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Evaluating the Cost-Effectiveness of Corporate Water Stewardship Projects

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1. Introduction

Water is a top business risk for many companies and the risk is growing as pressures on water resources intensify. Corporate water stewardship allows companies to identify and manage water-related business risks, understand and mitigate their adverse impacts on ecosystems and communities, and support more sustainable management of shared water resources (Souza et al. 2020). To effectively guide water stewardship action, companies often set quantitative and time-bound volumetric water goals, such as a 2030 replenishment goal or contextual water targets, that can be met through a variety of projects within a company's direct operations, across their value chain, and in surrounding communities and watersheds.[1]

Assessing the alignment of project opportunities with a company's goals is a critical step in the water stewardship process. Companies often consider multiple criteria when evaluating water stewardship activities, including location, geographic scope, feasibility, innovation, and the water challenges addressed. Given ambitious goals and limited budgets, cost also plays a significant role, with metrics like cost per million gallons ($/MG) or megaliters ($/ML) serving as common benchmarks.

However, comparing project costs can be complicated due to the diversity of potential water stewardship projects. These projects vary widely in geographic scope, timing, and the distribution of costs and benefits over their lifespan. Some projects involve significant up-front costs and ongoing benefits, while others may have a different balance of costs and benefits over time. Such variation in cost and benefit profiles makes it difficult for companies to assess which projects offer the best value for achieving their water stewardship goals.

Assessing the alignment of project opportunities with a company's goals is a critical step in the water stewardship process.

To address this challenge, this white paper proposes a standardized approach and easy-to-calculate metric—the Levelized Cost of Water (LCOW),[2] which can provide a comprehensive and consistent framework for comparing project costs and benefits.

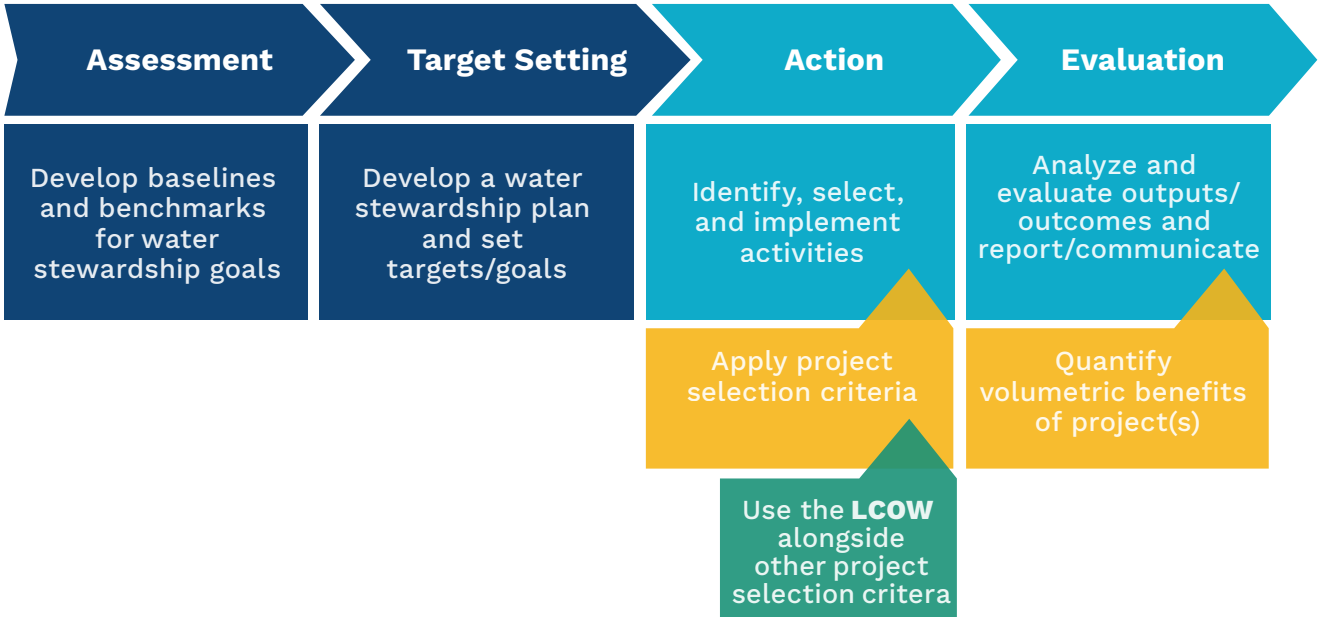
1 Projects within a company's direct operations affect the use(s) of water within its own operations and over which the company has direct control (e.g., irrigation of landscaping or use of water for cooling a server facility). Other projects, those across a company's value chain or in surrounding communities, address challenges (e.g., climate change or water scarcity) that are shared by wide range of water users including companies, governments, communities, and others.

2 The target audiences for this white paper are companies engaged in water stewardship. The LCOW is also relevant and applicable to the public sector and philanthropic investments in water projects.

The LCOW is a standardized evaluation method that provides a comprehensive and consistent framework for comparing project costs and benefits. Calculating the LCOW provides a snapshot of lifetime project costs and benefits for use in project evaluation and selection. Companies can use the LCOW to complement other project evaluation criteria when selecting water stewardship projects, and can integrate the analysis seamlessly with their existing water stewardship frameworks (Figure 1).

There is a growing suite of resources available to support water stewardship, including detailed guidance on volumetric water benefit accounting (Reig et al. 2019). The LCOW complements these approaches by offering a generally-accepted method for comparing cost-effectiveness across diverse water stewardship projects. Additionally, the LCOW can be integrated into existing and emerging frameworks. For example, it could be adopted as part of the overarching framework provided by Net Positive Water Impact and the emerging 100 Basins web application to allow users to compare projects of interest using a standard cost metric.

FIGURE 1: Where the Levelized Cost of Water Fits in a Water Stewardship Framework[3]



3 Framework adapted from CEO Water Mandate Implementing Net Positive Water Impact.

2. Cost-Effectiveness and the Levelized Cost of Water

Cost-effectiveness, cost-benefit, and return-on-investment analyses are common in corporate finance. Traditionally, these analyses work most effectively if all the costs and benefits are well-known and expressed in monetary terms. However, capturing the many benefits water projects provide in purely monetary terms can be challenging. The LCOW bridges this gap by calculating the net present value (NPV) of project costs (NPV_{Costs}) and dividing this value by the NPV of the total volumetric water benefits generated over the life of the project ($NPV_{Water\ Benefits}$) (Box 1). The result is a standardized metric (e.g., $/MG or $/ML) that incorporates key project differences, such as varying project lifespans and streams of costs and benefits. A similar approach could be utilized to assess non-volumetric WASH or water-quality projects (e.g., cost per water filter installed or cost per pound of nitrogen reduced), but in most water stewardship settings, water-related benefits from these projects could be converted to a volumetric benefit.

EQUATION 1: Calculating the Levelized Cost of Water

$$LCOW = \frac{NPV_{Costs}}{NPV_{Water\ Benefits}} = \frac{\$}{Units\ of\ Water}$$

The LCOW can be calculated with data that most, if not all, companies already collect when evaluating water stewardship projects. Project costs typically include capital and any ongoing operations and maintenance (O&M) costs. If relevant, any financial benefit to the company, generally in the form of cost savings (e.g., lower energy costs), could be subtracted from costs as part of this component of the formula. Figure 2 presents four examples to illustrate relevant inputs and how they may vary across different projects.[4] By using the LCOW, a company considering these four projects could standardize these costs and benefits. Appendix A provides additional detail on how the LCOW can be used to compare these hypothetical projects.

4 Figure 3 provides a step-by-step overview of how to apply the LCOW along with key considerations.

While these examples are focused on volumetric water benefits, a similar approach could be utilized to assess other water-related benefits, such as benefits provided by water access, sanitation, and hygiene (WASH) or water-quality projects. In these instances, the result could be, for example, the cost per capita to provide access to safe drinking water or cost per pound of nitrogen reduced.

FIGURE 2: Example Water Stewardship Projects

PROJECT 1: Implement HVAC Control Upgrades	
Start year: 2024 **Lifespan of benefits:** 20 years **Annual water savings:** 10 MG	• **Capital costs:** $1 million • **Annual water cost savings:** $50,000 • **Annual energy cost savings:** $50,000
PROJECT 2: Replace Water-Cooled Chiller with an Air-Cooled Chiller	
Start year: 2026 **Lifespan of benefits:** 20 years **Annual water savings:** 25 MG	• **Capital costs:** $5 million • **Annual water cost savings:** $125,000 • **Annual energy cost increase:** $375,000
PROJECT 3: Participate in Local Municipal Water Provider's Conservation Program	
Start year: 2024 **Lifespan of benefits:** 7 years **Annual water savings:** 5 MG	• **Capital costs:** $280,000
PROJECT 4: Partner with Local Municipality to Remove Invasive Plants	
Start year: 2024 **Lifespan of benefits:** 20 years **Annual water savings:** 90 MG	• **Capital costs:** $1.5 million

Note: Reduced water consumption in both Project 1 and Project 2 also likely results in cost savings associated with reduced wastewater (typically a separate cost category for municipally supplied water); however, in the interest of keeping the examples straightforward, these costs are not included here.

BOX 1: Net Present Value

In simple terms, NPV is a method economists use to account for the time value of money and other benefits. All else being equal, most individuals would prefer to receive a dollar today rather than receive that same dollar a year from now because there is both an opportunity cost and risk associated with uncertainty about the future. Similarly, there can be risk associated with water stewardship project function and success over time. For example, a project may generate fewer water benefits than expected due to unforeseen events or benefits may vary due to climate fluctuations. Discounting future water benefits helps companies account for this risk. It is important to note that discounting future benefits is not a judgement of merit. It does not imply that water benefits are less valuable in the future compared to today; in fact, many water benefits may be more valuable in the future as water scarcity increases. Rather, using NPV is an economic approach that helps to standardize cost estimates by factoring in uncertainty about the future.

Because of this, the NPV calculation can be applied to both project costs and benefits in the LCOW. A key question is how to discount future values compared to the present. The discount rate, a critical variable for calculating NPV, is the rate at which future costs and/or benefits are discounted relative to the present and can be set, as appropriate, by each company. The discount rate may differ for costs and benefits, but it is important that the same discount rates are used consistently across projects being compared to one another. For example, a company could choose to use the company's internal weighted average cost of capital for discounting costs and a 0.0% discount rate for benefits if they believe that present and future benefits are valued equally. Alternatively, a company could choose a non-zero discount rate to help account for the opportunity cost of capital and uncertainty/risk associated with benefits from water stewardship projects that occur in the future. Regardless of the chosen discount rates, ensuring that they are applied consistently across all projects is essential for making fair and accurate comparisons.

For further reading, see US OMB 2023a; US OMB 2023b; and HM Government Department for Business, Energy and Industrial Strategy 2016.

3. Benefits of Levelized Cost of Water for Corporate Water Stewardship

The benefits of the LCOW for water stewardship are two-fold. First, it can be calculated using data that most, if not all, companies already track and can be integrated into companies' existing project evaluation and selection process (Figure 1). Second, it distills complex variables into a single number that can be quickly compared and easily understood across diverse project types. In particular, the LCOW allows companies to compare costs and benefits associated with a wide range of potential water stewardship projects and to consider these as one component in their evaluation and selection process.

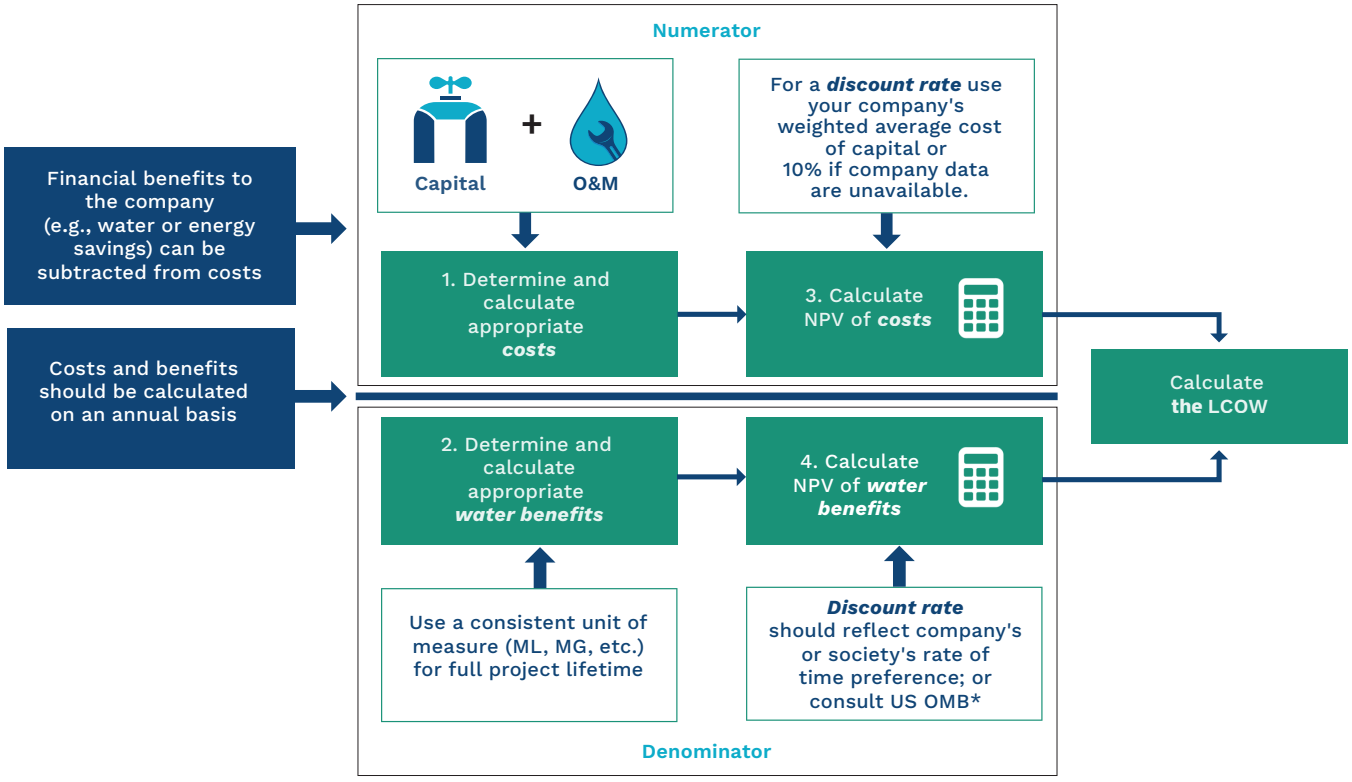
The LCOW provides the most insight when used with other, non-cost related evaluation criteria, such as project alignment with specific challenges in a watershed and project risk and uncertainties (Bluerisk et al. 2019 and 2023). Using the LCOW within a multi-criteria approach, therefore, is recommended to make trade-offs transparent and explicit within company decision-making.

Additionally, widespread adoption of the LCOW would help standardize calculation of project costs across the water stewardship practice space. A company exploring an opportunity to fund agricultural water use conservation project might consult with other companies or a publicly available clearinghouse of LCOW data (if one were created) to determine whether the costs of its project are in line with other similar projects. If a company found differing costs between two similar projects, they might investigate why and discover helpful insights. For example, agricultural water conservation might cost more in one region due to different equipment or technology needs. In the same scenario, if costs are different, but no underlying reasons are apparent, then a company might be able to generate a greater volume of benefits by selecting a project with a lower LCOW.

4. Applying the LCOW to Potential Projects

While the LCOW is a straightforward metric relying on only a few inputs, several considerations can impact the calculation. Figure 3 below provides a step-by-step overview of how to apply the LCOW metric, including the numerator and denominator components.

FIGURE 3. Considerations and Process for Calculating the LCOW



The numerator accounts for project costs, including capital and ongoing O&M costs, with financial benefits such as water or energy savings subtracted if present. The denominator focuses on the volumetric water benefits, calculated over the project's lifetime using a consistent unit of measure. Both costs and benefits are discounted to their NPV. The recommended discount rate for costs is either to use a company's internal weighted cost of capital, or alternatively 10% if company data is not available. The discount rate used for benefits, if a company chooses to discount benefits (see Box 1 above), should reflect the company's or society's rate of time preference. This comprehensive approach ensures that all relevant factors are considered in the evaluation process.

Another consideration in applying the LCOW is how it aligns with time-bound targets and metrics. For example, many companies have committed to replenishing 100% of their water consumption by 2030. This raises an important question: why calculate the lifetime costs and benefits of projects when the target is tied to a specific target year? While the LCOW accounts for the full lifespan of a project, understanding these long-term costs and benefits can help companies maximize volumetric water benefits within a given budget. At the same time, the LCOW framework allows companies to estimate the specific water benefits expected by 2030, ensuring they can evaluate progress toward interim goals while considering broader, long-term impacts.

Finally, it is important to understand the limitations of the LCOW to avoid misusing the metric. First, the formula is based on assumptions about certain factors—the discount rate, the project lifespan, and how costs and water benefits are distributed over time. These assumptions, and the user's confidence in each assumption, may differ across projects, all of which impact the final LCOW value to varying degrees. Sensitivity analysis can be used to test the impact of altering some or all these assumptions and calculation variables.

Second, the LCOW is typically most helpful when comparing projects of similar type, focus and/or geography, for example, when the metric is used to compare:

- a water quality project with other water quality projects rather than with projects that increase water quantity;
- an on-site water efficiency project with another on-site project rather than with an off-site WASH project; or
- a water quantity project with other water quantity projects addressing a specific challenge in a watershed rather than projects in a different watershed.

Conclusion

The LCOW is an easy-to-calculate measure of cost-effectiveness for companies to use when evaluating whether to fund water stewardship projects. It uses data companies already collect to distill several complex considerations, including varied lifespans, multiple benefits, project scales, and timing of both fixed and variable costs, into a single number that can quickly be compared across projects and is easily understood. Widespread adoption of the LCOW metric across the water stewardship practice would help to standardize consideration of cost effectiveness as one factor companies use in project selection. In turn, a widely accepted approach to understanding cost-effectiveness could help companies better meet ambitious water stewardship goals with limited budgets. When companies invest in water stewardship, they are doing so to mitigate water-related business risk. In a world where water risk for companies is increasing rapidly, the LCOW metric can help maximize the impact of water stewardship efforts.

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Appendix A: Applying the Levelized Cost of Water to a Hypothetical Use Case

Fictional company CloudCo (CC) is a provider of third-party data center services. CC has publicly committed to reduce its company-wide water use by 25% compared to a 2030 business-as-usual scenario, and to being water positive for each of its data center facilities by 2030 by funding water stewardship projects. CC's data center facility Cumulus is served by four water-cooled chillers using 100 million gallons of water per year, which it currently purchases from a local municipal water provider at $5,000 per million gallons. CC's sustainability team is considering the four possible water stewardship projects previously described in Figure 2 above. Projects 1 and 2 are on-site and would help reduce company-wide water use, while Projects 3 and 4 are off-site and would contribute to CC's water positive goal.

For calculating the LCOW, CC has chosen to use its weighted average cost of capital (i.e., 5%) to discount costs and the OMB recommended social rate of time preference (i.e., 2%) to discount water benefits. CC believes that this discount rate for benefits represents the small amount of risk introduced by possible variation in outcomes over time. The team runs these projects through a multi-criteria evaluation process that includes the LCOW, which is summarized for each project in Figure A1. Detailed calculations also are provided in Table 1.

FIGURE A1. CloudCo's Levelized Cost of Water Calculations

PROJECT 1: **Implement HVAC Control Upgrades**	• **NPV costs (incl. savings):** -$246,221 • **NPV water benefits:** 164 MG • **LCOW: -$1,506/MG**
PROJECT 2 **Replace Water-Cooled Chiller with an Air-Cooled Chiller**	• **NPV costs (incl. savings):** $7,361,045 • **NPV water benefits:** 377 MG • **LCOW: $18,735/MG**
PROJECT 3 **Participate in Local Municipal Water Provider's Conservation Program**	• **NPV costs (incl. savings):** $243,028 • **NPV water benefits:** 33 MG • **LCOW: $7,363/MG**
PROJECT 4 **Partner with Local Municipality to Remove Invasive Plants**	• **NPV costs (incl. savings):** $1,500,000 • **NPV water benefits:** 1,472 MG • **LCOW: $1,019/MG**

Examining the results, the sustainability team proposes the following:

- Move ahead with Project 1 as it improves CC's bottom line and contributes to the Cumulus site goal of decreasing water use;
- Set Project 2 aside for now due to its high LCOW and integrate results into a LCOW analysis of alternatives for saving water at all of CC's sites;
- Conduct further due diligence on Project 3 to validate the program and understand why the benefits cannot be claimed over a longer time frame. For example, if the program was focused on converting traditional lawns to more water-efficient landscapes, the water-savings benefits could be expected to last longer than seven years and the resulting LCOW would be adjusted downward;
- Consider funding some or all of Project 4, adjusting the acreage and water benefit to meet revised 2030 water usage at the Cumulus site based on final expected numbers from other selected projects.

TABLE A1. Levelized Cost of Water Calculations

PROJECT 1	NPV	Total	2024	2025	2026	2027-2044
Capital Costs	$1,000,000	$1,000,000	$1,000,000	—	—	—
O&M Costs	—	—	—	—	—	—
Benefits - Cost Savings	$1,246,221	$2,000,000	—	$100,000	$100,000	$100,000
Total Costs	-$246,221	-$1,000,000	$1,000,000	$100,000	$100,000	$100,000
Benefits - Water (MG)	164	200	—	10	10	10
LCOW ($/MG)	**-$1,506**					

PROJECT 2	NPV	Total	2024	2025	2026	2027-2046
Capital Costs	$4,535,147	$5,000,000	—	—	$5,000,000	—
O&M Costs	$4,238,847	$7,500,000	—	—	—	$375,000
Benefits - Cost Savings	$1,412,949	$2,500,000	—	—	—	$125,000
Total Costs	$7,361,045	$10,000,000	—	—	$5,000,000	$500,000
Water Benefits (MG)	393	500	—	—	—	25
LCOW ($/MG)	**$18,735**					

PROJECT 3	NPV	Total	2024	2025	2026	2027-2030
Capital Costs	$243,028	$280,000	$37,500	$37,500	$37,500	$37,500
O&M Costs	—	—	—	—	—	—
Benefits - Cost Savings	—	—	—	—	—	—
Total Costs	$243,028	$280,000	$37,500	$37,500	$37,500	$37,500
Benefits - Water (MG)	33	35	5	5	5	5
LCOW ($/MG)	**$7,363**					

PROJECT 4	NPV	Total	2024	2025	2026	2027-2044
Capital Costs	$1,500,000	$1,500,000	$1,100,000	—	—	—
O&M Costs	—	—	—	—	—	—
Benefits - Cost Savings	—	—	—	—	—	—
Total Costs	$1,500,000	$1,500,000	$1,100,000	$0	$0	$0
Benefits - Water (MG)	1,472	1,800	—	90	90	90
LCOW ($/MG)	**$1,019**					

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