beans and pulses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beef	61,202	122,405	183,607	612,023	612,023	612,023	612,023	612,023	581,422	550,820	520,215	489,618	5,569,407								
Bottled water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Butter & Cream	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cakes, Biscuits & Desserts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Camel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheese	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chicken & Poultry	1,409,205	1,301,127	1,193,046	1,084,965	978,885	1,143,163	1,309,441	1,475,719	1,641,957	1,409,205	1,301,127	1,193,046	15,438,933								
Coffee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eggs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish and seafood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fruit	342,630	274,104	274,104	274,104	274,104	274,104	274,104	274,104	274,104	274,104	274,104	274,104	3,357,778								
Fruit juices	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grains, Breads & Pasta ex. Rice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lamb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meat - other (inc. pork)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milk & Yoghurts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oils (other)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Olive Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roots and Tubers	246,540	246,540	246,540	246,540	246,540	246,540	246,540	246,540	246,540	246,540	246,540	246,540	2,974,914								
Soft drinks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sugar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tea	10,378	0	0	0	0	0	0	0	0	0	0	0	10,378								
Vegetables	75,338	75,338	75,338	75,338	75,338	75,338	75,338	75,338	75,338	75,338	75,338	75,338	904,060								
Mixed waste	261,496	261,496	130,748	26,149,616	26,149,616	26,149,616	26,149,616	26,149,616	26,149,616	26,149,616	26,149,616	26,149,616	236,000,280								
Redistributed waste	403,833	396,509	457,711	886,127	886,127	886,127	886,127	886,127	855,526	824,925	794,324	763,723	8,927,185								
TOTAL WATER FOOTPRINT EMBODIED IN FOOD WASTE [litres]	2,810,626	2,627,519	2,577,531	29,328,713	29,328,713	29,328,713	29,328,713	29,328,713	29,328,713	29,328,713	29,328,713	29,328,713	273,182,935								

Figure 8. The ‘Food Waste – Blue WF’ sheet shows the blue water footprint embodied in food waste. There is also a sheet for the green water footprint called the ‘Food Waste Green – WF’ sheet.

Green water (m³ per t)											Blue water (m³ per t)													
	UAE	North Africa	Africa	West Asia	Asia	Europe	North America	Latin Amer	Oceania	Rest of the World		UAE	North Africa	Africa	West Asia	Asia	Europe	North America	Latin Amer	Oceania	Rest of the World			
1	Food Items																							
2	Alcoholic beverages	2,933	719	1,242	2,247	1,419	1,428	1,491	1,646	2,068	343		138	1,245	471	740	98	155	381	556	1,738	12		
3	Beans and pulses	2,003	1,600	8,294	3,358	9,556	3,261	4,866	5,038	8,412	1,543		1,233	4,321	31	671	241	47	311	138	171	71		
4	Beef	68,480	67,106	45,491	110,153	62,239	10,000	20,923	32,093	20,108	27,359		6,120	2,678	1,540	13,394	4,872	675	1,422	821	682	859		
5	Bottled water	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0		
6	Butter & Cream	1,409	5,117	9,693	16,368	12,426	6,918	6,354	19,966	4,438	4,320		17	654	1	3,661	990	104	502	102	143	16		
7	Cakes, Biscuits & Desserts	3,741	5,798	11,579	7,175	12,116	4,852	5,518	11,475	6,686	4,580		5,777	5,511	985	3,623	1,321	1,115	549	257	588	344		
8	Camel	9,931	22,749	44,712	12,527	8,734	49,902	50,056	50,056	50,056	50,056		1,035	386	143	2,268	710	1,233	606	1,244	1,244	1,244		
9	Cheese	15,612	10,234	19,386	32,736	24,852	13,837	12,709	39,932	8,876	16,813		648	1,307	5	7,322	1,981	209	1,005	205	287	648		
10	Chicken & Poultry	7,354	2,919	2,307	2,899	3,664	1,641	1,023	2,884	1,768	2,243		1,039	1,952	106	243	176	72	106	17	72	106		
11	Coffee	3,511	0	0	38,575	11,342	38,566	14,285	2,239	46,010	72,099		19	0	95	12,852	4	147	0	161	0	161		
12	Dates	3,122	1,058	2,076	531	783	74	74	353	698	74		1,837	2,192	0	9,939	475	187	42	39	187	899		
13	Eggs	3,970	2,401	2,117	2,547	2,446	1,347	2,154	5,498	9,144	2,929		555	845	65	216	338	85	218	25	308	246		
14	Fish and seafood	2,827	2,827	2,827	2,827	2,827	2,827	2,827	2,827	2,827	2,827		3,246	3,246	3,246	3,246	3,246	3,246	3,246	3,246	3,246	3,246		
15	Fruit	7,755	915	5,182	1,754	8,512	2,407	1,663	5,374	1,969	930		5,028	4,727	1,548	5,426	2,723	1,158	1,046	1,241	1,241	1,241		
16	Fruit juices	7,755	915	5,182	1,754	8,512	2,407	1,663	5,374	1,969	930		5,028	4,727	1,548	5,426	2,723	1,158	1,046	1,241	1,241	1,241		
17	Grains, Breads & Pasta ex. Rice	1,646	12,288	25,455	5,483	24,001	7,814	9,771	13,683	12,558	4,507		427	8,514	2,839	829	2,024	158	285	578	1,091	129		
18	Lamb	18,691	20,564	10,872	831	9,708	6,897	15,310	13,168	13,446	10,740		1,285	439	646	47	528	310	345	459	204	248		
19	Meat - other (inc. pork)	103,572	20,820	33,274	130,808	59,654	29,469	60,926	74,969	54,844	52,424		10,812	1,265	911	11,980	1,134	1,518	415	861	1,789	1,141		
20	Milk & Yoghurts	6,881	2,786	2,142	5,880	1,050	611	676	1,950	300	2,339		319	953	66	2,187	63	15	52	17	15	15		
21	Oils (other)	24,139	40,859	111,700	54,864	112,175	72,055	58,491	66,382	67,752	64,364		3,482	4,539	2,788	11,790	8,953	2,653	2,848	1,836	1,187	1,436		
22	Olive Oil	10,074	36,840	11,156	12,639	17,160	14,019	5,378	12,082	6,183	19,682		3,235	5,587	1,103	5,032	5,118	3,014	2,059	6,529	1,862	1,591		
23	Rice	0	0	0	0	0	0	0	0	0	0		1,141	313	350	889	626	916	665	613	613	613		
24	Roots and Tubers	552	189	4,311	109	1,837	461	715	2,239	1,540	1,990		1,346	920	821	438	186	238	146	104	131	102		
25	Soft drinks	241	224	555	246	591	241	312	550	418	512		200	495	72	272	258	25	63	36	127	117		
26	Sugar	1,193	1,109	2,761	1,218	2,945	1,104	1,548	2,770	2,078	2,528		988	2,462	348	848	1,276	113	505	169	613	131		
27	Tea	20,355	51,653	96,575	1,117	1,117	1,117	1,117	1,117	1,117	1,117		994	519	2,682	1,281	1,281	1,281	1,281	1,281	1,281	1,281		
28	Vegetables	9,955	10,953	48,240	19,454	29,945	13,485	8,505	49,651	2,883	2,487		3,767	12,034	3,981	11,503	3,912	2,977	2,906	1,910	1,830	931		
29	Mixed waste	9,955	5,117	8,294	4,583	5,117	4,852	4,866	5,038	6,183	4,586		1,955	1,307	471	1,938	990	238	381	338	613	344		
30	Distributions waste is sent to																							
31	Anaerobic digestion / cogeneration																							
32	Composting / aerobic processes																							
33	Incineration / controlled combustion																							
34	Land application																							
35	Landfill																							
36	Sewer / wastewater treatment																							
37																								
38																								
39																								
40																								
41	...	Food Waste - Input sheet	Food Waste - Green Wf	Food Waste - Blue Wf	Appendix: Notes on water values																			

7.0 Communicating the benefits for governments.

Blue and green water footprints matter to the UAE government as the country is one of the most water-scarce countries in the world, with an average annual rainfall of only 78 mm and renewable water resources per capita of only 16 m³, compared to the global average of 5,500 m³. At the same time, the UAE's agricultural sector¹⁹ is a significant user of the country's limited and precious resources, accounting for approximately nearly half (~48%) of the freshwater withdrawals in the UAE¹⁹.

Despite agriculture's large water footprint, the sector produces less than 15% of the UAE's food. The remaining 85% is sourced through imports. This makes the UAE vulnerable to fluctuations in global food prices and availability, as well as potential disruptions in food supply chains due to climate change, conflicts, or pandemics.

The UAE is committed to achieving food security and sustainable development, as reflected in its National Food Security Strategy 2051 adopted in 2018²⁰, which includes amongst its objectives developing a comprehensive national system based

on enabling sustainable food production through the use of modern technologies; enhancing local production; and activating legislation and policies to reduce waste.

The UAE Water Security Strategy 2036 adopted in 2017 is committed to reduce total demand for water resources by 21% and increase the water productivity index to USD 110 per cubic meter (m³)²¹. Given that the agricultural sector is the largest water consumer, it is imperative to increase the water productivity in the sector if the UAE is to achieve the objectives of its strategy.

8.0 Communicating the benefits for businesses and other stakeholders

Blue and green water footprints matter to UAE hospitality, restaurants, and food producers because they reflect the environmental impact of their food choices and practices. By reducing the water footprint of their food, they can contribute to the UAE's food security and sustainable development goals, as well as enhance their reputation and customer satisfaction. Institutions across the UAE are also joining the "Ne'ma Pledge" launched by the Emirates Foundation to reduce food loss and waste.

The UAE's hospitality, restaurants, and food manufacturers and producers can play a vital role in supporting the UAE's food security and sustainable development goals by reducing the water footprint of their food. They can do this by adopting various measures, such as:

- Choosing food products that have a lower water footprint, such as fruits, vegetables, grains, and beans, over those that have a higher water footprint, such as meat, dairy, and eggs.
- Where appropriate, sourcing food products locally and seasonally, rather than importing them from other regions, to reduce the transportation and storage costs and emissions associated with food. For example, more than 80% of food in the UAE is imported from other regions, leading to a high environmental footprint.
- Reducing FLW, which is estimated to be around 44% in the Arab region. During holidays FLW may increase to 50%.²²

¹⁹ [Our World in Data](#) based on [UN Food and Agricultural Organization \(FAO\) AQUASTAT](#)

²⁰ [UAE \(2018\). National Food Security Strategy 2051.](#)

²¹ [UAE \(2017\). The UAE Water Security Strategy 2036.](#)

²² [United Nations Environment Programme \(2021\). The State of Food Waste in West Asia.](#)

By reducing the water footprint of their food, any UAE-based organisation, can not only save water and money, but also improve their environmental performance and social responsibility. They will also be contributing to the UAE official commitment for halving their food loss and waste by 50% by 2030 as per the country’s Nationally Determined Contribution. By communicating about their positive impact, they can also attract more customers who are conscious of their food choices and their impact on the planet. By reducing food loss and waste we reduce the water footprint of food which also reduces the associated agrochemicals utilised for producing food including fertilizers, pesticides, herbicides, fungicides, antibiotics, and growth hormones. Furthermore, any associated health risks of the agrochemicals are also reduced, thus contributing to advancing the health and well-being of the people and wildlife, as well as the resilience and prosperity of the nation.



Annex 1:

Data sources and assumptions

The data presented in this tool represent average blue and green water intensities of crops for the years 1996-2005, using the 2020 crop supply-use, trade and processing structures from the Food and Agriculture Biomass Input Output model (FABIO). FABIO is a global set of trade-linked physical flow supply and use tables and physical flow input-output tables capturing detailed supply chain information for 130 raw and processed agricultural and forestry products covering 191 countries and one ‘rest of world’ region²³. The main data sources for FABIO are agricultural statistics from FAOSTAT²⁴. The FABIO database has environmental information for each of the 24,000 commodities, in four resource categories: 1) primary biomass extraction (in tonnes), 2) land use (in hectares, ha), 3) blue water use (in m3), and 4) green water use (in m3). The water footprint data in FABIO are sourced from Mekonnen and Hoekstra (2011)²⁵ and represent average blue and green water intensities of crops for years 1996-2005.

Whilst FABIO has 130 products, there are seven non-food items such as tobacco, rubber, and wool. In the tool presented in this document, non-food items were excluded leaving 123 products. The average blue and green water intensities for the 123 food products were calculated by water use for each country/product²⁶. These were then aggregated into 10 regions by weighting them according to imports (tonnes) into the UAE. This enabled imports for intermediate use to be considered in the final water footprints.

The 10 regions and 123 food products were then aggregated to 27 food group categories. If more than one item matched the classification, the average of all matching items was used to represent the water footprint of that category. The reporting units for the UAE water footprint tool is Litres per kg²⁷.

It should be noted that blue and green water footprints for the following categories are not included in FABIO: cakes and biscuits, fish and seafood, bottled water, cheese. Therefore, water footprints for these categories were estimated using data from other, similar food categories. For example, the footprint for “Fruit Juices” uses data from the “Fruit” category. These assumptions are summarised in Table 2. A “mixed waste” category has also been created to assist with estimations of FLW water footprints where no other information was available on origin or waste composition.

23 Bruckner, M., Wood, R., Moran, D., Kuschnig, N., Wieland, H., Maus, V., Börner, J., 2019. FABIO – [The Construction of the Food and Agriculture Input-Output Model](#). *Environmental Science & Technology* 53(19), 11302-11312.

24 FAOSTAT. Food and Agriculture Organization of the United Nations. [FAOSTAT Statistics Database](#). 2019

25 Mekonnen, M.M. and Hoekstra, A.Y. (2011) [National water footprint accounts: the green, blue and grey water footprint of production and consumption](#). *Value of Water Research Report Series No. 50*. UNESCO-IHE, Delft, the Netherlands.

26 average blue and green water intensities for the 123 products were calculated using the Leontief Inverse Matrix multiple, a type of mathematical equation used in input-output models.

27 Whilst FABIO reports in m3 per tonne this is equivalent to Litres per kg and so no conversion was necessary.

Table 2. Food categories and assumptions used in the water footprint tool.

Categories	Assumptions	Categories	Assumptions
Cakes and biscuits	Water footprint was equivalent to a combination of 30% flour, 30% sugar, 30% butter and 10% eggs.	Fish and seafood	Farmed fish values are used for all fish and seafood. Green water value for Mexico used for every region ²⁹ . Blue water value for Latin America is based on data from Mexico ³⁰ , and a wider Asia blue water value for Asia ³¹ . For the rest of the regions, we assumed a median of these two values.
Cheese	Water footprint was double the value supplied to butter and cream.		
Bottled water	1 L PET assuming + 0.8L for energy linked to processing, transport, and cleaning operations ²⁸ .		
Soft drinks	Water footprint values of 80% bottled water, and 20% sugar.	Fruit Juices	Fruit water footprint values used.
		Mixed waste	Median of all other food water footprint values.

For some geographic regions and food products there were data gaps for the UAE, suggesting that the UAE currently imports limited amounts of the product from that specific region. In these instances, median values of the available data from other regions were used. These are summarised in Table 3.

28 Tandon, S.A., Kolekar, N. and Kumar, R., 2014. Water and energy footprint assessment of bottled water industries in India. Natural Resources, 2014.

29 Guzmán-Luna P, Gerbens-Leenes PW and Vaca-Jiménez SD, "The Water, Energy, and Land Footprint of Tilapia Aquaculture in Mexico, a Comparison of the Footprints of Fish and Meat" (2021) 165 Resources, Conservation and Recycling 105224

30 Guzmán-Luna P, Gerbens-Leenes PW and Vaca-Jiménez SD, "The Water, Energy, and Land Footprint of Tilapia Aquaculture in Mexico, a Comparison of the Footprints of Fish and Meat" (2021) 165 Resources, Conservation and Recycling 105224

31 Poore J and Nemecek T, "Reducing Food's Environmental Impacts through Producers and Consumers." (2018) 360 Science 987

Table 3. Regions used in the water footprint tool and products for which there were data gaps.

Region	Product(s) for which there were data gaps
UEA	Butter, rice, tea
North Africa	Coffee, eggs, tea
Africa	Olive oil
West Asia	N/A (complete)
Asia	Olive oil
Europe	Dates, tea
North America	Camel, tea
Latin America	N/A (complete)
Oceania	Dates, tea
Rest of the world	beans & pulses, butter & cream, camel, chicken & poultry, coffee, eggs, lamb, meat - other (inc. pork), milk & yoghurts, oils (other), rice, sugar, tea
Fish and seafood	Farmed fish values are used for all fish and seafood. Green water value for Mexico used for every region. Blue water value for Latin America is based on data from Mexico, and a wider Asia blue water value for Asia. For the rest of the regions, we assumed a median of these two values.

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About WRAP

Our vision is a thriving world in which climate change is no longer a problem. WRAP is a climate action NGO working around the globe to tackle the causes of the climate crisis and give the planet a sustainable future. We were established in the UK in 2000; we now work in 40+ countries.

About Thriving Solutions LLC

Thriving Solutions is a social enterprise established by two Arab women dedicated to decarbonizing our economy, safeguarding biodiversity, advancing food-nutrition-water security, as well as supporting SDG 2030 and ESG priorities, with a focus on the Arab region. Our services help companies and municipalities implement nature-based solutions and adopt innovations that eliminate waste and pollution, regenerate ecosystems, transition to circular food systems, and sequester carbon. Vision: circular, regenerative food systems. Mission: To reimagine local, regional and global agri-food systems, to sustain our future. You can learn more about us on www.thrivingsolutions.earth

About City, University of London

City, University of London is a public research university in London, United Kingdom, and a member institution of the federal University of London. The Centre for Food Policy is an interdisciplinary centre dedicated to improving food policy worldwide. We explore how the food system really works in practice. The Centre for Food Policy is one of the very few places in the world dedicated to exploring how the food system really works in practice and what policies are needed to make it work effectively. <https://www.city.ac.uk/research/centres/food-policy>

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