Planet Tracker

RIPPLE EFFECTS

Quantifying Water Risks in the Apparel Supply Chain

March 2024

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KEY TAKEAWAYS

The direct operations of many major fashion brands/retailers are likely to have fairly low water-related risk. Retail stores, corporate headquarters and warehousing are likely to have a low water footprint, largely determined by the hygiene needs of the workforce. However, indirect impacts could be materially detrimental to the operations of these companies.

Planet Tracker sees a number of potential business risks from water to major apparel brands/retailers and considers there to be three classes of these risks:

1. Physical risks to operations and supply chains from a lack of water;
2. Regulatory risk from potential changes to water costs, access rights or social licence to operate;
3. Reputational risk from adverse coverage of a brand's water impacts.

Water Stress is already significant in many major apparel supplying regions. Since projected changes in water stress are also often significant and paired with sanitation/drinking water concerns, they pose a problem for brands/retailers attempting to move to a sustainable business model. Most brands/retailers are impacted – Planet Tracker's analysis found North American ones face the biggest increase in water stress.

A brand operating with a typical 55% gross margin and 15% EBIT margin would see a -3% fall in operating profit from a +1% increase in COGS driven by water-related disruption.

Given a potential material impact to revenues and margins, major apparel corporates need to consider water risk as a strategic threat and develop plans to manage and reduce this risk over time.

For investors to appropriately price water-related risk in the apparel sector, they need consistent comparable data. However, today the textile sector remains some way from meeting this need. Investors need to work with their holdings to address this data gap.

Once data is available, investors should work to push corporates to set targets (preferably based on SBTs for freshwater) and develop a water "transition plan", where they reduce their negative water impacts and move to a sustainable water footprint for both direct and indirect operations.

EXECUTIVE SUMMARY

Many stages of the manufacture of apparel are significant users of water, from dyeing to raw material manufacture. Companies in the apparel industry should be talking about and reporting on their use of water and how they are exposed to water-related risk.

The availability of water is expected to be increasingly stressed in many key apparel manufacturing regions as a result of climate change, inefficient use and untreated disposal. This could threaten production of textiles in many key regions and thus disrupt supply chains.

Planet Tracker used open source data to map the location of apparel factories across the globe and consider the current level of water stress they are exposed to and how this is projected to change over time.

Much of the apparel supply chain is already operating in areas of moderate to high water stress, with the problem expected to worsen in the medium-term. We see this as representing a potential risk to future sales and margins for apparel brands/retailers.

Investors and lenders to the apparel industry are financially exposed to this water-related risk. Water risk is not a non-financial issue; it could materially affect volumes, therefore revenues, as well as profit margins.

Financial institutions should be factoring this risk into their investment decisions. Using tools such as the Investor Water Toolkit from Ceres, they should engage with their holdings on water risk. They should push companies to publicly disclose their water use and water risks via a standardised framework such as the CDP and to develop a strategy for water risk and start exploring sector transition plans to reduce those risks. They should also support engagement with the textile supply chain to address its use of water and the pollution associated with textile manufacture.

INVESTOR, LENDER AND INSURER ENGAGEMENT

We encourage investors, lenders and insurers to ensure that the apparel industry is reflecting the risks related to water when pricing their investments, financial instruments and premia.

Investors, in particular, need to fully understand these risks to the business operations of their investments and how increasing water stress could impact the ability to deliver product and affect sales.

They should ensure that water dependency is raised with management – please see the Investor Engagement Sheet - and challenge their risk assessments and strategic plans for water to ensure they are robust and well targeted.

Investors should push corporates to transparently report their water impacts using a standardised framework such as that provided by the CDP.

Once this data is available, apparel corporates should present a comprehensive strategy to address their water impacts across their supply chain and how they will transition to a future where they minimise their negative impacts on water quality and availability.

This strategy should be backed by concrete capex plans with management teams incentivised to deliver on the strategy over time.

The major apparel corporates can also be drivers for improved water management across the industry and have an opportunity to prove their sustainability credentials by engaging with their supply chains and using their relative financial strength to support their suppliers' efforts to transition to more sustainable production techniques. Investors should push for and support such engagement as a means to reduce water risk, whilst also offering the potential to improve sales on the back of reputational gains.

INTRODUCTION

Water is fundamental to the production of textiles, from the growing of natural fibres to the dyeing and finishing of fabric – see Figure 1.

Tier	Activities	Water Dependencies	Water Impacts
0	Retail/Brands	Sanitary	Consumption
1	Garment Production	Sanitary	Consumption
2	Fabric Manufacturing	Sanitary, Dyeing, Washing, Finishing, Heating	Pollution, consumption
3	Fibre Production	Sanitary, Dyeing, Humidification	Pollution, consumption
4	Raw Materials	Sanitary, Irrigation	Eutrophication, pollution, consumption

Figure 1: *Water is critical to many stages of the textile supply chain (Source: Planet Tracker).*

However, water can also be a significant threat to the textile supply chain. Firstly, water stress, i.e. a potential lack of water, is expected to be a growing issue in many areas which have significant parts of the textile supply chain as a result of climate change, inefficient use and untreated disposal - see Figure 2 & Figure 3.

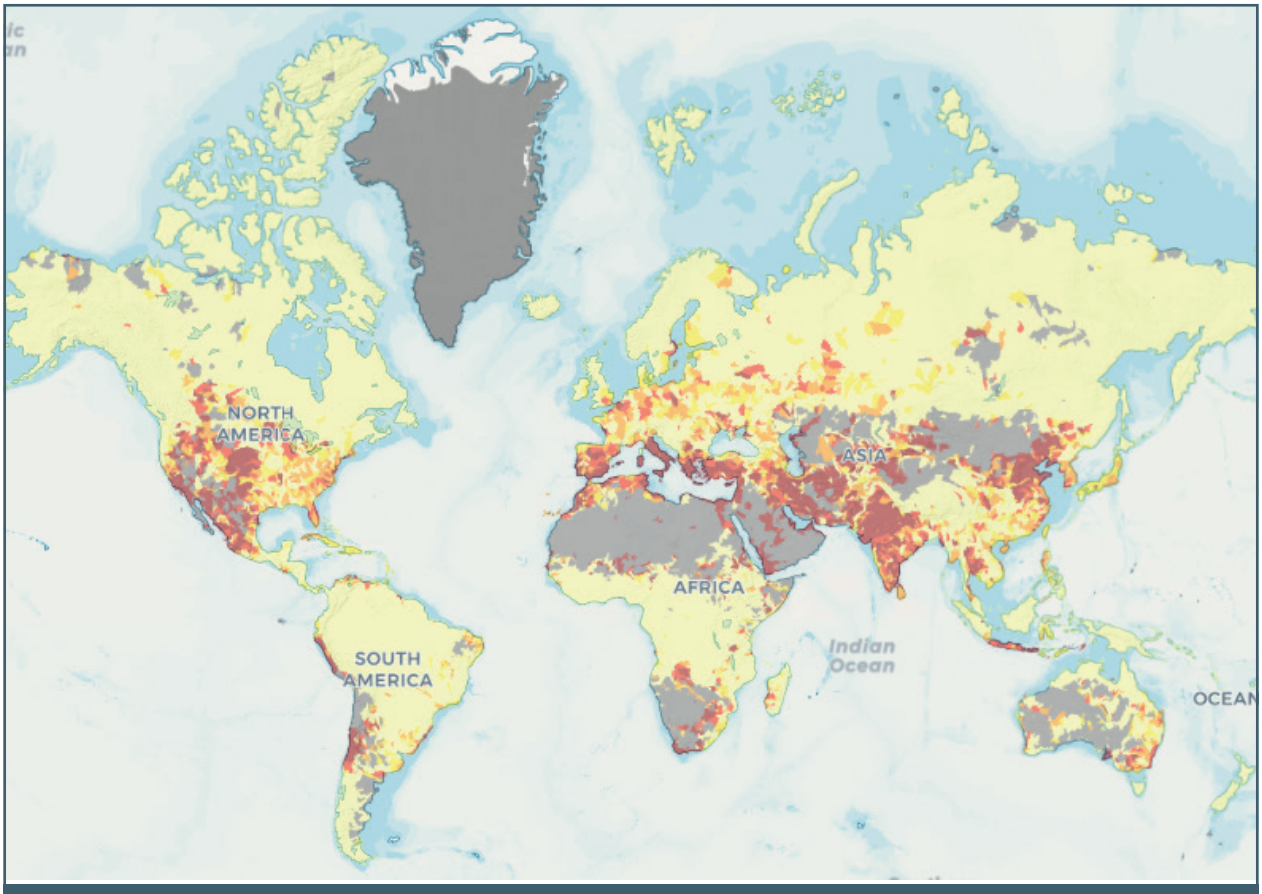


Figure 2: *Current water stress – deeper red is more stressed (WRI Aqueduct).*

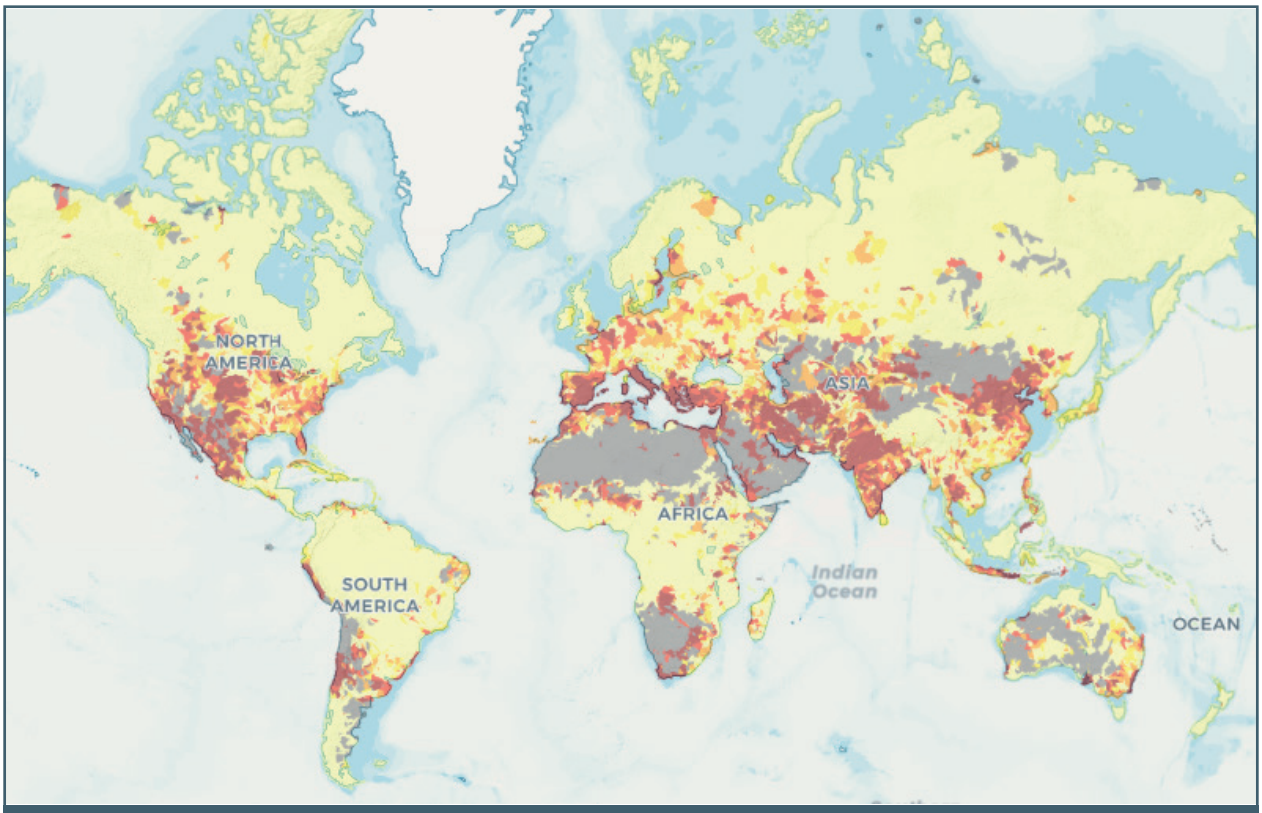


Figure 3: *2050 water stress under a business as usual scenario – deeper red is more stressed (WRI Aqueduct).*

Climate change could also increase the risk of flooding (both riverine and coastal) in many areas, potentially putting workers and factories at risk of inundation and damage (see the report from Cornell University – Higher Ground).

As such, the textile industry faces potential challenges from multiple angles to its current business model arising from water-related risks.

Our previous work has highlighted the risk from growing water stress to the wet processing stage of garment manufacture (see our report Will-Fashion-Dye-another-Day). We highlighted that the wet processors would likely find it difficult to adapt to greater regulation of water use or higher costs without support from the fashion brands/retailers. We also note that relatively small levels of investment can be transformative in terms of the environmental impacts of the textile supply chain (see our report Easy-UnPickings).

With the majority of the capital in the industry allocated to the retail stage of the supply chain, in general financiers would seem to be sheltered from much of the direct risk of rising water stress impacting the production stages. However, the big apparel brands rely on the continued functioning of their supply chains to produce product and thus water-related disruption could materially impact sales and cost of goods. Investors are therefore exposed to this water-related risk.

Given the importance of water to the industry, we would expect it to be a point of concern for both corporates across the value chain and their financiers. However, our previous work has shown that the reporting by corporates of the water impacts from textile production is often limited (see our report Threadbare-Data).

Given the issues discussed above, investors should be demanding high quality data from their holdings on their direct and indirect water impacts and dependencies, so that they can better quantify the risks to which they are exposed.

WHAT DO MAJOR APPAREL RETAIL CORPORATES SAY ABOUT WATER?

We examined whether 29 top apparel brands report on their water impacts and dependencies and what targets they have to reduce their water footprints. Of the 29, 15 report to CDP on their usage of water – see Table 1. We see this as a fairly positive starting point, suggesting that water is something management teams are thinking about.

Table 1: *Do the brands in our analysis report on water to CDP?*

No.	Company	CDP 2022 Water Report	CDP 2023 Water Report
1	Adidas	Yes	Yes
2	American Eagle	No	No
3	ANTA	No	No
4	Burlington	Yes	Yes
5	Capri	No *	Yes
6	Fast Retailing	Yes	Yes
7	Foot Locker	No *	No *
8	GAP	Yes	Yes
9	H&M	Yes	Yes
10	Hanes Brands Inc	Yes	Yes
11	Hermes	Yes	Yes
12	Inditex	Yes	Yes
13	Kering	Yes	Yes
14	Levis	Yes	Yes
15	LVMH	Yes	Yes
16	Nike	No	No
17	Nordstrom	Yes	Yes
18	Puma	Yes	Yes
19	PVH	Yes	Yes
20	Ralph Lauren	Yes	Yes
21	Ross	No	No
22	Tapestry	Yes	Yes
23	TJX	No	No
24	Under Armour	No	No *
25	VF Corporation	Yes	Yes
26	Zalando	No	No

* The company does submit a water response, however, it is either not available to the public or is not scored by CDP.

** Data as of 26/03/2024

Moving on to the sort of metrics brands are setting on water management - see Table 2 - there are a number of different target areas across the brands in our analysis. Many of these targets focus on one or two areas, for instance water use efficiency. In Planet Tracker's view, a truly robust approach to water management would likely focus on a number of metrics across a brand's own operations and most importantly also encompass their supply chain and should cover both dependency and impact. Moving forward, we would like to see more companies setting Science Based Targets for Water following the recently published guidance.

Using the SBT framework to set targets for water guides corporates through the process of developing public targets and plans to address their water footprint across both direct and indirect operations. We see widespread adoption of this framework as a critical step for the sector as a whole to address its water impacts and dependencies and mitigate the risk of water-related disruption. We note the SBT framework also encourages collective action with local communities and civil society in areas of impact so will help ensure that the targets and plans developed are equitable for those directly impacted by the issue.

Table 2: *Examples of targets on water for major textile brands (Source: Planet Tracker).*

Company	Target established	Target Category: Water Use Efficiency	Target Category: Consumption	Target Category: Discharge	Target Category: Withdrawls	Target Category: Sustainable raw materials	Target Category: Water pollution reduction	Target Category: Water recycling/ reuse	Target Category: Product water intensity	Target Category: Watershed remediation and habitat restoration, ecosystem preservation	Signatory to Un Global Compact CEO Water mandate
Adidas	Yes	•	•								No
Burlington	No										No
Fast Retailing	Yes						•				Yes
GAP	Yes										Yes
H&M	Yes	•		•	•	•	•	•			Yes
Hermes	Yes		•								Yes
Inditex	Yes	•	•								Yes
Kering	Yes	•					•				Yes
Levis	Yes		•								No
LVMH	Yes	•									Yes
Nordstrom	No										No
Puma	Yes		•	•							Yes
PVH	Yes								•	•	No
Tapestry	Yes		•								Yes
VF Corporation	Yes								•		Yes

WHAT ABOUT THE SUPPLY CHAIN?

Much of the negative impact on water from apparel occurs in the supply chain. As such, we see brands reporting their "Scope 3" impacts for water as an important target to move towards.

We can examine the extent to which the supply chain is already focused on water by looking to see whether they are already reporting on water and setting targets in the same way as we did for the major brands shown above.

We looked at three upstream nodes within the textiles supply chain – Raw Materials, Fibres and Fabrics. We used our proprietary Textile Supply Chain Universe to find companies active in those nodes (see our note – Following the Money Thread). We found 42 leading companies in these three nodes and consulted CDP data for whether they report on water.

Of the companies analysed, 17 report to CDP on their usage of water – see Table 3.

Table 3: *Examples of targets on waters for major upstream companies within the textiles supply chain (Source: Planet Tracker).*

Raw Materials		Fibres		Fabrics	
Company	CDP Water Report	Company	CDP Water Report	Company	CDP Water Report
Hengyi Petrochemical Company	No	Toray Industries	Yes	Toray Industries	Yes
Kuraray Co Ltd	Yes	Tongkun Group co	No	Rongsheng Petrochemical Co	No
Rongsheng Petrochemical	No	Hyosung TNC Corp	No	Chori Co Ltd	No
Eastman Chemical Co	Yes	Xinfengming Group	No	Nan Ya Plastics Corp	Yes
Nan Ya Plastics Corp	Yes	Rongsheng Petrochemical	No	China Hi Tech Group	No
Far Eastern New Century Corp	Yes	Kolon Industries	No	Shenma Industry Co	No
Billion Industrial Holdings	No	Daiwabo Holdings Co	Yes	Jiangsu Sanfame Polyester Material	No
Hwaseung Industries	No	Teijin Ltd	Yes	Jiangsu Eastern Shenghong Co	No
PDS Limited	No	Hyosung Advanced materials	No	Far Eastern New Century Corp	Yes
Teijin Frontier Co	No	Indorama Ventures	No	Wuxi Taiji Industry Ltd Corp	No
Lotte Chemical Corp	Yes	Eastman Chemical Co	Yes	Huafo Chemical Co	No
Hubei Yinfeng Cotton Co	No	Huafu Fashion CO	No	Welspun India Ltd.	Yes
Huntsman Corp	Yes	Shanghai Shenda Co	No	Eclat Textile Co	Yes
Dainichiseika Color & Chemicals MFG Co	Yes	Nan Ya Plastics	Yes	Welspun Ltd	No

Table 4 shows examples of the sort of targets companies are setting on water management. There are a number of different target areas being used across the companies in our analysis. Many of these targets focus on one or two areas, for example, withdrawals. However, there are a number of target categories which we found none of these companies addressing, such as discharge and water recycling.

Table 4: *Examples of targets on water for waters for major upstream companies within the textiles supply chain (Source: Planet Tracker).*

Company	Target established	Target Category: Water Use Efficiency	Target Category: Consumption	Target Category: Discharge	Target Category: Withdrawals	Target Category: Sustainable raw materials	Target Category: Water pollution reduction	Target Category: Water recycling/ reuse	Target Category: Product water intensity	Target Category: Watershed remediation and habitat restoration, ecosystem preservation
Dainichiseika	Yes								•	
Eastman Chemical	No									
Eclat Textile	Yes				•					
Huntsman	Yes								•	
Kuraray	Yes	•					•			
Lotte	Yes		•				•			
Nan Ya Plastics	Yes				•		•			
Teijin	Yes				•		•			
Toray	Yes				•					

CURRENTLY INVESTORS DON'T SEEM CONCERNED ABOUT WATER RISK

In a recently published report (see our note – Exposing Water Risk) we assessed how executive management teams at major apparel brands perceive risk to their businesses from water. Planet Tracker used a proprietary Natural Language Processing (NLP) algorithm to scan corporate disclosures and transcripts from 29 leading apparel brands for incidences of discussion of water-related risk.

One of the most important findings from our analysis was that investors rarely seem to ask about water-related risk in public fora. We found very few mentions of water-related risk in transcripts from earnings calls or capital market events (only 1% of all mentions recorded).

The apparent lack of concern about water-related risks is surprising given how critical water is to many stages of the textile supply chain.

Potentially, investors believe water-related risk is already appreciated and being well managed by corporates. Alternatively, they may be discussing water risk in private meetings with company managements.

In our view, investors should be considering water-related risks in their interactions with apparel industry corporates. Water could be a driver of disruption to supply chains, either from a lack of access to water needed in manufacturing, a loss of social licence to operate for suppliers or risk of disruption to operation due to flooding (for instance inundation of factories) or drought (for instance shipping being impacted by low water in key transit canals or rivers).

Given the potential risk, we believe investors should be including water risk in their due diligence and investment decisions when appraising corporates in the textile sector.

We acknowledge the challenge of incorporating the water risk of indirect operations. This is especially true for corporates which provide little or no detail on their supply chain at all. However, widespread moves over recent years towards reporting Scope 3 GHG emissions shows that reporting on water use across supply chains could happen.

In the rest of this report, we examine available data on the water stress exposure of the apparel supply chain and consider the potential impact on major brands from future water related disruption.

BUSINESS RISK FROM WATER STRESS

There are a number of potential business risks from water to major apparel brands/retailers. We consider there to be three classes of these risks – see Table 5.

1. Physical risks to operations and supply chains from a lack of water;
2. Regulatory risk from potential changes to water costs, access rights or social license to operate;
3. Reputational risk from adverse coverage of a brand's water impacts.

Table 5: *Water risk types overview (Source: Planet Tracker).*

	Physical Risk	Regulatory Risk	Reputational Risk
Operational Water Risk	**Availability of water - Quantity and Quality**	**Price changes, supply availability, license to operate**	**Negative brand impact from poor water use communications**

Below we discuss some examples of potential water related risks:

Firstly, increasing water stress in many manufacturing regions may require exposed corporates to increase their capital expense and/or operating expense budgets to develop or access alternative water supplies. For instance, they may need to invest in new boreholes, rainwater recycling or other technologies, or they may have to pay more to withdraw water from local water sources. This higher cost or need for investment would likely raise the cost of manufacturing. Assuming some of this increase is passed on to brands/retailers over the medium-term would drive potential gross margin compression.

Corporates may also see an increased cost of raw materials caused by water. In the apparel industry, cotton is probably the raw material most exposed to water-related disruption. Cotton requires, on average around 8,000 litres of water per 1kg of lint produced.[i] This consumption figure must be considered together with where the cotton is being grown and whether it is irrigated or rain-fed. 8,000 litres of consumption will be more meaningful when irrigation is used and in areas of already significant water stress.

CASE STUDY - THE ARAL SEA

The Aral Sea, once the fourth-largest saline lake in the world, has experienced a catastrophic decline in volume in recent decades, primarily due to the Soviet Government's diversion of its main water sources in the 1960s. This diversion aimed to irrigate surrounding areas for agricultural purposes, with a significant focus on cotton cultivation. The unintended consequences of this decision have led to an environmental disaster, impacting not only the Aral Sea itself but also creating ripple effects in the textile industry.

The desiccation of the Aral Sea has resulted in profound environmental consequences. The water level has plummeted by approximately 23 meters since the diversion of its primary water sources, triggering a feedback loop between evaporation and sea surface temperature. As the lake loses water, it becomes shallower, leading to faster increases in water temperature and subsequent evaporation. Additionally, the salinization of the lake has caused vertical stratification, accelerating evaporation. The region has witnessed significant desertification, with vegetation reduced by at least 40%, intensifying winds and giving rise to frequent dust storms. The increase in salt content has led to soil salinization, soil erosion, and pollution, adversely affecting both the land and the air quality. Dust storms, exacerbated by the loss of the sea's protective action, now occur regularly, affecting areas far beyond the Aral Sea region.

The shrinking sea has also impacted nearby mountain glaciers. The decrease in surface area impedes the disruption of frigid north winds, leading to decreased moisture contribution to mountain snowfall. Consequently, mountain glaciers experience a reduction in overall volume due to increased dust and salt storms, which coat the glaciers and accelerate melting.

The Aral Sea Crisis has far-reaching social and economic implications also, particularly in Uzbekistan, which heavily relies on its neighbor Kyrgyzstan for freshwater. The regional soils, saturated with salt, demand up to four times more freshwater for agricultural growth than under normal conditions. To combat soil salinity, croplands are flushed at least four times, depleting essential minerals and salts.

Regional health has suffered significantly due to increased dust storms, elevated pesticide concentrations, and poor water quality. Rates of diseases such as tuberculosis, typhus, and paratyphoid have surged, impacting the health of over 5 million people and displacing more than 100,000 people, creating a public health crisis.

The Aral Sea Crisis is a stark example of the interconnectedness of environmental issues and industrial practices. The diversion of water for cotton cultivation, driven by the textile industry's demand, has led to an irreversible ecological catastrophe. This case study emphasizes the urgent need for sustainable and environmentally conscious practices in industries such as textiles to prevent future ecological disasters.

WRI data suggests that, in 2010, around 49% of the global cotton crop was produced in an area of extreme water stress. This is projected to increase to 67% of global production by 2030 - see Figure 4. See the "Case Study - the Aral Sea" for an example of how cultivation of cotton can drive extreme water impacts.

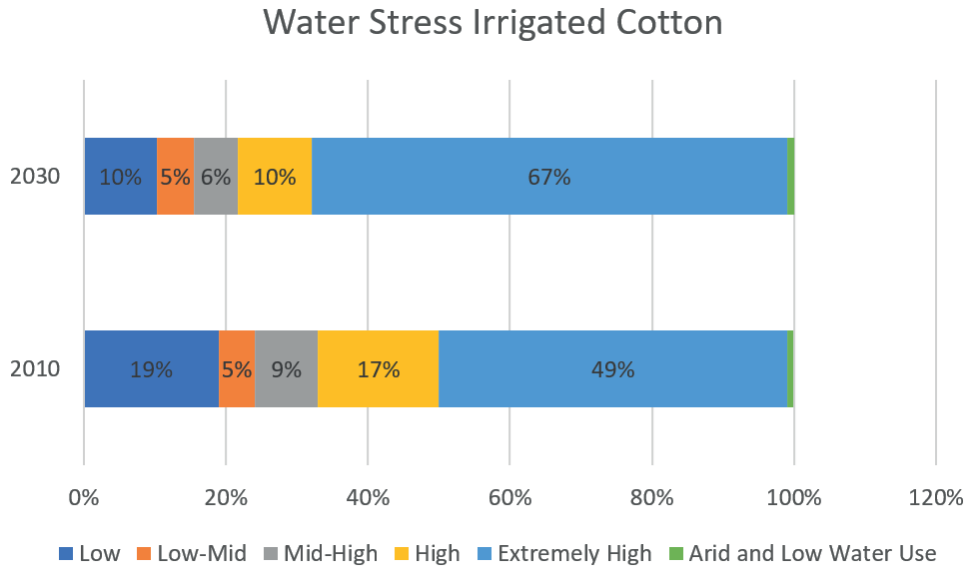


Figure 4 : *Water stress levels of the irrigated cotton crop in 2010 and 2030 (Source: WRI).*

Severe weather conditions, likely exacerbated by climate change, significantly impacted the global cotton crop in 2022, with prices spiking by as much as +30% - see Figure 5.

Figure 5: *Cotton price history (Source: Tradingeconomics.com).*

This sort of volatility is a big issue for the industry when trying to negotiate contracts for production runs. Our proprietary Textile Universe database (see our dashboard) indicates that EBITDA margins in the supply chain are on average around 7%, so suppliers do not have much capacity to absorb those sort of price spikes and the impacts will likely, at least in part, flow through to brands/retailers.

If manufacturers do pass on any increase in cotton price to the brands/retailers this could also drive pressure on margins if they cannot pass on the increase to consumers (this may be most difficult for brands/retailers competing on price at the cheaper end of the market).

From a sustainability perspective, another concern from cotton being increasingly challenged by water stress would be if brands/retailers choose to switch volumes into other fibres instead, most likely synthetics. Although this might reduce their exposure to sudden cotton price spikes, it would be a step backwards from a sustainability perspective given that synthetics are based on fossil fuels and release plastic micro-fibres, CO_2 and toxins into the environment during use and end-of-life.

Water could also disrupt production in key regions, either due to flooding, or due to significant droughts. Flood water inundating factories could delay production runs and/or damage equipment. It could also hamper logistics slowing the delivery of orders. Droughts could lead to factories not having enough water to produce ordered volumes, or even being required to shut completely as water is prioritised for other industries, sanitation and drinking.

THE SOCIAL IMPACT OF WATER

Beyond a risk to business operations, we note that investors and corporates should also consider their exposure to any negative social impacts of water use.

A litre of potable water used for apparel production is one that is no longer available to the local population, or those downstream, unless it is appropriately cleaned and released back into the water system.

With apparel manufacture often occurring in countries which lack universal access to potable water, investors should consider their end responsibility for the impacts of consumption of dirty and unsanitary water by local people, for instance the spread of disease or parasites and ensuing morbidity or mortality.

Moving forward, increased demand for water from growing populations and potentially increasingly erratic weather driven by climate change could see growth in litigation risk for corporates regarding their impacts on water availability and water quality. Longer term we could even see a loss of the social licence to operate where water availability is particularly challenged, and apparel production faces off against the basic human need for water for drinking and sanitation.

MAPPING TEXTILES FACTORIES TO WATER RISK

With the above in mind, Planet Tracker has sought to provide quantitative evidence to the claims that water poses a social as well as a business risk for stakeholders involved in the textiles value chain. To do so, Planet Tracker leveraged the following two open-source databases:

- ***Aqueduct 4.0*** – Maintained by the World Resources Institute, Aqueduct provides a host of water-related indicators, by basin across the world. Aqueduct's Water Risk Atlas[ii] covers baseline, current figures as well as future projections to 2080.

- ***Open Supply Hub*** – formerly known as the Open Apparel Registry, Open Supply Hub is an initiative born in 2019 to bring transparency to global supply chains. While it initially focused exclusively on factories involved within the textiles value chain, it has recently been expanding into other sectors. They now have over 100,000 apparel facilities on their database, with a host of descriptive information alongside geographical locations and key suppliers served (where available).[iii]

The two datasets were overlaid using specific geographical co-ordinates across the globe, providing a detailed picture of where apparel factories are located, and what level of water stress level they face. A geospatial snapshot of the two overlayed maps is provided below, where icons representing textile factories overlap color coded regions, according to water stress severity – with red areas representing the highest stressed areas – see Figure 6. For more detail on the methodology, please see the Appendix A to this report.

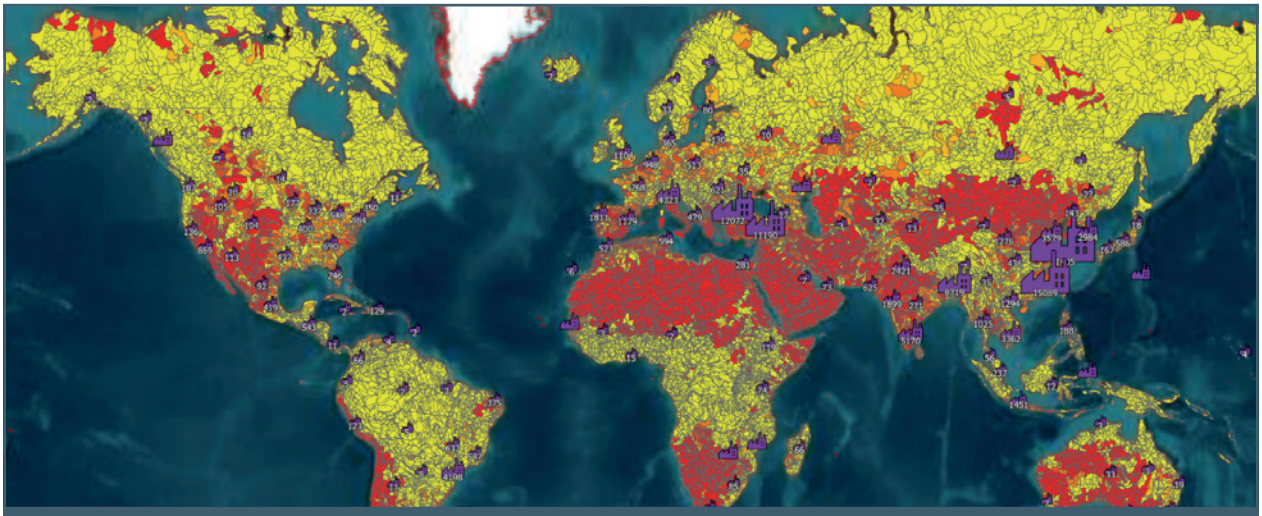


Figure 6: *WRI Aqueduct & Open Supply Hub Factories locations (Source: Planet Tracker, WRI Aqueduct, Open Supply Hub).*

SOME DEFINITIONS

All the metrics defined below are sourced from WRI[iv] and are used in the following section looking at the geographic footprint and potential risks of the apparel supply chain.

Water Stress - Baseline water stress measures the ratio of total water demand to available renewable surface and groundwater supplies. Water demand includes domestic, industrial, irrigation and livestock uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate more competition among users.

Water Depletion - Baseline water depletion measures the ratio of total water consumption to available renewable water supplies. Total water consumption includes domestic, industrial, irrigation and livestock consumptive uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate larger impact on the local water supply and decreased water availability for downstream users. Baseline water depletion is similar to baseline water stress; however, instead of looking at total water demand (consumptive plus non-consumptive), baseline water depletion is calculated using consumptive withdrawal only.

Unimproved to No Sanitation – Unimproved to no sanitation reflects the share of the population using pit latrines without a slab or platform, hanging/bucket latrines, or directly disposing of human waste in fields, forests, bushes, open bodies of water, beaches, other open spaces, or with solid waste (WHO and UNICEF 2017). Higher values indicate areas where people have less access to improved sanitation services.

Unimproved to No Drinking Water – Unimproved to no drinking water reflects the share 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). Higher values indicate areas where people have less access to safe drinking water supplies.

KEY FINDINGS

- Water Stress is already significant in most supplying regions
- Projected change in water stress is significant and paired with sanitation/drinking water concerns, it poses a problem for brands/retailers attempting to move to a sustainable business model
- Most brands/retailers are impacted – North American ones face the biggest increase in water stress

Firstly, looking at the sample's geographic composition, we find that the majority of the textiles value chain, as portrayed in Open Supply Hub, is located in Asia. Nearly one in two apparel factories is operating in either China or Turkey, areas which display a medium to high water stress score. Including Bangladesh and India, respectively with high or very high (in the case of Bangladesh) water stress scores, increases the number of factories to nearly two thirds of the overall sample – see Figure 7. The median factory across the globe today displays a medium to high water stress score of 2.6. This shows that apparel garments are being sourced from areas which are more often than not already considerably water stressed.

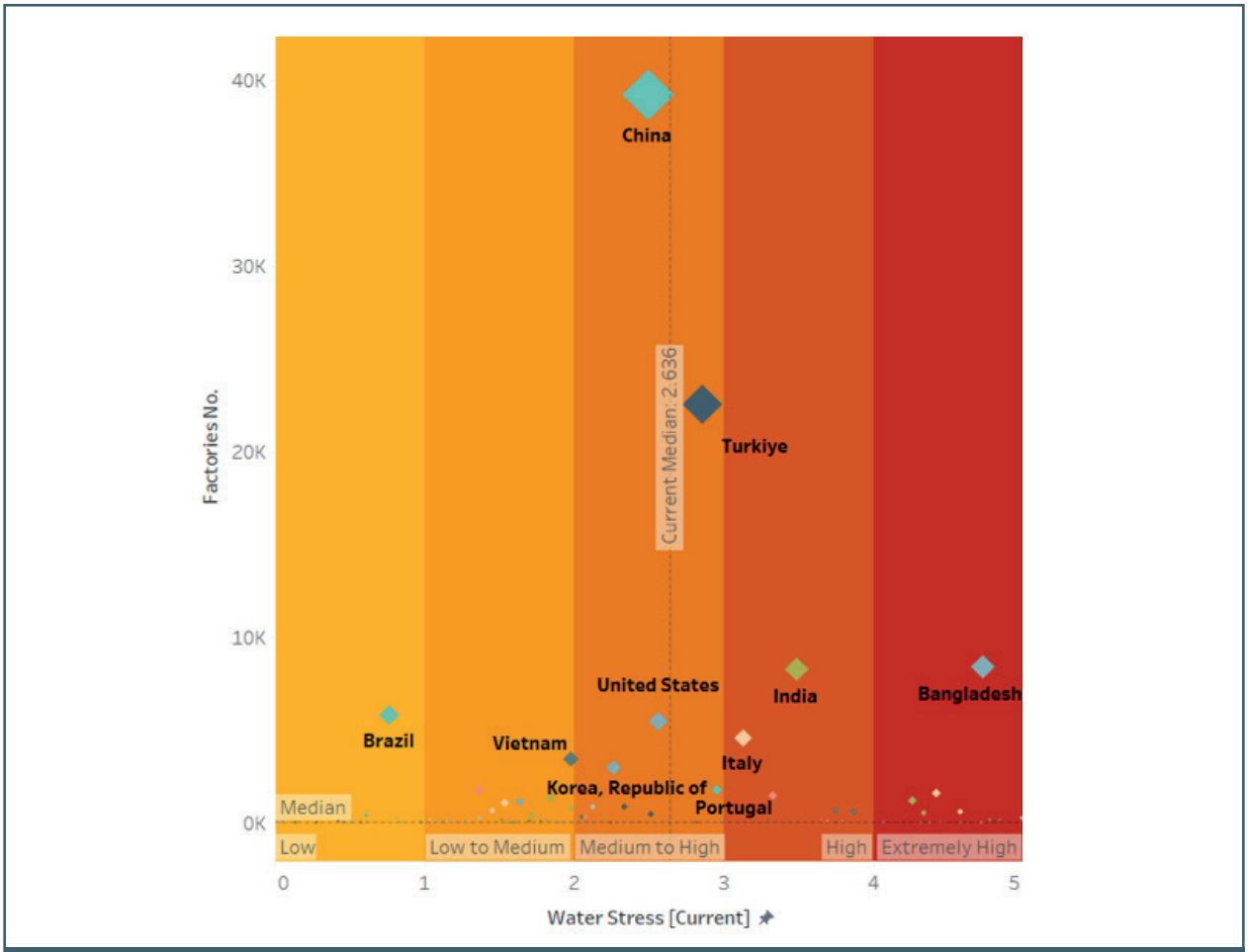


Figure 7: *Top 10 Factories Locations and their current average Water Stress scores. The size of each rhombus represents the number of factories located in the specific country (Source: Planet Tracker, WRI Aqueduct, Open Supply Hub).*

Moving to future projections for water stress, the picture becomes even more concerning. By 2050, numerous textile manufacturing locations are expected to be under more heightened water stress pressures, as Figure 8 below shows. We particularly note the cases of Brazil and Vietnam, both of which are poised to rise up one water stress category on the scale. Similarly, Turkey is projected to transition into a high water stressed area (from Medium-High today), with its score projected to increase by a third.

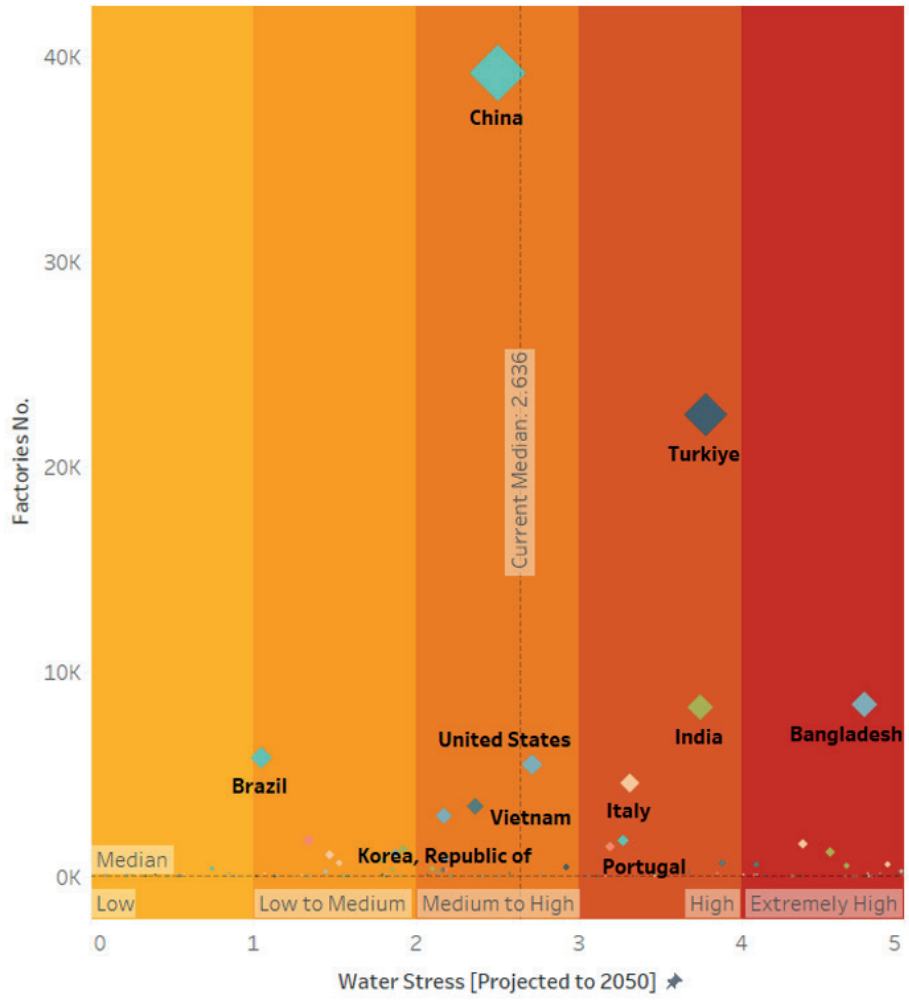


Figure 8: *Top 10 countries for Apparel Locations and their projected 2050 average Water Stress scores. The size of each rhombus represents the number of factories located in the specific country (Source: Planet Tracker, WRI Aqueduct, Open Supply Hub).*

Heightened environmental challenges to water availability and industrial demands for growing manufacturing volumes are likely to pile more pressure on the local availability of water. With potentially shrinking supply and growing demand, the value of water is likely to increase, potentially raising costs and causing heightened competition for access.

A particular potential breaking point is likely to be seen in areas where intense textiles production is paired with existing socioeconomic concerns such as poor sanitation levels and low access to safe drinking water.

As Figure 9 indicates, an instance where this is likely to play out is Brazil. In spite of a generally lower-than-average water stress, the biggest economy in Latin America is projected to incur a 4-fold increase in water stress by 2050. As such, irrespective of the current low score, mounting pressure on the future need for water is likely to be heavily compounded by the poorer-than-average sanitation and drinking water standards found in Brazil. Regions such as São Paulo and Santa Caterina are those where the biggest challenge will be felt.

Among the other textile producing heavyweights, India faces a similar situation. In particular, with sanitation quality currently on the lower end of the scale, the projected 12% increase in water stress is likely to represent a significant hurdle for local municipalities in the quest to improve health standards. This is especially true in key apparel producing regions in India, such as Tamil Nadu and Karnataka, where the significant water footprint that textiles production involves may ultimately impact manufacturing volumes, should water rationing policies be introduced to prioritise sanitation.

Figure 9: *Top 5 Countries for Apparel Locations. Current water stress levels are paired with their projected water stress increase to 2050. These datapoints are intersected with Sanitation and Safe Drinking water scores, for which a* ***higher number is associated with poorer standards****. The size of each ball represents the number of factories located in the specific country (Source: Planet Tracker, WRI Aqueduct, Open Supply Hub).*

Sanitation and drinking water standards would seem to represent more of a direct concern for governments and local municipalities rather than global apparel corporates. However, there is a trend in legislation towards greater due diligence requirements meaning global brands/retailers are facing more and more scrutiny on matters happening outside their direct operations. Increasingly, poor social or environmental actions in their supply chains are not something to which they can turn a blind eye. Competition for water in areas where basic social needs are still only partially met may well be one of those cases and represent a potential long-term risk to brand reputations.

By mapping and identifying major fashion brands' suppliers, Planet Tracker was able to begin to determine which brands/retailers, if any, are likely to face the highest water related pressures among the ones that report on Open Supply Hub.

First, we searched Refinitiv for financials details for the nearly 800 brands and factory owners associated with the sites mapped from the Open Supply Hub data. For those for whom financial details were found, we created five equal-size revenue bands, expressed in descending order from higher to lower turnover. As Figure 10 below shows, most fashion suppliers are located in middle income countries, in areas that more often than not are already facing at least medium-to-high water stress.

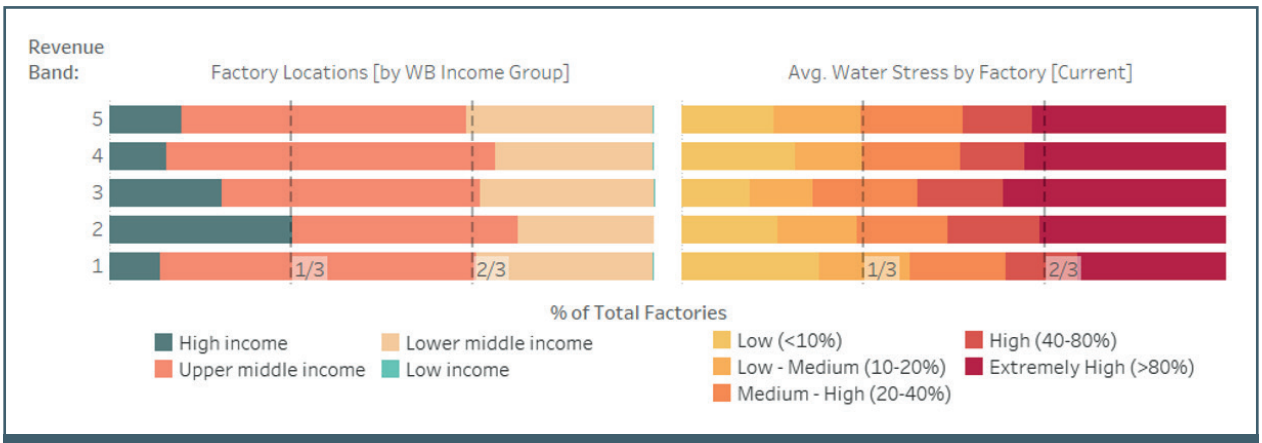


Figure 10: *Fashion Brands/retailers, factories locations and their average water stress scores, by revenues bands (Source: Planet Tracker, WRI Aqueduct, Open Supply Hub) – Revenue bands 1 (lowest turnover) to 5 (highest turnover).*

As noted previously, apparel manufacturing is often associated with areas with poor drinking water and sanitation levels – see Figure 11. This is true across revenue bands.

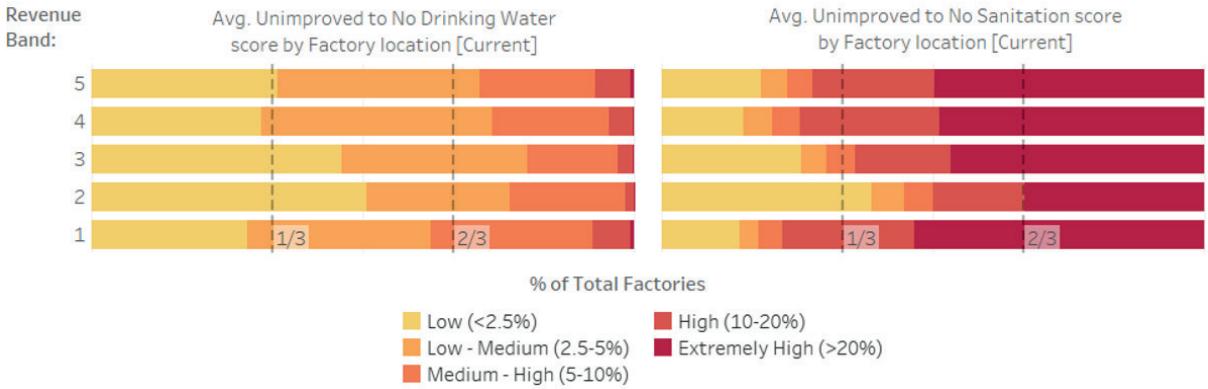


Figure 11: *Fashion Brands/retailers, factories locations and their average Sanitation and Safe Drinking water scores, by revenues bands.* ***A higher category (ie. High) is associed with poorer standards*** *(Source: Planet Tracker, WRI Aqueduct, Open Supply Hub) – Revenue bands 1 (lowest turnover) to 5 (highest turnover).*

We found that the average firm in the highest revenue band is likely to have over two thirds of its factories located in areas with poor or significantly poor sanitation levels.

Moving to analysis of water stress projections to 2050, as shown in Figure 12, a significant increase in water stress exposure by 2050 is associated with suppliers to revenue bands 4 and 2, with a near 100% increase in their respective water stress scores. This represents a much larger increase than that registered for the other revenue bands.

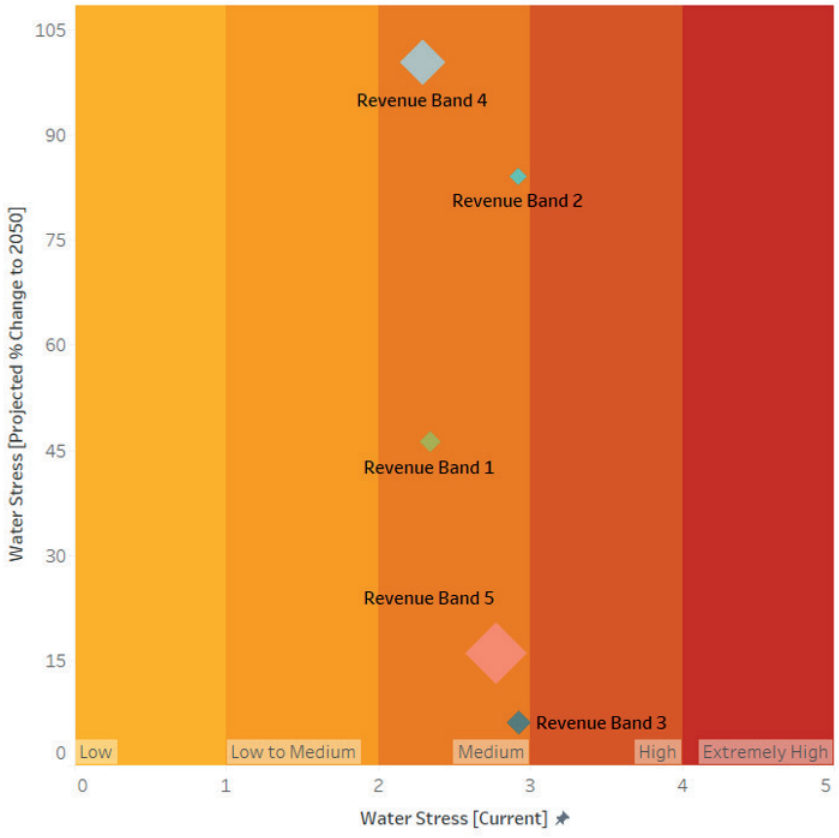


Figure 12: *Revenue bands, current average water stress scores and their projected change to 2050. The size of each rhombus represents the number of factories associated with the specific revenue band (Source: Planet Tracker, WRI Aqueduct, Open Supply Hub).*

Finally, we also analysed whether brands/retailers headquartered in different regions face any difference in their future water stress exposure. This was carried out by segmenting companies according to their registered headquarters. Given the intertwined nature of global supply chains, one would expect most regions to show similar values in their future and current water stress exposure. However, this does not prove to be the case.

As shown in Figure 13, firms headquartered in North America are expected to record a substantially bigger increase in water stress scores to 2050, were they to keep their existing set of suppliers. Incidentally, when compared to European retailers, suppliers servicing North American firms are also associated with areas displaying poorer sanitation levels. Overall, this would suggest the average North America domiciled brand is at higher risk.

Figure 13: *Fashion firms by headquarter region, according to UN Regions classification. Current water stress levels are paired with their projected water stress increase to 2050. These datapoints are intersected with Sanitation and Safe Drinking water scores, for which a* ***higher number is associated with poorer standards****. The size of each ball represents the number of firms headquartered in the specific region (Source: Planet Tracker, WRI Aqueduct, Open Supply Hub).*

WATER-RELATED RISK IS LIKELY TO BE FINANCIALLY MATERIAL

The direct operations of many major fashion brands/retailers are likely to have fairly low water-related risk. Retail stores, corporate headquarters and warehousing are likely to have a low water footprint, largely determined by the hygiene needs of the workforce. However, indirect impacts could be materially detrimental to the operations of these companies.

Given the typically poor reporting of their supply chains by major apparel corporates, quantifying the potential financial impact of water-related risk on their operations is challenging. We should also acknowledge that the industry sources from water stressed regions today, so some of the risk could be argued to be "in the price" of the corporates involved.

Our mapping of Open Supply Hub data against data from the Aqueduct Water Risk Atlas data from the WRI allows us to attempt to drill down into the risk the industry faces from water stress and consider the value at risk from potential water-related disruptions.

We see two major potential financial impacts to apparel corporates from water stress in the supply chain - see Figure 14. Firstly, a potential impact on revenues. This could, for instance, be due to suppliers having to reduce their production levels in light of water stress, meaning brands cannot source as much product as they need. This could also be due to a lack of available water or regulation limiting access to water to prioritise water for sanitation in a region.

Secondly, a potential impact on margins if suppliers are forced to pay more for water, or water management technology and pass on this cost to brands. We note that these two impacts are not mutually exclusive. A reduction in production volumes by manufacturers could well drive up prices for brands/retailers as they have to pay more to source supply from a more limited pool of availability.

These are not the only potential impacts. For instance, increasing water-related disruption could push up the insurance costs on production or lead to higher logistic costs as product has to be sourced from new locations or air freighted due to production delays.

Profit & Loss	Potential Water Impacts
Revenues	Reduced product volumes available due to supply constraints
Cost of Goods Sold (COGS)	Increased COGS due to higher costs of materials
Gross Margin	Negative impact from the above
Operating Expenses	Increased opex from higher insurance costs or logistics costs
Earnings Before Interest & Tax	Negative impact from the above

Figure 14 : *How water-related disruption could impact the P&L of apparel brands/retailers (Source: Planet Tracker).*

To try and address the potential impacts of these sort of risks, we have created a simple model of the potential impact of disruption to supply chains (for instance by water stress) on the revenues and gross margins of major apparel brands/retailers. Although our model is built to focus on water stress induced disruption, we note that any disruption would likely have a similar impact. For instance, work by Cornell University has previously highlighted that rising temperatures in key apparel manufacturing countries risk factories being closed due to the risk to human health of working above certain wet bulb temperatures (see the report from Cornell University – Higher Ground).

We acknowledge that the apparel industry today sources significant volumes of product from regions with high water stress.

As such, it is clear that a region being water stressed is not a priori a reason for it to see disruption to production. However, it does make it more likely that the region could see water-related disruption in the future as any impact on water availability is more likely to feed through immediately due to the lack of spare capacity.

Our simple model sensitises the odds of a water-related disruption event and the size of the impact of any event. We assume that the odds and size of impact are highest for regions of extreme water stress and halve for each lower step of water stress, reaching zero for areas of no water stress. We allocate a theoretical supply base of 100 factories of equal size to water stress bands in the proportions shown in Table 1 which is based on the distribution of water stress for all the factories in the OSH data we analysed.

Roughly a third of factories fall into each of the High, Moderate and Low categories – see Table 6.

Table 6: *The allocation of factories in our model by water stress band.*

Water Stress Level	Proportion
High	**33%**
Moderate	**32%**
Low	**35%**

The revenue impacts assume that the noted proportion of volumes from affected factories is not supplied, i.e. a 10% impact implies that 10% of volumes from that factory are not supplied, so the brand loses those potential sales.

Gross margin impact assumes that the disruption drives an increase in price on the disrupted portion of goods purchased. For instance, a 10% impact implies that goods from the impacted factory are 10% more costly relative to baseline.

The outputs of our model are shown in Table 7 and Table 8 which show the potential impact on overall brand revenue (Table 7) and gross margin (Table 8).

Table 7: *The potential impact on overall brand revenues of water-related disruptions.*

Revenues		Odds of Impact									
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%
Size of Impact	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	5.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%
	10.0%	0.0%	-0.1%	-0.1%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%	-0.4%
	15.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.3%	-0.4%	-0.5%	-0.5%	-0.6%	-0.6%
	20.0%	-0.1%	-0.2%	-0.3%	-0.3%	-0.4%	-0.5%	-0.6%	-0.7%	-0.8%	-0.9%
	25.0%	-0.1%	-0.2%	-0.3%	-0.4%	-0.5%	-0.6%	-0.8%	-0.9%	-1.0%	-1.1%
	30.0%	-0.1%	-0.3%	-0.4%	-0.5%	-0.6%	-0.8%	-0.9%	-1.0%	-1.2%	-1.3%

Table 8 : *The potential impact on gross margin of water-related disruptio*

Gross Margin		Odds of Impact									
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%
Size of Impact	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	5.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
	10.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%
	15.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%
	20.0%	0.0%	-0.1%	-0.1%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%	-0.4%
	25.0%	-0.1%	-0.1%	-0.2%	-0.2%	-0.3%	-0.3%	-0.4%	-0.4%	-0.5%	-0.5%
	30.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.3%	-0.4%	-0.5%	-0.5%	-0.6%	-0.6%

In general, the impact on both metrics remains minimal until the odds of impact and size of impact reach fairly high levels. However, we note that this level of and frequency of disruption may not be out of the question given projections for growing water stress in many key regions.

As shown earlier in our analysis of factory locations, there are also significant regions of concentration for apparel manufacture. This means that when a water-related event occurs in an area, potentially many closely located suppliers could be affected, compounding the degree of impact of any event and making it challenging to switch suppliers to try and ameliorate the disruption.

Although the change in revenue or cost of goods sold (COGS) output by our modelling would seem relatively small, we note that a brand operating with a typical 55% gross margin and 15% EBIT margin would see a -3% fall in operating profit from a +1% increase in COGS.

We also note that pushing a +1% increase in COGS back onto suppliers might prove challenging. Our previous analysis of profitability across the supply chain (see our note - Follow-the-Money-Thread) suggests that supplier margins are often low single digit levels. For a supplier operating on a 5% operating margin, absorbing a +1% COGS increase for a brand would require accepting a -1% reduction in their revenues and reduce profits by -20%, all else being equal.

POTENTIALLY SMALL INVESTMENT COULD REDUCE SUPPLY CHAIN WATER RISK

Planet Tracker's report Easy-UnPickings examined the potential environmental benefit of relatively small levels of investment - an average one-off investment of USD 455K by wet processors, one of the most water-intensive steps of the textile manufacturing process. Although the investments focused first on energy efficiency, they produced notable water savings. Focusing in on the potential to reduce water impacts, the analysis showed the potential for an average water consumption reduction of 125,500 m^3 per year and wastewater discharge reduction of 61,500 tonnes per year.

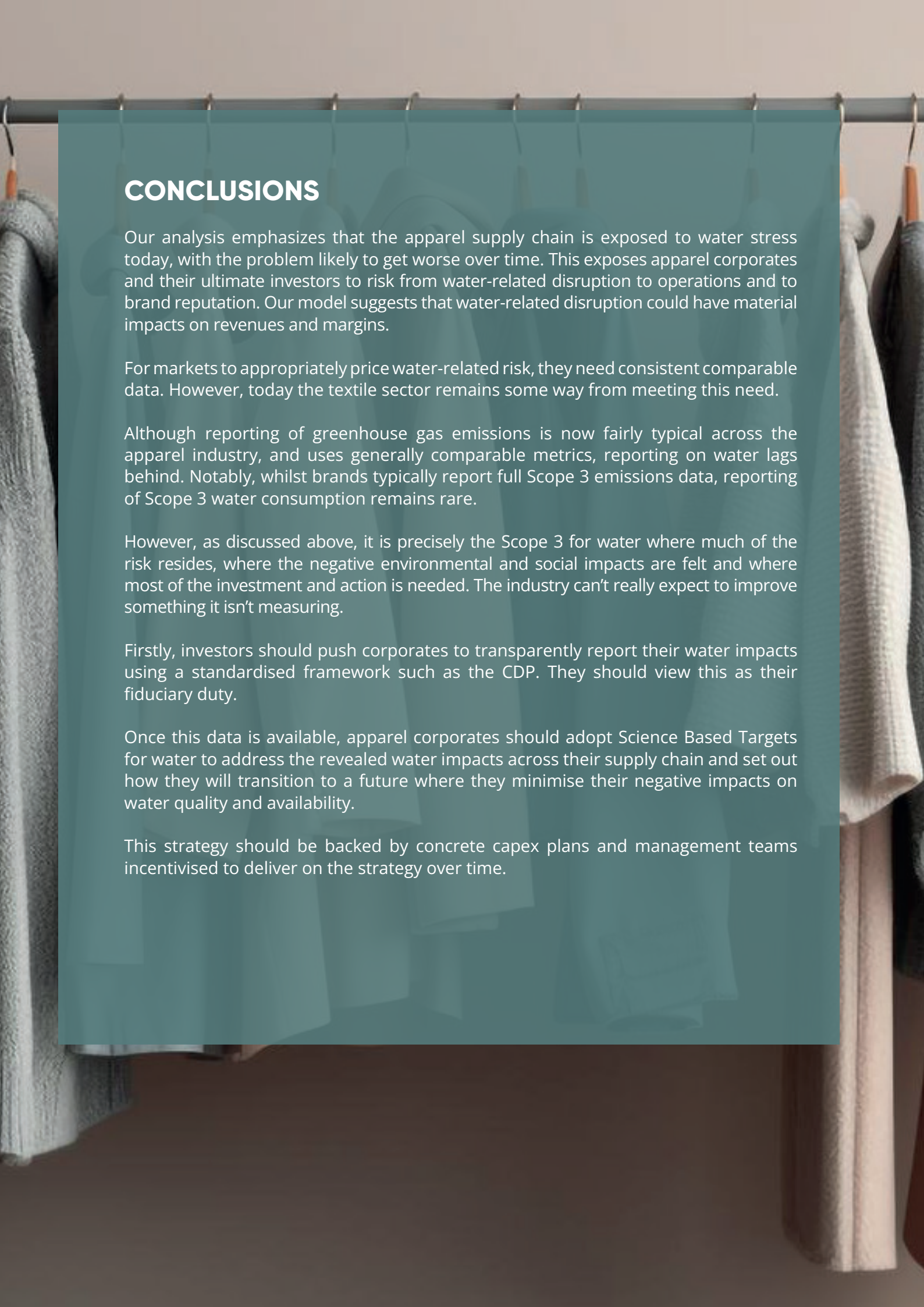
Given the potential to materially improve water impacts for a relatively small investment, we believe the major apparel corporates should be actively working with their suppliers to implement these sort of programmes.

Of course, one pushback on making this sort of co-operative investment would be that global apparel corporates can (and/or should) shop around between suppliers to reduce their costs and maximise their own profits. If a supplier needs to invest in water and their costs rise as a result, brands/retailers could simply move to another supplier.

Such a decision would of course require there to be enough spare capacity in the industry. As noted previously in this report, many major hubs for apparel manufacture have high water stress levels, suggesting the capacity to move volumes to low water stress suppliers may be quite limited. With a number of "hot spots" for production, there is also the issue that impacts of water-related disruption will be felt by many suppliers at the same time.

With regulators increasingly focused on the supply chain impacts of retailers/brands, it is also questionable whether a strategy of a highly fluid supply chain footprint to avoid water costs is practicable. For instance, the EU's Corporate Sustainability Due Diligence Directive may make fast switching to a new supplier problematic, as corporates will need to be able to provide data on their environmental and social impacts. Meanwhile, we also question the potential risk to brand reputation if called out as a poor partner for suppliers due to a failure to develop strong relationships.

A Just Transition for water requires major apparel corporates to take ownership for the water impacts of their supply chains and develop strategies to reduce these impacts over time. A footloose strategy of changing suppliers to avoid this responsibility is something we think investors should be highly critical of.



CONCLUSIONS

Our analysis emphasizes that the apparel supply chain is exposed to water stress today, with the problem likely to get worse over time. This exposes apparel corporates and their ultimate investors to risk from water-related disruption to operations and to brand reputation. Our model suggests that water-related disruption could have material impacts on revenues and margins.

For markets to appropriately price water-related risk, they need consistent comparable data. However, today the textile sector remains some way from meeting this need.

Although reporting of greenhouse gas emissions is now fairly typical across the apparel industry, and uses generally comparable metrics, reporting on water lags behind. Notably, whilst brands typically report full Scope 3 emissions data, reporting of Scope 3 water consumption remains rare.

However, as discussed above, it is precisely the Scope 3 for water where much of the risk resides, where the negative environmental and social impacts are felt and where most of the investment and action is needed. The industry can't really expect to improve something it isn't measuring.

Firstly, investors should push corporates to transparently report their water impacts using a standardised framework such as the CDP. They should view this as their fiduciary duty.

Once this data is available, apparel corporates should adopt Science Based Targets for water to address the revealed water impacts across their supply chain and set out how they will transition to a future where they minimise their negative impacts on water quality and availability.

This strategy should be backed by concrete capex plans and management teams incentivised to deliver on the strategy over time.

APPENDIX A

METHODOLOGY & LIMITATIONS OF THE MAPPING ANALYSIS

Planet Tracker leveraged two main sources of information for the analysis:

- WRI Aqueduct
- Open Supply Hub

WRI Aqueduct published their latest set of data in September 2023. Open Supply Hub was scanned in August 2023.

After performing a series of data cleansing tasks, the two datasets were merged through geospatial intersection, in other words by combining geographical co-ordinates.

Company names were standardised, and finally scanned via Refinitiv Eikon to source their latest Revenues. Companies were then aggregated into five equal-size revenue bands, as well as geographical segments based on their country of headquarters.

It is worth noting that the analysis has a few limitations. First, Open Supply Hub is an open-source platform. This means that, while verifications do take place, the platform ultimately relies on its contributors' thoroughness. Data quality can be more volatile when analysing more subjective information, such as factories' processing type or workforce size.

While Open Supply Hub adoption has steadily been growing over the years, there are still numerous, high-profile brands which do not report any supply chain information on the platform. It is therefore important to recognise the incompleteness of the data. We praise those brands reporting their supply chain information on Open Supply Hub and urge those who do not to follow suit.

Finally, while Open Supply Hub provides details on the suppliers from whom brands source their garments, it does not disclose any information about clothing volumes. In aid of simplicity, we have assumed that all factories supply equal amounts of garments. In other words, we are not assigning any higher weight or importance to particular suppliers or regions. While we recognise this to be a gross simplification, we also believe more sophisticated estimates may ultimately not provide more accurate numbers until reporting of production volumes becomes more standard.

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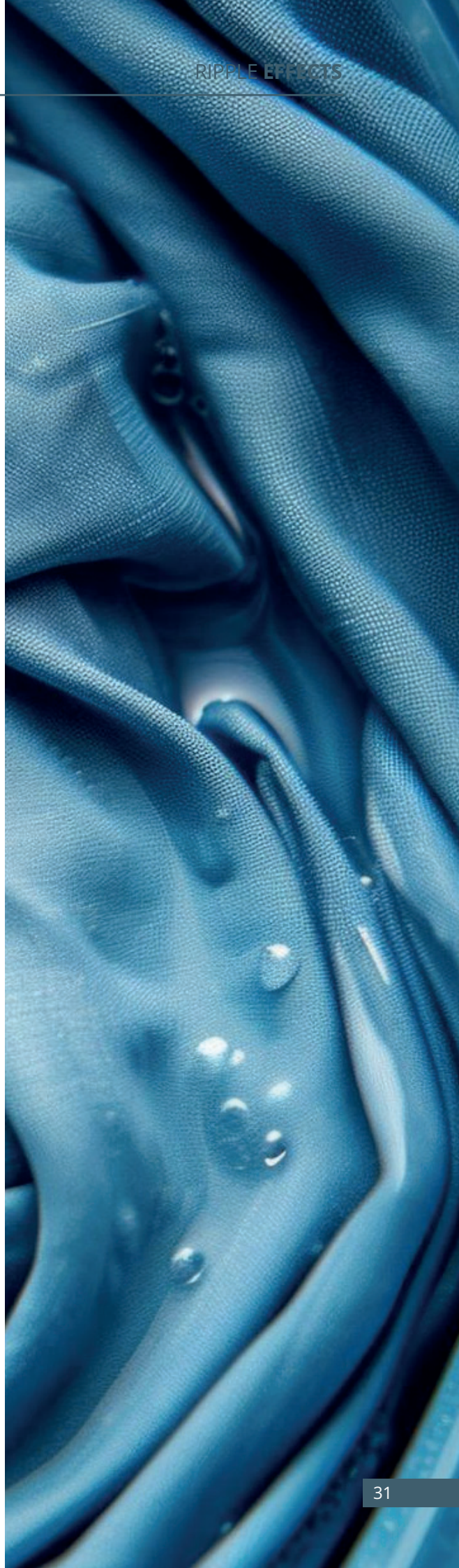

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Planet Tracker is an award-winning non-profit think tank focused on sustainable finance. We engage directly with financial institutions to drive transformation of global financial activities, achieve real world change in our means of production and align investment with a resilient, just, net-zero and nature-positive economy. Our purpose is to ensure that capital markets' investment and lending decisions are aligned with planetary boundaries and support a just transition.

TEXTILE TRACKER

Textiles Tracker investigates the impact that financial institutions have in funding companies across the Textiles, Apparel & Clothing sector. Fast Fashion has created cheap and abundant clothing globally, but the natural capital cost has been high, with toxic production practices, degradation of natural resources, massive and growing waste as well as labour injustice. By providing information and analysis on these problems, placing a value on them and quantifying the negative impact on profits and investor returns from current practices and the potential benefits and opportunities from changes Textiles Tracker will support and stimulate a transition to greater sustainability in the industry. Textiles Tracker identifies the nodes in the textiles supply chain that are creating the greatest damage, analyses their financial value, provides transparency of ownership and, through owners and investors, pressures for change in industry practices.

ACKNOWLEDGEMENTS

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WITH THANKS TO OUR FUNDER

Suggested citation: Wielechowski R., Cozzolino G., Layden A., Ripple Effects: Planet Tracker (2024).

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