INTERNATIONAL FOUNDATION FOR VALUING IMPACTS

value balancing alliance

ENVIRONMENTAL METHODOLOGY 2

Water Consumption

Topic Methodology

(EXPOSURE DRAFT)

COMMENTS TO BE RECEIVED BY **DECEMBER 7, 2024**

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This Exposure Draft has been produced by the International Foundation for Valuing Impacts (IFVI) in partnership with the Value Balancing Alliance (VBA) as part of the impact accounting system (the Methodology). The Methodology is a globally applicable and comprehensive methodology for the public good for valuing organizational social and environmental impact that is designed for incorporation into financial analysis and organizational planning and decision-making.

The Methodology is governed by the Valuation Technical & Practitioner Committee (VTPC), an independent committee comprising 18 members, established by IFVI and authorized by its Terms of Reference to direct, validate, and approve impact accounting research and methodology produced by the cooperation of the IFVI and VBA.

VTPC members are global leaders in the fields of impact, sustainability, accounting, business, and finance. Members provide advice in their individual capacities as experts, with composition and procedures designed to ensure independence, balance, and the avoidance of conflicts of interest. Please refer to the full Terms of Reference for information regarding membership, voting, and approval processes.

Methodology development aims to follow a rigorous and credible due process balanced with the urgent and dynamic needs of stakeholders in the face of great social and environmental challenges. The development process is outlined in the Due Process Protocol and designed to be impact-focused, stakeholder-informed, collaborative, and transparent. As detailed in the Due Process Protocol, formal methodology statements undergo public exposure prior to final approval by the VTPC.

The IFVI Board of Directors provides oversight to the Due Process Protocol through its Due Process Oversight Committee. More information about the VTPC and Due Process Protocol are available in the VTPC Terms of Reference and Due Process Protocol.

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Explanatory Note

Background

This document, the Exposure Draft for the *Water Consumption Topic Methodology* (Water Consumption Exposure Draft), provides an initial proposal in order to solicit feedback on impact pathway that causally links water consumption with outcomes and impacts that affect the well-being of people through changes in the condition of the natural environment.

The purpose of the Water Consumption Methodology is to guide preparers of impact accounts through the process of measuring and valuing in monetary terms an entity's water consumption impacts. This provides preparers and users with impact information about water consumption that aids decision-making regarding an entity's contribution to sustainability. It is one of a series of Topic Methodologies to be developed as part of the impact accounting system for a comprehensive assessment of material value created and destroyed by an entity.

The Water Consumption Exposure Draft was developed by the technical staff of the International Foundation for Valuing Impacts (IFVI) and the Value Balancing Alliance (VBA) beginning in December 2023. The development process involved a comprehensive literature review of methodologies for valuing water consumption impacts, including methods developed previously by the Impact Weighted Accounts Initiative (IWA), VBA, and others. Subsequent research sought alignment with established protocols, frameworks, and disclosure requirements by relevant standard setters. Throughout the process, the technical staff regularly sought expert consultation from various entities to better understand key technical aspects.

The Water Consumption Methodology is intended to augment and build on the foundational work of other protocols and sustainability standard setters. The Water Consumption Methodology aligns or expands upon the European Sustainability Reporting Standards (ESRS) E3: Water and marine resources and the Global Reporting Initiative (GRI) 303: Water and effluents 2018. Ideas and definitions also build on work by the Capitals Coalition, Transparent Project, National Institute for Public Health and Environment, Netherlands, PricewaterhouseCoopers (PwC), World Resources Institute (WRI), World Wide Fund for Nature (WWF), Ecosystem Service Valuation Database (ESVD), and WifOR Institute. The intentional alignment with these leading organizations and initiatives is meant to build consensus on and advance the measurement and valuation of water consumption impacts.

The development of the Water Consumption Exposure Draft included engagement with the Valuation Technical and Practitioner Committee (VTPC) members. A Pre-Exposure Draft of the Water Consumption Methodology was shared with the full VTPC in advance of a May 2024 VTPC meeting to provide an opportunity for all VTPC members to share detailed feedback on the draft. Based on discussions at that meeting and written feedback received from VTPC members, revisions were incorporated into the Water Consumption Exposure Draft and a complete version of the Exposure Draft was then shared with the full VTPC for review in advance of a June 2024 VTPC meeting. The Water Consumption Exposure Draft received approval at that meeting and was prepared for public comment.

Exposure draft summary

The following is a section-by-section summary of key proposals made in the Water Consumption Exposure Draft and is not an exhaustive overview of the statement. The summary is included to support the public comment questions by highlighting key points and decisions made in the development of the Exposure Draft.

Section 1: Introduction

This section lays out the purpose of the Water Consumption Methodology (section 1.1), provides a high-level description of the topic and its impacts (section 1.2), introduces key concepts and definitions (section 1.3), and defines the scope of what is and is not included within the Water Consumption Methodology (section 1.4).

Section 1.1 states that the purpose of the Water Consumption Methodology is to generate impact information by measuring and valuing impacts of corporate entities in monetary terms. It also acknowledges that practical considerations may challenge a full water consumption impact account but that the methodology should be followed to the fullest extent possible.

Section 1.2 serves as an introduction to the topic of water consumption including defining the impacts on society and other context that mediates impacts. These include the importance of climate change and local context such as water scarcity, types of water use, municipal water infrastructure, sanitation practices, or land use in understanding water consumption impacts. The decision was also made to introduce the societal lens considered, a framing of value chain considerations, and acknowledges many use cases of the Water Consumption Methodology.

Section 1.3 defines the following key terms: water consumption, water withdrawal, water discharge, and water stress. All definitions are sourced from ESRS or GRI with added context needed for each definition. A complete set of defined terms is included in the Glossary in Appendix A.

Section 1.4 provides guidance on the scope of the Water Consumption Methodology. Included is all water consumed along the full value chain of an entity. The Water Consumption Exposure Draft intentionally defines full value chain impacts and the process of attribution but also acknowledges that value chain water consumption may be modeled due to the lack of complete data at present. Impacts caused by the discharge of contaminated or altered water are not within the scope of the methodology, as they will be covered in a separate topic methodology., the Water Consumption Methodology only applies to the negative impacts that come from the consumption of water. Because water consumption impacts are mediated by scarcity, it was decided that positive impacts likely are not just the opposite of negative impacts and more research would be needed and explored in future work.

Section 2: Impact pathway

As laid out in General Methodology 1, the impact pathway serves as the framework for measuring impacts and defines the causal relationship between an entity's activities and changes in the well-being of people. Section 2 of the Water Consumption Exposure Draft lays out the impact pathway in both visual (Figure 3) and descriptive (section 2.2) form. Both forms are structured to delineate inputs, activities, outputs, outcomes, and impacts as well as the linkages between each.

Several key decisions are highlighted by the impact pathway. First, the unit of output needed from an entity is water consumed which considers both water withdrawal and discharge. In outcomes, it notes that many of these are the loss of available water for other users including agriculture, municipalities, the public, industry, power, and nature. Each of these drive well-being outcomes leading to the four impacts.

In addition to laying out the impact pathway, this section also highlights that many potential impacts from water consumption exist that do not have sufficient research to include in the impact pathway. These will be considered in the future as research develops.

Section 3: Impact driver measurements

This section focuses on the impact driver information needed from an entity to develop water consumption impact accounts. In addition to guiding preparers through data requirements and outlining how these data align with reporting standards (section 3.1), the section also highlights approaches to address data sources, gaps, and uncertainty (section 3.2).

Section 3.1 and Table 1 lay out the data required from the entity as well as data required from other sources to produce water consumption impact accounts. Required data from the entity includes water consumption from own operations, upstream value chain, and downstream value chain organized by the location of water consumption. Because water consumption impacts need to consider local context, location of water consumption is a necessary data point.

Two issues present challenges for water consumption data: the need for local context to determine impacts and the difficulties for entities to collect data at this specificity. Therefore, the Water Consumption Methodology presents two options, a preferred and minimum option. The preferred option has location tied to a specific watershed and analysis occurs at a sub-national scale. The minimum option has location tied to a country and the analysis occurs for each country. Location data should be organized at the most precise geographical unit that data is available to maximize accuracy and representativeness of the impact account.

The section also reinforces that while many aspects of impact accounts are quantitative, significant notes and qualitative commentary should be included such as calculation methodologies, approaches to handling data gaps, key assumptions, alignment with planetary boundaries or science-based thresholds for sustainable consumption, and progress towards water consumption targets (Science Based Targets for Water).

A table (Table 2) is also provided in this section to highlight the ways in which the Exposure Draft's data requirements are both aligned with and expand upon the disclosure requirements established by ESRS E3: Water and marine resources and GRI 303: Water and effluents 2018. A detailed breakdown of the linkages between ESRS E3, GRI 303, and the Water Consumption Exposure Draft is provided in Appendix G.

Because some data are likely to be missing or estimated using proxy data, section 3.2 provides general guidance for preparers to address data gaps and uncertainty. Much of the guidance of this section also builds on the foundational Scope 3 guidance of the GHG Protocol. While the GHG Protocol was written to apply to GHG emissions, the guidance provided is applicable and consistent with considering data sources and gaps for all environmental impacts.

Section 4: Outcomes, impacts, and valuation

This section provides the specific equations used to calculate the impacts in monetary terms (section 4.1), explains the variables that translate impact driver measurements to outcomes (section 4.2), and discusses the monetary valuation approach (section 4.3) for the Water Consumption Methodology.

In section 4.1, five equations are used to measure and value the impacts of water consumption. The calculations begin by using equations 3 – 5 to determine local site-specific value factors for each category of impact. These equations take national value factors produced in Appendix D, Table D1 and applies local context by utilizing the local water stress and pressure on biodiversity.

Once each local value factor is determined, they are aggregated to a single, site-specific value factor for each location of water consumption using equation 2. This is done by taking the highest value of the three near-term impacts: affected health from malnutrition, affected health from water-borne disease, and affected well-being from ecosystem services. This approach was chosen because all three impacts could not have been driven by the same unit of water and therefore represent three lost opportunity costs. Similar to other opportunity cost frameworks, the impact is defined as the loss of the largest value that could have come.

The highest opportunity cost is then added to the financial costs to access future water to obtain the site-specific value factor. This value factor is added because it represents a long-term impact that occurs because of present water consumption. In the final step, equation 1 is used to multiply water consumption of each location by the site-specific value factor and then sum across all locations to obtain a total water consumption impact. This section also provides guidance for calculating water consumption impact if country data is the only level at which data is available.

Sections 4.2 describes the approach to determine outcomes and impacts for each of the four value factors.

Section 4.3 describes the valuation approach used to convert impacts described above to impacts in monetary terms. Both affected health impacts convert DALYs lost by using the value of statistical life (VSL). A single globally representative VSL is used based on the mean estimate from the OECD’s 2012 global meta-analysis of willingness-to-pay (WTP) studies. This was done to respect human rights by valuing each person’s life equally regardless of their country or other demographic factors. The valuation approach for altered ecosystem services uses the ESVD which provides 9,500 estimates of ecosystem services values in monetary terms using an array of valuation approaches. The ESVD was used because of the scale of the database driving towards more replicated and globally representative values. A replacement cost to access water as measured through the operational cost of providing water is used to value the financial costs to access future water. While this likely represents a lower bound of impacts, a replacement cost approach was used as the best available proxy for these impacts.

Section 5: Future development

The closing section reinforces that the Water Consumption Exposure Draft reflects the latest understanding of the impacts of water consumption and builds on decades of rigorous scientific work. At the same time, opportunities for the continued development of the Water Consumption Methodology are highlighted.

Request for Public Comment

Instructions to comment

The VTPC invites comment letters on the proposals in the Water Consumption Exposure Draft, particularly on the questions set out below. Feedback from stakeholders will be incorporated impartially. Comments are most helpful if they:

a) address the questions as stated;

b) specify the paragraph(s) to which they relate;

c) contain a clear rationale;

d) identify any wording in the proposals that is ambiguous in its interpretation; and

e) include alternative proposals the VTPC should consider, if applicable.

In providing comments, not all questions need to be addressed. When addressing a question please provide sufficient detail and context for the comment. Comments should also be included when there is strong support for the proposal in the Exposure Draft. The VTPC is requesting comments only on matters addressed in the Water Consumption Exposure Draft.

Please note that comment letters are a matter of public record and will be published on the IFVI website after the closure of the public comment period. Comments can be submitted using the Water Consumption Public Comment Form. Alternatively, comment letters could be sent to the technical staff via e-mail at research@ifvi.org with "Water Consumption Public Comment" in the subject line.

Questions for feedback

Each box outlines a series of questions pertaining to a specific topic. Use the 'Exposure Draft Summary' for added context to each question.

Question 1 – Overall usability of the Water Consumption Methodology
1a. Is the presentation of the Topic Methodology clear and understandable? Is it possible to be understood and implemented by a practitioner with a sufficient, but not necessarily advanced, level of expertise? **1b.** Are the data requirements proposed in the Topic Methodology achievable? If not, what changes would better align it with best practices in data collection in a way that is sufficiently linked to the outcomes and impacts to be valued?

1c. As presented, does the Topic Methodology add value to an organization's impact management and/or reporting practices ? Why? What would help improve the value proposition of the Topic Methodology?

Question 2 – Scope of the Water Consumption Methodology (sections 1.2 and 1.4)

2a. Does the Exposure Draft provide sufficiently clear rationale for focusing on the metric of water consumption along the value chain?

2b. Does the Exposure Draft clearly define what is inside and outside the scope of the Water Consumption Methodology?

Question 3 – Clarity and feasibility of providing two options of application based on data availability (section 3.1)

3a. Do you agree with the approach of having two options to use the methodology based on the availability of water consumption data? If no, how should challenges about data availability and the local application of water consumption impacts be addressed?

3b. Is the guidance provided in the Exposure Draft for when to use the *Preferred Option* or *Minimum Option* sufficiently clear to understand when each should be used? If no, what additional guidance would be valuable?

Question 4 – Determination of the impacts including methodological approaches (sections 4.2 & 4.3)

4a. Do you agree with the framing of the impacts included in the impact pathway (affected health from malnutrition, affected health from water-borne disease, altered ecosystem services, and financial costs to access future water)?

4b. Do you agree with the methodological approaches used to determine outcomes, impacts, and valuation for each impact? If no, what other approaches should be considered?

4c. Is the guidance provided in Sections 4.2, 4.3, and Appendix B sufficient to understand how the value factors for each impact were developed? If no, what additional detail would be valuable?

Question 5 – Approach and clarity for local application and aggregating impacts (section 4.1)
5a. Are the approaches to localize national value factors clear? What could be incorporated to improve usability? **5b.** Do you agree with the approach of valuing near-term impacts via the highest value factor of the three near-term impacts following the framework of lost opportunity cost? If no, how should these three value factors be aggregated? **5c.** Do you agree with the approach to add the future impacts from present water consumption to the other impacts? If no, how should this value factor be incorporated? **5d.** Is the guidance provided in Sections 4.2, 4.3 and Appendix B sufficient to understand how the value factors for each category of impact were developed? If no, what additional detail would be valuable?

Question 6 – Additional feedback
6a. Do you disagree or have concern with any additional proposal(s) in the Exposure Draft? For example, this could include feedback on references used and definitions, among other areas. If so, what are they and what do you see as viable alternative approaches?

Due Process Provisions Applicable to the Exposure Draft

The Due Process Protocol of IFVI establishes an independent committee, the Valuation Technical and Practitioner Committee (VTPC), to direct, validate, and approve the impact accounting methodology produced by the partnership between IFVI and VBA. The VTPC oversees and is supported by the work of the technical staff of IFVI and VBA.

Public exposure is a vital step in the Due Process Protocol to ensure the development of high-quality methodologies that reflect stakeholder input. When the VTPC has reached general agreement on a methodology statement, the VTPC votes on whether to proceed with releasing a proposed methodology statement. An approval by a simple majority of the VTPC is required to proceed with releasing an exposure draft of a proposed statement.

The Exposure Draft herein reflects feedback provided by members of the VTPC and is a proposal of a statement that has been approved for public exposure.

After the conclusion of the public comment period, the VTPC reviews the received comment letters. To support the VTPC's considerations, the technical staff will prepare a summary of the comment letters. The summary provides an overview of the significant issues raised in the letters and any additional related research and/or consultations. Comments are published on the IFVI website and significant matters are deliberated at a VTPC meeting.

Executive Summary

- The Water Consumption Topic Methodology can be used by preparers of impact accounts to measure and value the impact of water consumption on people and the natural environment. This Topic Methodology can also be applied by users of impact information to manage the sustainability-related risks, opportunities, and impacts of an entity and inform decision-making regarding an entity's contribution to sustainability.
- To use this Topic Methodology in its entirety, preparers should:
    - develop a full accounting of water consumption including an entities' own operations as well as upstream and downstream in the value chain, considered separately;
    - organize water consumption data by location, either locally or nationally, at the most precise geographical unit that data is available;
    - utilize the impact pathway and value factors developed in this Topic Methodology to convert water consumption into impact accounts;
    - present any related impact information with supplemental notes and qualitative commentary necessary to meet the qualitative characteristics of impact information.[1]
- **Section 1** introduces the purpose of the document, outlines key concepts and definitions, and defines the scope for the Topic Methodology. This includes defining water consumption as the amount of water drawn into the boundaries of the entity and not discharged back to the water environment or a third-party water manager, in alignment with the European Sustainability Reporting Standards (ESRS) and the Global Reporting Initiative (GRI).
- **Section 2** develops the impact pathway for water consumption, consisting of inputs, activities, outputs, outcomes, and impacts. The primary input to an entity's activities is the water withdrawn from a water source, which results in water discharged as an output back to the environment, with water consumption serving as the difference in these two values.
- This leads to outcomes related to natural capital and environmental quality, resulting in impacts on human well-being. These impacts include:

[1] See General Methodology 1: Conceptual Framework for Impact Accounting.

  - altered ecosystem services;
  - financial costs to access to water;
  - affected health malnutrition; and
  - affected health from waterborne diseases.

- **Section 3** establishes the data required for the Topic Methodology including water consumption(m^3) data of the entity and its value chain, organized by the location of water consumption at the most precise geographical unit available. Based on these locations, the local water stress and biodiversity pressure can be sourced to apply local value factors. The Topic Methodology has two options for application based on the precision of location data.

- The data requirements are aligned with and expand upon disclosure requirements established by relevant standard setters including European Sustainability Reporting Standards (ESRS) E3: Water and marine resources and the Global Reporting Initiative (GRI)303: Water and effluents 2018.

- **Section 4** outlines the approach of the Topic Methodology for measuring and valuing the impacts of water consumption, leading to value factors for altered ecosystem services, financial costs to access future water, affected health from malnutrition and health from water-borne diseases.

    - Ecosystem Services: The relationship between ecosystem services and water availability is developed using The Ecosystem Services Valuation Database (ESVD);
    - Financial Costs to Access Future Water: Models of water supply and demand are valued based on replacement costs;
    - Affected health from malnutrition: Impacts are measured by the links between water consumption and water deprived from agriculture, the number of people malnourished within the region, and the disability-adjusted life years (DALYs) lost from malnutrition, then valued using a value of statistical life (VSL); and
    - Affected health from water-borne diseases: Links between lost DALYs to domestic freshwater usage, house connection to water supply and sanitation, gross domestic product per capita, health care expenditure, and average annual temperatures are valued using the VSL.

- Each value factor can be determined nationally or sub-nationally. To determine the aggregated value factor, the largest value factor of ecosystem services, malnutrition and waterborne diseases (representing a near-term opportunity cost) is added to the value factor for access to future water.

- To determine the societal cost of water consumption, preparers than multiply the aggregated value factor by the entity-specific water consumption (m^3) for each location.

- **Section 5** articulates opportunities for further development of the Topic Methodology, including potential areas of improvements in data quality for water consumption, advancement in valuation approaches and frameworks to quantify potential positive impacts of an entity producing and discharging more water than it withdraws.

- This Topic Methodology builds on frameworks and protocols published by leading organizations in the impact management ecosystem and sustainability-related disclosures required by governing jurisdictions and international standard setters, including:

    - Capitals Coalition;
    - Ecosystem Service Valuation Database (ESVD);
    - European Sustainability Reporting Standards (ESRS);
    - Global Reporting Initiative (GRI);
    - Intergovernmental Panel on Climate Change (IPCC);
    - National Institute for Public Health and Environment, Netherlands;
    - The Transparent Project;
    - World Resources Institute (WRI); and
    - World Wide Fund for Nature (WWF).

1 Introduction

1.1 Document purpose

1. The purpose of this document is to outline the Topic Methodology for Water Consumption (henceforth, Water Consumption Methodology) as part of the *impact accounting* methodology being developed by the International Foundation for Valuing Impacts and the Value Balancing Alliance.

2. The impact accounting methodology measures and values the *impacts* of corporate entities (entities or an entity) in monetary terms for the purposes of preparing impact accounts and generating impact information. The Water Consumption Methodology can be used to inform internal decision-making, investment decisions, and understand the significance of water consumption impacts of an entity.

3. Preparers of impact accounts should adhere to the entirety of the Methodology to the fullest extent possible and should disclose any deviations from it when shared with users of impact information.

1.2 Topic description

4. For the purposes of the Water Consumption Methodology, water consumption is the volume of water drawn into the boundaries of the entity and not discharged back to the water environment or a third-party water manager.[1]

5. Water is a necessary human right and a requirement for life, exemplified by the United Nations enshrining "Access to water and sanitation for all" in the UN 17 Sustainable Development Goals.[2] Because of the necessity for numerous activities, nearly all entities are reliant on water at some stage in the value chain. The wide-spread negative impacts of water over-extraction on *stakeholders* has led to increased calls for improved water stewardship by the United Nations,[3] World Resources Institute,[4] CDP,[5] Science Based

[1] ESRS. (2023). *Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023; supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards*.

[2] United Nations. (2024). *U.N. Sustainable Development Goal 6: Ensure access to water and sanitation for all*.

[3] United Nations. (2024). *U.N. Sustainable Development Goal 6: Ensure access to water and sanitation for all*.

[4] Lakshman, S. (2023). *The Next Phase of Corporate Sustainability: Addressing Consumer Water Use*.

[5] CDP. (2023). *CDP water security 2023 reporting guidance*.

Targets Network Freshwater Hub,[6] Global Commission on the Economics of Water,[7] Alliance for Water Stewardship,[8] and sustainability reporting standards.[9]

6. While a global issue, the impacts of water consumption are often local, leading to disproportionate effects on some populations more than others. Many impacts occur because water consumption drives scarcity, depriving use by others. Local impacts are mediated by regional differences such as water stress, types of water use, municipal water infrastructure, sanitation practices, or land use. The seasonality of rainfall also drives greater impacts during the dry periods of the year when rainfall is low.

7. The negative impacts on society continue to worsen as water consumption continues to increase. In the last century, water use has increased at nearly twice the rate of the human population.[10] Only 0.5% of water on Earth is usable freshwater which will continue to be a stressed, finite resource into the future.[11] Approximately two billion people globally have limited access to safe drinking water, and roughly half of the global population experiences a duration of severe water stress every year.[12] Climate change[13] is further exacerbating the impacts from water consumption in numerous ways, including through increased rainfall variability, toxic algal blooms and further reductions in access to clean water sources. [14,15,16]

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[6] Science Based Targets Network. (2024). *Corporate water stewardship and science-based targets for freshwater: Alignment and interoperability between leading approaches*.

[7] Global Commission on the Economics of Water. (2023). *Turning the Tide: A call to collective action by the Global Commission on the Economics of Water*.

[8] Alliance for Water Stewardship. (2019). *The AWS Standard 2.0 and Guidance*.

[9] GRI. (2018). *GRI 303: Water and effluents*. and *ESRS E3: Water and marine resources*.

[10] Food and Agriculture Organization of the United States. (2017). *Water for sustainable food and agriculture: A report produced for the G20 Presidency of Germany*.

[11] United Nations. (2024). *Water – at the center of the climate crisis*.

[12] United Nations. (2022). *The sustainable development goals report 2022*.

[13] Intergovernmental Panel On Climate Change (Ipcc). (2023). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Chapter 4: Water*.

[14] World Wildlife Fund. (2023). *High Cost of Cheap Water: The true value of water and freshwater ecosystems to people and planet*.

[15] Intergovernmental Panel On Climate Change (Ipcc). (2023). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Chapter 4: Water*.

[16] Ho, J. C., & Michalak, A. M. (2020). *Exploring temperature and precipitation impacts on harmful algal blooms across continental U.S. lakes*.

8. The Water Consumption Methodology takes a societal perspective by considering the impacts on society within the region where water is consumed. By measuring and valuing the impacts on society, water consumption impact accounts can provide guidance to entities by considering local context, such as water stress, to manage and mitigate risks.

9. The Water Consumption Methodology, as presented, covers an entity's own operations as well as its upstream and downstream value chain. The extent to which all value chain levels should be included in impact accounts is dependent upon the relevance of the impacts at each value chain level from an impact materiality perspective.

10. While the Water Consumption Methodology measures the impacts of the entity on stakeholders, understanding and managing water consumption impacts may also help an entity manage production needs, operational costs, supply chain disruptions, resource allocation, and reduce the risk of costs related to reputational damage and legal action.

1.3 Key concepts and definitions

11. For the Water Consumption Methodology, important key terms are defined as follows:

    a) Water consumption: The amount of water drawn into the boundaries of the entity and not discharged back to the water environment or a third-party water manager over the course of the reporting period.[17]

    b) Water withdrawal: The sum of all water drawn into the boundaries of the entity from all sources for any use over the course of the reporting period.[18] These sources include (1) surface water, (2) groundwater, (3) seawater, and (4) produced water such as water harvesting[19] whether withdrawn directly from a source by the entity or provided to the entity through water suppliers.

    c) Water discharge: The sum of effluents, used water, and unused water released to surface water, groundwater, seawater, or a third-party over the course of the reporting period.[20]

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[17] ESRS. (2023). *Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023; supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards*.

[18] ESRS. (2023). *Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023; supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards*.

[19] See definition of each type of water in the Glossary.

[20] Definition adapted from GRI. (2023). *GRI Standards Glossary*. This also aligns with the definition in ESRS.

d) Water stress: The ability, or lack thereof, to meet the human and ecological demand for water.[21] Water risk[22], more broadly, considers water stress as well as accessibility of water and regulatory or reputational issues.

12. A complete set of defined terms is included in the Glossary.

1.4 Scope and assumptions

13. Water consumption represents water that may have been used in production, incorporated into products, consumed by humans or animals, evaporated or transpired, stored by the entity, generated as waste, or contaminated beyond acceptable limits within the reporting period (Figure 1).[23]
14. The scope and boundaries of the Methodology includes full value chain water consumption. This includes *upstream*, *direct operations*, and *downstream* as defined in General Methodology 1. An entities' own operations should be the same scope used for financial statements to ensure comparability. Value chain water consumption may be based on models and not directly measured due to the challenges of measuring upstream and downstream water consumption impacts.[24]

15. The Water Consumption Methodology recognizes full responsibility of an entity for its upstream and downstream water consumption. Water consumption is attributed to an entity through physical or economic relationships by partitioning the inputs or outputs of water consumption and determining the portion that is linked to the entity. The inclusion of value chain water consumption means that double counting will occur if aggregating across entities in the same value chain. However, this will not lead to double counting within an individual entity's impact statement.

16. Impacts caused by the discharge of contaminated or altered water do not fall within the scope of the Water Consumption Methodology. These impacts may be subject to future development under a distinct Topic Methodology.

17. Any actions taken to alter water recycled, stored, or lost will affect water consumption (Figure 1). For example, increasing the use of recycled water can decrease water withdrawal and reduce water consumption.
18. Since water impacts are local, a high degree of precision in the source of water consumption is necessary for a proper valuation. To maximize the usefulness in decision-making, preferred water consumption data should be for the watershed or

[21] As defined in GRI. (2018). *GRI 303: Water and effluents*.

[22] As defined in ESRS. (2022). *E3: Water and marine resources*.11/18/2024 6:16:00 PM

[23] Examples from GRI. (2018). *GRI 303: Water and effluents*.

[24] See Section 3.3

more precise. As an alternative, country data is also recognized in cases when this level of detail is not known.

19. In most circumstances, water is consumed by an entity, leading to negative impacts. The scope of this methodology only considers these negative impacts. However, there are possible scenarios where the production (as opposed to consumption) of water leads to positive impacts.

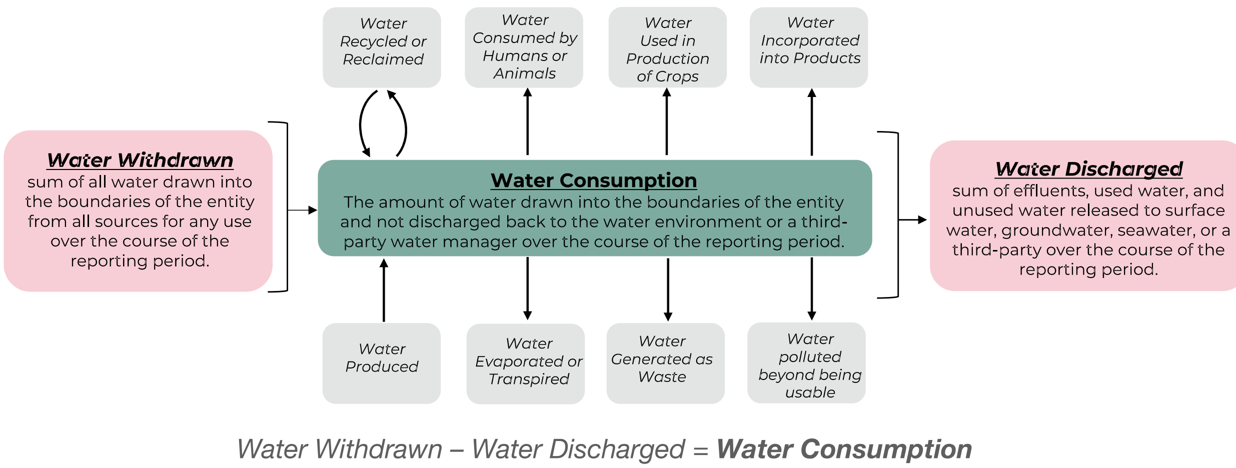

Figure 1. Schematic diagram of the linkages between various flows of water for an entity, including water consumption[25]

[25] Categories of water consumption come from GRI. (2018). *GRI 303: Water and effluents*.

2 Impact Pathway

2.1 Summary

20. The water consumption impact pathway is the series of consecutive, causal relationships, ultimately starting with water consumed by entities as the input for an entity's activities and linking effects on natural capital and environmental quality with related changes in the well-being of society.

21. Detailed components of the impact pathway are outlined in subsequent sections, leading to the measurement and valuation of an entity's water consumption in *Section 4: Outcomes, Impacts, and Valuation*.

22. The impact pathway for water consumption is as follows:

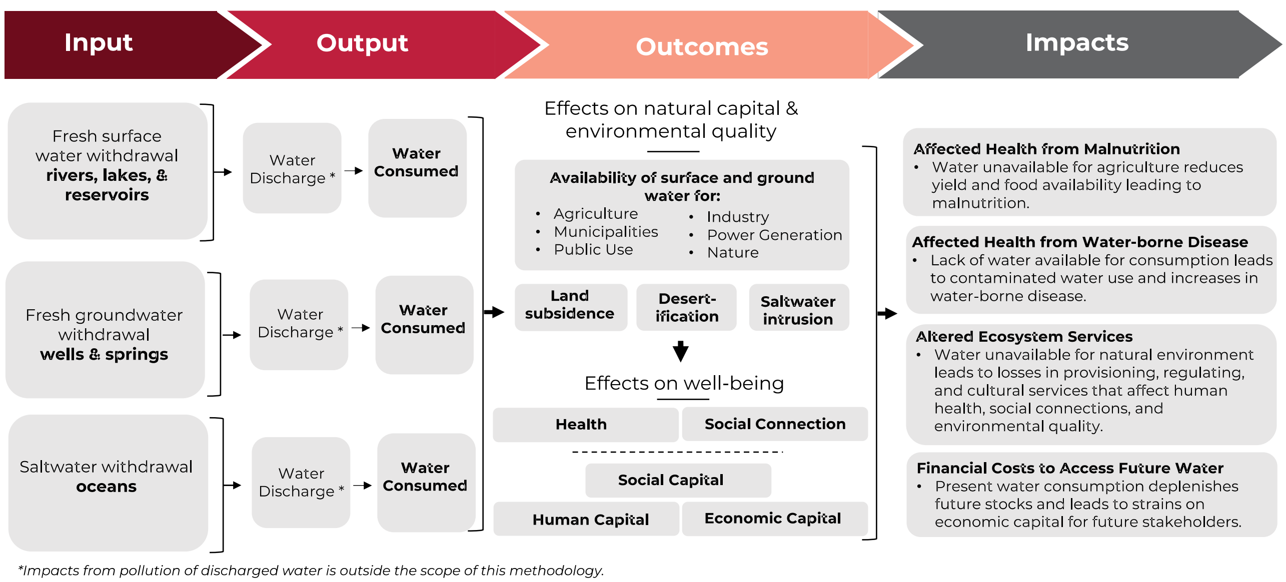

Figure 2. Water consumption impact pathway

2.2 Description and notes

23. The primary input for the water consumption impact pathway is the water withdrawn[26] from a water source into the boundaries of the entity. Water can be withdrawn from surface water (rivers, lakes, and reservoirs), groundwater (wells or springs), or seawater (oceans). *Water withdrawal* is considered whether it is withdrawn directly by the entity or provided to the entity through municipal water suppliers.

[26] Sometimes termed “water use”. Reig, P. (2013). *What's the Difference Between Water Use and Water Consumption?*

24. Outputs from the entity include *water discharged* back to the water environment and the subsequent determination of water consumption. The water discharged occurs when water leaves the boundaries of the entity and released back to surface water, groundwater, seawater, or a third-party water manager.

    a) The primary unit of output used to calculate impacts is water consumption. Water consumption is water that is withdrawn from a water source and not discharged back to the water source over the course of the reporting period.[27,28] Any produced water would be captured in water consumption by increasing the water discharge.

25. The first outcomes of water consumption are effects on natural capital and environmental quality. Nature has a systemic relevance for society and thus these effects drive the subsequent outcomes.[29] Available surface water and groundwater are depleted leading to lost opportunities for others to access this water. These include lost opportunities for use by agriculture, municipalities, the public, industry, power, and nature. Environmental quality outcomes occur when groundwater extraction also leads to land subsidence, desertification, and saltwater intrusion damages in coastal communities.

    a) Stemming from altered conditions of the natural environment, human well-being outcomes are also affected by water consumption. The lost opportunities for water to be supplied to humans for consumption or agriculture for irrigation leads to reduced human health outcomes. The long term overextraction of water also drives losses in economic capital as new sources of water are sought. The lost opportunities to provide water to nature lead to several negative well-being outcomes as quantified through ecosystem services. Those particularly affected include human health, social connections, social capital, human capital, and economic capital.

26. The impacts applied in the Water Consumption Methodology fall into four categories:

    a) *Affected health from malnutrition*. The lost opportunity to use water for agriculture can lead to lower food production. Reduced food production

[27] Reig, P. (2013). *What's the Difference Between Water Use and Water Consumption?*

[28] ESRS. (2023). *Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023; supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards*.

[29] See NGFS. (2023). *The Green Scorpion: the Macro-Criticality of Nature for Finance* which expands on this systemic relevance.

increases malnutrition rates, particularly in locations with limited connections to alternative food sources, impacting human health.

b) *Affected health from water-borne disease.* Similarly, when water is not available for human consumption, this can force people to use alternative water sources that may have lower quality and increased contaminants. The consumption of this water can lead to increases in water-borne disease rates, impacting human health.

c) *Altered ecosystem services*. Water consumption also deprives the natural environment of water, leading to reduced ecosystem quality. Reduced quality of nature driven by water deprivation then minimizes its ability to sustain human life by providing ecosystem services for human well-being. The extent to which ecosystem service impacts are affected by water consumption is mediated by stability and resilience of an ecosystem with biodiversity serving as the key metric. Therefore, in areas where biodiversity is already under pressure[30] from other factors such as invasive species or land clearing, the loss of water will lead to greater impacts of water consumption on ecosystem service provisioning. The impacts may come through altered *provisioning*, *regulating*, *habitat*, and *cultural services*.[31]

d) *Financial costs to access future water*. The present consumption of water at a greater rate than it is replenished leads to long-term impacts on *water access*. Increased scarcity of water in the future will lead to significant strains on economic capital as a variety of stakeholders seek alternative strategies to obtain clean water. This cost will lead to added financial burdens long into the future that occurred because of present day unsustainable water consumption. This may come through paying for bottled water, new infrastructure to access water (desalinization or deeper wells), travelling further distances to access water, or paying increased water fees to water providers.

27. While several other impacts are known, present research is not yet sufficiently developed to capture these impacts of water consumption. These include damages to infrastructure and agriculture from land subsidence, loss of livable land area from desertification and saltwater intrusion, algal blooms from sedimentation affecting health, emigration from water-stressed regions, and the added systemic dimensions of

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[30] The pressure on biodiversity as a mediator of ecosystem services is further expanded upon in Section 3.1 *Data Requirements.*

[31] See definitions and examples of each category of service in the Glossary.

nature for the financial system.[32] New research will continue to develop techniques to capture additional impacts.

[32] NGFS. (2023). *The Green Scorpion: The Macro-Criticality of Nature for Finance*.

3 Impact Driver Measurements

28. *Impact drivers* consider inputs and outputs and reflect the data needs expected of a preparer to provide an impact account for water consumption. The section below outlines the specific data needed along with how preparers should consider data gaps and uncertainty.

3.1 Data requirements

29. To utilize the Water Consumption Methodology, the following data are needed (Table 1):

    a) An entity's total water consumption is required, including own operations as well as upstream and downstream in the value chain, considered separately. All water consumption data should be in units of m^3.

    - Water consumption considers both water withdrawn from a water source and water discharged back to the water environment.[33] Section 3.3 provides additional guidance for determining water consumption including guidance on filling data gaps with estimation.

    - Water consumption data needs to be organized by the location of water consumption at the most precise geographical unit that data is available.

    b) The local water stress (WS_{local}) and the country water stress ($WS_{national}$) are required for each location of water consumption, as determined by the Aqueduct Water Risk Atlas.[34]

    - This resource uses the PCR-GLOBWB 2 model[35] to determine the ratio of total water demand to available renewable surface and groundwater for sub-watersheds. This model runs at monthly intervals and considers multiple sources of water demand to determine water stress in each sub-watershed. The data in Aqueduct can be determined for each watershed, administrative unit (e.g. state or province), or country.

[33] See definition in Section 1.3

[34] The Aqueduct Water Risk Atlas is referenced as a tool to assess water stress in ESRS. (2023). *E3: Water and marine resources* and GRI. (2018). *GRI 303: Water and effluents*.

[35] Sutanudjaja, E. H. et al. (2018). *PCR-GLOBWB 2: a 5 arcmin global hydrological and water resources model*.

- Guidance on how to obtain local or national water stress via the Aqueduct Water Risk Atlas[36] is provided in Appendix C. The national water stress data are also reported in Table D1.

c) The local pressure on biodiversity (BD_{local}) and the country pressure on biodiversity ($BD_{national}$) are required for each location where water consumption occurs, as determined by the WWF Biodiversity. Risk Filter. [37]

- Biodiversity is a trait of nature that serves to mediate the supply of ecosystem services and therefore serves as a useful metric to consider local impacts within the Methodology.[38] Biodiversity and ecosystem processes[39] are known to have a direct impact on ecosystem stability, productivity, resilience to environmental and anthropogenic stressors, and susceptibility to invasion.[40]

- The Pressures on Biodiversity was selected because it takes a comprehensive approach to assessing local risks to biodiversity. This metric considers the risks and pressures on biodiversity by location and industry including effects on (1) land, freshwater, and sea use change, (2) forest canopy loss, (3) invasive species, and (4) pollution.[41] Taken together, the Pressure on Biodiversity metric presents a comprehensive understanding of the risk of biodiversity loss in a location, therefore serving as a good mediator for how water deprivation will drive loss in ecosystem service value.

- Guidance on how to obtain local and national pressure on biodiversity via the WWF Biodiversity Risk Filter[42] is provided in Appendix C. The national biodiversity pressure data are also reported in Table D1.

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[36] For further detail on how to obtain local water scarcity and biodiversity values, see Appendix C.

[37] World Wildlife Fund. (2023). *WWF risk filter: Methodology documentation*. The WWF Risk Filter Suite is referenced in both ESRS. (2023). *E3: Water and marine resources* and GRI. (2018). *GRI 303: Water and effluents*.

[38] IPBES. (2019). *Global assessment report on biodiversity and ecosystem services*.

[39] IPBES. (2017). *Models of drivers of biodiversity and ecosystem change*.

[40] Tilman, D. (1999). *The Ecological Consequences of Changes in Biodiversity: A Search for General Principles*.

[41] IPBES. (2017). *Models of drivers of biodiversity and ecosystem change*.

[42] National Biodiversity Risk Filter parameters, aggregated to national and sub-national levels, can be found via: https://riskfilter.org/biodiversity/explore/country-profiles

Data input	*Preferred:* *Minimum:*	Location 1 (Country 1)	Location 2 (Country 2)	Location 3 (Country 3)
Data from the entity				
Water Consumption:				
• own operations				
• upstream value chain				
• downstream value chain				
Location of water consumption				
• Preferred option – local				
• Minimum option – country				
Data from other sources				
Water Stress:				
• Local (Preferred option only)				
• National				
Biodiversity Pressure:				
• Local (Preferred Option Only)				
• National				

Table 1. Data required from the entity and from other sources, disaggregated by location of water consumption

30. To provide sufficient detail for impact accounts, water consumption should be collected separately for (1) own operations, (2) upstream value chain, and (3) downstream value chain in each watershed where water consumption occurs as in Table 1.

31. All data should be organized by location at the most precise geographical unit that data is available. Since water consumption impacts occur locally, the precise location of water consumption improves the decision-usefulness of information about water consumption impacts. Specific location data will also lead to the most representative and accurate impact accounting. There are two options, based on data availability:

    a) *Preferred Option*: This option is used when entities have water consumption data that is tied to a specific location. This is likely the case when water consumption is known from public utility data or from sourcing by the entity on the site (i.e. a well). In this option, an entity's water consumption data is organized by watershed and local water stress and pressure on biodiversity data is obtained from those same locations. Alternatively, data could be pulled at the smallest administrative region (e.g. *administrative level 1*, state, province, or district). The purpose of this option is to apply the Methodology at the most precise geographical unit. This is the preferred option for use of the Methodology as it will lead to the most accurate determination of the impact of an entities water consumption.

b) *Minimum Option*: When an entity does not have knowledge of water consumption in a subnational geographic unit, the Methodology can be applied for each country of water consumption. In this case, water consumption data would be organized for each country with only national value factors used. If an entity has water consumption data at a higher level of detail than the country, the minimum option should not be used. Where preparers use the minimum option, they should disclose their reasons for doing so.

32. Supplemental notes or qualitative commentary should be included in water consumption impact accounts as noted in General Methodology 1. For water consumption this should clearly state which options (Preferred or Minimum) were used including justification for doing so. Additional commentary may include but is not limited to calculation methodologies, approaches to handling data gaps, key assumptions, alignment with planetary boundaries or science-based thresholds for sustainable consumption, and progress towards water consumption targets (Science Based Targets for Water).[43]

33. The data requirements of the Water Consumption Methodology are aligned with and expand upon disclosure requirements established by relevant standard setters including European Sustainability Reporting Standards E3: Water and marine resources and the Global Reporting Initiative 303: Water and effluents 2018. Additional alignment may exist with other regional or topic specific reporting standards as well. Further details are presented in Table 2 and Appendix G.

[43] Science Based Targets Network. (2024). *Corporate water stewardship and science-based targets for freshwater: Alignment and interoperability between leading approaches*.

Metric	ESRS	GRI
Water Consumption – own operations	Fully aligned E3-4, p. 27(a)	Fully aligned 303-5(a)
Water Consumption – value chain	Expands upon p. 2, 3, 7(a), 11(c)*	Expands upon 303-1*
Location of water consumption	Expands upon E3-4, p. 27(b)	Expands upon 303-5 (b)
Water Stress	Expands upon E3-4, p. 27(b)	Expands upon 303-5 (b)
Biodiversity Pressure	Expands upon E4-5	Expands upon 304-2

**When deemed material, value chain water consumption is required for both ESRS and GRI.*

Table 2. Alignment with reporting standards[44]

3.2 Data sources, gaps, and uncertainty

34. Preparers should strive to measure water consumption in a manner that is complete, neutral, and free from error. This includes faithfully representing the water consumption from all parts of the value chain.

35. In practice, obtaining full value chain water consumption data may be challenging for entities, particularly from upstream or downstream in the value chain. Barriers such as cost, accounting methods, or availability of data may require the use of secondary data to measure water consumption impacts in their entirety.

36. To determine water consumption, knowledge of water withdrawal and water discharge are both needed. If withdrawal is from a municipal water utility, then utility bills should provide detailed data on water withdrawal. If water is withdrawn by the entity itself (e.g. a well), then direct measure or estimation from activity data is needed. Water discharge data is often more difficult to obtain as water utilities often do not monitor it. If an entity is not directly measuring discharge, it can be assumed that no water discharge has occurred or estimated from secondary data.

37. Preparers should prioritize approaches that:[45]

[44] Categories of alignment include (1) fully aligned: data from reporting can be used as is for preparation of impact accounts; (2) expands upon: data from reporting conceptually aligns with the impact accounting methodology, but additional detail, context, or presentation is necessary for an accurate accounting of impact; or (3) independent: Data needed for the preparation of impact accounts are not covered by the reporting standards and would require separate data collection and analysis.

[45] Language adapted to water consumption from the Greenhouse Gas Protocol. (2011). *Corporate value chain (scope 3) accounting and reporting standard*.

a) directly measure water consumption over those that estimate water consumption based on calculations from activity data,

b) utilize primary data from specific activities within a company value chain over secondary data, and

c) consider sources of data that are of the highest quality possible.

38. High quality data sources should consider:[46]

a) technological representativeness. Does the data match the technology used?

b) temporal representativeness. Does the data represent the actual time or age of the activity?

c) geographical representativeness. Does the data reflect geographic considerations of the activity?

d) completeness. Is the data statistically representative of the activity?

e) reliability. Are the data sets or sources dependable?

39. Various estimation techniques can be used to determine water consumption. While a variety of techniques exist, those recommended for water consumption analysis include life cycle analysis (LCA) and *environmentally extended input-output (EEIO)* tables. Both approaches have developed frameworks for determining water consumption but may differ in levels of data specificity or considerations depending on the context of application.

40. Other resources may provide guidance for developing water consumption data including ISO 14046: 2014 Environmental Management Water Footprint,[47] CEO Water Mandate Corporate Water Disclosure Guidelines,[48] or CDP Water Security 2023 Reporting Guidance.[49] Additional guidance for developing water consumption data may also come from ESRS E3: Water and marine resources and GRI 303: Water and effluents 2018.

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[46] Language adapted to water consumption from the Greenhouse Gas Protocol. (2011). *Corporate value chain (scope 3) accounting and reporting standard*.

[47] ISO 14046. (2020). *Environmental management Water footprint: Principles, requirements and guidelines*.

[48] The Global Compact. (2014). *The CEO Water Mandate: Corporate water disclosure guidelines, Toward a common approach to reporting water issues*.

[49] CDP. (2023). *CDP water security 2023 reporting guidance*.

41. Uncertainty will arise when quantifying water consumption. Preparers should report qualitative uncertainty and, when possible, quantitative uncertainty. These may include but are not limited to propagated measured uncertainty, pedigree matrices, sensitivity analyses, or probability distributions.

4 Outcomes, Impacts, and Valuation

42. The impacts that result from the water consumption of an entity affect the environmental quality dimension of well-being and the well-being resource of natural capital. These are linked to the well-being of people through their effects on health, social connections, economic capital, human capital, and social capital.

43. The impact pathway in this statement has been developed using a value factor that collapses the impact measurement and valuation stages into a summary value that is location-specific for each category of impact. The value factors can then be multiplied directly by entity-specific water consumption using the equations in section 4.1. The measurement and valuation approaches are expanded upon in sections 4.2 and 4.3 and Appendix B.

4.1 How to calculate impacts

44. To determine the monetary cost of water consumption (H_2O Value$_{Total}$) using the preferred method, preparers should use the following equations:

$$\mathbf{H_2O\ Value_{Total}} = \sum (WC_{site} * VF_{H_2O-site}) \text{ for all locations} \quad \text{(Eq. 1)}$$

$$VF_{H_2O-site} = VF_{access-site} + MAX(VF_{es-site}, VF_{nutrition-site}, VF_{disease-site}) \quad \text{(Eq. 2)}$$

$$VF_{es-site} = VF_{es} * \frac{BD_{local}}{BD_{national}} \quad \text{(Eq. 3)}$$

$$VF_{nutrition-site} = VF_{nutrition} * \frac{WS_{local}}{WS_{national}} \quad \text{(Eq. 4)}$$

$$VF_{disease-site} = VF_{disease} * \frac{WS_{local}}{WS_{national}} \quad \text{(Eq. 5)}$$

45. The variables in the equations are as follows:

WC_{site}	Water consumption (WC_{site}) represents the total volume, in m^3, of water consumed at each site of use. Water consumption is determined by an entity and described in Section 3.1.
$VF_{access-site}$	The value factor for the financial costs to access future water. For the preferred method, this value factor should be at administrative level 1 and be obtained from the Water Consumption Local Value Factor Tool in Appendix E. If subnational water consumption data is not available a country value factor can be accessed in Table D1.
VF_{es}	National value factor for altered ecosystem services. The country value factor used should correspond to the country of water consumption and can be accessed in Appendix D, Table D1.

$VF_{nutrition}$	National value factor for affected health from malnutrition. The country value factor used should correspond to the country of water consumption and can be accessed in Appendix D, Table D1.
$VF_{disease}$	National value factor for affected health from water-borne disease. The country value factor used should correspond to the country of water consumption and can be accessed in Appendix D, Table D1.
BD_{local}	Local biodiversity pressure. This value, combined with the national biodiversity pressure, is used to convert national value factors to local value factors using equation 3. This value can be accessed by obtaining the "Pressures on Biodiversity" value via the WWF Biodiversity Risk Atlas.[50,51]
$BD_{national}$	National biodiversity pressure. This value, combined with the local biodiversity pressure, is used to convert national value factors to local value factors using equation 3. National biodiversity pressure is also provided in Table D1.
WS_{local}	Local water stress. This value, combined with the national water stress, is used to convert national value factors for malnutrition and water-borne disease to a local value factor using equations 4 and 5. This value can be accessed by obtaining the local "Water Stress" value via the Aqueduct Water Risk Atlas.[52]
$WS_{national}$	National water stress. This value, combined with the local water stress, is used to convert national value factors for malnutrition and water-borne disease to a local value factor using equations 4 and 5. This value can be accessed by obtaining the national "Water Stress" value via the Aqueduct Water Risk Atlas.[18] National water stress values are also provided in Table D1.

46. The water consumption impact (H_2O $Value_{Total}$) calculation is described below.

a) Determining local, site-specific value factors:

- Eq. 3: The national value factor for ecosystem services is multiplied by the ratio of local (BD_{local}) to national ($BD_{national}$)biodiversity pressure. This ratio serves to translate the national value factor provided to the specific location of water consumption.

- Eq. 4 and 5: The value factors for malnutrition and water-borne disease are each multiplied by the ratio of local (WS_{local}) to national ($WS_{national}$)

[50] World Wildlife Fund. (2023). *WWF water risk filter: Methodology documentation*.

[51] See further description on how to access biodiversity and water scarcity values in Appendix C.

[52] See further description on how to access biodiversity and water scarcity values in Appendix C.

water stress. This ratio serves to translate the national value factor provided to the specific location of water consumption.

- For $VF_{access\text{-}site}$, the local value factor has already been calculated and can be obtained from the Water Consumption Local Value Factor Tool in Appendix E.

b) Aggregating to a single, site-specific value factor:

- Eq. 2: All value factors are converted into a total water consumption impact for each site ($VF_{H_2O\text{-}site}$). The value factors for affected health from malnutrition ($VF_{nutrition}$), affected health from water-borne disease ($VF_{disease}$), and affected well-being from ecosystem services (VF_{es}) each represent a near-term lost opportunity cost. The impact of each single unit of water could not have been used for all three alternative uses, therefore adding the three would overstate the impact. In this case, the largest value factor of the three should be taken as this is the missed opportunity to maximize the value of that water for another use.

- The impact of financial costs to access future water is added to the highest value factor from the three near-term impacts. This value factor was developed by assessing the long-term impacts of habitual unsustainable extraction of present-day water in a given region. The VF_{access} is capturing impacts not represented by the other three value factors. In particular, it is assessing changes to long-term stocks of water which may not always present near-term impacts but will lead to long-term deprivation to future users. Therefore, near-term impacts from the other VFs can occur while simultaneously having long-term impacts represented by VF_{access}.

c) Equations 2-5 should be calculated separately for each location to obtain each site-specific impact. This is because the value factors, water stress values, and biodiversity values vary geographically. After applying equation 2 for each location, the total water consumption impact is determined by multiplying the water consumption by the impact of that site using equation 1. These are then summed to determine a total impact of water consumption.

d) If an entity does not have knowledge of the location of water consumption, the minimum option applies the Water Consumption Methodology at a national level for each country. In this case, equations 3, 4, and 5 would not be used and the country value factors for VF_{access}, VF_{es}, $VF_{nutrition}$, and $VF_{disease}$ would replace site-specific value factors. Equation 1 would be organized and calculated by country instead of by site. Country value factors are in Appendix D.

47. Upstream value chain, downstream value chain, and own operations of water consumption should always be considered separately to increase transparency, comparability, and decision-usefulness. Additional levels of detail may be useful such as an assessment of water consumption regionally, nationally, or within specific value chain categories.

48. Because the consumption of water causes negative impacts to stakeholders via the impact pathway, the H_2O $Value_{Total}$ is negative.

4.2 Outcomes and impacts

49. For each impact, the approaches used to link water consumption to outcomes and impacts are described below. Additional methodological details are in Appendix B.

    a) Affected Health via Malnutrition ($VF_{nutrition}$): The $VF_{nutrition}$ utilizes the approach of ReCiPe 2016 to link water consumption to the loss of human health that comes from reduced agricultural production.[53] This occurs by a series of regressions that connect water consumption, water deprived from agriculture, the number of people malnourished within the region, and the *disability-adjusted life years* (DALYs) lost from malnutrition. The DALYs lost serve as the objective indicator of well-being.

    b) Affected Health via Water-borne Disease ($VF_{disease}$): The $VF_{disease}$ measures damage to human health by water-borne diseases known to be caused by limited domestic water availability (i.e., ascariasis, trichuriasis, hookworm disease, and diarrhea).[54] A multiple regression analysis links water consumption to DALYs using the following predictors: domestic freshwater usage, house connection to water supply and sanitation, gross domestic product per capita, health care expenditure, and average annual temperatures.[55] The DALYs lost serve as the objective indicator of well-being.

    c) Altered Ecosystem Services (VF_{es}): The VF_{es} measures impacts to health, social connections, economic capital, human capital, and social capital that come

[53] Huijbregts, M. A. J. et al. (2016). *ReCiPe 2016 v1.1*.

[54] Motoshita, M. et al. (2011). *Development of impact factors on damage to health by infectious diseases caused by domestic water scarcity*.

[55] Motoshita, M. et al. (2011). *Development of impact factors on damage to health by infectious diseases caused by domestic water scarcity*.

through the lost ecosystem services. This is done by using the Ecosystem Services Valuation Database (ESVD),[56] a meta-analysis of 9,500 ecosystem service estimates across 6 continents. The studies in this analysis use numerous objective and subjective well-being indicators and methods to determine impacts across 23 individual ecosystem services that fall into four broad categories – provisioning services, regulating services, habitat services, and cultural services.[57] Some ecosystem service impacts are already captured by other impacts in the impact pathway. Specifically, the provisioning service of food production is captured in the malnutrition impact and the provisioning service of water is included in the water-borne disease impact. These ecosystem services are excluded in this pathway to avoid double-counting. The impacts from the ESVD are linked to water consumption using a global database of annual *potential evapotranspiration (PET),*[58] and an analysis of global land extents of biomes.[59] The impacts from the ESVD are converted to water impacts using the PET value which estimates ecosystem water needs and, therefore, how the deprivation of water leads to lost ecosystem services. The final step converts the ecosystem service value per m^3 to country ecosystem service impacts by doing a weighted average, considering the proportion of each biome type within the country.

d) Financial Costs to Access Future Water (VF_{access}): The VF_{access} represents the outcomes and impacts to economic capital of finding alternative sources of water for future users resulting from present-day water consumption. These impacts can persist for thousands or millions of years in many contexts. For each watershed, the model determines when water demand is greater than available renewable surface and groundwater supplies using the World Resources Institute's Aqueduct Water Risk Atlas.[60,61] The output from the model is a ratio of water demand over water supply with values above 1 representing unsustainable rates of extraction. This is repeated for every year and watershed to the year 2080. This year represents a likely, yet conservative estimate of the length of impacts and also the length of the model predictions from the Aqueduct Water Risk Atlas. This ratio is then used to determine the proportion

[56] De Groot, R. et al. (2012). *Global estimates of the value of ecosystems and their services in monetary units*.

[57] For definitions of these categories, see the Glossary.

[58] Zomer, R. J. et al. (2022). *Version 3 of the Global Aridity Index and Potential Evapotranspiration Database*.

[59] Song, X.-P. (2018). *Global Estimates of Ecosystem Service Value and Change: Taking Into Account Uncertainties in Satellite-based Land Cover Data*.

[60] Kuzma, S. et al. (2023). *Aqueduct 4.0: Updated decision-relevant global water risk indicators*.

[61] World Resource Institute. (2023). *Aqueduct 4.0 Water Risk Atlas Data Dictionary*.

of each unit of water that was extracted unsustainably, calculated as the percent of total water demand that is in excess of supply. The objective well-being indicator assesses the percent of total water demand in excess of supply for each watershed and year.

4.3 Monetary valuation

50. Monetary valuation uses value factors to estimate the relative importance, worth, or usefulness of changes in well-being indicators in monetary terms. The monetary valuation approach and value factors are developed individually for each impact in the Water Consumption Methodology. Each approach is described briefly below with additional methodological details in Appendix B.

    a) Affected Health via Malnutrition ($VF_{nutrition}$) and Water-borne Disease ($VF_{disease}$): The DALYs lost for both value factors are valued using the *value of statistical life (VSL).* The VSL applied uses a single globally representative VSL of $4,889,008 USD (2023), based on a VSL of $3,135,447 USD (2005)[62] from the OECD, adjusted for inflation.[63] The VSL is converted to the valuation of one year of life lost by considering life expectancy. This value is then multiplied by the DALYs from ReCiPe and correcting for inflation to the relevant year.[64]

    b) Altered Ecosystem Services (VF_{es}): Because the ESVD represents a meta-analysis of 9,500 ES estimates across 6 continents, there are many valuation approaches used in this analysis. Some of the more common approaches in the database include market prices, damage costs, contingent valuation, and choice modelling.[65]

    c) Financial Costs to Access Future Water (VF_{access}): The valuation considers a replacement cost to access new sources of water. This is done by utilizing the projected unit operational cost[66] to produce water supplied from water utilities. The operational cost to produce water represents a conservative lower bound of potential impacts. This is multiplied by the proportion of water contributing to future shortage as defined by the ratio of water demand to supply each year

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[62] See Table 1 in Biausque, V. (2012). *The Value of Statistical Life: A meta-analysis*.

[63] Inflation adjusted using OECD's Inflation (Consumer Price Index) and Inflation Forecast data series, which can be accessed via: https://data.oecd.org/price/inflation-cpi.htm

[64] See Appendix B for more detail about the VSL to DALY determination.

[65] See the ESVD for more detail about valuation methods.

[66] The International Benchmarking Network. (2023). *Country Profile United States*.

until 2080 and aggregated for each watershed. Future impacts are discounted at 2%[67] and impacts are PPP adjusted to each country.

51. Appendix D presents country value factors (Table D1) produced using the valuation methods described above. In addition, Appendix E provides a link to a Water Consumption Local Value Factor Tool that can assist in determining the local value factor for any location. The distribution of value factors for each impact and some examples are highlighted in Box 1. For countries where data is not available in Table D1, a regional average can be used and has been calculated and provided in Table D2.

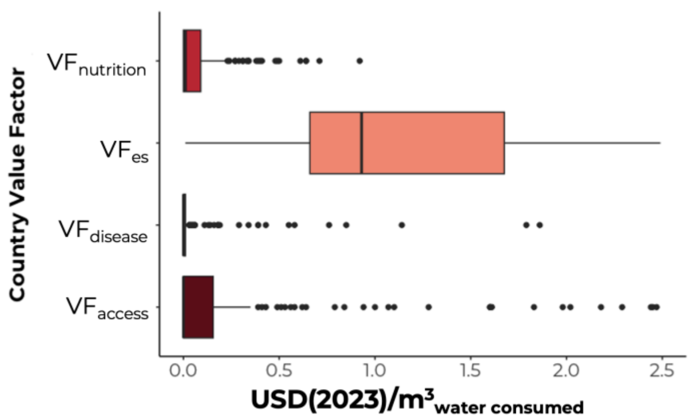
52. The value factors will be reviewed and updated regularly. These updates will be made to the value factor only without revision to the methodology itself.

[67] This target social discount rate aligns with other Topic Methodologies.

Box 1. Distribution and Localization of Country Value Factors

Country Value Factors

The distribution of country value factors for each category of impact are presented below. For malnutrition, water-borne disease, and economic costs to access water, most country impacts are relatively small with median values near \$0.01 USD (2023) per m^3 water. Though water-borne disease and access impacts are generally small, impacts within select countries are significant. Altered ecosystem services are much more evenly distributed across countries with a median of \$1.01 USD (2023) per m^3 water. The economic costs to access water has a cluster of values between \$0 and \$0.2 USD (2023) per m^3 water with a significant number of values that scatter well above \$1.0 USD (2023) per m^3 water. Note that the figure does not show value factors that are greater than \$2.5 USD (2023) per m^3 water, as the existence of large outliers make it difficult for clear visualization. Thus, 15 countries for VF_{es}, 3 countries for $VF_{disease}$, and 23 countries for VF_{access} are not displayed in the graph below. All country value factors can be seen in Table D1.

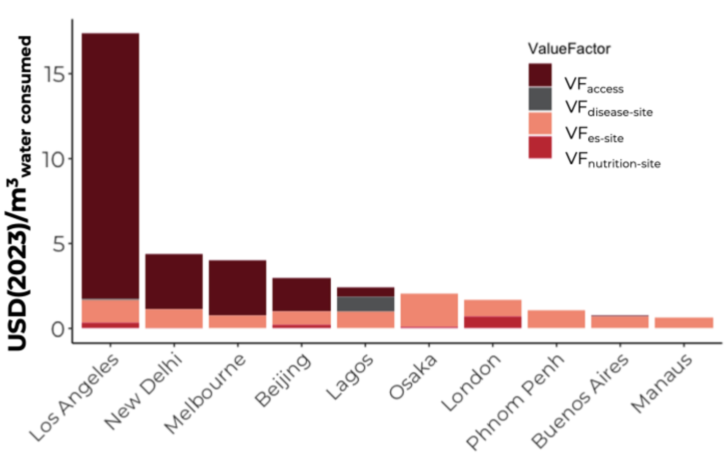


Value	Value Factors				
	VF_{es}	$VF_{nutrition}$	$VF_{disease}$	VF_{access}	$VF_{H2O,\ Country}$
Five Largest Valuations USD (2023)	\$16.73 (Maldives)	\$0.92 (Nicaragua)	\$285.45 (South Africa)	\$71.13 (Qatar)	\$287.63 (South Africa)
	\$15.02 (Marshall Islands)	\$0.71 (Iraq)	\$5.88 (Estonia)	\$40.73 (United Arab Emerates)	\$71.19 (Qatar)
	\$13.27 (Kiribati)	\$0.64 (Eswatini)	\$4.80 (Ukraine)	\$39.82 (Bahrain)	\$40.76 (United Arab Emirates)
	\$8.99 (Tuvalu)	\$0.64 (Namibia)	\$1.86 (Cameroon)	\$25.24 (Isreal)	\$40.20 (Bahrain)
	\$4.38 (Seychelles)	\$0.61 (Papua New Guinea)	\$1.79 (Chile)	\$23.45 (Cyprus)	\$26.19 (Isreal)
Median	\$1.01 (Nigeria, Kyrgyzstan, Myanmar, Senegal)	\$0.02 (12 Countries)	\$0.00 (123 Countries)	\$0.01 (Dem. Rep. Congo, Madagascar, Cambodia, Venezuela)	\$1.61 (Morocco, Pakistan)
Number of Countries with value of 0	0	67	123	93	0
Lowest non-zero value	\$0.01 (Oman, Saudi Arabia, Kuwait, Libya)	\$0.01 (24 Countries)	\$0.01 (10 Countries)	\$0.01 (Dem. Rep. Congo, Madagascar, Cambodia, Venezuela)	\$0.13 (Mauritania)

Localization of Value Factors

The country value factors presented above are to be localized using local data for water stress and biodiversity pressure using equations 3 – 5. The site-specific value factors are then aggregated to determine a local water consumption value factor ($VF_{H2O\text{-}site}$) using equation 2.

Examples of local water consumption value factors from selected cities are below. In locations where water scarcity is high, the economic costs to access water are high (e.g. Doha and Dubai). In other locations, altered ecosystem services, water-borne disease, or malnutrition can drive the impacts. The stacked bar chart below shows relative proportions of each value factor for example cities. The table applies equation 2 to determine the site value factor for each city ($VF_{H2O\text{-}site}$).



City	Country	$VF_{H2O,\ Site}$ USD (2023)	
Doha	Qatar	\$	74.23
Dubai	United Arab Emirates	\$	57.57
Brussels	Belgium	\$	21.84
Los Angeles	United States	\$	17.03
New Delhi	India	\$	4.39
Melbourne	Australia	\$	4.02
Dhaka	Bangladesh	\$	2.93
Beijing	China	\$	2.78
Osaka	Japan	\$	1.98
Managua	Nicaragua	\$	1.96
Lagos	Nigeria	\$	1.51
Phnom Penh	Cambodia	\$	1.05
London	United Kingdom	\$	1.00
Buenos Aires	Argentina	\$	0.76
Manaus	Brazil	\$	0.63

5 Future Development

54. The Water Consumption Methodology represents the current state of knowledge on water consumption impacts and builds upon decades of rigorous scientific work. But some opportunities for improvement exist including enhancing water consumption data accounting across the value chain and further development of the valuation of impacts.

55. Opportunities to further advance water consumption impact accounting include:

    a) Improvements in data quality for water consumption accounting. As the desire and expectation to measure water consumption increases, there will be an expansion of techniques for determining water consumption and the number of entities conducting water consumption accounting.

    b) Increased public disclosure of water consumption data to support the development of water consumption impact accounts. Increased use of reporting standards and disclosure frameworks will augment the availability of value chain water consumption impacts.

    c) Advancement to valuation approaches that can determine impacts at finer spatial and temporal resolutions. The type of water (e.g. groundwater vs. surface water), the location (e.g. arid vs. rainy environment), and the time of year (e.g. wet vs. dry season) all affect the impacts of water consumption. Future work will continue to incorporate these considerations to refine water consumption valuation.

    d) New methods that incorporate additional impacts from water consumption such as the impacts of land subsidence and additional opportunity costs that stem from overconsumption of water.

    e) Techniques and frameworks to quantify potential positive impacts that arise when an entity produces and discharges more water than it withdraws.

56. Significant updates on any of the above, among other developments in the landscape will be used to inform future updates to the Water Consumption Methodology, which will be considered periodically.

Appendix A: Glossary

Term	Definition	Source[68]
Administrative level 1	Administrative 1 is defined as boundaries at the first sub-national level (e.g., States in the United States, Provinces in Canada, or Regions in France.)	FAO
Biodiversity	The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. This includes variation in genetic, phenotypic, phylogenetic, and functional attributes, as well as changes in abundance and distribution over time and space within and among species, biological communities and ecosystems.	IPBES
Biome	Global-scale zones, general defined by the type of plant life that they support in response to average rainfall and temperature patterns (e.g., tundra, coral reefs, or savannas)	TNFD
Cultural services	The experimental and intangible benefits related to the perceived or actual qualities of ecosystems, i.e. the non-material benefits from spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, including the appreciation of the existence of diverse species.	ESVD
Direct operations/ Operational processes (gate-to-gate)	Covers activities over which the business has direct operational control, including majority owned subsidiaries.	Natural Capital Protocol
Disability-adjusted life year (DALY)	One DALY represents the loss of the equivalent of one year of full health. DALYs for a disease or health condition are the sum of the years of life lost to due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population.	World Health Organization

[68] Some definitions are adapted from the original source.

Downstream processes (gate-to-grave)	Covers activities linked to the purchase, use, re-use, recovery, recycling, and final disposal of the business' products and services.	Natural Capital Protocol
Ecosystem services	The benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling.	Millennium Ecosystem Assessment
Environmentally extended input output models	A family of models designed to bridge the gap between traditional economic calculations, sustainability, and environmental decision-making.	The U.S. Environmental Protection Agency
Groundwater	Water that is being held in, and that can be recovered from, an underground formation.	GRI
Habitat services	The benefits of ecosystems providing space (habitat) to allow the proper functioning of evolutionary processes needed to maintain a healthy gene pool, and by providing essential habitats in the life cycle of migratory species. Some classifications, like CICES, combine Regulating and Habitat services into one category.	ESVD
Impact	A change in one or more dimensions of people's well-being directly or through a change in the condition of the natural environment.	N/A (GM1)
Impact accounting	The system for measuring and valuing the impacts of corporate entities and generating impact information to inform decisions related to sustainability performance.	N/A (GM1)
Impact drivers	Refers to the sequence of an entity's inputs and outputs that may have positive and/or negative impacts on people's well-being.	Impact Management Platform (GM1)
Impact pathway	The series of consecutive, causal relationships, ultimately starting at an input for an entity's activities and linking its actions with related changes in people's well-being.	ISO (GM1)
Input	The resources and business relationships that the entity draws upon for its activities.	Impact Management Platform (GM1)

Malnutrition	Refers to deficiencies, excesses, or imbalances in a person’s intake of energy and/or nutrients.	WHO
Monetized impact	The assignment of monetary values to damages.	N/A
Outcome	The level of well-being experienced by people or condition of the natural environment that results from the actions of the entity, as well as from external factors. Outcomes are used to describe the one or more dimensions of people's well-being that are affected by an input, activity, and/or output.	Impact Management Platform (GM1)
Output	The direct result of an entity's activities, including an entity's products, services, and any by-products.	Impact Management Platform (GM1)
Potential evapotranspiration (PET)	The amount of water evaporated (both as transpiration and evaporation from the soil) from an area of continuous, uniform vegetation that covers the whole ground and that is well supplied with water.	American Meteorological Society
Produced water	Water that enters the organization’s boundary as a result of extraction (e.g., crude oil), processing (e.g., sugar cane crushing), or use of any raw material, and has to consequently be managed by the organization.	GRI
Provisioning services	The products or resources that can be harvested or extracted from ecosystems (e.g., food and raw materials) and which can usually be traded in markets.	ESVD
Regulating services	The benefits obtained from ecosystem processes that maintain environmental conditions beneficial to individuals and society (e.g., air quality, flood protection, biological control). Generally, these services have an indirect market value.	ESVD
Saltwater intrusion	The movement of saltwater into freshwater aquifers. Saltwater intrusion decreases freshwater storage in aquifers, and, in extreme cases, can result in the abandonment of wells. The intrusion of saltwater caused by withdrawals of freshwater from the groundwater system can make the resource unsuitable for use.	The United States Geological Survey
Seawater	Water in a sea or ocean.	GRI

Stakeholders	Stakeholders are defined as those who can affect or be affected by the entity.	European Sustainability Reporting Standards (GM1)
Subsidence	The sinking of the ground because of underground material movement, often caused by the removal of water, oil, natural gas, or mineral resources out of the ground by pumping, fracking, or mining activities.	National Oceanic and Atmospheric Administration
Surface water	Water that occurs naturally on the Earth's surface in ice sheets, ice caps, glaciers, icebergs, bogs, ponds, lakes, rivers, and streams.	GRI
Transpiration	The evaporation of water from plants through small openings found on the underside of leaves.	National Oceanic and Atmospheric Administration
Upstream processes (Cradle-to-gate)	Covers the activities of suppliers, including purchased energy.	Natural Capital Protocol
Value factor	Value factors help to translate the impact drivers of an entity into estimations of the relative importance, worth or usefulness of impacts to the people who experience the impact, expressed as a monetary value.	N/A (GM1)
Value of a statistical life	The amount individuals would be willing to pay or to accept to experience small changes in mortality risk, aggregated to estimate the monetary value of a reduction in mortality risk of 100%.	US EPA
Water stress (WS)	The ability, or lack thereof, to meet the human and ecological demands for water.[69] Water risk,[70] more broadly, considers water stress as well as accessibility of water and regulatory or reputational issues.	EU commission/ESRS
Water consumption	The amount of water drawn into the boundaries of the undertaking (or facility) and not discharged back to the water environment or a third party over the course of the reporting period.	EU commission/ESRS
Water withdrawal	The sum of all water drawn into the boundaries of the undertaking from all sources for any use over the course of the reporting period.	EU commission/ESRS

[69] Definition adapted from GRI. (2018). *GRI 303: Water and effluents*

[70] As defined in ESRS. (2022). *E3: Water and marine resources*.

Water discharge	Sum of effluents, used water, and unused water released to surface water, groundwater, seawater, or a third party, for which the organization has no further use, over the course of the reporting period.	GRI Standards Glossary
Water-borne disease	Diseases caused by consuming contaminated water. Examples include diarrhea, cholera, dysentery, and typhoid.	WHO
Water access	The sustainable and equitable availability of clean and potable water sources for future use.	N/A
Well-being	Well-being is the state of being or doing well in life; happy, healthy, or prosperous condition; moral or physical welfare. According to the OECD Well-being Framework, well-being encompasses 11 dimensions of current well-being and 4 dimensions for future well-being.	Impact Management Platform Organization for Economic Co-operation and Development (OECD)

Appendix B: Methodological Details

Table of Contents

1. Introduction

B1. Four categories of value factors were developed to determine water consumption impacts: affected health from malnutrition, affected health from water-borne disease, altered ecosystem services, and financial costs to access future water. For each category, a wide array of approaches were considered ranging from techniques in the academic and business literature to methods developed internally. The value factors presented considered the valuation techniques, the recency of the underlying data, the spatial extent and resolution, the physical or socioeconomic sophistication in the underlying models, and the assumptions made in each step.

B2. The details of how each value factor is determined can be found in the sections below.

2. Affected Health from Malnutrition

B3. The deprivation of a unit of water to agricultural users is represented by affected health from malnutrition. This category assumes that the deprivation of water to agricultural users reduces the caloric production of staple crops, leading to increased rates of malnutrition.

B4. Malnutrition impacts are based on water use-related human health characterization factors (CFs) provided by ReCiPe2016.[71]. ReCiPe uses life cycle impact assessments (LCIAs) to translate inputs related to human health, ecosystem quality and resource scarcity into midpoint and endpoint CFs. ReCiPe2016 was chosen as a significant

[71] Huijbregts, M. A. J. et al. (2017). *ReCiPe2016: a harmonised life cycle impact assessment method at midpoint and endpoint level*.

advancement from ReCiPe2008[72] by providing CFs on a global scale with more expansive water use impacts.

B5. Here, characterization factors (CFs) are defined as values that indicate environmental impact per unit stressor (e.g., per cubic meter of water consumed). Midpoint CFs represent a point located somewhere in the middle of a particular impact pathway, where endpoint CFs reflect the direct damage represented at the very end of the impact pathway (here, DALYs per cubic meter of water consumed).

B6. ReCiPe2016 water use-related human health CFs utilize a cause-effect chain relating malnutrition to water stress developed by Pfister et al. (2009)[73] and a Cultural Theory Framework developed by De Schryver et al. (2011).[74] The final endpoint CFs represent malnutrition impacts in units of DALYs per cubic meter of water consumed.

B7. Midpoint CFs developed by Pfister et al. (2009) are represented by a water stress index (WSI) that is the ratio between the sum of freshwater withdrawals for different sectors and the hydrological availability within a particular watershed. WSI also incorporates inter-annual variation in both water withdrawals and hydrological availability, where increased withdrawals and/or lower water availability leads to increased WSI values. This is completed by calculating the multiplicative standard deviations of monthly and annual precipitation for the years 1961-1990, assuming a log-normal distribution, and aggregated to a watershed level.

B8. Midpoint CFs are translated into endpoint CFs by incorporating damages to human health. This is completed by the multiplication of a fate factor, an effect factor, and a damage factor. The fate factor (units of m^3 deprived per m^3 consumed) is determined by multiplying the WSI by the percentage of water extracted by agriculture. The effect factor (units of capita*year per m^3 deprived) represents the number of malnourished people per quantity of water deprived within a watershed, incorporating a standard per-capita water requirement to prevent malnutrition (1,350 m^3 per capita per year), multiplied by a human development factor (HDI). The HDI is represented by a polynomial fit of malnutrition-related DALY values to national HDI reports. Finally, the damage factor (units of DALYs per year per capita) represents a country-level linear regression of malnutrition rates by DALY malnutrition rates. The multiplication of the

[72] Goedkoop, M. et al. (2009). *Recipe 2008: A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and endpoint level*.

[73] Pfister, S. et al. (2009). *Assessing the environmental impacts of freshwater consumption in LCA*.

[74] De Schryver, A. M. et al. (2011). *Value Choices in Life Cycle Impact Assessment of Stressors Causing Human Health Damage*.

fate, effect and damage factors creates endpoint CFs in units of DALYs per cubic meter of water consumed.

B9. De Schryver et al. 2011 developed the Cultural Theory Framework, in which CFs can be represented by three distinct perspectives – the individualist, hierarchist, and egalitarian perspectives. The individualist perspective represents weak group cohesions (relationships) and regulations for social relations, while considering nature to be stable and quick to recover from disturbance.[75] The hierarchist perspective represents strong group cohesion and binding regulations for social relations, while considering nature to be in equilibrium. The egalitarian perspective represents strong group cohesion coupled with few regulations and considers nature to be fragile and unstable.

B10. For water consumption, the hierarchist and egalitarian perspectives produce equal CFs.[76] The egalitarian/hierarchist perspective was selected to determine the malnutrition value factor.

B11. The DALYs from ReCiPe2016 were converted to currency by determining the value of a DALY from a *value of a statistical life* (VSL). The VSL is frequently used in the monetary valuation of human mortality risk, and has been applied in many government, multilateral, academic, and corporate impact contexts. The VSL is the amount individuals would be willing to pay or to accept to experience small changes in mortality risk, which is then aggregated to estimate the monetary value of a reduction in mortality risk of 100%.[77] The VSL is not an estimate of any individual's willingness to pay to prevent (or willingness to accept to endure) certain death and does not place a monetary value on individual lives.

B12. The OECD VSL estimate of $4,889,007.90 USD (2023) was chosen as a single globally representative value. This is based on a VSL of $3,135,447 USD (2005) adjusted for inflation using the OECD's Inflation (Consumer Price Index) and Inflation Forecast data series. This value is derived from the mean of 366 estimates from stated preference studies around the world[78] taken from Table 1 of a 2012 meta-analysis by the OECD.

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[75] De Schryver, A. M. et al. (2011). *Value Choices in Life Cycle Impact Assessment of Stressors Causing Human Health Damage*.

[76] Huijbregts, M. A. J. et al. (2016). *ReCiPe 2016 v1.1: A harmonized life cycle impact assessment method at midpoint and endpoint level. Report 1: Characterization*.

[77] United States Department of Transportation. (2021). *Treatment of the value of preventing fatalities and injuries in preparing economic analyses*.; United States Environmental Protection Agency. (2024). *Mortality Risk Valuation*.

[78] See Table 1 of Biausque, V. (2012). *The Value of Statistical Life: A meta-analysis*.

B13. Estimates of the VSL do vary empirically by subpopulation, reflecting both income differences (i.e., willingness to pay is constrained by ability to pay) as well as genuine differences in attitudes toward health risk.[79] National and local VSLs may therefore be valuable in complementary analyses of impact accounts. Nonetheless, the Water Consumption Methodology uses one global VSL, taking a human rights approach that values each person's life equally, irrespective of their race, color, sex, language, religion, political or other opinion, national or social origin, property, birth or other status.[80] A single VSL is intended to avoid distortionary results that unintentionally favor one population over another when impact accounting decisions cross country and other demographic lines.

B14. The VSL is converted into a valuation of one year of life lost (YLL) by dividing the VSL by the remaining life expectancy of the respondents included within the meta-analysis (31 years, represented by the total life expectancy of 78 years minus the median age of the respondents in the study, 47 years). For equity reasons, no age-weighting or income-adjusting techniques were utilized.[81] The value of a single DALY was converted to USD (2023) using data from the U.S. Bureau of Economic Analysis (BEA).[82] This resulted in the value of a DALY of $157,710 USD (2023).

3. *Affected Health from Water-borne Diseases*

B15. The deprivation of a unit of water to domestic users is represented by affected health through water-borne illnesses. This category assumes that corporate water consumption increases domestic water scarcity, leading to a reduction of access to safe drinking water. This loss of access to safe drinking water increases the risk of contracting water-borne illnesses where water sanitation infrastructure is lacking. Other parameters such as health care expenditure and house connection to sanitation have strong effects on this relationship and cannot be ignored.

B16. To represent the effect of water consumption on the spread of water-borne disease, country-level estimates were based on research provided by Motoshita et al (2011).[83] Motoshita et al. (2011) makes use of multiple regressions relating water scarcity to

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[79] Biausque, V. (2012). *The Value of Statistical Life: A meta-analysis*.; Health and Safety Executive. (2020). *A scoping study on the valuation of risks to life and health: the monetary Value of a Life year (VOLY)*.

[80] United Nations. (1948). *Universal Declaration of Human Rights*.

[81] Arnesen, T., & Nord, E. (1999). *The value of DALY life: problems with ethics and validity of disability adjusted life years*.

[82] U.S. Bureau of Economic Analysis. (2024). *Table 1.1.9. Implicit price deflators for gross domestic product*.

[83] Motoshita, M. et al. (2011). *Development of impact factors on damage to health by infectious diseases caused by domestic water scarcity*.

DALY estimates for diarrheal, ascariasis, trichuriasis, and hookworm disease. This was completed through the creation of two distinct modules: a water accessibility assessment module and a health damage assessment module.

B17. The water accessibility assessment module was represented via a regression analysis where house connection to water supply was predicted by three explanatory variables: domestic use of freshwater, GDP per capita, and gross fixed capital formation expenditure per capita. The results of the regression describe the changes to house connection to water supply caused by unit changes to domestic water use.

B18. The health damage assessment module assessed changes to health damage data (DALYs) for water-borne disease predicted by seven explanatory variables: average annual temperature, house connection to water supply, house connection to sanitation, average dietary consumption, undernourished population rate, the Gini coefficient of dietary energy consumption, and health expenditure per capita. One regression was done for each disease. The results of the health damage assessment module were used to predict the damage to human health caused by a unit change in the house connection to water supply.

B19. By combining the water accessibility and health damage assessment modules, the effect of water-borne disease damage caused by the shortage of a unit volume of domestic water could be calculated based on the data of domestic fresh water use in each country and represented in terms of DALYs per cubic meter of water deprived from domestic water use.

B20. DALYs were monetized in the same manner as used in the malnutrition category. Refer to B12-B14 for details.

4. *Altered Ecosystem Services (ES)*

B21. The deprivation of a unit of water to the natural environment is represented via altered ecosystem services. This category is framed under the assumption that nature needs water to sustain the ecosystem services that support human life.

B22. The ES impacts were developed by utilizing biome-level ES values, considering the water needs for each biome, and assessing the coverage of each biome at the national level.

B23. Biome-level ES values in the Water Consumption Methodology are based on summary statistics provided by the Ecosystem Service Valuation Database (ESVD).[84] The ESVD is a globally representative meta-analysis of 9,500 ES estimates across 6 continents. The

[84] De Groot, R. et al. (2012). *Global estimates of the value of ecosystems and their services in monetary units*.

ES values are represented among 23 individual ecosystem services that fall into four categories – provisioning services, regulating services, *habitat services*, and cultural services.[85] The biomes considered include coastal wetlands, inland wetlands, freshwater (rivers/lakes), tropical forests, temperate forests, woodlands, grasslands, deserts, snow/ice, and croplands. Urban, marine, and coral reef biome types in the ESVD were excluded from the analysis as water consumption was not likely to affect these categories. Further, all ecosystem services except for food production and water provisioning were included in the analysis. These were removed to avoid double counting of impacts with the malnutrition and water-borne disease impacts.

B24. ESVD values, in dollars per hectare per year at 2020 price levels, were represented as standardized averages and categorized for each selected biome and associated ecosystem services. Averages were standardized by applying a common outlier exclusion rule, where values were excluded if they were lower than the first quantile minus 1.5 times the interquartile range, or higher than the third quartile plus 1.5 times the interquartile range. Estimates that used value transfer or benefits transfer as a valuation method were excluded from ecosystem service averages, as these methods apply valuations from existing studies and do not represent unique, site-specific estimates. Further, food provisioning services were excluded from the biome-level averages to avoid double-counting with the malnutrition impact. Values were adjusted for inflation by using data provided by the Bureau of Economic Analysis National Income and Product Accounts.[86]

B25. To assess the impacts of water consumption on ecosystem services, an assessment of how much water a biome requires was needed. The potential evapotranspiration (PET) was selected as a proxy for biome water requirements as it represents the sum of two important ecological processes – evaporation and *transpiration*. These two metrics incorporate many other ecologically relevant variables including solar radiation, air temperature, relative humidity, wind speed, as well as other characteristics related to ecosystem health. The PET was extracted from Version 3 of the Global Aridity Index and Potential Evapotranspiration Database.[87]

B26. PET values (in mm / year) were extracted by the locations of ESVD valuations (in dollars per square meter per year) using the *sample raster values* tool in QGIS.[88] Extracted PET values were then merged with the ESVD database and averaged to the

[85] For definitions of these categories, see the Glossary.

[86] U.S. Bureau of Economic Analysis. (2024). *Table 1.1.9. Implicit price deflators for gross domestic product*.

[87] Zomer, R. J. et al. (2022). *Version 3 of the Global Aridity Index and Potential Evapotranspiration Database*.

[88] QGIS software can be accessed QGIS.org: QGIS Association: *QGIS Geographic Information System*.

biome level. Finally, ESVD valuations were divided by PET estimates to determine the impact of depriving a biome of each unit of water on ES valuation via:

$$\frac{USD(2023)_{biome}}{m^2 * yr} \times \frac{yr}{mm_{PET}} \times \frac{1{,}000\ mm}{m_{PET}} = \frac{\boldsymbol{USD(2023)_{biome}}}{\boldsymbol{m^3}_{\boldsymbol{H_2O\ deprived}}}$$

B27. To convert from biome estimates to national estimates, the total land extents of each biome for each country was used. Satellite coverage values from Song et al. (2018) were utilized as they harmonized data from nine different satellite-based land cover maps into biome categorizations defined by the ESVD itself.[89] Using these data and country-level administrative border polygons from Natural Earth,[90] the biome composition for each country was determined using the *Zonal Histogram* tool from QGIS.

5. *Financial Costs to Access Future Water*

B28. The deprivation of a unit of water for future use is represented via a financial cost of access to future water. This category is framed under the assumption that unsustainable sources of water will be depleted when projected water demand in a location outweighs projected renewable water supply and that future impacts are driven by present water consumption.

B29. In many areas of the globe, the demand for clean freshwater is higher than the available renewable surface and groundwater supply. Where water demand outweighs the water renewal rate, water extraction deprives access of water for future use by using the remaining water.

B30. To value this phenomenon, baseline (present-day) and future metrics for water stress (WS) were extracted from the World Resource Institute's AQUEDUCT Water Risk Atlas.[91] Here, baseline and future WS are represented by the ratio of total water demand for domestic, industrial, irrigation, and livestock consumptive and non-consumptive uses to the available renewable surface and groundwater supplies at a sub-watershed level. AQUEDUCT's baseline WS metric is calculated using sub-watershed data sourced from PCR-GLOWB2.[92] Baseline WS data is represented by an average of twelve water stress time series (one for each month, 1979-2019) weighted by total demand, so that months with higher demand have more influence on the

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[89] Song, X.-P. (2018). *Global Estimates of Ecosystem Service Value and Change: Taking Into Account Uncertainties in Satellite-based Land Cover Data*.

[90] Natural Earth. (2024). *Natural Earth: Admin 0 -- Countries*.

[91] Kuzma, S. et al. (2023). *Aqueduct 4.0: Updated decision-relevant global water risk indicators*.

[92] Sutanudjaja, E. H. et al. (2018). *PCR-GLOBWB 2: a 5 arcmin global hydrological and water resources model*.

annual WS values.[93] Future projections are based on three, 30-year periods centered on the years 2030, 2050, and 2080, provided by the PCR-GLOWB-based hydrological projection of future global water stress with CMIP 6 (HYPFLOWSCI6).[94]

B31. Baseline and future WS data were analyzed and cleaned in R[95] so that WS values and projections for present, 2030, 2050, and 2080 were represented for each sub-watershed. Linear regressions (WS ~ time) for each sub-watershed were applied from present day to 2080. Linear regression formulas were used to extrapolate the WS value for each individual year between present-day and 2080.

B32. The WS value represents the degree to which water extraction is above or below a sustainable rate and is based on the ratio of water demand to water supply in each year. A sustainable rate of extraction is defined here as a WS < 1 and, therefore, any year or watershed where WS is < 1, no shortage exists, and no cost was applied. For WS values above 1, a proportion of the present water consumption is considered above the sustainable rate and, therefore, driving future shortage. Future generations will have to resolve that shortage leading to financial costs. The proportion above the sustainable rate was considered as (WS-1) / (WS). This ratio was multiplied by a cost (the cost to supply water) to represent the increase in price of obtaining water in the future because of scarcity in supply.

B33. Precisely how much higher future prices will be relative to current prices is unknown but can be conservatively estimated as the International Benchmarking Network's price of unit operation costs for water extraction in the U.S. [96] This value was then adjusted for inflation to 2023 and transferred to other countries using PPP adjustment. A 2% social discount rate was applied to values after 2023. Once prices were applied to each year where water demand outweighed water supply and the discounting factor was applied, all values for each sub-watershed were summed together to represent the resource cost at a sub-watershed level. These values were then aggregated to the national level by a weighted average of the water cost, with the weight represented by the sub-watershed size.

[93] Kuzma, S. et al. (2023). *Aqueduct 4.0: Updated decision-relevant global water risk indicators*.

[94] Sutanudjaja, E. H. (2023). *HYPFLOWSCI6: HYdrological Projection of Future gLObal Water States with CMIP6*.

[95] R Core Team (2023). *A language and environment for statistical computing.*

[96] The International Benchmarking Network. (2023). *Country Profile United States*.

Appendix C: Accessing Local Water Stress and Biodiversity Pressure

C1. This section provides guidance on how to obtain local water stress (WS_{local}) and biodiversity pressure (BD_{local}) for each location of water consumption. Local water stress is obtained from the Aqueduct Water Risk Atlas while local biodiversity pressure is obtained from the WWF Biodiversity Risk Filter.

C2. The guidance below is meant to assist preparers of Water Consumption Impact Accounts, particularly those new to these tools. The guidance does not serve as a definitive resource on obtaining these values and is subject to change based on updates from the organizations that host each of the tools.

Local Water Stress (WS_{local}) from the Aqueduct Water Risk Atlas

C3. Begin by navigating to the Aqueduct Website[97] and launching the "Aqueduct Water Risk Atlas". This will open a global map with a list of "Indicators" to select from on the left side of the screen.

C4. Select the "Water Stress" indicator to display it on the map. Ensure that the "Temporal resolution" is "Annual". Using the map tools, navigate to the first location of water consumption of the entity.

C5. The "Analyze" tool, located on the bottom left of the screen, will allow the preparer to access local site Water Stress. Once the "Analyze" tool is open, there are options to locate sites by either clicking on the map or entering the address of the site.[98]

   a. To use the "click map tool", press the "Click Map" button which will allow for each site of water consumption to be entered by clicking on the map.

   b. To enter an address, press the "Enter Address" button which will bring up a dialog box that allows for an address, decimal degrees, or coordinates to be entered. Once the address is located, the box will close, and a point will be placed on the map in that location.

C6. As each location is entered, a table begins to populate in the bottom left of the screen with some metadata about each location. This table does not present the local water stress needed to apply the Water Consumption Methodology.

[97] https://www.wri.org/aqueduct

[98] There is also an option to import a .csv or .xlsx file with addresses, but this is still under development.

C7. Once all sites of water consumption have been populated in the table, it can be downloaded as a spreadsheet (.csv) or geospatial file (.gpkg). The following describes how to obtain the data from the spreadsheet (.csv).

C8. Once the spreadsheet is downloaded and opened, navigate to the "bws_score"[99] column. *The data in this column is the local water stress (WS_{local}) to be used in the Water Consumption Methodology.*

C9. Other tools in the Aqueduct Water Risk Atlas and data extracted may provide useful context for preparers but should not be used or manipulated to replace the local water stress factor described above.

C10. For additional guidance on how to use the Aqueduct Water Risk Atlas see the Frequently Asked Questions[100] and the manuals and publications.[101]

Local Biodiversity Pressure (BD_{local}) from the WWF Biodiversity Risk Filter

C11. To access the local biodiversity pressure data, begin by registering for a free WWF Risk Filter Suite account.[102] Once an account has been made and the preparer is logged in to the website, navigate to the "Portfolio Manager" by clicking the button at the top right of the screen or navigating via the dropdown menu under the Biodiversity Risk Filter tab. Once in the Portfolio Manager, make a company by entering the details of the company of interest.

C12. Next, navigate to the "Sites" button in the center of the page. This is where each location of water consumption will be entered to obtain the local biodiversity pressure data. There are options for entering sites one at a time or to import a set of sites together in a single file.

   c. To add sites individually, click "Add Single Site" which will bring up a dialog box with various details to be entered for the site. Company name, Site name, Industry, Business importance, and Location are all required variables. Selecting the correct Industry is necessary as it will influence the Pressure on Biodiversity value. To add a location, use the search box to find a location or click on the map. Once complete, click "Save" at the bottom of the box.

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[99] This abbreviation means "baseline water stress score"

[100] FAQs: https://www.wri.org/aqueduct/faq

[101] Publications: https://www.wri.org/aqueduct/publications

[102] Site to register: https://riskfilter.org/register

d. To add multiple sites, click “Add Multiple Sites” which will bring up a box to upload an excel file. This also provides a template file for how to provide the data. The excel template has a Help tab to aid in entry. Once the file is complete, uploaded it to the Portfolio Manager.

C13. Once all sites have been entered, they should be visible on the Sites page of the Portfolio Manager.

C14. Navigate back to the “Company & Groups” page of the Portfolio Manager by clicking the button in the center of the screen. Once there, click the green “Analyze Biodiversity” button beside the company of interest. This will take you to a global map where each variable can be explored visually.

C15. Navigate to the “Details” page by clicking the button in the center of the page. This page will present various graphs for the user to explore. To obtain the biodiversity pressure click the “Export to Excel” button at the top right of the screen.

C16. Once the spreadsheet is downloaded and opened, navigate to the “Pressures on Biodiversity” column. The data in this column is the local biodiversity pressure (BD_{local}) to be used in the Water Consumption Methodology.

C17. Other tools in the WWF Risk Filter Suite and data extracted may provide useful context for preparers but should not be used or manipulated to replace the local biodiversity pressure described above.

C18. For additional guidance on how to use the WWF see the Frequently Asked Questions[103] and the manuals and reports.[104]

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[103] FAQs: https://riskfilter.org/#faq

[104] Reports: https://riskfilter.org/risk-reports

Appendix D: National Value Factors, Water Stress, and Biodiversity Pressure

D1. Table D1 provides national value factor, water stress, and biodiversity pressure. Using the preferred option to apply the methodology, the national value factors should be converted to local value factors using the monetary valuation approach described in the Section 4.3 of the Water Consumption Methodology. The national water stress and biodiversity pressure values are made accessible here but can also be obtained from Aqueduct Water Risk Atlas or WWF Biodiversity Risk Filter. Local water stress and biodiversity pressure values must be collected by the preparers by following Appendix C or using the tool in Appendix E. The United Nations Classifications for the Region and Economy Status are also provided for reference.

D2. Where national value factors for a particular country are missing, an aggregate value, represented as the average value of other countries within the same UN region and economy status, is used. Aggregated values are noted with an asterisk (*) in Table D1 below and are provided separately in Table D2.

D3. Value factors will be updated regularly considering: (1) adjustments for inflation, (2) updated impact functions that more fully represent the impacts of water consumption, (3) updated estimation of future damages as they are closer to present day, and (4) advancements in water consumption research that align with principles and concepts laid out in the General Methodology.

$$\sum(WC_{site} * VF_{H_2O-site}) \text{ for all locations} = \mathbf{H_2O\ Value_{Total}} \quad \text{(Eq. 1)}$$

$$VF_{H_2O-site} = VF_{access-site} + MAX(VF_{es-site}, VF_{nutrition-site}, VF_{disease-site}) \quad \text{(Eq. 2)}$$

$$VF_{es-site} = VF_{es} * \frac{BD_{local}}{BD_{national}} \quad \text{(Eq. 3)}$$

$$VF_{nutrition-site} = VF_{nutrition} * \frac{WS_{local}}{WS_{national}} \quad \text{(Eq. 4)}$$

$$VF_{disease-site} = VF_{disease} * \frac{WS_{local}}{WS_{national}} \quad \text{(Eq. 5)}$$

Country	UN region[105]	Economy status[106]	Value factors (USD (2023) per m^3)[107]				Biodiversity and water stress		$VF_{H2O\text{-}national}$
			VF_{es}	$VF_{nutrition}$	$VF_{disease}$	VF_{access}	$BD_{National}$	$WS_{National}$	
Afghanistan	Southern Asia	Developing Economies	0.28	0.49	0.06	0.32	2.37	3.37	0.81
Albania	Southern Europe	Economies in Transition	1.94	0.02	0.13	1.00	2.73	3.47	2.93
Algeria	Northern Africa	Developing Economies	0.08	0.24	0.00	0.43	2.34	3.87	0.68
Andorra	Southern Europe	Developed Economies	1.52	0.00	0.00	2.44	3.43	3.54	3.96
Angola	Middle Africa	Developing Economies	0.54	0.05	0.00	0.39	2.26	1.13	0.93
Antigua and Barbuda	Caribbean	Developing Economies	1.17	0.08*	0.76	0.00	2.12	1.21*	1.17
Argentina	South America	Developing Economies	0.86	0.01	0.00	1.10	2.83	1.83	1.97
Armenia	Western Asia	Economies in Transition	1.72	0.19	0.00	0.10	3.26	2.99	1.82
Australia	Australia and New Zealand	Developed Economies	0.60	0.00	0.00*	0.27	2.82	2.91	0.87
Austria	Western Europe	Developed Economies	2.00	0.00	0.00	0.00	3.06	0.26	2.00
Azerbaijan	Western Asia	Economies in Transition	1.54	0.21	0.00	1.07	3.07	2.47	2.60
Bahamas, The	Caribbean	Developing Economies	2.93	0.00	0.00	0.00	2.63	1.21*	2.93
Bahrain	Western Asia	Developing Economies	0.38	0.15*	0.00*	39.82	2.03	5.00	40.20
Bangladesh	Southern Asia	Developing Economies	2.13	0.31	0.00	0.84	3.09	2.66	2.97
Barbados	Caribbean	Developing Economies	1.52	0.08*	0.02	0.00	2.25	1.21*	1.52
Belarus	Eastern Europe	Economies in Transition	2.08	0.00	0.00	0.00	3.36	1.18	2.08
Belgium	Western Europe	Developed Economies	1.73	0.00	0.00	10.01	3.46	4.41	11.74
Belize	Western Africa	Developing Economies	0.91	0.00	0.00	0.00	2.86	0.07	0.91
Benin	Western Africa	Developing Economies	0.58	0.02	0.00	0.00	3.2	0.00	0.58
Bhutan	Southern Asia	Developing Economies	1.71	0.01	0.19	0.02	2.27	0.37	1.74
Bolivia	South America	Developing Economies	0.67	0.09	0.06	0.00	2.61	0.16	0.67
Bosnia and Herzegovina	Southern Europe	Economies in Transition	2.12	0.00	0.00	0.00	2.61	0.40	2.12
Botswana	Southern Africa	Developing Economies	0.37	0.31	0.00	0.11	1.94	4.66	0.49
Brazil	South America	Developing Economies	0.77	0.01	0.00	0.00	3.17	1.04	0.77
Brunei Darussalam	South-Eastern Asia	Developing Economies	0.74	0.00	0.00	0.00	2.4	0.00	0.74

[105] Determined using categories created by the UN. See: https://esa.un.org/MigFlows/Definition%20of%20regions.pdf

[106] Categories determined via: United Nations. (2022). *World Economic Situation and Prospects 2022*.

[107] Asterisks (*) indicate that a regional average is used in place of missing data. Regional values can be found in Table D2.

Bulgaria	Eastern Europe	Developed Economies	2.00	0.02	0.00*	0.00	3.35	1.46	2.00
Burkina Faso	Western Africa	Developing Economies	0.87	0.01	0.00	0.35	2.79	1.65	1.22
Burundi	Eastern Africa	Developing Economies	1.92	0.01	0.16	0.00	2.73	0.00	1.92
Cabo Verde	Western Africa	Developing Economies	1.21	0.04*	0.00	0.09*	0.00	0.78*	1.30
Cambodia	South-Eastern Asia	Developing Economies	1.37	0.01	0.29	0.01	3.42	1.87	1.39
Cameroon	Middle Africa	Developing Economies	0.74	0.01	1.86	0.00	2.93	0.01	1.86
Canada	North America	Developed Economies	1.94	0.00	0.02	0.33	2.68	1.23	2.27
Central African Republic	Middle Africa	Developing Economies	0.61	0.00	0.39	0.00	2.05	0.01	0.61
Chad	Middle Africa	Developing Economies	0.27	0.14	0.58	0.02	1.86	0.85	0.60
Chile	South America	Developing Economies	1.38	0.05	1.79	2.89	2.74	4.47	4.69
China, People's Republic of	Eastern Asia	Developing Economies	0.96	0.12	0.00	1.98	3.2	2.80	2.94
Colombia	South America	Developing Economies	0.66	0.00	0.00	0.00	2.55	0.50	0.67
Comoros	Eastern Africa	Developing Economies	1.94	0.05*	0.00	0.00	1.5	1.26*	1.94
Congo, Democratic Republic of the	Middle Africa	Developing Economies	0.86	0.01	0.00	0.01	2.59	0.01	0.86
Congo, Republic of the	Middle Africa	Developing Economies	0.67	0.00	0.05	0.00	2.38	0.01	0.67
Costa Rica	Central America	Developing Economies	0.82	0.00	0.04*	0.00	2.94	0.65	0.82
Croatia	Southern Europe	Developed Economies	2.03	0.00	0.01	0.00	2.99	0.17	2.03
Cuba	Caribbean	Developing Economies	1.35	0.03	0.00	0.00	2.43	1.65	1.35
Cyprus	Western Asia	Developed Economies	1.27	0.00	0.00	23.45	3.00	5.00	24.72
Czechia	Eastern Europe	Developed Economies	1.98	0.00	0.00	0.00	3.48	1.84	1.98
Denmark	Northern Europe	Developed Economies	2.11	0.00	0.43	0.00	2.74	0.95	2.11
Djibouti	Eastern Africa	Developing Economies	0.19	0.08	0.00	0.00	1.83	3.18	0.19
Dominica	Caribbean	Developing Economies	0.68	0.08*	0.00	0.00	2.12	1.21*	0.68
Dominican Republic	Caribbean	Developing Economies	0.96	0.02	0.18*	0.00	3.05	1.60	0.96
East Timor	South-Eastern Asia	Developing Economies	0.91	0.01*	0.00	0.00	2.36	1.77	0.91
Ecuador	South America	Developing Economies	0.76	0.07	0.00	0.00	2.99	0.66	0.76
Egypt	Northern Africa	Developing Economies	0.15	0.41	0.00	1.60	2.63	4.85	2.00
El Salvador	Central America	Developing Economies	1.06	0.00	0.00	0.02	2.41	1.95	1.09
Equatorial Guinea	Middle Africa	Developing Economies	0.70	0.00	0.00	0.00	2.55	0.00	0.70
Eritrea	Eastern Africa	Developing Economies	0.23	0.17	0.00	0.41	1.76	3.94	0.63
Estonia	Northern Europe	Developed Economies	2.86	0.00	5.88	0.00	3.08	1.22	5.88
Eswatini	Southern Africa	Developing Economies	0.86	0.64	0.00	0.00	3.13	0.31	0.86

Ethiopia	Eastern Africa	Developing Economies	0.68	0.34	0.00	0.03	2.29	0.96	0.71
Fiji	Melanesia, Micronesia, Polynesia	Developing Economies	1.30	0.00	1.14	0.00	3.07	0.00*	1.30
Finland	Northern Europe	Developed Economies	3.09	0.00	0.01	0.00	2.76	0.81	3.09
France	Western Europe	Developed Economies	1.74	0.01	0.00	0.51	3.64	1.92	2.25
Gabon	Middle Africa	Developing Economies	0.72	0.00	0.00	0.00	2.2	0.00	0.72
Gambia, The	Western Africa	Developing Economies	1.76	0.00	0.00	0.00	2.24	0.02	1.76
Georgia	Western Asia	Economies in Transition	1.81	0.00	0.18	0.00	2.5	0.93	1.81
Germany	Western Europe	Developed Economies	1.93	0.01	0.00	0.00	3.32	2.04	1.93
Ghana	Western Africa	Developing Economies	0.95	0.15	0.00	0.00	3.35	0.11	0.95
Greece	Southern Europe	Developed Economies	1.74	0.00	0.01	7.06	2.97	4.34	8.80
Grenada	Caribbean	Developing Economies	0.92	0.08*	0.00	0.00	2.25	1.21*	0.92
Guatemala	Central America	Developing Economies	0.82	0.03	0.04*	0.00	3.12	1.03	0.83
Guinea	Western Africa	Developing Economies	0.60	0.01	0.00	0.00	3.02	0.36	0.60
Guinea-Bissau	Western Africa	Developing Economies	1.26	0.00	0.02	0.00	2.96	0.31	1.26
Guyana	South America	Developing Economies	0.68	0.01	0.04	0.00	2.04	2.70	0.68
Haiti	Caribbean	Developing Economies	1.30	0.02	0.00	0.00	2.44	1.60	1.30
Honduras	Central America	Developing Economies	0.83	0.02	0.14	0.00	2.66	0.11	0.83
Hungary	Eastern Europe	Developed Economies	1.97	0.00	0.00	0.00	3.25	0.43	1.97
Iceland	Northern Europe	Developed Economies	0.66	0.07	0.00	0.00	1.4	0.00	0.66
India	Southern Asia	Developing Economies	1.52	0.01	0.00	1.60	3.7	4.11	3.11
Indonesia	South-Eastern Asia	Developing Economies	0.89	0.00	0.00	0.03	3.54	2.67	0.92
Iran	Southern Asia	Developing Economies	0.30	0.00	0.00	5.38	2.56	4.65	5.67
Iraq	Western Asia	Developing Economies	0.37	0.71	0.00	2.88	2.76	4.15	3.59
Ireland	Northern Europe	Developed Economies	0.74	0.12	0.00	0.00	2.38	0.36	0.74
Israel	Western Asia	Developing Economies	0.94	0.15	0.00	25.24	3.07	4.94	26.19
Italy	Southern Europe	Developed Economies	1.86	0.33	0.00	8.10	3.8	3.34	9.96
Ivory Coast	Western Africa	Developing Economies	0.68	0.01	0.00	0.00	3.26	0.00	0.68
Jamaica	Caribbean	Developing Economies	0.82	0.00	0.00	0.00	2.62	0.00	0.82
Japan	Eastern Asia	Developed Economies	2.42	0.09	0.00	0.00	3.2	1.97	2.42
Jordan	Western Asia	Developing Economies	0.17	0.00	0.00	2.47	2.47	4.62	2.64
Kazakhstan	Central Asia	Economies in Transition	0.84	0.00	0.00	1.61	1.87	2.51	2.45
Kenya	Eastern Africa	Developing Economies	0.73	0.00	0.00	0.06	2.44	0.79	0.79

Kiribati	Melanesia, Micronesia, Polynesia	Developing Economies	13.27	0.3*	0.00	0.03*	1.5	0.00*	13.30
Kuwait	Western Asia	Developing Economies	0.01	0.11	0.00*	14.23	2.2	5.00	14.34
Kyrgyzstan	Central Asia	Economies in Transition	1.03	0.10	0.00*	0.17	2.42	3.28	1.20
Laos	South-Eastern Asia	Developing Economies	0.76	0.02	0.00	0.00	3.59	0.74	0.76
Latvia	Northern Europe	Developed Economies	2.24	0.00	0.00	0.00	3.44	0.57	2.24
Lebanon	Western Asia	Developing Economies	0.95	0.21	0.00	6.05	3.49	5.00	7.00
Lesotho	Southern Africa	Developing Economies	0.36	0.01	0.00	0.30	2.33	2.95	0.66
Liberia	Western Africa	Developing Economies	0.70	0.00	0.03	0.00	2.94	0.00	0.70
Libya	Northern Africa	Developing Economies	0.01	0.23	0.34	0.58	1.68	4.81	0.92
Liechtenstein	Western Europe	Developed Economies	1.89	0.48	0.00*	0.00	3.00	0.81	1.89
Lithuania	Northern Europe	Developed Economies	2.04	0.02	0.00	0.00	3.7	2.14	2.04
Luxembourg	Western Europe	Developed Economies	1.84	0.10	0.00	0.00	3.64	2.93	1.84
Madagascar	Eastern Africa	Developing Economies	0.51	0.00	0.00	0.01	2.78	0.90	0.52
Malawi	Eastern Africa	Developing Economies	3.69	0.00	0.01	0.00	2.88	0.75	3.69
Malaysia	South-Eastern Asia	Developing Economies	0.78	0.00	0.04	0.00	3.35	1.03	0.78
Maldives	Southern Asia	Developing Economies	16.73	0.15*	0.00	1.17*	0.00	3.06*	17.90
Mali	Western Africa	Developing Economies	0.29	0.06	0.02	0.19	2.12	0.68	0.48
Malta	Southern Europe	Developed Economies	1.07	0.05*	0.00	16.48	3.25	2.8*	17.55
Marshall Islands	Melanesia, Micronesia, Polynesia	Developing Economies	15.02	0.3*	0.00	0.03*	1.5	0.00*	15.05
Mauritania	Western Africa	Developing Economies	0.06	0.02	0.02*	0.07	1.76	2.73	0.13
Mauritius	Eastern Africa	Developing Economies	1.62	0.05*	0.00	0.04*	0.00	1.26*	1.66
Mexico	Central America	Developing Economies	0.63	0.00	0.00	4.15	3.12	4.00	4.78
Micronesia, Federated States of	Melanesia, Micronesia, Polynesia	Developing Economies	1.38	0.3*	0.00	0.03*	1.5	0.00*	1.41
Moldova	Eastern Europe	Economies in Transition	1.82	0.34	0.00	0.00	2.72	1.26	1.82
Monaco	Western Europe	Developed Economies	2.65	0.08*	0.00*	1.38*	3.44	1.8*	4.03
Mongolia	Eastern Asia	Developing Economies	0.46	0.03	0.00	0.08	1.52	3.13	0.54
Montenegro	Southern Europe	Economies in Transition	2.19	0.04	0.01	0.00	2.87	0.72	2.19
Morocco	Northern Africa	Developing Economies	0.35	0.01	0.00	1.28	2.54	3.99	1.63
Mozambique	Eastern Africa	Developing Economies	0.73	0.01	0.00	0.00	2.62	0.37	0.74
Myanmar	South-Eastern Asia	Developing Economies	1.03	0.00	0.55	0.02	3.03	2.13	1.05
Namibia	Southern Africa	Developing Economies	0.26	0.64	0.11	0.06	2.01	4.18	0.70

Nauru	Melanesia, Micronesia, Polynesia	Developing Economies	3.74	0.3*	0.00	0.15	1.5	0.00*	3.89
Nepal	Southern Asia	Developing Economies	1.19	0.22	0.03*	0.24	2.55	3.18	1.43
Netherlands	Western Europe	Developed Economies	2.49	0.00	0.02	0.53	3.14	1.58	3.02
New Zealand	Australia and New Zealand	Developed Economies	2.12	0.05	0.00	0.00	3.6	0.05	2.12
Nicaragua	Central America	Developing Economies	2.00	0.92	0.00	0.00	2.42	0.21	2.00
Niger	Western Africa	Developing Economies	0.12	0.00	0.00	0.12	1.82	3.47	0.24
Nigeria	Western Africa	Developing Economies	1.03	0.00	0.18	0.19	3.18	0.80	1.21
North Korea	Eastern Asia	Developing Economies	2.19	0.01	0.00	0.00	2.67	2.32	2.19
North Macedonia	Southern Europe	Economies in Transition	2.12	0.00	0.00	0.00	2.99	3.01	2.12
Norway	Northern Europe	Developed Economies	1.39	0.17	0.7*	0.00	2.21	0.19	1.39
Oman	Western Asia	Developing Economies	0.01	0.50	0.00	2.71	1.94	5.00	3.21
Pakistan	Southern Asia	Developing Economies	0.65	0.19	0.00	0.94	3.09	3.79	1.59
Palau	Melanesia, Micronesia, Polynesia	Developing Economies	2.65	0.3*	0.00	0.03*	1.5	0.00*	2.68
Palestine	Western Asia	Developing Economies	0.36*	0.00	0.00*	4.04	3.02	4.68*	4.40
Panama	Central America	Developing Economies	0.91	0.07	0.04*	0.00	2.56	0.75	0.91
Papua New Guinea	Melanesia, Micronesia, Polynesia	Developing Economies	0.78	0.61	0.00	0.00	2.96	0.00	0.78
Paraguay	South America	Developing Economies	0.78	0.10	0.03	0.00	2.99	0.00	0.78
Peru	South America	Developing Economies	0.61	0.00	0.00	0.64	2.77	3.74	1.25
Philippines	South-Eastern Asia	Developing Economies	1.27	0.00	0.00	0.02	2.85	2.03	1.29
Poland	Eastern Europe	Developed Economies	2.00	0.00	0.00	0.03	3.42	1.66	2.03
Portugal	Southern Europe	Developed Economies	1.54	0.03	0.00	3.80	3.47	3.26	5.35
Qatar	Western Asia	Developing Economies	0.06	0.00	0.00	71.13	1.62	5.00	71.19
Romania	Eastern Europe	Developed Economies	2.02	0.00	0.00	0.00	2.9	1.19	2.02
Russian Federation	Eastern Europe	Economies in Transition	1.68	0.00	0.00	0.03	2.42	1.17	1.71
Rwanda	Eastern Africa	Developing Economies	1.66	0.01	0.00	0.00	3.12	0.00	1.66
Saint Kitts and Nevis	Caribbean	Developing Economies	1.08	0.08*	0.85	0.00	1.44	1.21*	1.08
Saint Lucia	Caribbean	Developing Economies	0.79	0.08*	0.18*	0.00	2.25	1.21*	0.79
Saint Vincent and the Grenadines	Caribbean	Developing Economies	1.04	0.08*	0.18*	0.00	2.25	1.21*	1.04
Samoa	Melanesia, Micronesia, Polynesia	Developing Economies	0.81	0.3*	0.11*	0.03*	0.00	0.00*	0.84
San Marino	Southern Europe	Developed Economies	1.68	0.00	0.00*	10.95	3.81	4.45	12.64

Sao Tome and Principe	Middle Africa	Developing Economies	1.48	0.02	0.00	0.00	2.69	0.25*	1.48
Saudi Arabia	Western Asia	Developing Economies	0.01	0.01	0.00*	8.44	2.38	4.98	8.45
Senegal	Western Africa	Developing Economies	0.99	0.00	0.00	0.56	2.5	2.22	1.54
Serbia	Southern Europe	Economies in Transition	2.01	0.00	0.01	0.31	3.19	1.24	2.33
Seychelles	Eastern Africa	Developing Economies	4.38	0.05*	0.00	0.00	2.00	1.26*	4.38
Sierra Leone	Western Africa	Developing Economies	0.81	0.00	0.02*	0.00	2.95	0.00	0.81
Singapore	South-Eastern Asia	Developing Economies	0.78	0.01*	0.39	0.00	3.48	1.8*	0.78
Slovakia	Eastern Europe	Developed Economies	2.10	0.09	0.00	0.00	3.08	1.62	2.10
Slovenia	Southern Europe	Developed Economies	2.23	0.02	0.00	0.00	3.09	0.53	2.23
Solomon Islands	Melanesia, Micronesia, Polynesia	Developing Economies	1.43	0.3*	0.00	0.00	3.07	0.00*	1.43
Somalia	Eastern Africa	Developing Economies	0.27	0.01	0.01*	0.04	1.45	1.67	0.31
South Africa	Southern Africa	Developing Economies	0.53	0.03	285.45	2.18	3.16	4.17	287.63
South Korea	Eastern Asia	Developing Economies	2.27	0.00	0.00	0.00	3.03	2.38	2.27
South Sudan	Northern Africa	Developing Economies	0.53	0.03	0.01	0.00	1.8	1.39	0.53
Spain	Northern Africa	Developed Economies	1.46	0.40	0.00	9.08	3.56	3.94	10.55
Sri Lanka	Southern Asia	Developing Economies	0.98	0.00	0.00	0.00	3.2	2.36	0.98
Sudan	Northern Africa	Developing Economies	0.28	0.00	0.01	0.28	2.36	1.46	0.55
Suriname	South America	Developing Economies	0.82	0.00	0.00	0.00	2.47	1.67	0.82
Sweden	Northern Europe	Developed Economies	2.76	0.38	0.00	0.49	2.71	0.78	3.25
Switzerland	Western Europe	Developed Economies	1.95	0.00	0.00	0.00	3.14	0.41	1.95
Syria	Western Asia	Developing Economies	0.51	0.19	0.00	0.62	2.75	4.01	1.13
Tajikistan	Central Asia	Economies in Transition	0.52	0.00	0.00	0.27	2.36	2.34	0.79
Tanzania, Republic of	Eastern Africa	Developing Economies	1.53	0.05	0.00	0.03	2.94	1.91	1.55
Thailand	South-Eastern Asia	Developing Economies	1.38	0.00	0.00	0.79	3.21	3.62	2.17
Togo	Western Africa	Developing Economies	0.51	0.29	0.02*	0.00	3.32	0.00	0.51
Tonga	Melanesia, Micronesia, Polynesia	Developing Economies	3.06	0.3*	0.05	0.03*	0.00	0.00*	3.09
Trinidad and Tobago	Caribbean	Developing Economies	0.84	0.39	0.18*	0.00	2.00	1.21*	0.84
Tunisia	Northern Africa	Developing Economies	0.40	0.02	0.00	2.02	2.63	4.28	2.43
Turkey	Western Asia	Developing Economies	1.22	0.05	0.00	3.40	2.93	3.39	4.61
Turkmenistan	Central Asia	Economies in Transition	0.40	0.05	0.00	2.45	2.59	3.74	2.85
Tuvalu	Melanesia, Micronesia, Polynesia	Developing Economies	8.99	0.3*	0.00	0.03*	2.5	0.00*	9.02

Uganda	Eastern Africa	Developing Economies	3.11	0.00	0.01*	0.00	2.83	0.20	3.11
Ukraine	Eastern Europe	Economies in Transition	2.10	0.01	4.80	0.15	2.92	1.37	4.94
United Arab Emirates	Western Asia	Developing Economies	0.02	0.03	0.00	40.73	2.12	5.00	40.76
United Kingdom	Northern Europe	Developed Economies	1.20	0.27	0.00	0.00	3.37	1.30	1.20
United States	North America	Developed Economies	1.62	0.15	0.01	4.47	3.44	2.60	6.10
Uruguay	South America	Developing Economies	0.84	0.17	0.00	0.00	2.97	1.83	0.84
Uzbekistan	Central Asia	Economies in Transition	1.09	0.27	0.00	1.83	2.41	3.63	2.92
Vanuatu	Melanesia, Micronesia, Polynesia	Developing Economies	1.94	0.3*	0.00	0.00	1.69	0.00*	1.94
Venezuela	South America	Developing Economies	0.72	0.01	0.18*	0.01	2.24	1.82	0.73
Vietnam	South-Eastern Asia	Developing Economies	1.14	0.03	0.00	0.03	3.49	2.11	1.18
Yemen	Western Asia	Developing Economies	0.06	0.01	0.00	2.29	1.98	4.69	2.35
Zambia	Eastern Africa	Developing Economies	0.80	0.00	0.01	0.09	2.86	0.85	0.89
Zimbabwe	Eastern Africa	Developing Economies	0.51	0.00	0.00	0.02	2.62	2.17	0.53

Table D1. Country value factors

D4. Table D2 should be used when the country of water consumption has no data available in Table D1. This table presents averages for each UN region and economy status. These values should not be used to replace national value factors that are available in Table D1.

Region	Economy status	VF_{es}	$VF_{nutrition}$	$VF_{disease}$	VF_{access}
Australia and New Zealand	Developed Economies	1.36	0.02	0.00	0.13
Caribbean	Developing Economies	1.19	0.08	0.18	0.00
Central America	Developing Economies	1.01	0.15	0.04	0.60
Central Asia	Economies in Transition	0.78	0.09	0.00	1.27
Eastern Africa	Developing Economies	1.44	0.05	0.01	0.04
Eastern Asia	Developed Economies	2.42	0.09	0.00	0.00
Eastern Asia	Developing Economies	1.47	0.04	0.00	0.52
Eastern Europe	Developed Economies	2.01	0.02	0.00	0.00
Eastern Europe	Economies in Transition	1.92	0.09	1.20	0.04
Melanesia, Micronesia, Polynesia	Developing Economies	4.53	0.30	0.11	0.03
Middle Africa	Developing Economies	0.73	0.03	0.32	0.05
North America	Developed Economies	1.78	0.08	0.01	2.40
Northern Africa	Developed Economies	1.46	0.40	0.00	9.08
Northern Africa	Developing Economies	0.26	0.14	0.05	0.88
Northern Europe	Developed Economies	1.91	0.10	0.70	0.05
South America	Developing Economies	0.80	0.04	0.18	0.39
South-Eastern Asia	Developing Economies	1.00	0.01	0.12	0.08
Southern Africa	Developing Economies	0.48	0.33	57.11	0.53
Southern Asia	Developing Economies	2.83	0.15	0.03	1.17
Southern Europe	Developed Economies	1.71	0.05	0.00	6.10
Southern Europe	Economies in Transition	2.08	0.01	0.03	0.26
Western Africa	Developing Economies	0.78	0.04	0.02	0.09
Western Asia	Developed Economies	1.27	0.00	0.00	23.45
Western Asia	Economies in Transition	0.36	0.15	0.00	16.00
Western Asia	Developing Economies	1.69	0.13	0.06	0.39
Western Europe	Developed Economies	2.02	0.08	0.00	1.38

Table D2. Regional Value Factors

Appendix E: Water Consumption Local Value Factor Tool

E1. The Water Consumption Local Value Factor Tool can be used to aid preparers in determining the local value factor for each site of water consumption. In the tool, preparers enter site locations and water consumption and the tool then determines the local value factor ($VF_{H2O\text{-}site}$) and the local water consumption impacts at administrative level 1 (e.g. state, province, region). For each site of water consumption, the preparer enters the (1) country, (2) sub-national administrative level (state, province etc.), local pressure on biodiversity (BD_{local}), (4) local water stress (WS_{local}), and (5) site water consumption (WC_{site}).

Water Consumption Local Value Factor Tool available here

Appendix F: Previous Year Value Factors

F1. To conduct water consumption impact analysis for past years, the Value Factors need to be adjusted for inflation. In the table below, country Value Factors for each category are provided, adjusted for inflation to the year in reference (e.g. the 2020 Value Factors is in 2020 U.S. Dollars).

Previous Year Value Factors available here

Appendix G: Alignment with Reporting Standards

G1. The data inputs required to prepare water consumption impact accounts closely align with the disclosure requirements of the ESRS E3: Water and marine resources, ESRS E4: Biodiversity and ecosystems, GRI 303: Water and Effluents 2018, and GRI 304: Biodiversity 2016. The International Sustainability Standards Board has not yet developed standards related to water consumption. Appendix G describes the linkages between data needed for reporting standards and the Water Consumption methodology.

G2. ESRS Alignment

a. Water consumption – own operations

   i. In ESRS E3, Disclosure Requirement E3-4 paragraph 25 states "The undertaking shall disclose information on its water consumption performance related to its material impacts, risks and opportunities."

   ii. The data needed for the Water Consumption Methodology fully aligns with the data required for E3-4 by focusing on water consumption in m^3 as the metric of interest.

b. Water consumption – value chain

   i. In ESRS E3, paragraphs 2, 3, 7(a), and 11(c) state that understanding water consumption in the upstream and downstream value chain is important for assessing materiality, impacts, and policies. Therefore, ESRS E3 demonstrates the need for water-related impacts in the value chain.

   ii. The data needed for the Water Consumption Methodology expands upon this expectation, even though Disclosure E3-4 does not explicitly require reporting of value chain water consumption.

c. Location of water consumption

   i. In ESRS E3, Disclosure Requirement E3-4 paragraph 27(b) states an entity shall report "total water consumption in m^3 in areas at material water risk, including areas of high-water stress". To determine areas of material water risk requires some knowledge of the specific location of water consumption.

ii. The data needed for the Water Consumption Methodology expands upon the data needed for Disclosure E3-4 by asking for the location of all sites of water consumption.

d. Water stress

i. In ESRS E3, Disclosure Requirement E3-4 paragraph 27(b) states an entity shall report “total water consumption in m^3 in areas at material water risk, including areas of high-water stress”. This statement acknowledges that water stress is an important variable within the context of water consumption.

ii. The data needed for the Water Consumption Methodology expands upon the data needed for Disclosure E3-4 by asking for a metric of water stress at each site of water consumption.

e. Biodiversity pressure

i. The interactions of water, ecosystems and biodiversity is acknowledged in both ESRS E3: Water and marine resources, ESRS E4: Biodiversity and ecosystems. In ESRS E4, paragraph 7 states “All Disclosure Requirements concerning material impacts related to biodiversity and ecosystems change arising from other ESRS are listed and referenced in this Standard, and in particular to: (b) ESRS E3 Water and marine resources. Further, Disclosure Requirement E4-5 asks for reporting “metrics related to its material impacts resulting in biodiversity and ecosystem change.”

ii. The data needed for the Water Consumption Methodology expands upon the data required for E4-5 by asking for a consideration of the risks and pressures on biodiversity in the locations of operation.

G3. GRI Alignment

a. Water consumption – own operations

i. In GRI 303, Disclosure Requirement 303-5 (a) states that the reporting organization shall report “Total water consumption from all areas in megaliters.”.

ii. The data needed for the Water Consumption Methodology fully aligns with the data required for 303-5 by focusing on water consumption in m^3 as the metric of interest.

b. Water consumption – value chain

i. In GRI 303, Disclosure 303-1 paragraph 1.2.1 recommends that an organization should report “an overview of water use across the organization's value chain” while also acknowledging that an organization can affect water availability “through its value chain”. At this time, this is a recommendation and not a requirement.

ii. The data needed for the Water Consumption Methodology fully aligns with recommendation 1.2.1 and expands upon the requirements of 303-1 and 303-5.

c. Location of water consumption

i. In GRI 303, Disclosure Requirement 303-5 (b) states that the reporting organization shall report “Total water consumption from all areas with water stress in megaliters.”. To determine areas of material water risk requires some knowledge of the specific location of water consumption.

ii. The data needed for the Water Consumption Methodology expands upon the data needed for Disclosure 303-5 by asking for the location of all sites of water consumption.

d. Water stress

i. In GRI 303, Disclosure Requirement 303-5 (b) states that the reporting organization shall report “Total water consumption from all areas with water stress in megaliters.”. This statement acknowledges that water stress is an important variable within the context of water consumption.

ii. The data needed for the Water Consumption Methodology expands upon the data needed for Disclosure 303-5 by asking for a metric of water stress at each site of water consumption.

e. Biodiversity pressure

i. The interactions of water, ecosystems and biodiversity is acknowledged in both GRI 303: Water and Effluents 2018 and GRI

304: Biodiversity 2016. In GRI 304, Disclosure 304-2 (a) requires reporting on the “Nature of significant direct and indirect impacts on biodiversity.” This Disclosure includes consideration of land use, change, invasive species, and pollution which are all considerations that go into the biodiversity pressure value in the Water Consumption Methodology.

ii. The data needed for the Water Consumption Methodology expands upon the data required for 304-2 by asking for a consideration of the risks and pressures on biodiversity in the locations of operation.

Appendix H: Value Commission Transparency Report: Value Factor

This Appendix presents the Water Consumption Topic Methodology summarized in the form of the Transparency Report proposed by the Value Commission. Minor adaptations have been made to the report structure to align with the impact accounting methodology.

<table>
<tr><th colspan="3">Transparency Report – Value factors</th></tr>
<tr><td colspan="3">Title and version #: Water Consumption Topic Methodology Value Factor, Version 1
Developed by: International Foundation for Valuing Impacts, in partnership with Value Balancing Alliance
Published and updated date: September 24, 2024</td></tr>
<tr><td colspan="3">Unit: The impact in dollars per meter cubed ($\$/m^3$) of water consumption to calculate the total impact from water consumption with distinct values used based on geography.</td></tr>
<tr><td colspan="3">Linkages to other value factors: This value factor is part of the public good, independent, impact accounting methodology being developed by IFVI, in partnership with VBA and can be combined or complemented with value factors from other topic methodologies.</td></tr>
<tr><th colspan="3">SCOPE OF VALUE FACTOR</th></tr>
<tr><td>Impact pathway scope</td><td colspan="2">- The scope of the value factor includes all water consumption along the entire value chain.
- The value factor captures four impacts: affected health from malnutrition, affected health from water-borne disease, altered ecosystem services, and financial costs to access future water. Future work will continue to explore the valuation of additional impacts.
- More detail about the impact pathway scope can be found in ‘Section 1.4: Scope and Assumptions.
- Application of the methodology by an entity is based on a materiality assessment as outlined by General Methodology 1: Conceptual Framework for Impact Accounting</td></tr>
<tr><th></th><th>ESTIMATING CHANGES IN WELL-BEING</th><th>ESTIMATING MONETARY VALUE</th></tr>
<tr><td>Approach and specificity</td><td>- The changes in well-being estimated include affected health via malnutrition, affected health via water-borne disease, altered ecosystem services, and financial costs to access future water.
- For affected health via malnutrition and water-borne disease, changes in well-being are determined through two models that link water consumption to disability-adjusted life years (DALYs) lost.
- For ecosystem service impacts, a measure of ecosystem water needs (PET) is combined with the ecosystem</td><td>- For the two health related impacts, valuation is done using the value of statistical life (VSL) to convert DALYs to impacts.
- For altered ecosystem services, a wide array of valuation approaches are used in the ESVD database including market prices, damage costs, contingent valuation, and choice modelling.</td></tr>
</table>

	services valuation database (ESVD) to estimate impacts from water lost. - For future financial impacts, well-being is measured by determining the water scarcity of each year in the future driven by present water consumption. - All approaches are considered nationally or subnationally, reflecting geographic variation and future projections of water availability leading to strong representation anywhere in the world. - Present research has not yet captured all impacts on society in rigorous models and future work will continue to develop value factors for these impacts. - Additional details about estimating changes in well-being can be found in 'Section 4.2: Outcomes and Impacts' and 'Appendix B: Methodological Details.'	- For financial costs to access future water, a replacement cost approach is used. These impacts are discounted to present-day values using a 2% discount rate. - The value factors can be applied at spatial scales as precise as a watershed or city. This detailed representation of value leads to improved representation of localized impacts. - Additional details about estimating monetary value can be found in 'Section 4.3: Monetary Valuation' and 'Appendix B: Methodological Details.'
Data inputs	- The data sources are extensive and embedded within the models and associated citations therein. - For data sets, see 'Appendix B: Methodological Details' along with the primary literature sources cited in each.	
VIEWS OF AFFECTED STAKEHOLDERS		
Representation of stakeholders	- The impact accounting methodology is overseen by a Valuation and Technical Practitioner Committee (VTPC) and developed through due process designed to ensure stakeholder inputs and representation. - This process includes independent research, expert engagement, piloting, and a public comment period prior to finalization by the VTPC. - In addition, the models included data inputs and feedback from a globally diverse sample of countries leading to better representation of global stakeholders. The application of the value factor at a local level also increases stakeholder-specific representation of impacts.	
ETHICAL DECISIONS IN ESTIMATING SOCIETAL IMPACT		
Equity weightings and income adjustments	- Equity weighting and income adjustments are not incorporated into the impact pathways for health (malnutrition, water-borne disease). - The financial cost to access water is based on a unit operation cost for water extraction in the United States, which is PPP adjusted when applied to other countries.	
Accounting for future impacts	- The value factor for financial costs to access future water captures future impacts through the year 2080.	

	- Future impacts are discounted using a 2% discount rate. See 'Section 4.3: Monetary Valuation' and 'Appendix B: Methodological Details' for more information about discounting.
Other ethical considerations	- DALYs were valued in the absence of age weighting or discounting. This decision is aligned with the Global Burden of Disease (GBD), with the justification that every year of life for every person, regardless of nationality and independently of when in life health was affected, should be counted and valued equally.[108]
SENSITIVITY	
Sensitivity to key variables	- All value factors are sensitive to local water scarcity and pressure on biodiversity, which can scale national to local value factors by up to five times. However, this reinforces the high spatial variability in both variables and the importance of local valuation for water consumption. - The aggregated value factor is sensitive to extreme outliers of any of the four value factors. This most commonly occurs with VFaccess which is mostly driven by high values in areas of current and future water scarcity. - The distribution of value factors across countries also varies across the four categories of impact. Three of the four value factors (VF_{access}, $VF_{nutrition}$, and $VF_{disease}$) have numerous countries with no impact (see Box 1). This results in the final valuation ($VF_{H2O\text{-}site}$) being sensitive to those countries with large values for one of these value factors. The value factor for ecosystem services (VF_{ES}) is more evenly distributed as most countries have some non-zero ecosystem services linked to water consumption. - For more information on sensitivity see Box 1, 'Appendix B: Methodological Details' along with the primary literature sources cited therein.

[108] Justifications can be found in Solberg, C. T. et al. (2020). *The Devils in the DALY: Prevailing Evaluative Assumptions*.

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