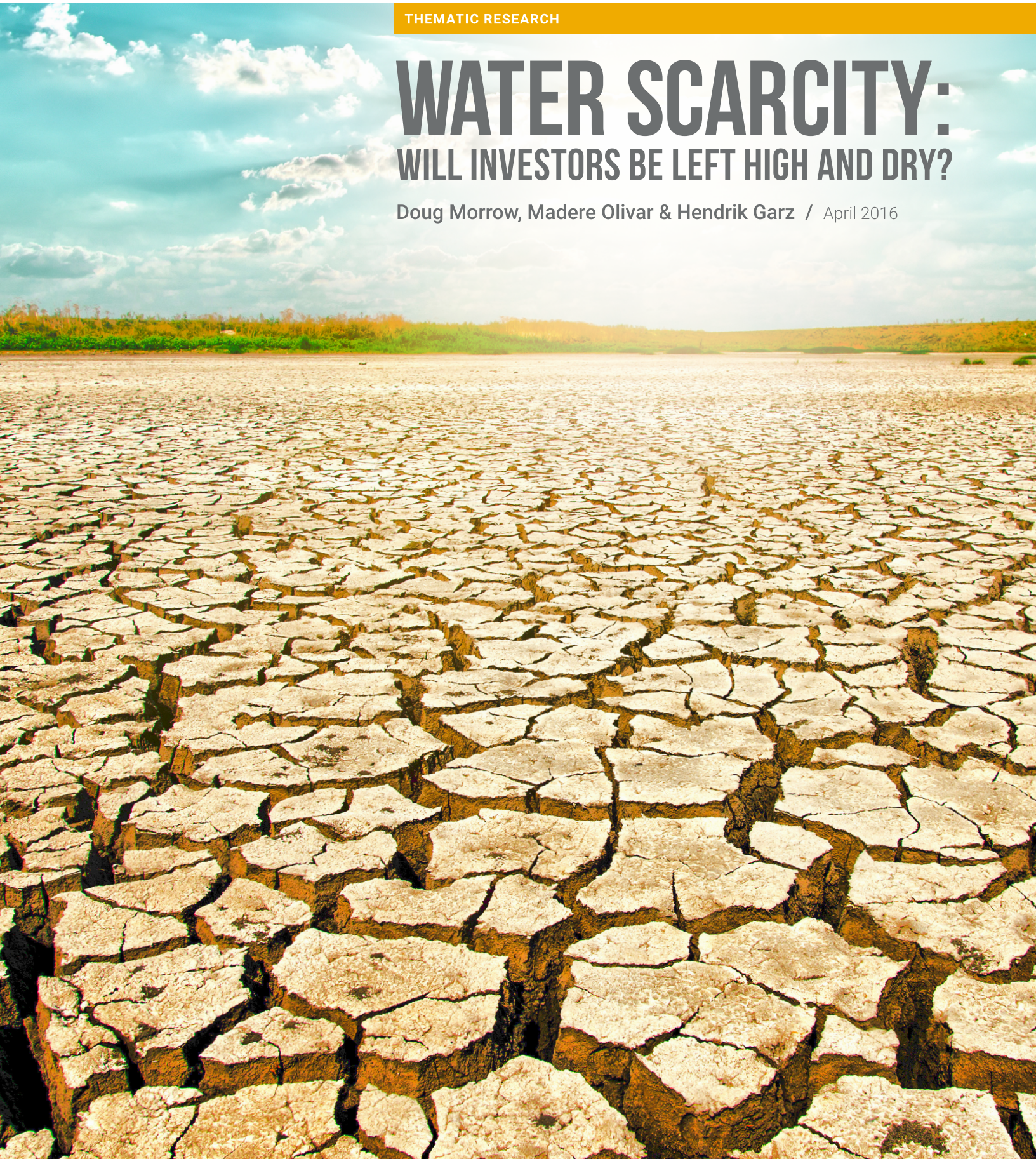
SUSTAINALYTICS

THEMATIC RESEARCH

WATER SCARCITY:
WILL INVESTORS BE LEFT HIGH AND DRY?

Doug Morrow, Madere Olivar & Hendrik Garz / April 2016



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Sustainalytics BV
De Entrée 35-37, Toren A, Amsterdam, 1101 BH
The Netherlands
Phone +31 (0)20 205 00 00

info@sustainalytics.com
www.sustainalytics.com

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Water scarcity: Will investors be left high and dry?

Key insights

- Global water demand is surging due to population growth and changing diets, investment in water supply infrastructure is not keeping pace, and the lack of a clear price signal is discouraging efficient water use. Investors should prepare for a **complete overhaul of water management and pricing practices** and an outlay of up to **USD 25trn in water infrastructure spending** in the years ahead.
- We expect a major ramp-up in investor activity on water themes in the next few years, driven by the **sheer extent of the water scarcity problem** and **growth in demand for technologies** that promise more efficient consumption or new supply.
- Climate change is likely to negatively impact fresh water supply and exacerbate water challenges for business in **meaningful but unpredictable ways**.
- A growing number of countries are depleting non-replenishable aquifers to meet water demand, including **China, India, Mexico, Spain, South Korea and the US**.
- Over 40% of researched companies in the **Food Products, Semiconductors and Utilities industries** have a poor water management programme, often characterized by the absence of water policies.
- Companies that compete in a water-intensive industry, have operations in countries that are (or are likely to become) water stressed, and have poor strategic awareness of water risks **stand out as engagement targets** for investors.
- Investors can play water scarcity by investing in the **desalination**, **recycled wastewater** and **water infrastructure sectors**. Sustainalytics' ESG analysis can serve as a useful consideration in security selection within these industries.

Analysts

Doug Morrow
Associate Director, Thematic Research
doug.morrow@sustainalytics.com

Madere Olivar
Associate Analyst, Thematic Research
madere.olivar@sustainalytics.com

Dr. Hendrik Garz
Executive Director, Thematic Research
hendrik.garz@sustainalytics.com

Water – A 21st century investment thematic

Water demand already outstrips today's renewable supply

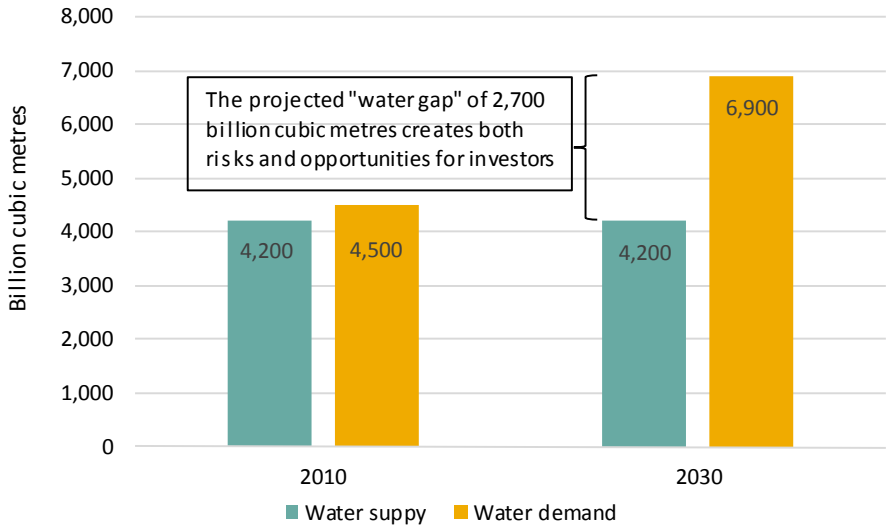
Water may not be a top-of-mind concern for most investors, but it could turn out to be one of the most important investment thematics of the 21st century. The nature of the challenge is that global water demand, which is projected to increase by more than 50% by 2030, already outstrips today's global (renewable) water supply. In this research note, we explore the global water scarcity problem and outline three initial steps that investors can take to **(1)** hedge against water-driven risk and **(2)** capitalize on upside opportunities in their portfolios.

The rationale

Water scarcity can impact companies' cash flow generation

The timing is apt for investors to consider how their portfolios might be impacted by water-driven risks and opportunities. In January the World Economic Forum recognized water scarcity as one of the most important threats facing the global economy.[1] A report released last month by the World Energy Council argues that a massive scale-up of private sector investment in water infrastructure and technology will be needed to avert a global water crisis.[2] And recent evidence shows that water scarcity can impact the productive capacity and cash flow generation of companies (see p. 12).

Projected global water demand vs. supply



Source: 2030 Water Resources Group[3], Sustainalytics

Most investors have not systematically analyzed water

Investor awareness about water issues is increasing. This can be seen in the growth of CDP's water programme, with the number of participating investors up from 137 in 2010 to over 600 in 2015.[4] Despite this encouraging trend, we suspect that most investors face unknown exposure to water risk in their portfolios. Indeed, despite the world's growing water scarcity problem and the essential role that water plays in economic growth and human survival, most investors have not systematically analyzed water from a portfolio risk or opportunity perspective.

Poor disclosure presents challenges for investors

One of the main reasons is the dearth of standardized corporate water use data. Only 1,100 listed companies worldwide currently disclose their annual water consumption, out of a global investable universe of 70,000 listed equities, including about 5,000 mid/large caps.[5] And the lack of comparability of corporate water use data has also been cited as a barrier in portfolio water risk analysis.[6]

Water reporting is improving

While this certainly does not prohibit investor action on water, it typifies the disclosure problem that afflicts other ESG issues and may present challenges for investors looking to tilt their portfolios towards water-efficient companies. Still, water reporting is improving, due in part to growing pressure from institutional investors and tightening disclosure requirements, such as the EU Directive on non-financial reporting, which takes effect in 2017.[7]

Investors may be overlooking water-driven investment opportunities

On the opportunity side, investors are clearly aware of water treatment companies, desalination plays, water utilities, infrastructure firms and other sectors that may *benefit* as water scarcity worsens. But we suspect that some investors are failing to properly value these opportunities by underestimating the scope of the water scarcity problem and future demand for water solutions. The lack of a compelling price signal – water is almost universally under-priced relative to its value – has also been a historic barrier to investment in water infrastructure.

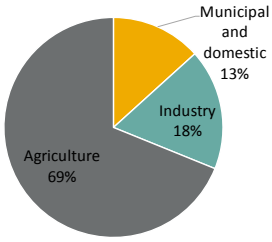
We foresee an increase in demand for water technologies

While we do not anticipate a sudden spike in corporate water disclosure or a path-breaking change in how water is priced (at least over the short run), we expect a significant ramp-up in investor action on water themes in the next few years, from both an engagement and investment integration standpoint. The catalyst, in our view, will be the sheer extent of the water scarcity problem (notably in the developing world) and a surge in demand for water technologies that promise more efficient consumption or new supply.

The water scarcity problem

Understanding demand

Agriculture accounts for 69% of total global water use



Source: 2030 Water Resources Group

The phrase "water scarcity" may connote complex images of hydrological cycles, drainage basis and watersheds, but it can actually be understood from a simple supply and demand perspective. Total global water withdrawal is currently estimated to be 4,500 billion cubic metres.[8] Agriculture accounts for 69% of this demand, followed by industry at 18% and municipal and domestic use at 13%. The bulk of global water use is thus tied to raising livestock and irrigating crops. To give an indication of the agriculture sector's immense water requirements, producing 1kg of meat is estimated to require between 5,000 and 20,000 litres of fresh water, while 1kg of wheat requires between 500 and 4,000 litres.[9]

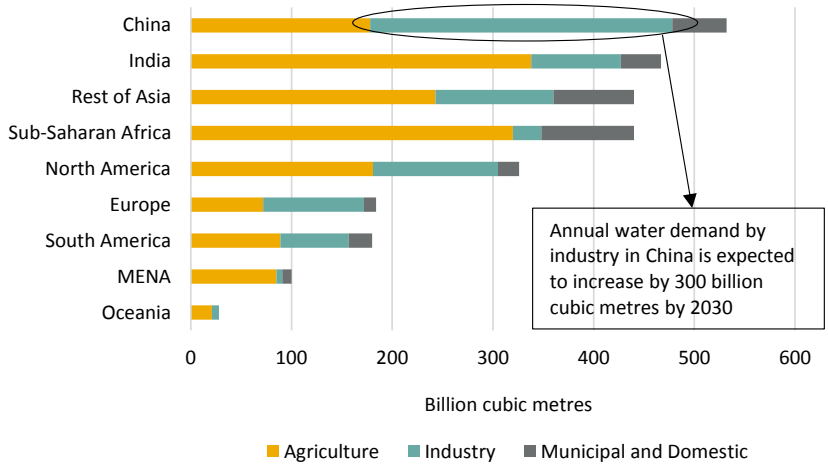
Water demand is a function of population and economic growth, as well as urbanization and rising meat consumption

According to the 2030 Water Resources Group, global water use is expected to reach 6,900 billion cubic metres by 2030, up more than 50% from current levels.[10] This increase will be driven by population growth (the Earth's population is forecasted to reach 8.5 billion by 2030, up from 7.4 billion today), economic development and continued urbanization. An additional demand driver is rising per-capita meat consumption. The OECD forecasts that global meat consumption will increase more than 4% per person over the next 10 years, partly due to a wealth effect in emerging markets.[11] That water use has been growing at more than twice the rate of the global population over the last century indicates how dependent the global economy has become on fresh water.

Water demand is growing rapidly in India, sub-Saharan Africa and China

The most important growth centres in water demand over the next 15 years are projected to be the agricultural sector in India (driven mainly by irrigation needs for rice, wheat and sugar), the agricultural sector in sub-Saharan Africa (driven by the irrigation of maize, sorghum and millet) and the industrial sector in China (driven mainly by the needs of thermal power generation companies).[12] By 2030, industry in China is expected to require an additional 300 billion cubic metres of water per year, which is more than 40% of China's total current water consumption.

Projected increase in annual water demand, 2005–2030



Source: 2030 Water Resources Group

Understanding supply

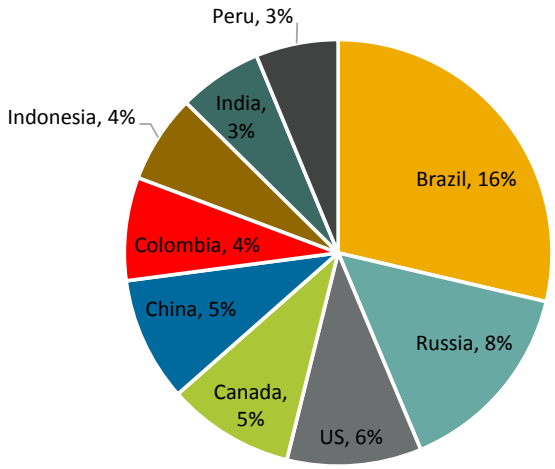
Less than one third of the world's fresh water is easily accessible

Only 2.5% of the world's water is fresh (the rest is salt water), and only 30% of this fresh water is easily accessible (i.e. found in lakes, rivers and aquifers, not frozen in glaciers, ice caps or ice sheets). And of this "accessible" supply, only a portion can be delivered sustainably (i.e. without drawing down non-replenishable aquifers). On top of these limitations, there is the question of water infrastructure. In many countries, inadequate or ageing surface water supply infrastructure – pumping stations, reservoirs, water pipes, storage tanks, watermains – prevents even easily accessible fresh water resources from being (sustainably) exploited. It has been estimated that 45 million cubic metres of fresh water are lost every day through underground leaks in the developing world alone.[13] While water from leaky pipes is not "lost" – it simply goes back into the water table – it cannot be used to meet (rising) short-term needs. Partly due to a lack of water infrastructure, over 750 million people, or 10% of the world's population, do not have access to clean drinking water.[14]

The amount of accessible fresh water that can be sustainably accessed with current infrastructure is 4,200 billion cubic metres

Thus, while the total supply of accessible fresh water has been estimated to be 10,600,000 billion cubic metres,[15] only a fraction of this amount can be reached with current water infrastructure and sustainably exploited to meet the (growing) needs of agriculture, industry and households.[16] The 2030 Water Resources Group estimates that the amount of accessible fresh water that can be sustainably exploited with current infrastructure is 4,200 billion cubic metres.[17] Over 50% of this resource is held by the world's nine water giants, as shown below.

Share of global fresh water held by the world's nine water giants



Source: Aquastat[18]

The risk of fresh water contamination

Fresh water is under threat of contamination

An added threat to the global supply of accessible freshwater is the growing risk of fresh water contamination from industrial discharge, agricultural runoff, domestic waste, chemical contaminants and/or sewer infiltration. Though water pollution of this sort can be treated with wastewater technologies, many countries, particularly in emerging markets, lack adequate access to sanitation infrastructure.

Climate change as a wild card

Climate change is likely to negatively impact water supply

Climate change is a final consideration in understanding global fresh water supply. As concluded by the IPCC, "freshwater resources are vulnerable and have the potential to be strongly impacted by climate change."[19] Climate change has been associated with changing rainfall patterns, longer and drier droughts, reduced snow cover and widespread melting of ice, and changes in soil moisture and runoff. Rising sea levels may also contaminate rivers, lakes and other sources of fresh water located along coastal regions. Although one assumes governments would implement measures to protect their fresh water resources against this threat, recent evidence suggests that cities around the world are largely unprepared to defend against the effects of sea level rise.[20] It is outside the scope of this note to fully analyze the impact of climate change on global water supply, and the specific effects are certainly difficult to measure, but it is widely acknowledged that climate change will exacerbate water challenges for business and increase the number of water-scarce regions.

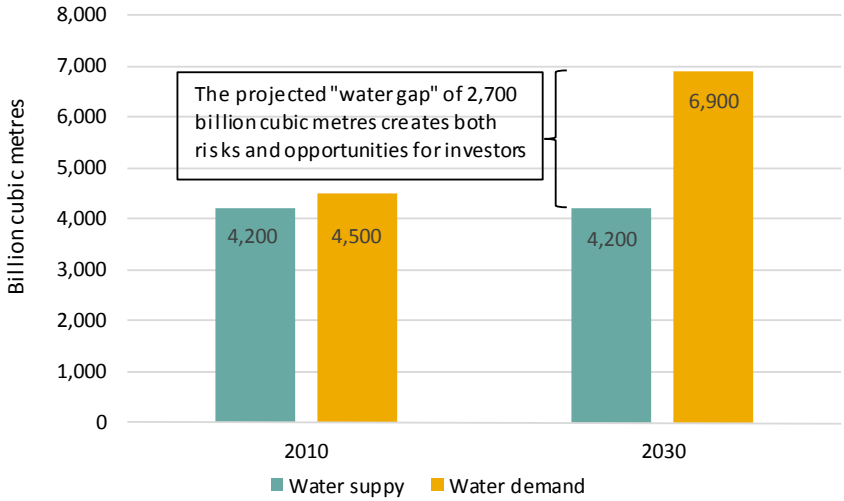
The water gap

Existing water use is already above total renewable supply – The shortfall is mostly met by tapping non-replenishable aquifers

The main implication of this analysis is that we may be moving toward a scenario where global water demand will vastly outstrip global (renewable) water supply. The projected withdrawal in 2030 of 6,900 billion cubic metres would be a full 40% higher than the current (sustainable) supply of fresh water (4,200 billion cubic metres). This points to a potential "water gap" of 2,700 billion cubic metres in 2030. In fact, current water

demand, at 4,500 billion cubic metres, is *already* above the amount of accessible fresh water that can be sustainably withdrawn: the shortfall is mostly met from tapping non-replenishable aquifers. While this is clearly an unsustainable strategy over the long run, many countries are relying on aquifer depletion to meet current demand, including China, India, Mexico, Spain, South Korea and parts of the US (notably Mississippi).[21]

Projected global water demand vs. supply



Source: 2030 Water Resources Group, Sustainalytics

Water productivity in agriculture is improving at 1% per year

A gap between water demand and supply could theoretically be met by improvements in conservation and water use efficiency (i.e. farmers, companies and households stretching the use of each water input) or, up to a certain point, through an increase in fresh water supply (i.e. from new investments in water infrastructure). However, historic levels of progress on both fronts has been poor. Water productivity in agriculture, for instance, as measured by the amount of output per unit of water (or "crop per drop"), is estimated to be improving by about 1% per year.[22] A similar rate of improvement is occurring in industry, although, as we discuss on p. 13, this masks significant differences across industrial sectors. Remarkably, the UN Food and Agriculture Organization estimates that 60% of the water currently used in irrigation is wasted, through runoff into waterways or evapotranspiration.[23]

Water scarcity is not being met with a "normal" market response

One of the main reasons for the modest track record in water efficiency and water provision is the lack of a compelling price signal: water tends to be under-priced relative to its value. When demand outstrips supply in a normal market, prices rise, which discourages further demand at the margin and encourages increased supply. A good example is oil. When prices hit USD 147 per barrel in 2008, this led to an increase in unconventional production (including Canada's oil sands) and motivated consumers to become more strategic about their oil use (as we saw with the decline in SUV sales). But the situation with water is fundamentally different. Governments control the vast proportion of global water resources, and there is tremendous resistance to putting a market price on water. While this makes sense from a humanitarian standpoint – the UN has recognized access to water as a human right – it does not send the appropriate price signal to corporates or investors, and does not incentivize responsible water

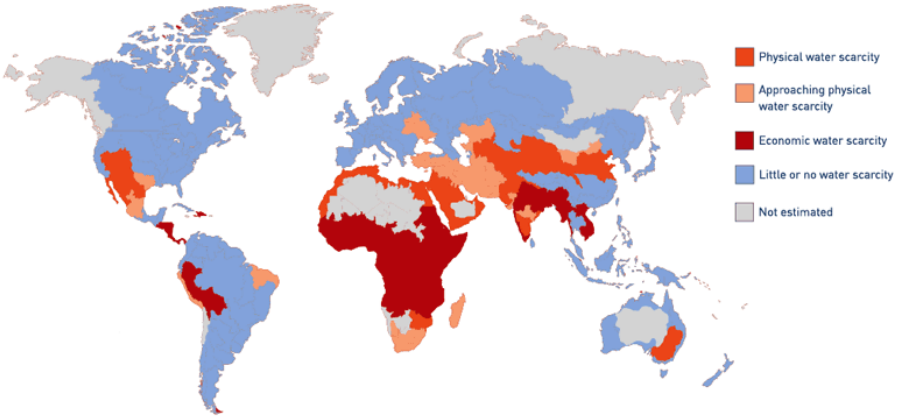
management. The 2030 Water Resources Group estimates that, at historical levels, improvements in efficiency and new supply will close less than half of the projected 2,700 billion cubic metre water gap in 2030.

Water scarcity – A distinctly localized phenomenon

Most countries have enough water to meet their growing needs

Like any forecast, the 2030 Water Resource's Group water gap estimate contains uncertainty. But the underlying principle is clear – water demand is surging, supply is not keeping pace, efficiency gains have been hindered by the lack of a pricing signal, and a growing number of countries are resorting to pumping groundwater from non-replenishable aquifers to meet demand. All of these factors are exacerbating the global water scarcity problem, which already affects 2.7 billion people around the world for at least one month of every year.[24] Yet, due to vast differences across countries in both water requirements and fresh water supply, water scarcity remains a local problem, not a global one. As succinctly expressed by the 2030 Water Resources Group, "most countries have more than enough water to supply their populations' growing needs."[25]

Areas of physical and economic water scarcity



Source: FEW Resources[26]

The map above shows regions already experiencing physical and economic water scarcity.[27] Regions under the highest water stress include:

- the Yangtze and Yellow river basins in **China**;
- the Cauvery Delta River basin in **India**;
- the Orange-Senqu basin, covering parts of **South Africa**, **Botswana** and **Namibia** and all of **Lesotho**;
- the Amu Darya basin, covering parts of **Tajikistan**, **Afghanistan** and **Uzbekistan**;
- the Persian Gulf states (**Saudi Arabia**, **Kuwait**, **United Arab Emirates**, **Qatar**, **Bahrain** and **Oman**);
- the Pacific basin in **Peru**;
- the Cantareira system in **Brazil**;
- the Murray-Darling basin in **Australia**; and
- the Colorado River basin in the **US**.

China's South-North water transfer project is one of the largest engineering projects in the world

As discussed on p. 7, three of these water scarcity hotspots – China, India and sub-Saharan Africa – are precisely those regions that are projected to experience the highest growth in water demand by 2030. While the Chinese, Indian and South African governments are plainly aware of these risks and are taking steps to improve water management, the most ambitious measures are being taken in China. Beijing has introduced national water usage caps and set aside USD 6trn to be spent on water infrastructure between 2011–2020.[28] The centrepiece project is the South-North Water Transfer Project, which aims to channel over 40 billion cubic metres of fresh water each year from the Yangtze river.[29] Despite these efforts, water will remain a question of critical strategic and commercial importance for China in the years ahead.

Strategies for investors

In this section we outline the implications of the water scarcity problem and identify three initial steps that investors can take to protect against downside water risk and capitalize on upside investment opportunities in their portfolios.

Assess exposure

There are eight water-intensive industries outside of agriculture

An investor's exposure to water risk will depend heavily on **(1)** the water requirements of their portfolio companies, which vary significantly by industry, and **(2)** the location of their portfolio companies' operations. There are eight industries outside of agriculture that are typically considered to have the largest water requirements.

Water-intensive industries

- **Food Products.** The primary exposure for food and beverage companies is indirect, as they use (water-intensive) agricultural products, including meat and cereals, as raw ingredients. Fresh water is also used in the production of sodas, spirits, beers, juices, and other food and beverage products.
- **Utilities.** Electric power generation has the second-largest water requirement after agriculture. Large quantities of water are used to create steam and cool turbines in thermal generation plants, including nuclear.
- **Automobiles.** Water is used in surface treatment and coating, paint spray booths, washing/rinsing vehicles and air conditioning systems. It is estimated that producing a single vehicle may require up to 145,000 litres of water.
- **Precious Metals**. Water is used in resource recovery and processing, tailings management and dust control. Gold and copper mines are particularly water intensive, as water is used to chemically process ore bodies.
- **Oil & Gas**. Water is used in upstream activities (conventional oil and gas production, enhanced oil recovery and hydraulic fracturing) and downstream activities. (refining, steam production and cooling).
- **Forestry**. Water is used in pulp making, processing and paper manufacturing. Producing one tonne of pulp requires an estimated 64,000 litres of water.
- **Semiconductors**. Water is a key requirement in semiconductor manufacturing. Producing a single wafer requires an estimated 7,500 litres of ultrapure water.
- **Textiles**. Water is used in "wet processing" and dyeing of fabric. Producing a pair of jeans is estimated to require up to 1,800 litres of water.

Food Products companies are uniquely exposed to water risk

Food Products is unique among other water-intensive industries, as it is doubly exposed through its own operations (many food and beverage products, including sodas and spirits, require large volumes of water) and through its supply chain (food companies significantly depend on agricultural inputs such as cereals and beef, whose supply may be threatened from water scarcity). The Textiles industry could also move in this direction, as low labour costs in East Africa, as well as a favourable trade agreement with the US, is likely to shift the epicentre of textile production to Ethiopia, Kenya, Tanzania and Uganda, countries prone to both physical and economic water scarcity.[30]

The financial impact of water constraints

As we have seen numerous times in recent years, lack of water can put constraints on firm production, with negative potential effects on cash flow and earnings. The table below shows recent salient examples of water-driven business impacts across industries.

Examples of water-driven business impacts, 2013–2016

Company	Date	Industry	Location	Description
NTPC	Mar-2016	Utilities	Kolkata, India	NTPC is forced to shut down its 1,600 MW Farakka thermal power plant due to a water shortage, which leads to an increase in power prices on the India energy exchange.
EDELCA	Mar-2016	Utilities	Caracas, Venezuela	A prolonged drought reduces electricity output from the Guri dam and forces the government to ration electricity and water supplies.
Growthpoint Properties	Mar-2016	Real Estate	Johannesburg, South Africa	The worst drought in South African history led to a 33% reduction in the country's corn harvest in 2015 and contributed to general economic weakening. Property companies are struggling with rising vacancies and unpaid rents.
KPCL	Mar-2016	Utilities	Karnataka, India	Water scarcity forces the shutdown of two units at the Raichur Thermal Power Station, a 1750 MW thermal power station.
Sabesp	Sep-2015	Utilities	Sao Paulo, Brazil	Brazil's worst drought in 80 years leads to an 80% collapse in net income for Sabesp, Brazil's largest publicly traded water utility.
Starbucks	May-2015	Food Products	California, US	Starbucks elects to move its bottled water business from California to Pennsylvania due to drought conditions.
EDP	May-2015	Utilities	Sao Paulo, Brazil	EDP tells investors that impacts from the ongoing drought in Brazil could reduce earnings by USD 167–223m in 2015.
J.M. Smucker	Apr-2015	Food Products	Sao Paulo, Brazil	Increases prices on Folger's K-Cup coffee packs by 8% in response to negative impact of Brazil's drought on coffee harvest.
Campbell Soup	Mar-2015	Food Products	California, US	Reports a 28% decline in profits at its California-based carrot divison due in part to drought conditions.
Anglo American	Jan-2015	Diversified Metals	Atacama, Chile	The company discloses that water constraints at the Los Bronces copper mine in Chile have led to “a material decrease in production”.
GrainCorp	Nov-2014	Food Products	Brisbane, Australia	GrainCorp discloses a 64% drop in 2014 profits due to drought conditions that impact grain deliveries and exports.
Coca-Cola	Jun-2014	Food Products	Uttar Pradesh, India	Coca-Cola is forced to abandon an USD 81m bottling factory in India due in part to local water shortages and allegations of excessive water use.
Infosys	Jul-2013	Software & Services	Chennai, India	A severe water shortage pushes Infosys to the brink of a shutdown. Projected losses were estimated to be more than USD 1m per day.

Source: Sustainalytics, Ceres[31]

Water intensity

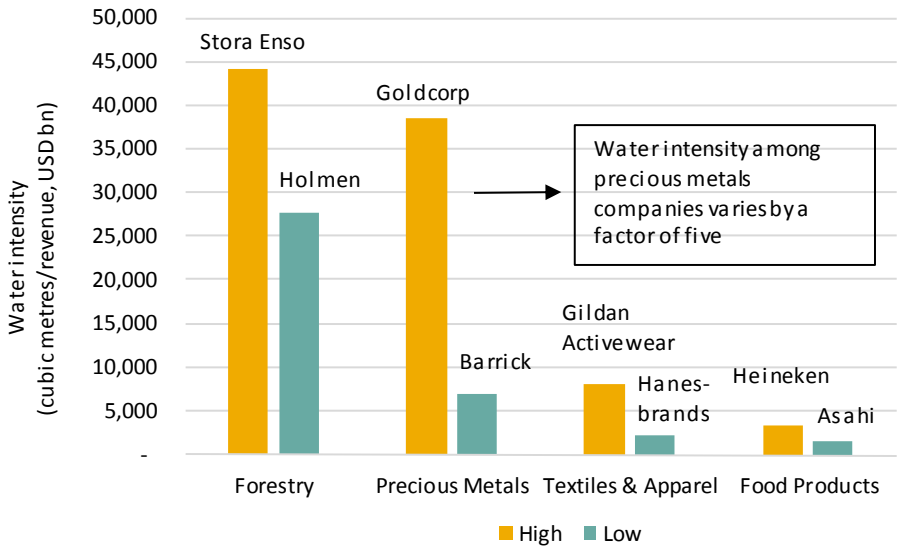
Water intensity can help investors assess their exposure

One way that investors can evaluate differences in water requirements across and within industries is to consider companies' water intensity, which measures annual water consumption over revenue.[32] While water intensity does not provide information about the location of a company's operations, which as mentioned above is one of the two primary drivers of water risk, it can be used to identify companies with particularly high water usage (adjusted for size and relative to industry norms), indicating a need for further investigation.

Water intensity can vary by as much as a factor of five

The chart below looks at the water intensity of companies in four of the eight water-intensive industries.[33] Special attention was taken to compare peers that compete against each other in the same sub-industry segment. Our analysis shows that water intensity can vary by as much as a factor of five, as exemplified in the Precious Metals industry (38,412 for **Goldcorp**, compared to 6,900 for **Barrick Gold**). We also found notable discrepancies in the Textiles & Apparel industry (8,088 for **Gildan Activewear** vs. 2,146 for **Hanesbrands**) and in the beer segment of the Food Products industry (3,367 for **Heineken** vs. 1,461 for **Asahi Group**).

Ranges of water intensity by industry



Source: Sustainalytics

A successful water engagement

Hanesbrands is a particularly interesting example because it illustrates the potential of investor engagement to catalyze improvements in corporate water management. Following a shareholder resolution filed by Calvert Investments in 2011, Hanesbrands committed to boost water efficiency targets, improve water disclosure and favour cotton from areas with low water stress (steps that Hanesbrands has subsequently taken).[34]

The table on p. 14 compiles overall ESG performance information for the water intensity leaders and laggards identified in the chart above. This analysis shows that superior water intensity does not necessarily correlate with a superior overall ESG score; in fact,

in three industries out of four, the company with higher water intensity earned a higher overall ESG score than its more water-efficient peer. This may indicate that otherwise strong ESG performers have yet to adequately focus on water management. It may also reflect the multi-factor nature of Sustainalytics' ESG model, which captures company performance on a range of material ESG issues.

Water intensity leaders and laggards in water-intensive peer groups

Company	Peer Group	Country	Water intensity (water use/revenue), 2012	P/E Ratio (TTM)*	ESG Score	Relative position
Stora Enso	Forestry	Finland	44,041	7.5	81/100	Outperformer
Holmen	Forestry	Sweden	27,621	60.8	85/100	Industry Leader
Goldcorp	Precious Metals	Canada	38,412	N/A	72/100	Outperformer
Barrick	Precious Metals	Canada	6,900	556.2	68/100	Average Performer
Gildan Activewear	Textiles & Apparel	Canada	8,088	20.6	73/100	Outperformer
Hanesbrands	Textiles & Apparel	US	2,146	16.4	57/100	Average Performer
Heineken	Food Products	Netherlands	3,367	23.8	75/100	Industry Leader
Asahi Group	Food Products	Japan	1,461	20.3	64/100	Average Performer

* Trailing twelve months. Data as of 11 April 2016.

Source: Sustainalytics, Bloomberg

Using water data in security selection

Investors can apply water intensity analysis in their engagement strategies or in their investment process, for example by integrating water intensity or other measures of corporate water performance into their security selection model. For fiduciary investors, this approach would obviously need to be executed alongside measures of corporate financial performance, and for most investors water-based considerations are likely to be marginal. Nevertheless, our expectation is that a growing number of portfolio managers will develop innovative tools to assess companies' water performance and hedge against portfolio water risk in the years ahead.

Engage management

Risk exposure can be mitigated by water programmes

Another step investors can take to minimize water risk in their portfolios is through engagement. We recommend that investors engage with their portfolio companies (particularly those that are classified in water-intensive industries) not only to verify water use trends and facility-level geographic information but to understand management's approach to water management. While the bulk of a company's water risk is driven by the location of its operations and its absolute water requirements, exposure can be mitigated by a sophisticated water management strategy, which includes water use policies, reduction and efficiency programmes, and board-level oversight of corporate water performance.

Environmental regulators can alter the amount of water that companies can legally withdraw

A practical benefit of a superior water management programme is that it can help companies respond to newly imposed reductions on their water allowances, which is a growing business concern in water-intensive industries. This risk can be seen in the experience of **Goldcorp** at its Cerro Negro Norte project in northern Chile. When Goldcorp acquired the mine in 2010, it came with water rights of 207 litres per second. However, Chile's environmental authority subsequently overruled this allowance and

set a new maximum of 54 litres per second, a 74% decrease.[35] Companies following best practice in water management can adapt to such exogenous constraints more easily (although complying with a 74% allowance reduction would clearly exhaust even the most ambitious efficiency programme).

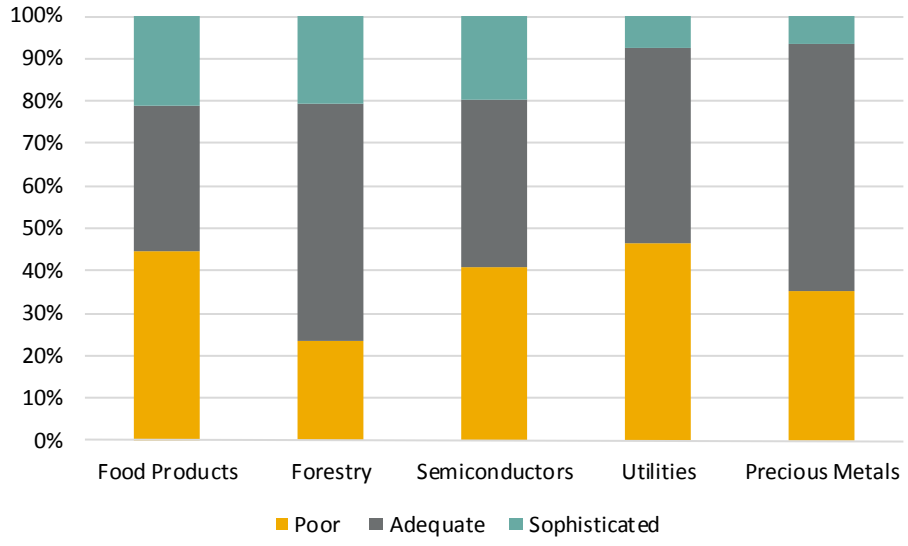
Best practices in corporate water management

- Develop an enterprise-wide water reduction and efficiency programme;
- Set site-specific water reduction targets;
- Build analytical tools to assess suppliers' water risk and management;
- Implement water-efficient manufacturing processes;
- Exhaust internal conservation measures;
- Boost capital expenditures on water management;
- Ensure board-level oversight of water issues.

Only a small minority of researched companies have developed a sophisticated water management programme

Sustainalytics' research demonstrates that strong water management programmes are the exception rather than the norm in most water-intensive industries. As shown in the chart below, which looks at five of the eight water-intensive industries,[36] only a small minority of companies have developed what we consider to be a sophisticated water management programme. In the Precious Metals industry, for instance, only five companies out of 77 (6%) have implemented such a programme (**Agnico Eagle Mines**, **Anglo American Platinum**, **Harmony Gold Mining**, **Lonmin** and **Randgold Resources**). At the other end of the spectrum, over 40% of researched companies in the Food Products, Semiconductors and Utilities industries demonstrate a poor water management programme, and frequently lack water policies.

E.1.3.4 Water management programmes



Source: Sustainalytics

A total water risk perspective

From a total water risk point of view, investors should be particularly concerned about companies that **(a)** compete in a water-intensive industry; **(b)** have operations in countries that are water stressed or are likely to become water stressed; and **(c)** have a

weak water management programme (or fail to disclose a programme). Companies within our coverage universe that meet these conditions include:

- Australia's **Resolute Mining**;
- China's **Guangdong Electric Power Development** and **Huaneng Power;**
- India's **JSW Energy** and **NTPC**;
- Egypt's **Juhayna Food Industries**.

Investors would be well advised to engage with these and similar companies in the pre-investment phase to clearly understand management's water strategy and strategic vision for adapting to water scarcity, as the absence of a long-term water management plan could present material financial risk.

Capitalize on upside opportunities

A compelling investment thesis

The world's growing water scarcity problem is also likely to create opportunities for investors. Opportunities are being driven by the same scenario that is creating risk: global water demand is surging due to population growth and other factors, growth in water supply is not keeping pace (and may even be negatively impacted by climate change), and efficiency gains are being discouraged by the lack of a compelling pricing signal. These trends are combining to exacerbate water scarcity, which is negatively impacting human health, food production and the productive capacity of companies in certain industries and geographies. Moreover, a growing number of countries are having to resort to pumping groundwater from non-replenishable aquifers to meet their domestic water gap.

Solutions are also needed in the short run

Against this backdrop, it is clear that a wholesale change is needed in how global water resources are managed. New policies, pricing mechanisms and incentives, in addition to a massive scale-up in public and private sector financing, will almost certainly be required. But because fresh water is indispensable, solutions will also be needed in the short run. While it is outside the scope of this research note to cover the full range of water-driven investment opportunities, we profile below three sectors that may benefit within an increasingly water-scarce economy.

Desalination

Desalination is forecasted to grow at a 10% CAGR out to 2020

Desalination is a supply-side solution to the water scarcity problem, as it turns seawater and brackish water into fresh water. The market is forecasted to grow at a 10% compound average growth rate out to 2020, which is in line with historic growth rates.[37] The advantages of desalination are that it is a proven technology, it taps the virtually unlimited supply of seawater, and it does not depend on rainfall, which means it can be used to generate fresh water in arid regions.

Costs are falling, but desalination is still expensive

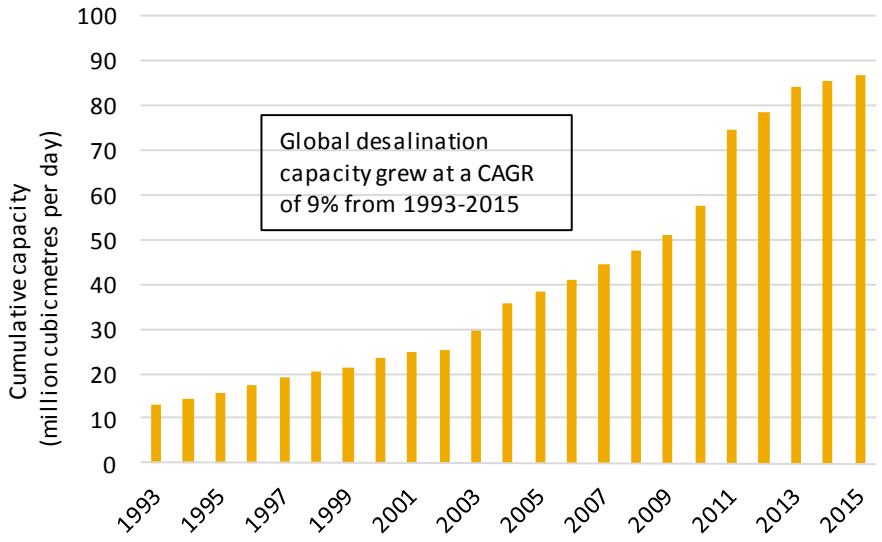
The major disadvantage is that is expensive. While costs have fallen about 50% over the last thirty years due to improvements in membrane technology, they are still in the range of range of USD 0.45 to 1 per cubic metre, which is more expensive than recycling wastewater or simple conservation measures.[38] Desalination is particularly problematic in inland regions or high-altitude locations, due to the high cost of pumping water.

Desalination is also controversial from an environmental perspective. Both methods, distillation and reverse osmosis, require large amounts of energy and produce significant quantities of brine. Desalination may therefore be out of step in an economy that is moving towards carbon reduction targets as specified in the Paris Agreement.

Desalination powered by renewables?

However, the use of renewables in the desalination sector is an emerging and environmentally attractive solution to this problem. A small but growing number of desalination facilities are powered by a combination of renewables (solar and wind power) and batteries, including the Al Khafji desalination plant in Saudi Arabia (scheduled to be completed next year) and numerous facilities in the Baja region of Mexico.[39]

Cumulative growth in desalination capacity



Source: Desaldata.com[40], Water Consultants International[41], Sustainalytics[42]

Future growth in China, India and the US

While desalination is not a panacea to the water scarcity problem, we expect a growing number of countries will turn to desalination in the years ahead to meet part of their domestic water gap. Indeed, some countries may turn to desalination technologies because they *have to*. Desalination has historically been concentrated in the Middle East and North Africa – these regions account for half of current global desalination capacity – but future growth centres are projected to be China, India and the US.

Acciona, Veolia Environment and GE have sophisticated environmental programmes

Companies involved in desalination that exhibit strong environmental management include Spain's **Acciona**, whose water business manages 70 desalination plants and specializes in reverse osmosis technologies; France's **Veolia Environment**, which operates 1,700 desalination plants in over 80 countries; and **GE**, whose water segment, GE Water, offers diversified desalination products and services. In terms of overall ESG performance, Acciona is an industry leader, GE is assessed as an outperformer and Veolia Environment is assessed as an average performer. However, all three companies are sophisticated environmental performers and have implemented advanced environmental management systems (EMS), which should help to minimize the

operational risks associated with managing desalination plants (e.g. wastewater discharges).

Recycled wastewater

Recycling wastewater is essentially an efficiency play

Recycling wastewater is a "downstream" supply solution that involves treating wastewater (sewage) to remove solids and impurities. The reclaimed water can be used for irrigation, industrial uses and for drinking. Infrastructure requirements include water treatment facilities, storage tanks, screens, chemical agents, pumping stations and a network of water pipes. Wastewater recycling is essentially an efficiency play, and while it does not address the availability of the upstream water resource, it allows for the extended use of water inputs. Recycling wastewater is less costly than desalination because it demands less energy. Costs are estimated to be in the range of USD 0.26 to 0.46 per cubic metre.[43]

We expect demand for wastewater treatment technologies to rise

We expect that demand for wastewater treatment processes and technologies will increase as a response to the water scarcity problem, particularly in water-scarce regions in both developed and emerging markets. Companies with established competencies in these areas are likely to be sought after by governments and other businesses in technology deals.

Top ESG players in the wastewater treatment space include Suez Environnement, American Water Works and Severn Trent

Multi- and water utilities involved in wastewater treatment that exhibit strong ESG performance include France-based **Suez Environnement**, which operates 2,200 wastewater treatment sites globally; **American Water Works**, which manages 81 surface water treatment plants in the US and Canada and offers water management services to businesses and communities; and UK-based **Severn Trent**, which produces recycled wastewater and offers water purification serves. Suez Environnement is an industry leader on overall ESG performance and is distinguished by its exceptional environmental policies. American Water Works is an outperformer with best-in-class environmental reporting. While Severn Trent is assessed as an average performer, partly due to some gaps in community policies, the company has a robust environmental policy and sources more than 10% of its energy needs from renewable sources (including methane recovery projects at its sewage treatment facilities), which we view as a proxy for environmental sophistication.

Infrastructure

The world's water infrastructure needs are staggering

Companies that manufacture and supply water infrastructure, such as water pipelines, smart meters, pumps, valves and analytic equipment, may also benefit as ageing water infrastructure in the developed world is replaced, and as greenfield water infrastructure projects are launched in developing countries. The amount that will need to be spent on water infrastructure over the next 20 years is staggering, as much of the water and wastewater infrastructure in the developed world is more than 50 years old and in need of repair or replacement. The water infrastructure needs of the US alone have been estimated to be USD 500bn over the next 20 years, while the global figure has been estimated USD 25trn.[44] While these estimates could prove to be inflated, demand for water infrastructure will almost certainly rise sharply in the years ahead.

Our top ESG performers in the water infrastructure sector include Geberit, Sulzer and Xylem

Companies involved in water infrastructure that exhibit strong ESG performance include Switzerland-based **Geberit**, which produces faucets and flushing systems, traps, piping and draining systems and shower channels; **Sulzer**, whose Pumps Equipment division produces pumps and systems for engineered, configured and standard pumping solutions; and US-based **Xylem**, which designs and manufactures water pumps, valves, filtration devices and analytic equipment. Geberit is an industry leader on overall ESG performance, and Sulzer and Xylem are both assessed as outperformers. All three companies have developed sophisticated ESG policies and demonstrate a clear understanding of the importance of managing water-related ESG risks.

Upside themes that may benefit from water scarcity

Theme	Company	Peer group	Country	P/E Ratio (TTM)*	ESG Score	Relative position
Desalination	Acciona	Utilities	Spain	25.3	84/100	Industry Leader
	Veolia Environnement	Utilities	France	30.7	69/100	Average Performer
	GE	Industrial Conglomerates	US	26.2	66/100	Outperformer
Recyled Wastewater	Suez Environnement	Utilities	France	16.8	82/100	Industry Leader
	American Water Works	Utilities	US	26.8	74/100	Outperformer
	Severn Trent	Utilities	UK	35.3	69/100	Average Performer
Infrastructure	Geberit AG	Building Products	Switzerland	31.4	78/100	Industry Leader
	Sulzer	Machinery	Switzerland	35.7	73/100	Outperformer
	Xylem	Machinery	US	22.6	73/100	Outperformer

* Trailing twelve months. Data as of 11 April 2016.

Source: Sustainalytics, Bloomberg

Conclusion – Assessing risks, reviewing opportunities

Water could become a major 21st century investment thematic

It is difficult to avoid the conclusion that water will become one of the most important ESG issues, public policy concerns and investment thematics of the 21st century. Water scarcity is a real and growing problem, and the competitive impacts for business are intensifying. In this report we have outlined three initial steps that investors can take to hedge against water-driven risk and capitalize on upside opportunities in their portfolios. While investors' exposure to water risk will depend heavily on the water requirements of their portfolio companies and the location of their portfolio companies' operations, a variety of steps can be taken at the individual company level to mitigate risk exposure. It is clear that demand for water solutions and technologies will increase in the years ahead, notwithstanding the challenges posed by current water pricing policies. The desalination, wastewater recycling and water infrastructure sectors are all poised to benefit as the water scarcity problem worsens, and investors would be well advised to explore opportunities in these growing markets.

Endnotes

1 World Economic Forum (2016), "The Global Risks Report 2016: 11th Edition", World Economic Forum, last accessed (07.04.2016) at: http://www3.weforum.org/docs/Media/TheGlobalRisksReport2016.pdf

2 World Energy Council (2016), "World Energy Perspectives 2016", World Energy Council, last accessed (07.04.2016) at: https://www.worldenergy.org/wp-content/uploads/2016/03/The-road-to-resilience-managing-the-risks-of-the-energy-water-food-nexus_-early-findings-report.pdf

3 The 2030 Water Resources Group (2009), "Charting our water future", McKinsey & Company, last accessed (07.04.2016) at: http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/charting-our-water-future

4 CDP (2015), "Accelerating action: CDP Global Water Report 2015", CDP, last accessed (07.04.2016) at: https://www.cdp.net/en-US/Pages/events/2015/water/Global-Water-Report-2015.aspx

5 Yow, M. (2015), "Measuring sustainability disclosure: ranking the world's stock exchanges, 2015", Corporate Knights Capital, last accessed (07.04.2016) at: http://www.corporateknights.com/reports/2015-world-stock-exchanges/

6 Freyman, M., Collins, S., Barton, B. (2015), "An investor handbook for water risk integration", Ceres, last accessed (04.11.2016) at: http://www.ceres.org/issues/water/water-and-esg-risk

7 Office Journal of the European Union (2014), "Directive 2014/95/Eu Of The European Parliament And Of The Council", European Parliament and the Council of the European Union, last accessed (07.04.2016) at: http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014L0095&from=EN

8 The 2030 Water Resources Group (2009), op. cit.

9 Sedghi, A. (2013), "How much water is needed to produce food and how much do we waste?", The Guardian, last accessed (07.04.2016) at: http://www.theguardian.com/news/datablog/2013/jan/10/how-much-water-food-production-waste

10 The 2030 Water Resources Group (2009), op. cit.

11 Reubold, T. (2015), "These maps show changes in global meat consumption by 2024. Here's why that matters.", ensia, last accessed (07.04.2016) at: http://ensia.com/articles/these-maps-show-changes-in-global-meat-consumption-by-2024-heres-why-that-matters/

12 The 2030 Water Resources Group (2009), op. cit.

13 Stewart, I. (2014), "How can our blue planet be running out of fresh water?", BBC, last accessed (07.04.2016) at: http://www.bbc.co.uk/guides/z3qdd2p

14 The Water Project (2014), "Facts about water: Statistics of the water crisis", The Water Project, last accessed (07.04.2016) at: https://thewaterproject.org/water_stats

15 USGS (1993), "Spheres representing all of Earth's water, Earth's liquid fresh water, and water in lakes and rivers", The USGS Water Science School, last accessed (04.11.2016) at: http://water.usgs.gov/edu/gallery/global-water-volume.html

16 Aquastat (2016), Aquastat datasets, Food and Agriculture Organization of the United Nations, last accessed (07.04.2016) at: http://www.fao.org/nr/water/aquastat/sets/index.stm

17 The 2030 Water Resources Group (2009), op. cit.

18 Aquastat (2016), op. cit.

[19] Bates, B., Kundzewicz, Z. W., Wu, S. and Palutikof, J. (2008), "Climate Change and Water: IPCC Technical Paper VI", Intergovernmental Panel on Climate Change, last accessed (07.04.2016) at: http://ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf

[20] Worland, J. (2016), "Why we're not prepared for the coming decades of sea level rise", Time, last accessed (07.04.2016) at: http://time.com/4234290/sea-level-rise-preparation/

[21] Brown, L. (2013), "Aquifer depletion", The Encyclopedia of Earth, last accessed (07.04.2016) at: http://www.eoearth.org/view/article/150159/

[22] The 2030 Water Resources Group (2009), op. cit.

[23] Wenzlau, S. (2013), "To combat scarcity, increase water-use efficiency in agriculture", Worldwatch Institute, last accessed (07.04.2016) at: http://www.worldwatch.org/combat-scarcity-increase-water-use-efficiency-agriculture-0. Evapotranspiration is the sum of evaporation and plant transpiration from the Earth's land and ocean surface to the atmosphere.

[24] WWF (2014), "Threats – Water Scarcity", WWF, last accessed (07.04.2016) at: http://www.worldwildlife.org/threats/water-scarcity

[25] The 2030 Water Resources Group (2009), op. cit.

[26] FEW Resources.org (2015), Water Scarcity, accessed (07.04.2016) at: http://www.fewresources.org/water-scarcity-issues-were-running-out-of-water.html

[27] Physical water scarcity is defined as a scenario where more than 75% of renewable water supply is being withdrawn. Economic water scarcity is defined as a scenario where water resources are plentiful, but a lack of infrastructure prevents local businesses, households and farmers from easily accessing the water.

[28] China Water Risk (2012), "Big Picture: China Water Crisis", China Water Risk, last accessed (07.04.2016) at: http://chinawaterrisk.org/big-picture/

[29] International Rivers (2016), "South-North Water Transfer Project", International Rivers, last accessed (07.04.2016) at: https://www.internationalrivers.org/campaigns/south-north-water-transfer-project

[30] Guguyu, O. (2016), "Kenya: Govt sets up textile investors near power plants to cut costs", allAfrica, last accessed (04.14.2016) at: http://allafrica.com/stories/201603180375.html

[31] Roberts, E. and Barton, B. (2015), "Feeding ourselves thirsty: How the food sector is managing global water risks", Ceres, last accessed (07.04.2016) at: http://www.ceres.org/issues/water/agriculture/water-risks-food-sector

[32] Normalizing water consumption by revenue allows for cross-industry comparison, but within industries we would recommend that investors use a metric that is more closely tied to production, such as tonnes of ore processed or units of clothing manufactured.

[33] Data collected by Sustainalytics from company reports. Based on 2012 water and revenue data. Remaining industries excluded due to insufficient disclosure.

[34] Frieder, J. (2013), "Shareholder pressure is forcing companies to address their water risk", The Guardian, last accessed (04.11.2016) at: http://www.theguardian.com/sustainable-business/shareholder-pressure-companies-water-risk

[35] Trinidad, P.A. (2015), "Environmental and water rights regulations for the development on mining Projects in Chile", Montt Y Cia S.A, presentation at 2016 PDAC conference, last accessed (04.11.2016) at: http://www.pdac.ca/convention/programming/presentation-reception-rooms/sessions/presentation-reception-rooms/regulatory-news-for-mining-exploration-and-extraction-industry-in-chile-montt-group-spa-

[36] Remaining industries excluded due to insufficient disclosure.

[37] WaterWorld (2011), "Desalination market to 2020 explored in new report", WaterWorld, last accessed (07.04.2016) at: http://www.waterworld.com/articles/2011/02/desalination-market-to-2020.html

[38] WateReuse Association (2012), "Seawater Desalination Costs", WateReuse Association, last accessed (07.04.2016) at: https://www.watereuse.org/wp-content/uploads/2015/10/WateReuse_Desal_Cost_White_Paper.pdf

[39] Water-technology.net (2016), "Al Khafji solar saline water reverse osmosis (solar SWRO) desalination plant, Saudi Arabia", water-technology.net, last accessed (04.11.2016) at: http://www.water-technology.net/projects/al-khafji-solar-saline-water-reverse-osmosis-solar-swro-desalination-plant/

[40] McGovern, R.K. (2013), "Why desalination might change the way we think about water", The Global Scientist, last accessed (07.04.2016) at: http://theglobalscientist.com/2013/08/04/why-desalination-might-change-the-way-we-think-about-water/

[41] Tonner, J. (2005), "Desalination Trends", Water Consultants International, last accessed (07.04.2016) at: http://siteresources.worldbank.org/EXTWAT/Resources/4602122-1213366294492/5106220-1213366309673/6.2JohnTonner_PPT_Desalination_Trends.pdf

[42] Data for 2005-2007, 2009 and 2014 were interpolated by Sustainalytics.

[43] Irwin, C. (2013), "Wastewater Recycling Part III: Costs and Challenges", Breaking Energy, last accessed (07.04.2016) at: http://breakingenergy.com/2013/05/16/wastewater-recycling-part-iii-costs-and-challenges/

[44] Guijarro, J.A. and Rozman, C. (2011), "The water infrastructure sector globally", Agbar, last accessed (07.04.2016) at: http://www.capstoneinfrastructure.com/Assets/Presentations/2011/Agbar%20Presentation%20December%206,%202011.pdf

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