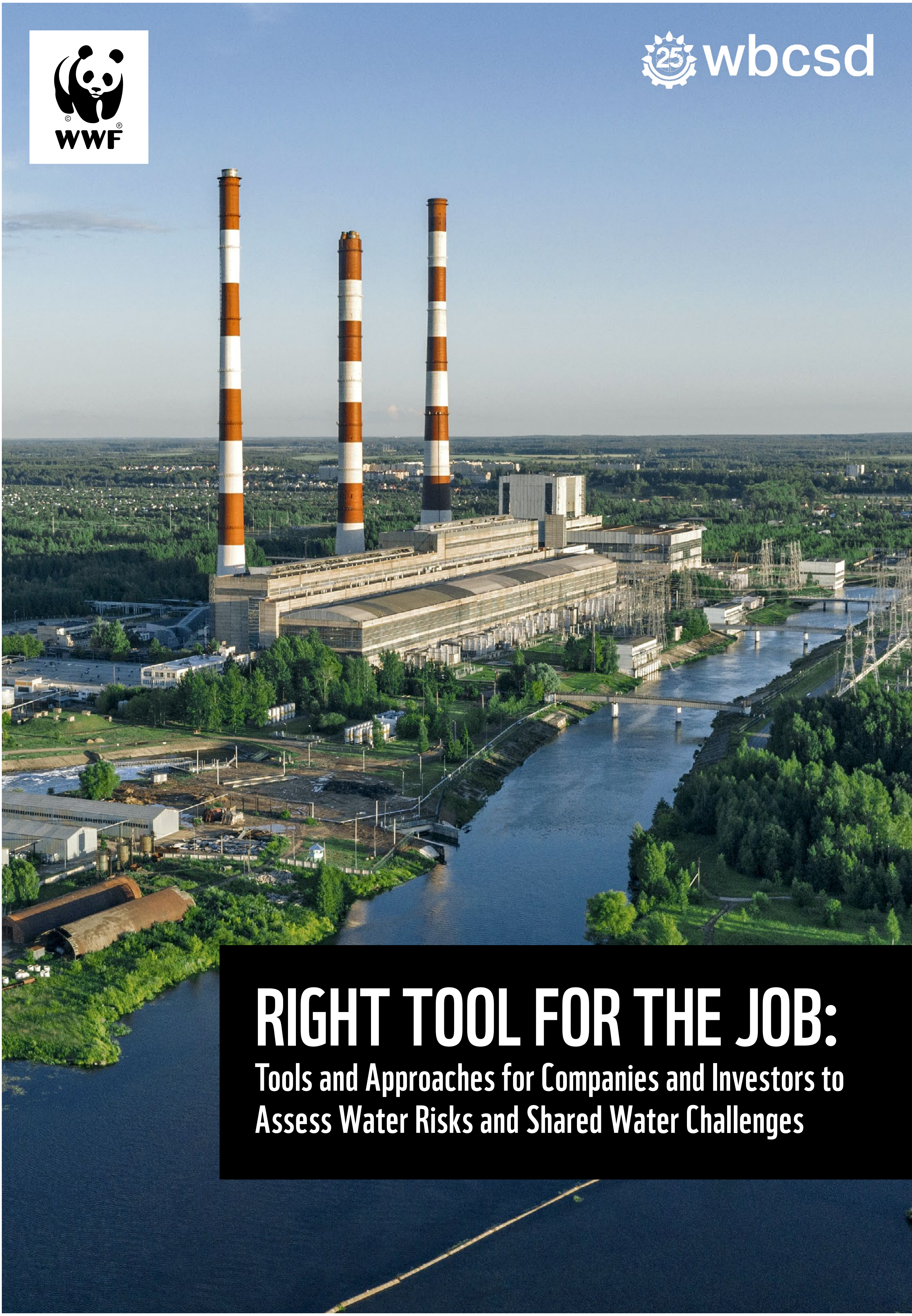

RIGHT TOOL FOR THE JOB:

Tools and Approaches for Companies and Investors to Assess Water Risks and Shared Water Challenges

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Date	April 2020
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EXECUTIVE SUMMARY

Over the past decade, various tools have emerged to help companies and financial institutions understand and respond to water challenges and risks. While the proliferation of these tools has helped in many ways, it has also created confusion amongst users around both the concept of water risk assessment and the differences/similarities between the tools themselves. This report seeks to shed light on the matter and provide clear guidance to users.

This report outlines the following key concepts:

- **Shared water challenge and basin water risk are related, but separate concepts** whith the latter involving an interpretation derived from/based on the former.
- **Water risk assessment involves both basin and operational (or company) risk.** The nature of both the basin conditions and the business matters considerably in driving risk exposure.
- Water is spatially and temporally dynamic. Accordingly, it is critical to **understand both the spatial and the temporal dimensions** of water challenges and water risks at different spatial levels and under different timeframes.
- **Water risk exposure and response are important** to understand in order to evaluate residual water risk. Having only one of these paints an incomplete picture of the overall situation.
- Recognizing that water impacts different parts of the value chain differentially, it is critical to **first determine and clarify the geographic and value chain scope** before running any assessment.

The report then provides a detailed overview of the latest development of three leading water tools to help users understand their similarities and differences, especially with respect to their unique functionalities.

WBCSD India Water Tool

World Business Council on Sustainable Development's India Water Tool

WBCSD's India Water Tool is an India-specific shared water challenge status tool. It provides granular and user-friendly information on water to help companies understand water challenges and plan water management interventions in India. WBCSD's Global Water Tool has been decommissioned and was taken offline in June 2019.

WRI Aqueduct

World Resources Institute's Aqueduct

WRI's Aqueduct Water Risk Atlas is primarily a global, basin water risk status assessment tool. It is part of a suite of Aqueduct tools specialized in providing detailed information on water risk to agriculture and food security (Aqueduct Food), flood risks and their impacts (Aqueduct Floods), and water risk at a national and sub-national level (Aqueduct Country Rankings).

WWF Water Risk Filter

WWF's Water Risk Filter

WWF's Water Risk Filter is primarily a global, basin and operational water risk status assessment tool. With version 5.0, the WWF Water Risk Filter also offers customized responses as well as a value section that can help identify valuation tools and quantify potentially affected value. The Water Risk Filter also acts as a nationally specific basin water risk status assessment tool for most countries.

The table summarizes some of the key similarities and differences between the three water tools.

Aspect	WBCSD India Water Tool	WRI Aqueduct	WWF Water Risk Filter
Shared Water Challenges / Risk	Shared Water Challenges	Water Risk	Water Risk
Geographic Coverage	National	Global	Global & National
Basin / Operational	Basin & Operational	Basin	Basin & Operational
Basin Water Challeng-es/Risks (# data layers)	Physical (13)	Physical (10), Regulatory & Reputational (3)	Physical (13), Regulatory (12), Reputational (7)
Spatial Resolution at Basin Scale	Basin boundaries from Central Ground Water Board, Government of India (1:250,000 scale)	HydroSHEDS HydroBASINS Level 6	HydroSHEDS HydroBASINS Level 7 (Global data) & Level 12 (National/regional data)
Temporal scope	Present/Recent	Past/Average, Present/ Recent, Future	Past/Average, Present/ Recent, Future
Assessment / Response	Assessment	Assessment	Assessment & Response
Data update frequency	Every 2 years	Every 2 years	Annual
Login	Not required	Not required	Required
Industry risk weightings	N/A	Yes – adjustable	Yes – adjustable
Additional differences	Focus on Groundwater & Local data	Focus on Flood & Food	Focus on Respond & Value

This report provides key recommendations on conducting a water risk assessment, including:

- **Ensure you understand whether you are assessing shared water challenges or water risks** (and which is a better fit for your needs);
- **Do not treat water risk assessment as a one-off prescriptive exercise, it is part of a regularly updated process which should help to inform decision-making;**
- **Use a diversity of reliable, peer reviewed data** to inform your understanding of water challenges and risks as unidimensional water risk assessments lead to skewed responses that typically leave companies materially exposed to water risks;
- Engage in a deeper understanding of water risks for the most **material and exposed parts of your value chain;**
- **Consider both basin context and operational risk** in the assessment of your water risks;
- **Consider response** as well as basin and operational water risk exposure **to account for residual risk; and**
- Prioritizing focus for response can be done through several means that **account for value.**

Through continuous innovation, collaboration and private sector engagement with these three leading water tools, WBCSD, WRI and WWF are advancing water stewardship and ultimately working to the same end: to ensure sustainable freshwater systems for both people and nature.

1. INTRODUCTION

1.1 Background

The risks that water imposes on a business have been broadly and globally recognised by the business community for a long time. Water has perennially ranked as one of the top global risks by impact in the World Economic Forum's Global Risks Report and has become a key aspect of major disclosure initiatives as investor concerns have grown. Understanding and responding to water risks are critical steps that companies and investors ought to do to ensure preservation of shareholder value and, at the same time, respond to stakeholder concerns.

Water has perennially ranked as one of the top global risks by impact in the World Economic Forum's Global Risks Report

In response to this demand to better understand shared water challenges and risks, the World Business Council for Sustainable Development (WBCSD) in 2007 followed by the World Resources Institute (WRI) in 2011 and the World Wide Fund for Nature (WWF) in 2012 independently developed freely-accessible tools to assess the status of water and water risks. While originally built with slightly different aims, these three tools broadly represent the mainstay tools of water and water risk assessment at the global level, and have had a degree of overlap in their core functionality: to enable users to assess basin water status and risks at given facility/asset locations. With linked aims, but differing data and outputs, many companies have ended up using more than one of these tools – and have often inquired as to their similarities and differences.

Meanwhile, the past eight years have seen significant changes in these tools as well as shifts in thinking about the process of water risk assessments. Both WRI Aqueduct and the WWF Water Risk Filter have evolved considerably and, to a large extent, diverged with the development of different and unique functionalities. In parallel, WBCSD made the strategic decision to decommission and take offline the Global Water Tool in 2019, while continuing to develop and release a new version of its India Water Tool.

1.2 Purpose and outline of this publication

This publication seeks to:

- outline key aspects to consider around shared water challenges and water risk;
- provide a clear overview of the similarities and differences between the three leading water tools: WBCSD India Water Tool, WRI Aqueduct and WWF Water Risk Filter; and
- provide recommendations on understanding water challenges and conducting a robust water risk assessment.

The report begins in Section 2 by highlighting the framework and issues that companies and investors ought to consider when understanding water challenges and water risks. Section 3 focuses on the specifics of the three leading water tools, unpacking their data sources, spatial resolution and functionalities. Section 4 offers guidance and recommendations on what constitutes a robust water risk assessment and understanding of water challenges. Lastly, Section 5 provides a summary conclusion.

2. A REVIEW OF FRAMEWORKS FOR ASSESSING WATER CHALLENGES AND WATER RISKS

Assessing water status and water risks requires an understanding of the frameworks and concepts that underpin the approach used by each respective tool. At the heart of the logic of why companies are interested in this topic is that (A) companies are dependent upon water for the goods and services they produce, and (B) water is a shared, common pool resource and can therefore be impacted by others, putting the value chains of companies at risk. Building on this logic, it is helpful to have a common understanding of the different aspects that underpin the frameworks for assessing water risks and shared water challenges. This includes whether the assessment:

- Focuses on the status of shared water challenges (i.e., 'raw' water data) or focuses on the status of water risk (i.e., data that's been interpreted for users into risk categories);
- Accounts for the dual notion of basin and operational (or company) water risk;
- Considers the temporal dimension of how the water challenge or risk is framed;
- Considers both water risk exposure and response (or mitigation); and
- Is restricted to a certain scope or scale – be it site, portfolio (one or more portions of a company's value chain) and/or corporate levels (e.g., a listed equity).

Sunsetting the WBCSD Global Water Tool & development of the WBCSD India Water Tool

The Global Water Tool was developed jointly by WBCSD member companies and partners bringing together global data on key water-related indicators, and allowing companies to understand their risks and plan water management strategies. The tool was the first publicly available resource to be developed for identifying corporate water risks and opportunities in 2007 and supported several corporates to prioritise water management actions across their global operations. The Global Water Tool was decommissioned in 2019 in view of the availability of more advanced GIS-based tools to support corporate decision-making at the global level.

Meanwhile, with a secretarial presence in New Delhi and recognizing the need for an open access data portal that can inform business action on water in India, WBCSD members and partners developed the India Water Tool.

India faces high water stress and has been identified as having some of the most fragile water resources in the world. A 2018 report from NITI Aayog - the erstwhile Planning Commission of India – highlighted that the country was facing the worst water crisis in history with about 600 million people facing high to extreme water stress. Businesses in India face significant operational risks and strong regulatory pressure in the face of rising water challenges. The India Water Tool provides granular and user-friendly information on water to help companies understand their risks and plan water management interventions in India. The tool is a rare example of collaboration between key stakeholders in India to create a sustainable future through responsible water management. Over the development of its three successive versions, the India Water Tool has involved 20 companies and 3 knowledge and funding partners. By bringing together government data on an open-access and user-friendly platform, the tool defines how data and digital access can play a role in participatory water management and informing investments in water.

2.1 Considering the status of shared water challenges

One of the primary distinctions lies at the very front end of these tools: assessing the status of shared water challenges versus assessing the status of water risk. While linked, these concepts differ as water risk is derived from the status of various water-related data. While risk levels can be interpreted from shared water challenge data, it requires a deeper understanding of water issues and, accordingly, this framework is a relevant consideration.

To understand how shared water challenges are being framed, it is important to note that the past decade has seen an array of efforts that have sought to build out frameworks on the constituent "elements" that make up freshwater issues. For example, the United Nations Sustainable Development Goals (SDGs) outlined six targets under SDG6: 6.1 access to safe and affordable drinking water, 6.2 access to adequate and equitable sanitation and hygiene, 6.3 improve water quality, 6.4 address water scarcity, 6.5 implement integrated water resources management, and 6.6 protect and restore water-related ecosystems. Similarly, the Alliance for Water Stewardship (AWS) has adopted five key outcomes: good water governance, sustainable water balance, good water quality, healthy important water-related areas, and access to water, sanitation and hygiene[1]. Generally, there is increasing alignment around five or six key areas that are summarized and categorized in Table 1 below, which offers a relatively comprehensive set of issues to consider in relation to freshwater challenges.

Table 1:
A General Framework for Shared Water Challenges

	Water Status Issue / Water Challenge	SDG Targets
1	Water Governance	6.5
2	Access to safe, adequate and equitable water, sanitation and hygiene (i.e., WASH)	6.1, 6.2
3	Water Quality	6.3
4	Water Scarcity (& events that exacerbate scarcity, such as droughts)	6.4
5	Freshwater ecosystem services (i.e., biodiversity)	6.5, 15.1
6	Extreme weather events (flooding)	2.4, 11.5, 13.1

The WBCSD India Water Tool (and previously the WBCSD Global Water Tool) focuses on providing and interpreting information on the status of various water issues. With users often expressing a primary interest in physical challenges, the framework of the WBCSD India Water Tool is primarily focused on physical water challenges – notably status, scarcity, quality and ecosystems. In certain cases, data are provided in raw formats, while in other cases, they are classified, but generally speaking, they are not converted into risk levels.

What many users subsequently did was to draw upon these data and, in turn, infer risk. However, this is a key point to consider as (A) not all users of tools are concerned about "risk", (B) in converting to "risk levels", data are degraded, (C) converting into risk from more "raw" data requires an expert understanding of thresholds, and (D) "raw" data is sometimes considered more acceptable in user interactions with other stakeholders, including governments. Indeed, in the particular case of the WBCSD India Water Tool, the Working Group decided to integrate the "raw" water data (as published by the Indian government data providers) and did not convert this data into risk scores, as the data in its '"raw" format is most valuable for supporting in-depth engagements with government representatives.

Thus, while such a framework can be, and is, used to inform risk, it differs from an outright risk approach. For users who are interested in the status of these shared water challenges, a risk framework may not be as useful. However, for many corporate users, especially those with a less rigorous understanding of how shared water challenges can result in business risks, a risk framework is highly useful as it links the status of these shared water challenges to the potential business impacts.

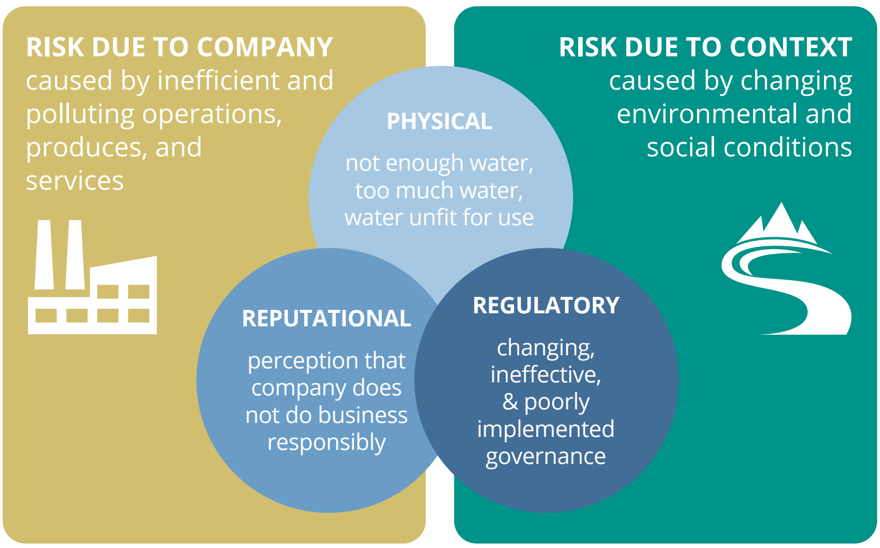
2.2 Considering the status of water risk and the water risk framework

Water risk can be defined as "the possibility [likelihood of a specific challenge occurring and the severity of the challenge's impact] of an entity experiencing a water-related challenge (e.g., water scarcity, water stress, flooding, infrastructure decay, drought). The severity of the impact itself depends on the intensity of the challenge, as well as the vulnerability of the actor."[2]

WRI Aqueduct and the WWF Water Risk Filter were, from the outset, explicitly intended as "water risk" tools and aimed to translate raw data into risk categorizations. The water risk frameworks of both WRI Aqueduct and the WWF Water Risk Filter employ a similar foundation illustrated in Figure 1 and described by the UN Global Compact's CEO Water Mandate. This "Physical, Reputational, and Regulatory Water Risk" framework is now relatively well-established and accepted in the corporate water stewardship landscape and, as a result, underpins the framework of these two water risk tools.

Figure 2 illustrates the link between the two frameworks: shared water challenges on left-hand side of the diagramme vs water risk framework on the right-hand side. Ultimately, the key issues for the user to consider are whether they are more

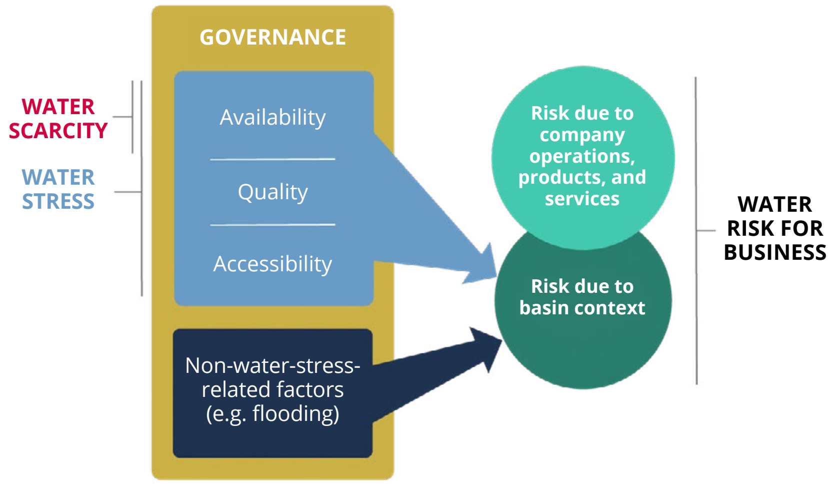
Figure 1:
Water Risk Framework
Source: CEO Water Mandate[3]



interested in the status of water issues in the basin or more concerned about how those issues manifest as risks.

It should be noted that to some extent water risk tools can also be (and are) used in reverse to evaluate shared water challenges. For example, water stress is a commonly employed metric, both for assessing the status of water balance as a shared water challenge, as well as assessing basin risk status. So, in that regard, there is some level of interoperability between these respective frameworks, but there are key distinctions too.

Figure 2:
Linking Shared Water Challenges to Water Risks
Source: CEO Water Mandate[4]



2.3 Considering basin and operational (company) risk

The concept of "shared water risk" has been employed by some authors to describe the fact that users within a common basin may share risks related to a common water challenge. While true to a certain extent, how risk impacts a given site – as described in the CEO Water Mandate's "water risk" definition – depends on the nature of the business or, as they describe it, "the vulnerability of the actor". Accordingly, when considering water risk and the potential impact of shared water challenges, it is also important to consider operational status/risk.

Each of the tools in this report approach this issue slightly differently. WRI Aqueduct has a focus on basin risk (i.e., "Risk due to basin conditions", as shown in Figure 2), the WBCSD India Water Tool considers basin and operational water use status, and the WWF Water Risk Filter focuses on basin and operational risk (or, as shown in Figure 2, both "Risk due to basin conditions" and "Risk due to company"). All three leading water tools account for company risk to a certain extent:

- **WRI Aqueduct** does not explicitly gather company/operational data nor assess operational water risk, but does offer adjustable industry weightings;
- The **WBCSD India Water Tool** gathers operational data, but does not convert these data into operational water risk, nor does it offer industry weightings; and
- The **WWF Water Risk Filter** gathers operational data, converts this into operational water risk scores, and offers adjustable industry weightings.

2.4 Considering the temporal dimension of water challenges and water risk

Water is a dynamic resource. It is not only variable in space, but very much through time. Accordingly, it is critical to understand the temporal dimension of water challenges and water risk. Broadly speaking there are two aspects to this: broad timeframes and persistent versus event-driven risks.

In terms of broad timeframes, water challenges and water risk can generally be broken down into three categories: (i) historic (average past) trends, (ii) current/recent conditions, and (iii) future/projected conditions. Typically, historic trends, which can be thought of as "what has been typical in the past", are based upon recorded data with time series data running from short (5-10 years) to long (150+ years) time periods. The longer baselines often tell very different stories from shorter term data sets. In contrast, current/recent conditions (i.e., "what is happening right now") are based on monitored, empirical data, but can also be based on models that use past data for calibration purposes. Lastly, future/projected conditions are based on future-facing indicators (i.e., "what is likely to happen in the future). Time periods for future/projected conditions typically range from 10-100 years (e.g., 2030, 2050, 2080, 2100) and are rooted in multiple models and assumptions.

It is critical to understand the temporal dimension of water challenges and water risk

Each different temporal approach has advantages and disadvantages, and those looking to explore water challenges and water risk exposure are encouraged to consider all three since each one will paint a slightly different picture. In short, average past conditions are rarely the same as present or future conditions.

Whilst the three water tools covered in this report have a general focus on present or recent water challenges and water risk conditions, they do employ a mix of the three timeframes described above.

Last but not least, there is also the issue of whether risks are persistent (i.e., predictably present, slower trending risks, such as scarcity or governance issues) or whether they are event-driven (i.e., more unpredictable, random events, such as a 1 in 1000 year flood or an extreme drought) – with the latter being something that can be represented through probabilities. Again, the tools broadly cover different levels of stochasticity in their indicators, but it is worth noting that mainstream media often focus on water stress/scarcity (persistent water risk), except during events when the focus shifts to these event-driven risks.

In addition to temporal resolution, spatial resolution is also critical to consider. This is tackled in Section 3.3 below.

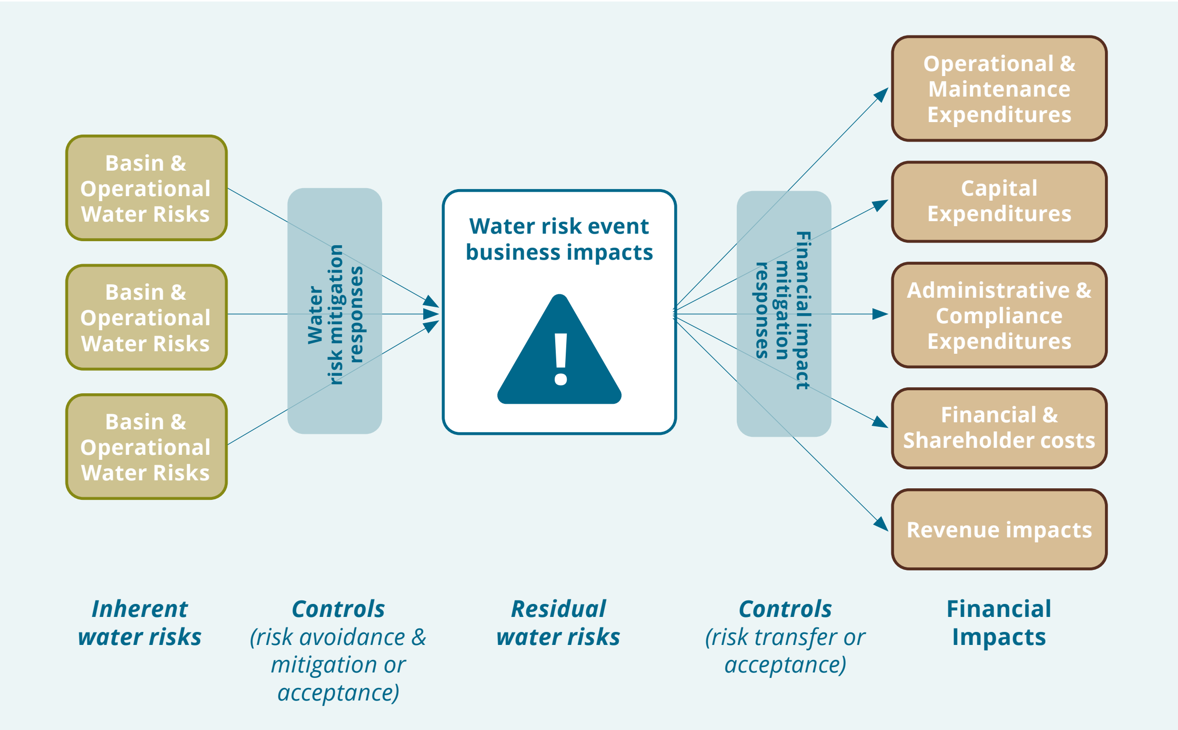
2.5 Considering risk exposure and response: the concept of residual water risk

Although much of the dialogue in the water risk assessment space has focused on water risk exposure, a less well considered framework is how risk exposure and risk response combine for what is ultimately important: residual water risk.

As it has been framed thus far, water risk exposure (basin & company/operational) can be referred to as the inherent risks before responses are accounted for (also sometimes referred to as controls), which results in residual water risk as illustrated in Figure 3. By implementing appropriate response/controls given their risk exposure, companies and financial institutions can mitigate water risks and thus minimize residual water risk. A risk-response approach enables companies and investors to adopt a more nuanced approach to water risk, which optimizes risk-reward value creation.

The WBCSD India Water Tool and WRI Aqueduct both focus on exposure. In addition to understanding water risk exposure, the WWF Water Risk also provides recommended response actions in an effort to help users better understand residual water risk.

Figure 3:
Residual Water Risk Framework
Source: WWF (2019)[5]



2.6 Considering the scope: geographic and value chain

There are two important dimensions to consider when defining the scope for a water risk assessment: geographic and value chain.

With respect to the geographic scope, the question basically concerns which countries are covered by the tool, and to what resolution. Generally speaking, the more restrictive the geographic scope, the greater the resolution (and often abundance) of data becomes. In this regard, the WBCSD India Water Tool has an array of water data specific for India that is not available at a global scale. Conversely, WRI Aqueduct and the WWF Water Risk Filter have global coverage, which helps to enable comparability, but also creates some data limitations. In an effort to address these short-comings, both tools have explored the use of higher-resolution data for select countries and basins. The geographic scope also has an influence on the level of spatial granularity (i.e., average basin size) that is feasible with the tool, though all three tools broadly employ a somewhat similar level of basin granularity. Please see Section 3.3 for additional details on this aspect.

With respect to the scope of the value chain, water risks can be assessed at: (i) site level, (ii) portfolio level (e.g. array of sites) or (iii) or for full value chains (i.e., corporate scope). All three water tools have the ability to handle both singular sites as well as portfolios, but none cover full corporate value chains in their innate structure. Although we are unaware of any existing water/risk tools that cover full value chain assessments, some of the water footprinting tools have the ability to potentially cover this sort of approach.

Given that it is often challenging for companies to assess their full value chain in one exercise, it is recommended that practitioners refine the scope of a water risk assessment to part of their value chain. **Typically it is prudent to focus on those portions of the value chain with the greatest strategic importance to the business (i.e., highest value/greatest materiality) and with a high reliance and/or impact on water (i.e., high water footprint).** Other elements that may be relevant to take into account when identifying the part of the value chain to focus of include: the level of control/influence, the degree of water stewardship maturity of that portion of the value chain (including resilience), and operational diversity (i.e., value chain redundancy).

3. THE LEADING WATER TOOLS: SIMILARITIES AND DIFFERENCES

While there are many water tools in the market, this report does not seek to exhaustively compare all tools, but rather focus on the three leading water tools, which have the greatest market share, are freely accessible, are built on peer-reviewed data, and share a common desire to improve water resource management for people and nature.

3.1 Summarizing key aspects of each tool

Both WRI Aqueduct and the WWF Water Risk Filter are ultimately based around the same core function: an ability to assess water risk across the globe in a consistent manner. Likewise, the WBCSD India Water Tool is rooted in the ability to assess water challenges across India in a consistent manner. In this sense, the tools do functionally overlap in their basin assessment functions, recognizing some of the aspect nuances related to the framing outlined in Section 2. As water risk tools, WRI Aqueduct and the WWF Water Risk Filter also employ a similar water risk framework (Figure 1).

Despite these similarities, the tools differ considerably, especially with respect to their functions. For example, while WRI Aqueduct offers a food and flood risk analyzer that specializes in providing additional, detailed information on flood and food related water risk, the WWF Water Risk Filter has sections that allow users to explore recommended mitigation response actions and conduct a valu-

Table 2: The table summarizes some of the key similarities and differences between the three water tools.

Aspect	WBCSD India Water Tool	WRI Aqueduct	WWF Water Risk Filter
Shared Water Challenges / Risk	Shared Water Challenges	Water Risk	Water Risk
Geographic Coverage	National	Global	Global & National
Basin / Operational	Basin & Operational	Basin	Basin & Operational
Basin Water Challenges/Risks (# data layers)	Physical (13)	Physical (10), Regulatory & Reputational (3)	Physical (13), Regulatory (12), Reputational (7)
Spatial Resolution at Basin Scale	Basin boundaries from Central Ground Water Board, Government of India (1:250,000 scale)	HydroSHEDS HydroBASINS Level 6	HydroSHEDS HydroBASINS Level 7 (Global data) & Level 12 (National/regional data)
Temporal scope	Present/Recent	Past/Average, Present/ Recent, Future	Past/Average, Present/ Recent, Future
Assessment / Response	Assessment	Assessment	Assessment & Response
Data update frequency	Every 2 years	Every 2 years	Annual*
Login	Not required	Not required	Required
Industry risk weightings	N/A	Yes – adjustable	Yes – adjustable
Additional differences	Focus on Groundwater & Local data	Focus on Flood & Food	Focus on Respond & Value

* NB: Not all data layers are updated by third party owners, but all data are reviewed annually for updates

ation exercise, and the WBCSD India Water Tool unpacks detailed groundwater data for India. Table 2 summarizes some of the key similarities and differences between the three water tools and the following sections provide more detailed information.

3.2 Water data

A common question posed by users is which tool should I use? The answer is any or, better yet, all. These three tools all use credible (peer reviewed) data, but each draws from different data sources and contains a different number of data layers. As a result, these three independent water tools provide users with different perspectives and insights on water challenges and risks.

One of the largest differences between (and combined strength of) the tools lies in their respective data sources and scope of water data coverage – see Appendix A for a complete list of each tool's data layers and sources. All of the tools use credible, peer-reviewed data to inform their indicators and, for the most part, all the tools draw data from third parties, though it should be noted that Baseline Water Stress is a WRI-created layer (modelled from other data layers). However, the nature and scope of the water data within the tools varies considerably:

WBCSD India Water Tool	WRI Aqueduct	WWF Water Risk Filter
The India Water Tool contains 13 data layers with pan-India data, and 8 layers with meso-watershed level data. Most of these datasets are focused on physical water stress. These layers are grouped into a series of sub-categories including point data, boundaries, groundwater, and surface water and stress indicators (as well as localized data).	The WRI Aqueduct contains 13 global water risk indicators organized into 3 categories: physical risk quantity, physical risk quality, and regulatory and reputational risks. It has a stronger emphasis on physical risk: 10 of the 13 risk indicators cover physical risks.	The WWF Water Risk Filter draws from 32 water risk indicators, which are subsequently assigned to one of 12 risk categories, and in turn, one of the 3 risk types: physical, regulatory and reputational.[6] The 32 risk indicators are relatively evenly split between the 3 risk types: physical (13), regulatory (12) and reputational (7). In addition to the 32 global risk indicators, the Water Risk Filter also contains high-resolution data for 12 countries.[7]

As the three water tools have different underlying data sets and sources, the water risk assessment results will differ. It is our belief that rather than being problematic, these differences can be treated as helpful for users as they typically offer different insights due to their nuances. While areas that show strong agreement between the tools' results are likely to elicit greater confidence, disagreements should also be seen as a useful result as they indicate areas that need to be explored in greater depth and are likely to require more detailed on-the-ground assessment. Not unlike the use of multiple IPCC climate models, companies and financial institutions should also explore multiple water models and data layers to understand the complex and multi-dimensional aspects of water challenges and water risks.

Terminology

Before diving into the tools, it is worth spending a moment to clarify a few aspects of terminology as these are important to the three tools. The most widely cited layer from WRI Aqueduct is its “Baseline Water Stress” layer, while the WWF Water Risk Filter has historically relied upon “Water Depletion” and has now also integrated WRI Baseline Water Stress. The WBCSD India Water Tool draws on WRI Baseline Water Stress, but also uses Normalized Difference Water Index and Normalized Deficit Cumulative, which have the advantage of being drawn from remotely sensed data (i.e., empirical vs. modeled data).

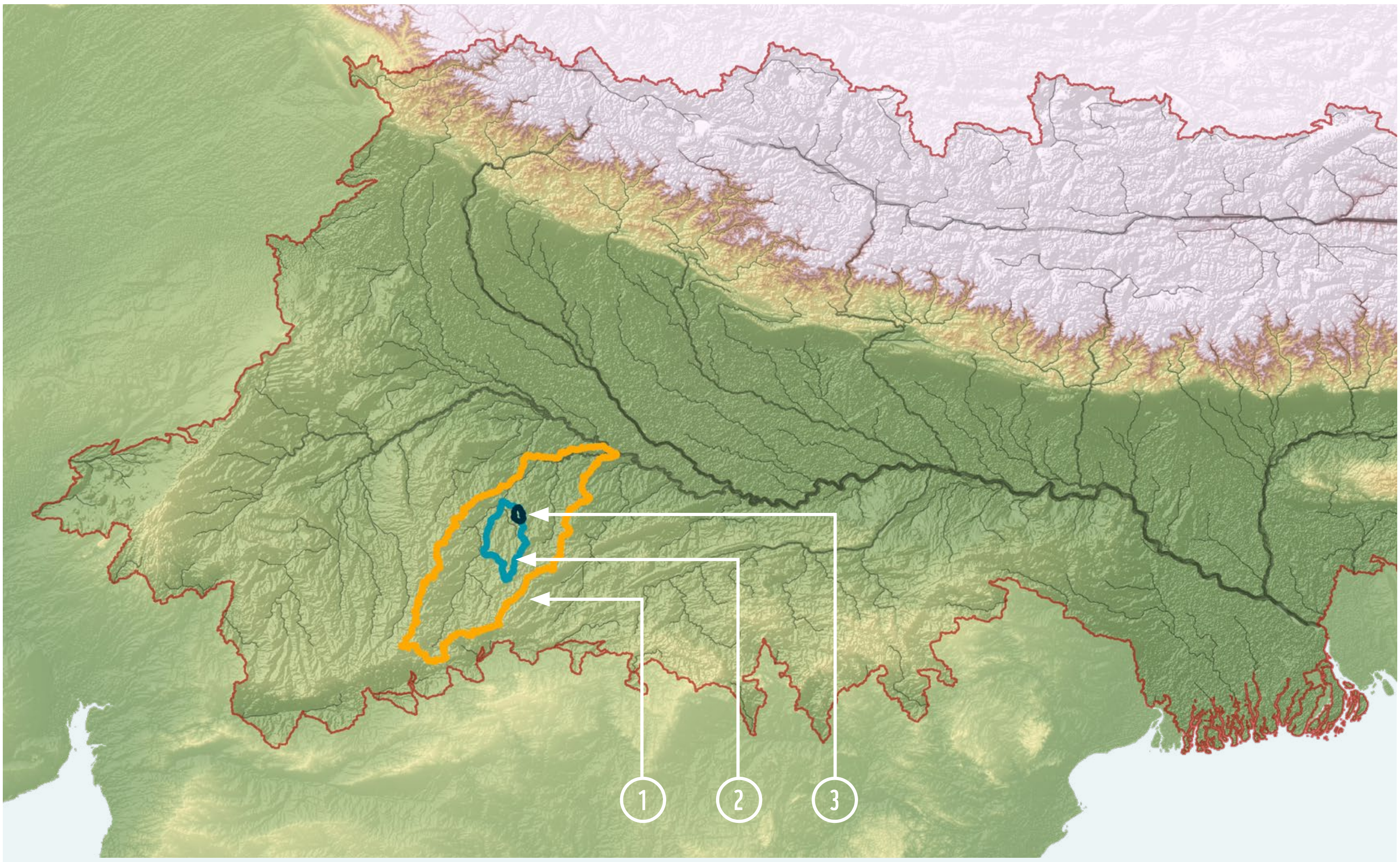
But what is “stress” versus “scarcity” and how do they link to water risk? Both WRI and WWF, along with several other organizations, sought to address this question back in 2015 when we informed the development of a graphic (see Figure 2 above). Note that the definitions below have been slightly amended from the original 2015 publication.

- Aridity – "the degree to which a climate lacks effective, life-promoting moisture" (Glossary of Meteorology, American Meteorological Society). This can be thought of as the natural availability of freshwater resources (i.e., natural supply, not accounting for demand).
- Water scarcity – “the volumetric abundance, or lack thereof, of freshwater resources”. Unlike aridity, water scarcity accounts for supply and demand, but only considers volume (not the quality of the available water).
- Water stress – “the ability, or lack thereof, to meet human and ecological demand for fresh water”. Compared to scarcity, “water stress” is a more inclusive and broader concept that also accounts for demand, but unlike scarcity, accounts for where supply is compromised from water quality impairment.
- Water risk – the possibility, often considered through a combination of likelihood and impact, of a given site experiencing a deleterious water-related challenge due to basin conditions and/or operational conditions (e.g., water scarcity, water stress, flooding, infrastructure decay, drought).

In unpacking water scarcity and stress, it is also worth noting that one of the other highly referenced “water stress” layers (FAO Water Stress) further increases confusion by using “scarcity” and “stress” as different thresholds within a singular continuum. This framing derives from Falkenmark’s original “water stress” work.

It is also important to note that unlike the definition of water stress, WRI Aqueduct’s “Baseline Water Stress” only measures water scarcity (total annual withdrawals to average annual blue water availability); it does not account for quality nor accessibility. The WWF Water Risk Filter’s “water depletion” indicator also measures water scarcity but employs different data and methods. Neither layer accounts for inter-basin transfers.

In conclusion, each of these layers offers slightly different insights into aspects of water scarcity. Therefore, it is recommended to explore multiple models and data layers on water scarcity as well as other water challenges and risk to understand where there is agreement and disagreement and develop a more nuanced understanding on water challenges and risk.



The HydroSHEDS database uses a hierarchical approach with 12 levels, ranging from HydroBASINS Level 1 (roughly the level of continental divides) all the way down to Level 12 (the highest possible resolution for sub-basins).

1) WRI Aqueduct aggregates global water data using HydroSHEDS HydroBASINS Level 6, which covers 16,397 basins with a mean area of ~8,200 km^2

2) WWF Water Risk Filter (Global) aggregates global water data using HydroSHEDS HydroBASINS Level 7, which covers 57,646 basins with a mean area of ~2,300 km^2

3) WWF Water Risk Filter (National/Regional High Resolution) aggregates national/regional water data for specific countries and regions* using HydroSHEDS HydroBASINS Level 12, which covers 1,034,083 basins with a mean area of ~130km^2

* Brazil, Cambodia (Mekong), Chile, Colombia, Great Britain, Hungary, Laos PDR (Mekong), South Africa, Spain, Thailand (Mekong), Vietnam (Mekong)

Ganges River Basin

0 250 500 km

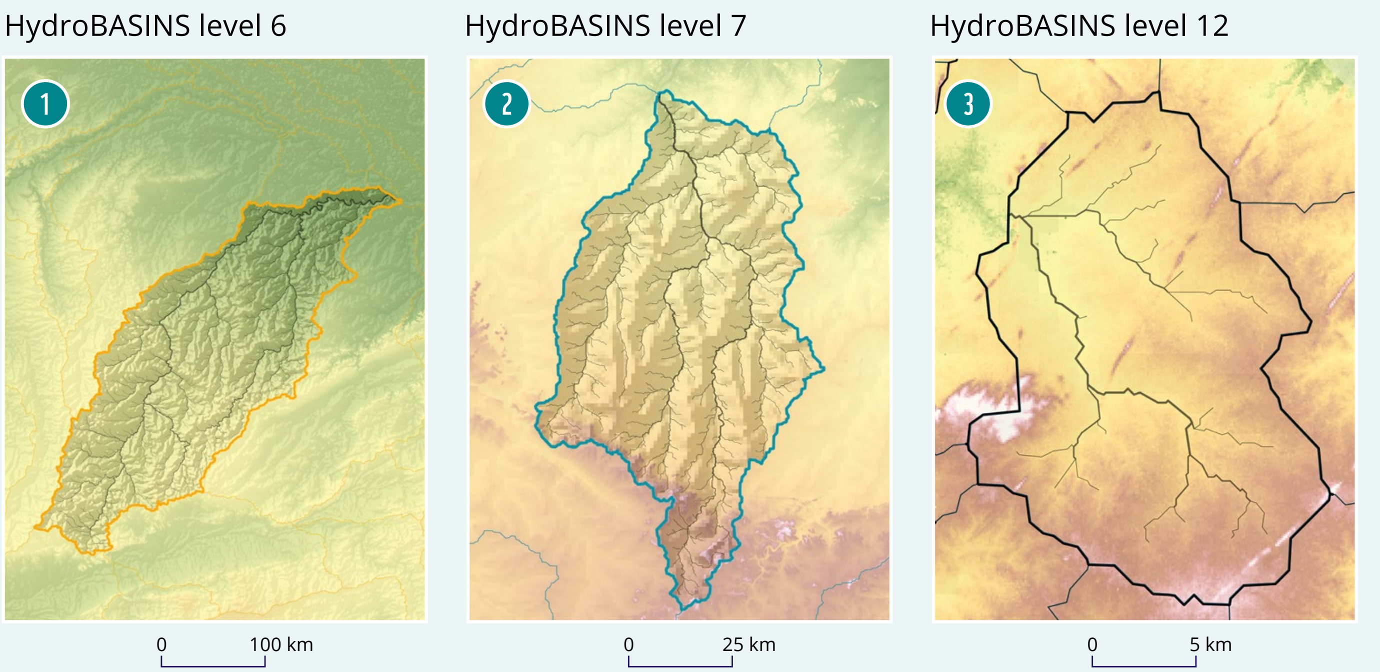


Figure 4: Spatial resolution of data

3.3 Spatial resolution

The three water tools aggregate water data at different geographical scales, depending on the nature of the data and intended use of the indicator:

- **WBCSD India Water Tool** uses government data aggregated at the political/administrative boundaries level, and data from localised modelling studies at the meso-watershed level[8]; and
- **WRI Aqueduct** and the **WWF Water Risk Filter** aggregate water data using different HydroBASINS sub-basin levels from the HydroSHEDS database[9] or in some cases at country level.

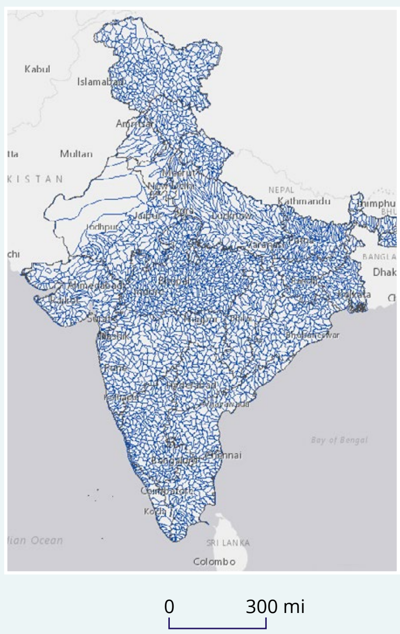
As the three water tools rely heavily upon publicly available data sets from third parties, they are somewhat bound by the constraints of the data providers when it comes to how detailed the data are (spatial and temporal resolution) and how often they are updated. Therefore, the spatial resolution largely depends upon the resolution of the third party's data layers, and many of the common core layers (e.g., around water stress) all offer approximately the same resolution of data.

It is also important for users to note that aggregation at a finer or coarser scale does not necessarily indicate "more accurate" or "better" data. Rather, each tool has made decisions around the most appropriate levels at which to aggregate and represent their data sets. Similarly, the three tools also use different colour schemes, but are independent, therefore a darker red colour in one tool does not infer greater risk than another tool, which uses a lighter shade (or a different colour entirely).

India watertool©

WBCSD India Water Tool
Administrative Boundaries

WBCSD India Water Tool
Watershed Boundaries

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Operational layers
Point data
Boundaries
Ground Water
Block Categorization
Aquifer System
Hydrogeological Map
Surface Water & Stress Indicators
Total Annual Rainfall
Availability Index
Normalized Deficit Index (NDI)
Normalized Deficit Cumulated (NDC)
Baseline Water Stress
Localized data
Andhra Pradesh
Madhya Pradesh
AFGHANISTAN
Kabul
Islamabad
Quetta
Multan
PAKISTAN
Karachi
Muscat
Kathmandu
Thimphu
Dhaka
Chittagong
MYANMAR (BURMA)
Mandalay
Nay Pyi Taw
Yangon
Jodhpur
Jaipur
Agra
Lucknow
Bhopal
Nagpur
Hyderabad
Chennai
Kolkata
Indian Ocean
SRI LANKA

India watertool©

3.4 WBCSD India Water Tool 3.0

First launched in 2013, the WBCSD India Water Tool (IWT) is now in its third iteration. The successive versions have included additional datasets as well as improvements to the application's IT platform in order to support business decision-making. Uniquely, IWT 3.0 introduces datasets that help companies understand the geographical and hydro-geological features of their sites so as to plan water recharge solutions in and around their sites of interest. The key additions to IWT 3.0 include:

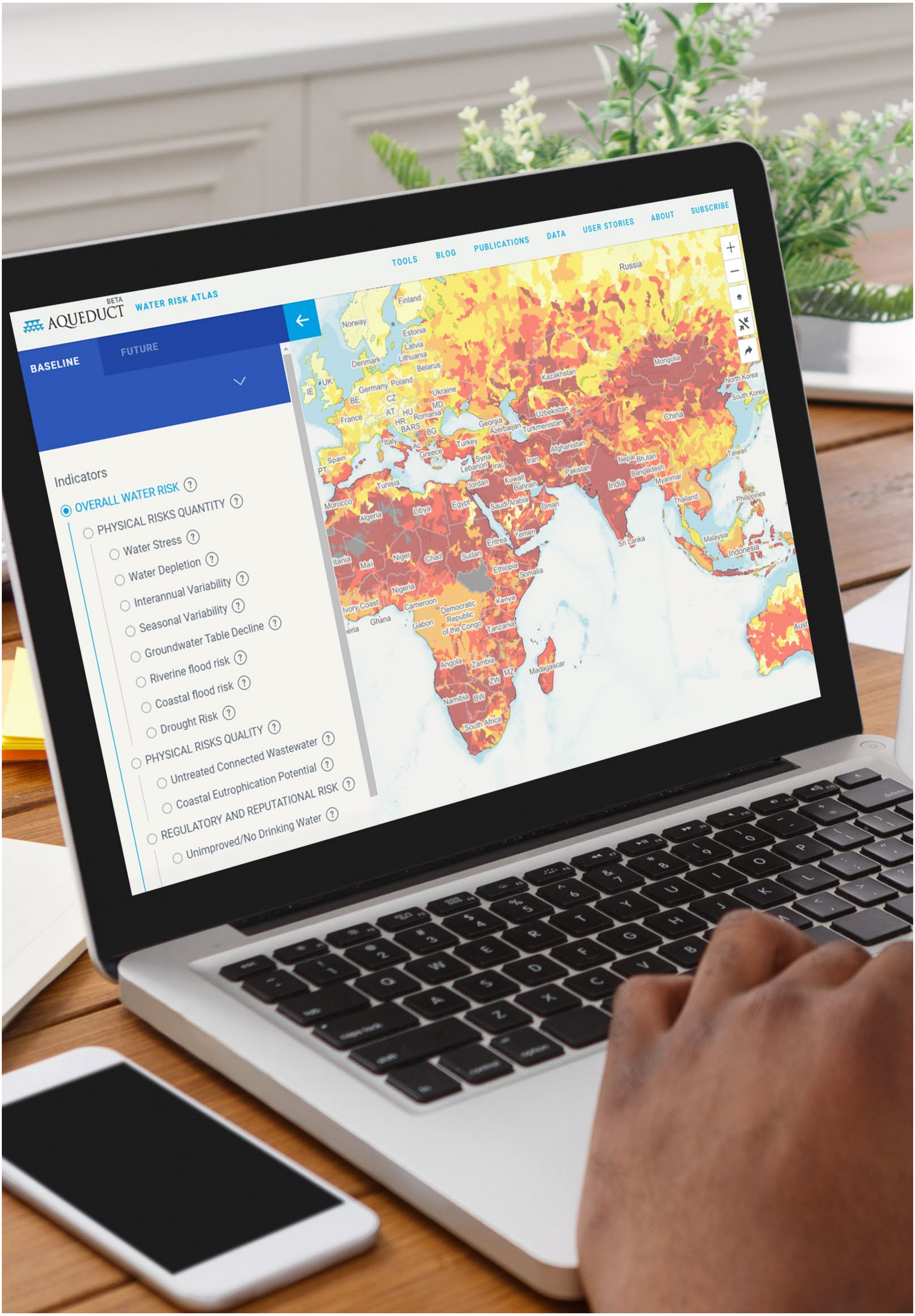
1. **Watershed boundaries:** In addition to the already incorporated Indian administrative boundaries (for which the water-datasets have been available), IWT 3.0 incorporates a map of watershed boundaries for the country. The boundaries have been sourced from the Watershed Atlas of India and are demarcated based on the drainage and elevation contour maps on 1:250,000 scale. The watersheds are the first reference of the users to the hydrological unit their sites are a part of. In other words, this dataset helps users view their sites in the hydrological context that governs the behaviour and shared use of water, as opposed to the administrative context.

2. **Availability Index:** While earlier versions of the India Water Tool primarily utilised groundwater data, IWT 3.0 has added the Availability Index as an indicator determining surface water availability to help identification of risks by companies that rely heavily on surface water. The Availability Index is a remote-sensing derived index developed by NASA and USGS under the LANDSAT 8 mission. The indicator incorporates water levels in open surface water and IWT 3.0 uniquely organises this output at the district level for India.

3. **Aquifer system and hydrogeological types:** To help users understand their sites better as they plan stewardship actions, IWT 3.0 includes pan-India datasets on aquifer system and hydrogeological types. The former provides information on the principal aquifer system with distinct rock formations and typical hydrological features, and the latter gives broad types of geological formations that determine the groundwater potential of the area.

4. **Localized data:** IWT 3.0 initiates the development of a solutions interface that can support all stakeholders to plan participatory water-management solutions based on very granular data available for key water stressed meso-watersheds in the country. This interface includes data from primary water-balance studies conducted at specific locations of interest, giving a complete picture of the watershed health. Along with the data, IWT 3.0 provides recommendations for demand and supply side management of water in the watershed.

https://www.indiawatertool.in →


AQUEDUCT
BETA
WATER RISK ATLAS
TOOLS
BLOG
PUBLICATIONS
DATA
USER STORIES
ABOUT
SUBSCRIBE
BASELINE
FUTURE
Indicators
OVERALL WATER RISK
PHYSICAL RISKS QUANTITY
Water Stress
Water Depletion
Interannual Variability
Seasonal Variability
Groundwater Table Decline
Riverine flood risk
Coastal flood risk
Drought Risk
PHYSICAL RISKS QUALITY
Untreated Connected Wastewater
Coastal Eutrophication Potential
REGULATORY AND REPUTATIONAL RISK
Unimproved/No Drinking Water

3.5 WRI Aqueduct 3.0

Since its inception in 2011, the WRI's Aqueduct Water Risk Atlas has been a freely accessible global water risk mapping tool, which can be used by companies and investors to assess water-related risks around the world.

In August 2019, WRI released an updated version of the Aqueduct Water Risk Atlas (version 3.0), which includes higher spatial and temporal variation, news indicators, and a more holistic hydrological model[10]. In this latest version, basin water risks associated with a company's geographical location are assessed using 13 risk indicators organized into three categories: physical risk quantity, physical risk quality, and regulatory and reputational risk.

The WRI Aqueduct Water Risk Atlas also provides information on projected water risks in 2030 and 2040 based on optimistic, pessimistic, or business-as-usual climate and economic growth scenarios. Therefore, companies and financial institutions can use the tool to evaluate and disclose on current and future geographic water risks, as recommended by the Task Force for Climate-related Financial Disclosure (TCFD).

In addition to the Aqueduct Water Risk Atlas, the WRI Aqueduct information platform also contains:

1. **Aqueduct Country Rankings:** It shows countries and provinces' average exposure to 3 of WRI Aqueduct 3.0's water risk indicators: baseline water stress, riverine flood risk, and drought risk. The Aqueduct Country Rankings aim to help users analyse and compare national water risk exposure.

2. **Aqueduct Food:** Launched in 2019, the Aqueduct Food tool helps users understand and identify current and future water risks to agriculture and food security. WRI's Aqueduct water risk maps are cross-referenced with data from the International Food Policy Research Institute (IFPRI) showing spatially explicit global crop area along with data on food production, demand, trade, prices, and hunger for every country in the world. By providing users with a better understanding of how population growth and climate change will affect global food systems, Aqueduct Food aims to enable proactive management of water related risks to food security.

3. **Aqueduct Floods:** Launched in 2015, the Aqueduct Global Flood Analyzer v1.0 enabled users to analyse current and future river-flood risks worldwide by measuring river flood impacts by urban damage, affected GDP, and affected population at the country, state, and river basin scale across the globe. WRI launched in April 2020 a new version to better identify coastal and riverine flood risks as well as analyze the costs and benefits of investing in flood protection.

https://www.wri.org/aqueduct →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WWF Basins
Risk Reports
Case Studies
Data & Methods
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Map Icons
Map region:
Global
Border and point layer:
Selected border and point layers (1)
Water Risk Layer:
Overall Risk Layer
Additional water-related layer:
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Atlantic Ocean
Indian Ocean
Map Layers
Legend
Sources and Descriptions
Download

Water Risk Filter

3.6 WWF Water Risk Filter 5.0

Launched in 2012, the first version of the WWF Water Risk Filter was co-developed with the German Development Financial Institution DEG. After a major upgrade in 2018-19 added a wealth of new functionalities, the WWF Water Risk Filter version 5.0 is a free online tool that now enables companies and financial institutions to explore, assess, respond, and value water risks worldwide.

1) Explore & Assess section

In version 5.0, the Water Risk Filter risk assessment structure and data sets have been upgraded to ensure a more comprehensive coverage of the three risk types: physical, regulatory and reputational.

a. Basin risks are assessed using a total of 32 global risk indicators and higher resolution data sets for 12 countries or regions. With version 5.0, the number of risk indicators was expanded from 20 to 32 with the objective of providing a diverse range of best available data sets to ensure better understanding of water risk exposure.

b. Operational risks are assessed using either a short questionnaire (10 drop-down questions) or a more detailed questionnaire (45 questions) depending on user needs.

c. Country profiles were updated to provide detailed information and country statistics for over 120 countries (e.g. national water governance, policies and water resources) and have been made interactive to allow for comparison between countries and risk scores.

2) Respond section: While earlier versions of the Water Risk Filter had a mitigation toolbox, version 5.0 now dynamically links companies' risk assessment results to provide users with a customized set of response actions that are aligned with leading water stewardship frameworks. The Respond section aims to guide users to identify relevant water stewardship actions to address their unique water risks and inform their water stewardship strategies.

3) Value section: In addition to the Valuing Water Database – an online resource to find the best tools to value water – the Value section also includes the Water And ValuE (WAVE) tool. This new excel-based tool provides an offline calculator that allows users to explore how water risk-driven events can impact a site's finances. Built in conjunction with Water Foundry, and powered by CDP Water Security database, WAVE will offer the ability to link together water risk and financial values to better understand the potential materiality of water challenges.

4) Water Risk Filter Scenarios – coming soon: WWF is in the process of integrating climate and socio-economic pathway-based scenarios into the tool to support scenario evaluation of water risks and resilience in line with the Task Force for Climate-related Financial Disclosure (TCFD) recommendations.

https://waterriskfilter.panda.org →

4. RECOMMENDATIONS

The WBCSD India Water Tool, WRI Aqueduct and WWF Water Risk Filter are all high quality, freely available, and well-recognized online water tools, which are built on peer-reviewed data and offer a strong basis for understanding shared water challenges and water risks. While there are many other tools in the market, they should also be evaluated for the breadth of their coverage, the quality of their data, and their rigour.

The three leading water tools covered in this report were developed for private sector actors to have a comprehensive understanding of water challenges and water risks, with a common interest in seeing business, investments, communities and freshwater systems thrive. Accordingly, these three water tools should be used to analyse shared water challenges and water risk exposure with the aim to mobilize private sector actors towards stronger, contextually relevant responses.

The following points reflect a series of key considerations and guidance points for companies and financial institutions on understanding water challenges and conducting a water risk assessment, regardless of how they proceed:

1) **Ensure you understand whether you are assessing shared water challenges or water risks** (and which is a better fit for your needs). Both approaches have value, so consider which framework makes most sense for your needs. Whichever framework you adopt ensure that it is comprehensively covers that framework (i.e., the six shared water challenges in Table 1 or the three risk types in Figure 1).

2) **Do not treat risk water assessment as a one-off prescriptive exercise: it should be part of a regularly updated decision-making process.** Given the many variables and local issues that manifest as water-related risk, it is recommended that companies and financial institutions use tools on an annual basis. Any water risk tool should be used primarily as a prioritization tool to identify water risk hotspots and should be augmented and refined with local/regional data and expert knowledge. Furthermore, the results of a water risk assessment should be taken as an input into the decision-making process, not as the decision-maker themselves.

3) **Use a diversity of reliable, peer-reviewed data to inform your understanding of water challenges and risks.** There is not a single "best" data layer; each comes with their own advantages and limitations. From global to local and recent to longer-term averages, nuances matter when attempting to get a full understanding of water issues. As the three leading water tools draw from different, credible (peer reviewed) data, it helps users to access a diverse range of best available data sets, strengthening their understanding of the nuances of water challenges and risk exposure. For all tools, the results require interpretation that should always be challenged and explored further. Areas that show strong agreement between the tools are likely to elicit greater confidence, while areas that show wide disagreement likely require more detailed on-the-ground assessment. Not unlike the use of multiple IPCC climate models, we believe that companies and financial institutions should explore multiple water models and data layers to understand where there is agreement and disagreement.

4) **Engage in deeper understanding of water risks for the most material and exposed parts of your value chain.** Given that there are no existing water tools that can cover full corporate value chains, it is recommended to focus risk assessment efforts on the parts of the value chain with the greatest strategic importance from a business perspective (e.g. high value) and with high reliance and impact on water/high water footprint. Furthermore, there are other elements to take into account when identifying which part of the value chain to focus on, such as the level of control/influence, the degree of water stewardship maturity, the operational diversity (e.g. redundancy) and resilience (e.g. preparedness to extreme events).

5) **It is important to consider both basin context and operational risk.** Water risk is heavily driven by basin context, but also reflects the nature of operations. Both of these aspects are critical to consider when thinking through water risk. Basin risk may also require consideration at multiple scales as the scale of different risks (e.g., flood vs. scarcity vs. governance) may vary for a site. Generally, we encourage a multi-scale evaluation of a site, which is framed in a basin and operational context.

6) **Risk exposure is only half of the story – companies and financial institutions must consider response as well to account for residual water risk.** Understanding the status of the basin and the nature of operations is critical to understanding water risks, but these risks also have the potential to be managed and mitigated. The concept of residual risk needs greater attention from both companies and investors, and responses (i.e., controls) also need to account for context and effectiveness.

7) **Prioritizing responses can be done through several means that account for value.** Ultimately how companies prioritize their response focus is up to them, but several approaches are worth considering, including: materiality of site production (potential impacts on revenue/value creation), opportunity for site-level risk reduction/savings (potential ability to reduce residual risk and/or lower costs), site asset value (potential loss of capital assets), and site impact liability (potential downstream impacts). These four approaches allow users to combine high water risk with value to consider how best to prioritize contextual responses.

5. CONCLUSION

WBCSD, WRI and WWF provide high quality, accessible online tools to help companies and investors assess and address shared water challenges and/or their water risk exposure. Different perspectives on water challenges and risk – from global to local and from tool to tool – are ultimately necessary as water is multi-dimensional and multi-scale. A key benefit of having three independent water tools is that they offer different insights on water challenges and risk as each draws upon different, credible data sources as well as offer different functionalities, enabling users to better understand nuances and diverse perspectives when it comes to water.

To appropriately make use of any water tool, it is important to understand its underlying frameworks and functionalities as well as how these overlap – and also differ – with other water tools, as described in this report. Distinguishing how the data are represented (as raw data tied to shared water challenge status or as risk categorizations) is critical, as are issues around basin versus operational risk, and the notion of residual risk and accounting for value. We strongly encourage all users to understand these nuances in order to help inform their use of tools.

The three water tools in this report have recently undergone, and are still undergoing, significant changes, which will further enhance their usability and scope of coverage. Within the India Water Tool 3.0, WBCSD has added the latest data from India, while also deciding to wind down the Global Water Tool. Within Aqueduct 3.0, not only has WRI updated their Water Risk Atlas data and future scenarios but it is also providing greater depth of information on flood and food water-related risks. Lastly, within the Water Risk Filter 5.0, WWF has updated the tool's risk assessment structure and data, dynamically linked assessment with mitigation, added a new valuation section and will soon be integrating future scenarios. As the tools are enhanced, they continue to expand in various directions, thereby helping to offer new and different analyses.

These leading water tools offer a strong starting point to help companies and financial institutions take the first critical steps on their water stewardship journey by identifying shared water challenges and risk exposure within operations, supply chains and investments. The results from these tools should be used as inputs to inform ongoing risk assessment processes and decision-making, but the process should not end there. Companies and investors should seek to move towards stronger, contextual responses, turning challenges and risks into opportunities to grow and profit, while simultaneously serving people and the planet.

Through continuous innovation, collaboration and private sector engagement with these three leading water tools, WBCSD, WRI and WWF are advancing water stewardship and ultimately working to the same end: to ensure sustainable freshwater systems for both people and nature.

APPENDIX A – DATA LAYERS AND SOURCES

WBCSD India Water Tool 3.0

India watertool©

Data layer	Description	Source	Spatial resolution
Groundwater level	Observed values of depth to ground water as recorded in government-installed observation wells in the country.	Central Ground Water Board, Government of India	Observation well
Hydrogeological Map	Broad types of geological formations informing groundwater potential and controlling hydraulics of ground water	Central Ground Water Board, Government of India	N.A.
Aquifer System	Principal aquifer systems made of distinct rock formations with typical hydrogeological characteristics	Central Ground Water Board, Government of India	N.A.
Stage of groundwater development	Existing draft of all ground water uses, per unit net groundwater availability expressed as a percentage	Central Ground Water Board, Government of India	District
Groundwater Block categorization	Categorisation of groundwater blocks based on stage of groundwater development and long-term decline of groundwater levels for pre-and post-monsoon readings	Central Ground Water Board, Government of India	Block
Notified Areas	Selected blocks in India where no permission to withdraw groundwater through any energized means is granted for purposes other than drinking and domestic use	Central Ground Water Board, Government of India	Block
Total annual rainfall	Arithmetic average of annual rainfall recorded at all meteorological stations in the country	India Meteorological Department	District
Surface Water Availability Index (NDWI - Normalised Difference Water Index)	An index that records surface water availability by recording water level in open surface water	National Aeronautics and Space Administration, and U.S. Geological Survey	District
Surface water quality	Status of surface water quality parameters recorded at observation stations	Central Pollution Control Board	Observation station
Baseline Water Stress	Total annual withdrawals expressed as a percentage of total annual available flow	World Resources Institute	Sub-catchment
Normalized Deficit Index	Amount of water that needs to be drawn from external storage within a year to meet the current demand pattern	Columbia University	District
Normalized Deficit Cumulated	Maximum cumulative deficit across years created due to multi-year drought period	Columbia University	District
Localized Data (Watershed Features)	Outputs from localised modelling studies done at the meso-watershed level at specific locations in the country	ICRISAT (from modelling studies at watershed level)	Meso-watershed

WRI AQUEDUCT 3.0

Data layer	Description	Source	Spatial resolution
PHYSICAL RISKS QUANTITY			
1. Baseline Water Stress	Ratio of total water withdrawals to available renewable surface and groundwater supplies	Partner Organization: Utrecht University PCR- GLOBWB 2: Wada et al. (2014a); Sutanudjaja et al. (2018)	HydroBASINS 6
2. Baseline Water Depletion	Ratio of total water consumption to available renewable water supplies	Partner Organization: Utrecht University PCR- GLOBWB 2: Wada et al. (2014a); Sutanudjaja et al. (2018)	HydroBASINS 6
3. Interannual Variability	The average between year variability of available water supply, including both renewable surface and groundwater supplies	Partner Organization: Utrecht University PCR- GLOBWB 2: Wada et al. (2014a); Sutanudjaja et al. (2018)	HydroBASINS 6
4. Seasonal Variability	The average within-year variability of available water supply, including both renewable surface and groundwater supplies	Partner Organization: Utrecht University PCR- GLOBWB 2: Wada et al. (2014a); Sutanudjaja et al. (2018)	HydroBASINS 6
5. Groundwater Table Decline	The average decline of the groundwater table as the average change for the period of study (1990–2014)	Partner Organizations: Deltares, Utrecht University PCR- GLOBWB 2: Wada et al. (2014a); Sutanudjaja et al. (2018) MODLFOW	Groundwater aquifer (WHYMAP)
6. Riverine Flood Risk	The percentage of population expected to be affected by Riverine flooding in an average year, accounting for existing flood-protection standards	Partner Organizations: Deltares, IVM, PBL, Utrecht University GLOFRIS: Ward et al. (Forthcoming) FLOPROS: Scussolini et al. (2016)	HydroBASINS 6
7. Coastal Flood Risk	The percentage of the population expected to be affected by coastal flooding in an average year, accounting for existing flood protection standards	Partner Organizations: Deltares, IVM, PBL, Utrecht University GLOFRIS: Ward et al. (Forthcoming) FLOPROS: Scussolini et al. (2016)	HydroBASINS 6
8. Drought Risk	Drought risk measures where droughts are likely to occur, the population and assets exposed, and the vulnerability of the population and assets to adverse effects	Partner Organization: JRC Carrão et al. (2016)	HydroBASINS 6

WRI AQUEDUCT 3.0

Data layer	Description	Source	Spatial resolution
PHYSICAL RISKS QUALITY			
9. Untreated Connected Wastewater	The percentage of domestic wastewater that is connected through a sewerage system and not treated to at least a primary treatment level	Partner Organizations: IFPRI, Veolia Xie et al. (2016)	Country
10. Coastal Eutrophication Potential	The potential for riverine loadings of nitrogen (N), phosphorus (P), and silica (Si) to stimulate harmful algal blooms in coastal waters	Partner Organizations: Utrecht University, Washington State University Billen and Garnier (2007) Bouwman et al. (2015) Mayorga et al. (2010) Vörösmarty et al. (2000)	HydroBASINS 6
REGULATORY & REPUTATIONAL RISK			
11. Unimproved/No Drinking Water	Reflects the percentage of the population collecting drinking water from an unprotected dug well or spring, or directly from a river, dam, lake, pond, stream, canal, or irrigation canal (WHO and UNICEF 2017)	Partner Organization: Joint Monitoring Programme (JMP) WHO and UNICEF (2017) van Huijstee et al. (2018) van Vuuren et al. (2007)	HydroBASINS 6
12. Unimproved/No Sanitation	Reflects the percentage of the population using pit latrines without a slab or platform, hanging/bucket latrines, or directly disposing human waste in fields, forests, bushes, open bodies of water, beaches, other open spaces, or with solid waste (WHO and UNICEF 2017)	Partner Organization: Joint Monitoring Programme (JMP) WHO and UNICEF (2017) van Huijstee et al. (2018) van Vuuren et al. (2007)	HydroBASINS 6
13. Peak RepRisk Country ESG Risk Index	Quantifies business conduct risk exposure related to environmental, social, and governance (ESG) issues in the corresponding country	Partner Organization: RepRisk RepRisk. n.d.	Country

WWF WATER RISK FILTER 5.0
(Global data only)

Water Risk Filter

Data layer	Description	Source	Spatial resolution
PHYSICAL RISK: QUANTITY – WATER SCARCITY			
1.0 Aridity	Potential availability of water in regions with low water demand	Trabucco & Zomer (2009)	HydroBASINS 7
1.1. Water Depletion	Ratio of water consumption-to-availability	Brauman et al. (2016)	HydroBASINS 7
1.2. Baseline Water Stress	Ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use	World Resources Institute	HydroBASINS 7
1.3. Blue Water Scarcity	Ratio of the blue water footprint in a grid cell to the total blue water availability in the cell	Mekonnen & Hoekstra (2016)	HydroBASINS 7
1.4. Projected Change in Water Discharge (by ~2050)	Relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050	Schewe et al. (2014)	HydroBASINS 7
1.5. Drought Frequency Probability	Relative frequency probability of hydrological drought events of moderate magnitude occurring in any 1-year period	Vicente-Serrano et al. (2010)	HydroBASINS 7
1.6. Projected Change in Drought Occurrence (by ~2050)	Relative change (%) in probability between pre-industrial and 2°C scenarios	Frieler et al. (2017)	HydroBASINS 7
PHYSICAL RISK: QUANTITY – FLOODING			
2.1. Estimated Flood Occurrence	Based on the recurrence of floods within the 34-year time frame period of 1985 to 2019	Dartmouth Flood Observatory, University of Colorado	HydroBASINS 7
2.2. Projected Change in Flood Occurrence (by ~2050)	Change (%) in probability between pre-industrial and 2°C scenarios	Frieler et al. (2017)	HydroBASINS 7
PHYSICAL RISK: QUALITY			
3.1. Surface Water Contamination Index	Calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).	Vörösmarty et al. (2010)	HydroBASINS 7

WWF WATER RISK FILTER 5.0
(Global data only)

Data layer	Description	Source	Spatial resolution
PHYSICAL RISK: ECOSYSTEM SERVICE STATUS			
4.1. Fragmentation Status of Rivers	Percentage of the basins' volume considered as fragmented (e.g not classified as 'Free-flowing')	Grill et al. (2019)	HydroBASINS 7
4.2. Catchment Ecosystem Services Degradation Level (tree cover loss)	Tree cover loss during the period 2000 – 2018 was applied as a proxy to represent catchment ecosystem services degradation	Hansen et al. (2013)	HydroBASINS 7
4.3. Projected Impacts on Freshwater Biodiversity	Projected changes [% increase or decrease] in extinction rate of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity	Tedesco et al. (2013)	HydroBASINS 7
REGULATORY RISK: ENABLING ENVIRONMENT (POLICY & LAWS)			
5.1. Freshwater Policy Status (SDG 6.5.1)	Based on SDG 6.5.1. "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the enabling environment category	UN Environment (2018)	Country
5.2. Freshwater Law Status (SDG 6.5.1)	Based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Law(s)" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category	UN Environment (2018)	Country
5.3. Implementation Status of Water Management Plans (SDG 6.5.1)	Based on SDG 6.5.1. Degree of IWRM Implementation "National IWRM plans" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category	UN Environment (2018)	Country
REGULATORY RISK: INSTITUTIONS AND GOVERNANCE			
6.1. Corruption Perceptions Index	Aggregated data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector	Transparency International (2019)	Country
6.2. Freedom in the World Index	Based on an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories	Freedom House (2019)	Country
6.3. Business Participation in Water Management (SDG 6.5.1)	Based on SDG 6.5.1. Degree of IWRM Implementation "Business Participation in Water Resources Development, Management and Use" indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category	UN Environment (2018)	Country

WWF WATER RISK FILTER 5.0
(Global data only)

Data layer	Description	Source	Spatial resolution
REGULATORY RISK: MANAGEMENT INSTRUMENTS			
7.1. Management Instruments for Water Management (SDG 6.5.1)	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "Sustainable and efficient water use management" indicator, which corresponds to one of the five national level indicators under the Management Instruments category	UN Environment (2018)	Country
7.2. Groundwater Monitoring Data Availability and Management	The level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability	UN IGRAC (2019)	Country
7.3. Density of Runoff Monitoring Stations	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator	BfG (2019)	HydroBASINS 7
REGULATORY RISK: INFRASTRUCTURE & FINANCE			
8.1. Access to Safe Drinking Water	Provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017	WHO & UNICEF (2019)	Country
8.2. Access to Sanitation	Provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017	WHO & UNICEF (2019)	Country
8.3. Financing for Water Resource Development and Management (SDG 6.5.1)	Based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database.	UN Environment (2018)	Country
REPUTATIONAL RISK: CULTURAL IMPORTANCE			
9.1 Cultural Diversity	Acknowledges that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions.	Oviedo et al. (2000)	Country
REPUTATIONAL RISK: CULTURAL IMPORTANCE			
10.1. Freshwater Endemism	Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks	WWF & TNC (2015)	HydroBASINS 7
10.2. Freshwater Biodiversity Richness	Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015)	HydroBASINS 7

WWF WATER RISK FILTER 5.0
(Global data only)

Data layer	Description	Source	Spatial resolution
REPUTATIONAL RISK: MEDIA SCRUTINY			
11.1. National Media Coverage	Indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnoma (TYPSA Group)	Country
11.2. Global Media Coverage	Indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnoma (TYPSA Group)	Country
REPUTATIONAL RISK: CONFLICT			
12.1. Conflict News Events (RepRisk)	Counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019)	Country
12.2. Hydro-political Risk	Based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues	Farinosi et al. (2018)	HydroBASINS 7

FOOTNOTES

1) Alliance for Water Stewardship (2020) The AWS Standard 2.0. Available online: https://a4ws.org/the-aws-standard-2-0/
2) CEO Water Mandate (2014) Detailed definitions. Available online: https://ceowatermandate.org/terminology/detailed-definitions/
3) CEO Water Mandate: https://ceowatermandate.org/university/101-the-basics/lessons/what-is-water-stewardship/
4) CEO Water Mandate: https://ceowatermandate.org/terminology/
5) WWF-Germany (2019) Freshwater Risks and Opportunities: An overview and call to action for the financial sector. Available online: https://tinyurl.com/urmt6bh.
6) The WWF Water Risk Filter breaks each of the 3 risk types into 4 different risk categories. Physical is composed of 4 risk categories: scarcity, flooding, quality, and ecosystem service degradation; Regulatory is composed of 4 risk categories: enabling environment (laws & policy), institutions & governance, management instruments, and infrastructure & finance (reorganized to align with SDG 6.5 on water governance); and Reputational is composed of 4 risk categories: cultural importance, biodiversity importance, media scrutiny, and conflict.
7) Brazil, Cambodia (Mekong), Chile, Colombia, Great Britain, Hungary, Laos PDR (Mekong), South Africa, Spain, Thailand (Mekong), Vietnam (Mekong). For more details see: http://waterriskfilter.panda.org/en/About/DataAndMethods
8) For more information, please read the WBCSD India Water Tool Methodology: https://www.indiawatertool.in/Methodology/index.html?page=2
9) For more information, please visit: http://www.worldwildlife.org/hydrosheds
10) Please read this document for further information on the updates for WRI Aqueduct Water Risk Atlas 3.0: https://wriorg.s3.amazonaws.com/s3fs-public/uploads/aqueduct-whats-new.pdf
11) For more detailed information, please read the Water Risk Filter Methodology documentation https://waterriskfilter.panda.org/en/Explore/DataAndMethod

https://www.indiawatertool.in

https://waterriskfilter.panda.org

Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

WBCSD

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