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Development of a Company-Level Cost-Benefit Analysis Framework

Assessing the Full Value of Water Stewardship Investments to Business and Society

Introduction

With the world's water supply in crisis, companies are increasingly recognizing the threats that they face from too little water, too much water, or polluted water, and how climate change is compounding these threats. Yet, there is a two-way interaction between the private sector and freshwater—industry affects water resources just as water resources affect industry. Research and companies' disclosures underscore the financial impacts that companies are already experiencing or are exposed to, and the impacts industry's practices are causing for society.

With the launch of the Valuing Water Finance Initiative, a global investor-led effort to engage companies with a high water footprint to value and act on water as a financial risk, Ceres in 2021 partnered with water risk consultant Bluerisk, sustainability intelligence provider S&P Global Sustainable1, and the asset manager DWS Group to develop two materiality briefs to estimate the cost of addressing water-related externalities in the value chains. These briefs, which focus on eight apparel companies and three meat companies provide insights into the potential magnitude of the cost of action to address water-related externalities and how those costs would impact company valuations.

Since then, engagements with financial institutions, investors, and companies have underscored the need to go one step further to estimate not only the cost to address externalities, but also the cost of solutions to address emerging water risks, as well as the magnitude of business and societal benefits that could be achieved from companies investing in water stewardship.

This brief introduces a framework to estimate both costs and benefits of engaging in water stewardship, enabling companies and investors to gain a more complete financial picture, better understand the full value of water, and prioritize action where it matters the most: to the business and to society.

Problem Statement

Companies have applied various methods to quantify the financial value of water to their business (Das et al. 2022). However, these metrics have typically been focused on risks or damage costs rather than the value that could be gained from taking action. For example:

- The price or tariff paid to access water supplies
- The true cost of water, based on the price of water and additional embedded costs, such as labor, operational, treatment, energy, maintenance, and legal costs associated with using water
- The risk-adjusted shadow price of water, informed by the price of water and the degree to which the company is exposed to water-related risks

While these water valuation metrics can help companies to quantify their dependence on water by using a single internal price for water, they are focused on the measure of damage or internalized cost, and do not consider the cost of solutions or the business and societal benefits that can be gained from engaging in water stewardship.

Some 55% of the 3,909 companies disclosing through CDP in 2022 did not disclose any water-related opportunities (such as increased efficiency, competitive advantages, access to new markets, or resilient supply chains), with most saying that opportunities exist but did not have a substantive financial or strategic impact on the business, hadn't been evaluated, or were judged unimportant. Moving forward, there is an opportunity to use water valuation metrics to better identify, justify, and facilitate water stewardship investments for companies.

By incorporating the full value of water into decision-making and understanding the cost of implementing solutions, as well as the resulting business and societal benefits, companies and investors can strengthen the business case for action and better identify where and how their investments can have the greatest impact.

Figure 1 · Examples of Water Risks and Benefits in the Apparel Sector

Water risks	Benefits of water action
Cotton prices soared in 2022 as water-related hazards—including drought in China and the United States and flooding in Pakistan—disrupted the global cotton supply chain.	Levi's estimated that the transition to sustainable cotton sourcing and "Water<Less" garments resulted in a cost-savings to the business of $1.6 million as a benefit from the "Water<Less" program.
Since 2017, textile manufacturers in China and Bangladesh experienced a crackdown on wastewater treatment, facing increased fines or threat of shutdown if pollution is not curtailed.	A research study conducted by WaterAid between 2018 and 2022 with the apparel and leather sector in Bangladesh and India calculated an average $1.32 return on investment for every dollar spent on water access, sanitation and hygiene (WASH) interventions.

Approach

The cost-benefit analysis (CBA) framework outlined in this brief is a practical, quantitative approach to estimate the full value of water to business and society and help communicate across functions and business units within a company, by clarifying and strengthening the business case for action on water across a company's value chain.

The CBA framework can be applied across all sections of a company's value chain and is replicable across companies and sectors. The CBA framework considers the costs and benefits of water stewardship interventions (Table 1) and helps estimate both the business and societal return on investment (ROI and SROI), informed by:

- Cost of solutions
- Water-related risks to the business
- Business-related water impacts on society

The CBA framework provides a tool for companies to understand and communicate not only their business risks, but also the social impact of their activities, helping to make informed decisions to maximize both business and societal value creation. This approach also aligns with emerging voluntary and mandatory disclosure standards, such as the Taskforce on Nature-related Financial Disclosures (TNFD) and the EU's Corporate Sustainability Reporting Directive (CSRD), that will compel companies to consider the full set of material dependencies, impacts, risks, and opportunities across their upstream and downstream operations.

This CBA framework builds on existing water valuation initiatives, such as the Valuing Water Initiative, and methods to assess the cost of action, such as the WRI Achieving Abundance working paper, to provide a holistic view on the full value of water throughout a company's value chain. To estimate the societal benefits from water stewardship investments, the CBA framework applies methods from Beyond Volumes: Exploring the Societal Value of Corporate Water Stewardship Projects (Vionnet et al. 2022), which incorporates the SROI ratio (Social Value UK 2012), the Natural Capital Protocol (Capitals Coalition 2016), and the Social & Human Capital Protocol (Capitals Coalition 2019).

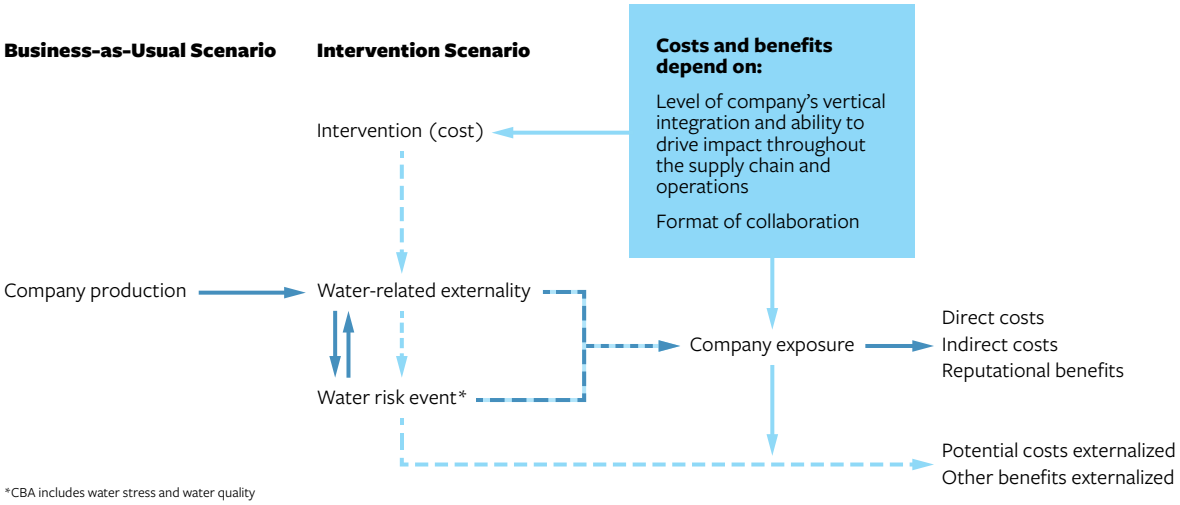
This brief demonstrates how the CBA framework (Table 1) can be applied at a company level (Figure 2), illustrating how the results can generate a strong case for where and why to implement corporate water stewardship programs. In turn, this information can strengthen investor engagement on water, by allowing them to understand the complete financial picture of a company's water stewardship efforts and ensure more informed engagements with the companies they own.

Table 1 · Overview of the Water Stewardship CBA Framework

	Costs	Value created
For business	Cost of solutions	Avoided direct costs due to water-related risks and impacts (increased CAPEX/OPEX to access alternative water supply, increased cost of raw material, reduced production value) Avoided indirect costs due to water-related risks and impacts (litigation over impacts on downstream water quality or groundwater depletion) Reputational benefits (strengthened social and legal license to operate and brand value)
For society	Potential externalized costs (costs absorbed by society and stakeholders)	Other externalized benefits (societal value created by protecting or restoring water availability and quality)

To demonstrate how the CBA framework can be used and its effectiveness, we applied it to a multi-national apparel company using publicly available information. The apparel sector provides an ideal test case because apparel companies have a significant impact and dependency on water resources. The global apparel industry withdraws more than 215 billion cubic meters of water annually, equal to the total amount of freshwater withdrawn by Indonesia in 2020, and the apparel sector is responsible for polluting 20% of the globe's freshwater.

Figure 2 · Company-Level Cost-Benefit Analysis Framework



The CBA framework aligns with methods developed in our materiality brief for companies in the apparel sector and builds on the brief by assessing not only the cost of solutions to address externalities, but also the costs of solutions to address water-related business risks, and the business and societal benefits that can be gained from water stewardship interventions. This illustrative example can be used to showcase how companies can apply the CBA framework and use the results to help guide investment decisions and build the business case for action.

We used four steps to apply the CBA framework to assess the costs and benefits of water stewardship investments to the business and society (see Appendix for more details):

- **Step 1: Customize the CBA framework for the identified sector.** For the apparel sector, we first identified the key sections of the value chain, and the activities with the greatest water-related materiality and the associated impact pathways leading to business risks and water-related impacts to society. (An impact pathway is defined here as a logical series of cause-and-effect chain of events that describe how a specific activity results in changes in natural or human capital. For instance, bleaching, dyeing, and finishing in the apparel production process that can pollute water and lead to penalties or fines.) For each of these impact pathways, we also identified water stewardship interventions that could be implemented to address the risks and impacts.
- **Step 2: Collect data for the specific sector and company.** For each of the impact pathways, we gathered publicly available information for the sector and the company. This data included, for example, fiber types and purchase volumes, water withdrawals throughout the value chain, wastewater treatment compliance levels, and costs to implement interventions. We used primary data when available from company disclosures, and secondary data to fill in the gaps.
- **Step 3: Calculate the costs and benefits for each impact pathway throughout the value chain.** To calculate the costs and benefits from water stewardship interventions, we first quantified the financial implications of water-related risks to the business and the water-related impacts on society from the company's activities across the value chain. We then estimated the cost of solutions to address those risks and impacts (for instance, through reducing water withdrawals, improving the quality of the wastewater discharge, implementing sustainable agricultural practices, or launching campaigns to minimize water-related impacts in consumer use and disposal). The final step was to estimate the benefits from those solutions; we did that by estimating how much of the business risk and impact were reduced and the associated financial value that was gained.
- **Step 4: Aggregate the impact pathways to quantify the full cost and value to the business and society, along with relative metrics for business and societal return on investment.** We used the CBA framework outlined in Table 1 to aggregate the impact pathways to the company level per value chain section and estimate the net present value (NPV) for 2030 of the total costs and benefits of the interventions, and the relative business and societal return on investment (ROI and SROI) that could be gained from the interventions.

This illustrative example showcases the application of the CBA framework. Specific results regarding a return on investment do not reflect sector-wide patterns nor should the results be interpreted for companies other than the anonymized one used in the illustrative example.

Results

The results of this CBA provide an overview of both absolute benefits (total value) and relative benefits (whether the value outweighs the cost), helping support company decision-making by:

- Identifying scenarios and sections of the value chain that could deliver the greatest absolute value to the business and society, to help prioritize actions that can reduce water-related risks and impacts and potentially strengthen the company's social and legal license to operate.
- Identifying scenarios and sections of the value chain that could deliver the greatest relative return on investment for the business and society, to help optimize investments where the benefits might outweigh the costs and to prioritize investments that deliver more relative value for each dollar invested.

To capture cost-sharing opportunities frequently used by companies in water stewardship interventions, the framework was applied under two plausible scenarios:

- Scenario #1: Company pays the full cost of solutions (100%) across the value chain
- Scenario #2: Company shares the cost of solutions (50%) across the value chain (i.e., with governments, other companies, or external stakeholders in the watersheds)

Table 2 · Results for an Application of the CBA Framework to an Apparel Company Illustrating the Value to the Business and Society under the Two Cost-sharing Scenarios

Value chain tier	Tier description	Percent of total cost to the business	Percent of total value to the business	Percent of total value to society	Scenario #1		Scenario #2	
					ROI	SROI	ROI	SROI
Tier 4	Fiber production	14%	12%	12%	●	●	●	●
Tier 3	Yarn preparation	30%	31%	9%	●	●	●	●
Tier 2	Fabric preparation	14%	15%	14%	●	●	●	●
	Dyeing and finishing	36%	37%	30%	●	●	●	●
Tier 1	Assembly	5%	6%	29%	●	●	●	●
Tier 0	Distribution	<1%	<1%	<1%	●	●	●	●
Use phase 1	Consumer use	1%	<1%	4%	•	●	•	●
Use phase 2	End of life	1%	<1%	<1%	•	●	•	●
				Overall ROI/SROI	●	●	●	●

ROI/SROI: ● >5.0 ● 5.0–1.0 ● 1.0–0.5 • 0.5–0

Return on investment (ROI) and societal return on investment (SROI) indicated in red signify that the calculated costs outweigh the benefits (ROI or SROI <1), and in green signify that the benefits outweigh the costs (ROI or SROI >1).

As previously noted, these results reflect data specific to the company used in this illustrative example and should not be applied to other companies nor considered representative of the apparel sector as a whole. However, from this example, several key insights emerge:

- **Under scenario #2, which incorporates cost-sharing approaches**, there is a larger positive business and societal return on investment across most of the value chain, underscoring the value of engaging in partnerships and collective action efforts to share the cost and scale the impact of each dollar invested in water stewardship solutions.
- **Business benefits:** The sections of the value chain where interventions deliver the largest benefits to the business are upstream of the company's direct operations, specifically during dyeing and finishing and yarn preparation. This is mostly due to the large water withdrawals and water quality impacts and consequently there is a much higher potential to address risk and yield business benefits.
- **Societal benefits:** Investing in water stewardship delivers a positive societal return on investment across the value chain, except for end of use.

Understanding this type of information can empower investors to better screen for listed equities based on the potential for water stewardship to be a value driver for the business, as well as for society, and develop approaches to help optimize portfolios of investments for both business returns and societal impact.

Companies can use results like these to engage senior leadership and the board and support an internal case for investing in water stewardship by better understanding the cost implications and associated benefits. Companies can also use cost-benefit analysis to inform their water strategy by having an objective and quantitative way to prioritize solutions at the site, supplier, or watershed scale that matter most to both business and society across the value chain.

Implications for Companies and Investors

The CBA framework described in this brief provides an innovative yet practical approach for companies to assess the full value of water stewardship interventions across the value chain. The proposed CBA framework comprehensively assesses the costs and benefits to both the business and society, going beyond a single internal price of water and helping to prioritize scenarios, sections of the value chain, and investments that matter the most to both business and society.

Whether the intent is to unlock funding within the company, understand how to strengthen the social and legal license to operate, guide engagements in collective action, reduce risks and impacts, or prioritize investments, companies can use the proposed CBA framework to help identify and quantify the business opportunities for engaging in water stewardship.

Investors should encourage companies to apply these methods to estimate the costs and benefits of water stewardship actions, using the following key takeaways to demonstrate the utility of the approach:

- The CBA framework can help show where and how much additional capital and operating budget will be required across the value chain, when investing and not investing in water stewardship.
- The CBA framework can help show where and how much the company and society will benefit across the value chain from engaging in water stewardship.
- The CBA framework can provide a strong case for action by identifying and quantifying opportunities with a positive business and societal return on investment (ROI and SROI).

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About Bluerisk

Bluerisk is a water strategy and data advisory firm focused on enhancing resilience and reducing risk in the face of emerging water challenges. Bluerisk's analysis, experience, and market insights provide new roadmaps to a sustainable water future, by aligning practical and actionable solutions with the contextual and shared value of water. For more information, visit blueriskintel.com.

Appendix

Four steps to apply the CBA framework to assess the costs and benefits of water stewardship to a company and society.

Step 1 · Customize the CBA framework for the identified sector.

We assessed the water-related risks companies in the apparel sector are exposed to and the impacts that the sector has on water resources, including contributing to water scarcity and water pollution. To focus on where water matters the most, we used the value chain sections and activities as outlined in the materiality brief (Ceres 2021) that were identified as material from a water perspective due to either having the largest water-related impacts on society or to contributing the largest water-related risks to companies (Quantis 2018, Ceres 2022, WWF and H&M 2022).

For these sections of the value chain and activities, we developed impact pathways to pinpoint the water-related risks and impacts that apparel production, distribution, use, and disposal cause for the business and society (Table 3), building on the framework for quantifying externalities in the materiality brief for the apparel sector (Ceres 2021), and the framework to assess societal impact (Vionnet et al. 2022). An impact pathway is defined here as a logical series of cause-and-effect chain of events that describe how a specific activity results in changes in natural or human capital. An impact pathway is described in terms of input, activity, output, outcome, and impact. (Vionnet et al. 2022).

Table 3 · Overview of the Apparel Sector Value Chain, Sample Activities, and Impact Pathways for the Business and Society

By using publicly available data, the assessment includes assumptions that create uncertainty

Value chain section	Activities	Sample business impact pathways	Sample societal impact pathways
Fiber production	Fertilizer, pesticide, herbicides Irrigation	Increased operational costs due to water stress Reduction of production Penalties/fines from water quality impacts Reputational risk	Cost of accessing alternative water supplies due to water stress Cost of ecosystem degradation due to water quality impacts
Yarn preparation	Spinning		
Fabric preparation	Knitting and weaving		
Dyeing & finishing	Bleaching, dyeing, and finishing		
Assembly	Cutting and sewing		
Distribution	Transportation		
Consumer use	Laundry washing		
End of life	Disposal		

in the results stemming from partial or incomplete company data from disclosures and the use of secondary data sources. Direct engagement with the company could further strengthen the analysis

by reducing uncertainty and providing insight into the selection and addition of relevant impact pathways and their associated costs and benefits.

Step 2 · Collect data for the specific sector and company

For each of the impact pathways, we gathered publicly available information for the company and the sector. This data included, for example, fiber types and purchase volumes, sustainable agriculture practices for fiber production, water withdrawals throughout the value chain, geographies of manufacturing sites and direct operations, wastewater treatment compliance in manufacturing and direct operations, water efficiency targets for the company, geographies of sales and associated sales volumes, water price, and the percentage of recycled clothing, among others. We collected primary data through company disclosures in the company's annual report, sustainability report, and responses to the CDP water security questionnaire online. For secondary data sources, we developed a ranking system to prioritize and guide the selection of data sources based on their uncertainty (how far removed the data sources were from company disclosures and company-specific data) (Table 4). Key secondary data sources used in this illustrative example include a report on the environmental impact of the apparel sector throughout the value chain (Quantis 2018) and a working paper on the cost of water stewardship interventions per country across the globe (WRI 2020).

Table 4 · Data Source Uncertainty Levels and Ranking System to Help Guide the Selection of Data Sources

Uncertainty level	Type of data source	Example
1 · Very low uncertainty	Reported by the company	Company disclosures through an annual report or CDP
2 · Low uncertainty	Reported for companies in the same industry	Life Cycle Assessment for the apparel industry (Quantis 2018)
	Reported by another company in the same industry	Better Cotton Initiative (BCI)
3 · Medium uncertainty	Reported by companies in other industries	Company disclosures through an annual report or CDP
4 · High uncertainty	Estimated from non-sector specific sources (i.e., for a country or a region)	WRI Achieving Abundance report for water stewardship solution costs
		WRI Aqueduct Water Risk Atlas
5 · Very high uncertainty	Estimated	Estimated from expert judgment due to lack of primary or secondary data

Step 3 · Calculate the costs and benefits for each impact pathway throughout the value chain.

To calculate the costs and benefits from water stewardship solutions, we first quantified the company's water withdrawals and wastewater discharge and used geographically specific data when available to estimate the associated water-related risks to the business and the water-related impacts on society from the company's actions, after which we applied valuation metrics to estimate the

financial implications of these risks and impacts. We then estimated how much it would cost to address those risks and impacts by either reducing water withdrawals or improving the quality of the wastewater discharge. The final step was to estimate the benefits from those solutions (how much of the initial risk and impact were reduced, and the associated financial value that was gained). For all methods, we used company disclosures and geographically specific information when available and estimated the net present value (NPV) for 2030.

- **Water withdrawals and wastewater discharge:** To estimate the magnitude of the company's water withdrawals and wastewater discharge, we used fiber sourcing volumes from company disclosures and multiplied them by water withdrawal intensities per fiber type during the fiber production stage (Quantis 2018). We then applied relative withdrawals and discharge for each section of the value chain (Quantis 2018) to quantify how much water is withdrawn and discharged during each stage. This follows a similar approach as the one we used with the 2021 apparel materiality brief.

- **Risks and impacts from water withdrawals and wastewater discharge:** We then estimated for each section of the value chain where the company's water withdrawals exceeded water balance thresholds in the catchment (WRI 2019), based on the key geographies of each value chain section. We also estimated the magnitude of ecosystem degradation stemming from water quality impacts for each section of the value chain (Quantis 2018, Ecoinvent v3.8, Quantis Plastic Leak Project, Levi Strauss & Co. 2015). Going a step further than the 2021 materiality brief, we included the consumer use and end-of-life phases in the scope of this analysis to capture the water quality and availability risks and impacts downstream of the company's operations to develop a more holistic picture of the value chain.

- **Financial implications of business water-related risks:**
  - **Water withdrawals:** For risks to the business, we valued the financial implications the company could face from water scarcity by applying an increase in operational costs due to disruptions in water supply during fiber production, manufacturing, and direct operations (company disclosures; Adidas CDP Disclosures 2022). Specifically for fiber production, we also estimated the financial implications from decreased raw material cotton sourcing stemming from decreased water supply availability and leading to reduced fiber production for the company.
  - **Wastewater discharge:** We valued water quality risks to the company by estimating fines due to untreated wastewater discharge during manufacturing and direct operations (company disclosures; CDP 2020).
  - **Reputational:** To value the financial implications from reputational risks, we used company disclosures for the potential loss of sales due to reputational risks from being associated with major suppliers that have inefficient water use and wastewater treatment practices that contribute to water supply depletion and pollution of water sources (company disclosures).

- **Financial implications of business water-related impacts on society:**
    - **Water withdrawal impacts on water quantity:** To value the financial implications of water scarcity to society, we used the estimate for the company water withdrawals that exceed catchment water balance thresholds in the top countries per value chain section and multiplied it by an average valuation of water across sectors (domestic, agriculture, industry, supply) per country (WRI 2020), which indicates the cost required for society to address the impacts.
    - **Wastewater discharge impacts on water quality:** To value the financial implications of water quality impacts on society, we multiplied the magnitude of ecosystem degradation stemming from water quality impacts from the company per value chain section by the environmental price of biodiversity loss (CE Delft 2018).
- **Cost of solutions:** To estimate the cost of solutions, we applied relative costs per cubic meter for each intervention type in the agricultural and manufacturing stages (agricultural water efficiency, agricultural non-point source pollution reduction, operational water efficiency, and operational wastewater discharge treatment) using the metrics from WRI 2020. To determine the cost of solutions for consumer use and end of life, we identified costs of company campaigns to encourage sustainable water use during laundry washing (based on expert judgment and engagement with other companies to understand the cost per cubic meter of reducing water use during consumer use), and company costs to invest in clothing recycling technology (company disclosures).
- **Benefits of interventions**: Interventions were assumed to eliminate 100% of the impacts to society that were estimated in the analysis (i.e., water withdrawal impacts on water availability, and wastewater discharge impacts on ecosystem degradation) following the methods and assumptions outlined in the materiality brief. For the business, only a portion of the risk was assumed to be addressed, with a higher amount of risk addressed during operations, followed up upstream sections of the value chain (i.e., fiber production and manufacturing), and the lowest amount of risk addressed during consumer use and disposal. These assumptions were based on expert judgment and engagement with companies in corporate water stewardship to understand how much business risk can be addressed by water stewardship interventions at different stages in the value chain.

Step 4 · Aggregate the impact pathways to quantify the full cost and value to the business and society, along with relative metrics for ROI and SROI.

We used the CBA framework outlined in Table 1 to aggregate the impact pathways to the company level per value chain section and estimated the NPV for 2030 of:

- The total cost of solutions
- The total value (avoided direct costs, avoided indirect costs, and reputational benefits) for the business
- The total value (other externalized benefits) for society

- The return on investment as the ratio between the total business value created divided by the cost of solutions
- The social return on investment as the ratio between the total societal value created divided by the cost of solutions that was attributed to the company (as outlined in Vionnet et al. 2022)

Given limited insight into the company's cost-sharing mechanisms for water stewardship investments (i.e., how much of the investments the company would pay versus how much would be shared with other stakeholders), we developed two scenarios to estimate the return on investment and social return on investment:

- Scenario #1: Company pays the full cost of solutions (100%) across the value chain
- Scenario #2: Company shares the cost of solutions (50%) across the value chain (i.e., with governments, other companies, or external stakeholders in the watersheds)