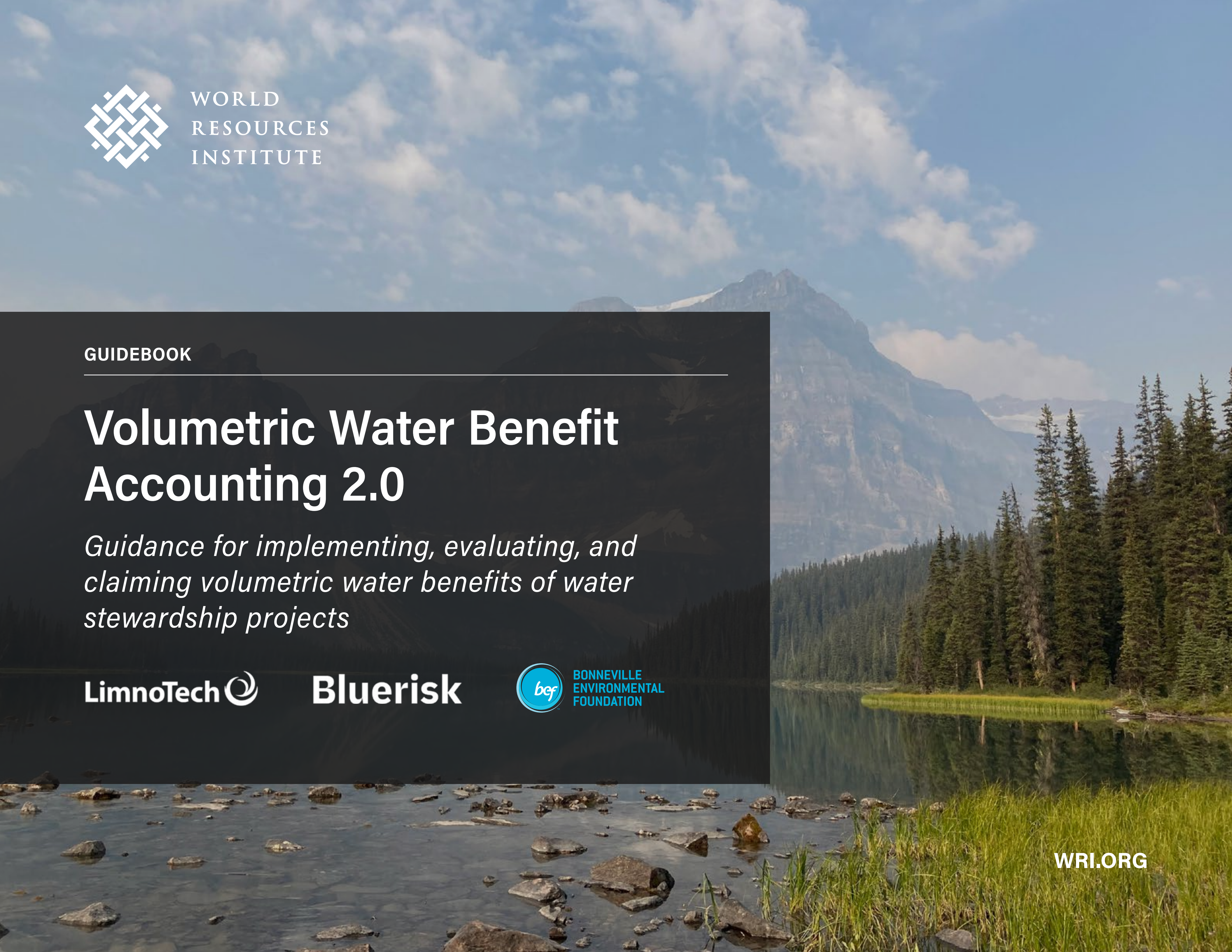

WORLD
RESOURCES
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GUIDEBOOK

# Volumetric Water Benefit Accounting 2.0

*Guidance for implementing, evaluating, and claiming volumetric water benefits of water stewardship projects*

LimnoTech

Bluerisk

BONNEVILLE
ENVIRONMENTAL
FOUNDATION

WRI.ORG

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**AUTHORS**

**World Resources Institute:** Natasha Collins, Marc Dettmann, Todd Gartner, Sara Walker

**LimnoTech:** Wendy Larson, Penelope Moskus, Pranesh Selvendiran, Laura Weintraub

**Bluerisk:** Paul Reig, Jenna Stewart

**Bonneville Environmental Foundation:** Sara Hoversten, Scott McCaulou, Todd Reeve, Robert Warren

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**LAYOUT**

Shannon Collins
shannon.collins@wri.org

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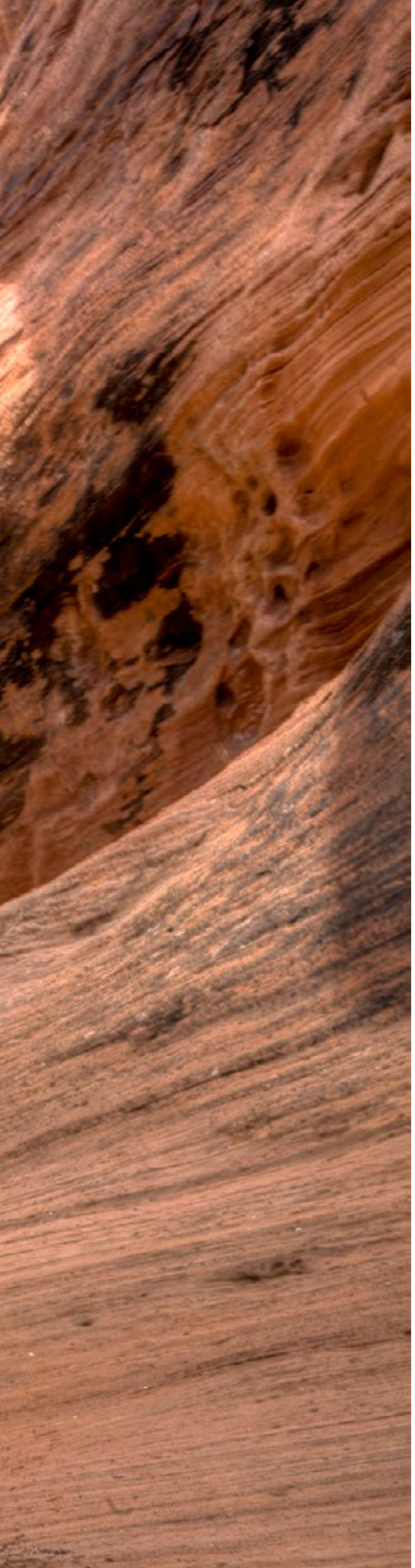


# EXECUTIVE
# Summary

As water challenges intensify, companies need clear, consistent, and science-based guidance to make credible volumetric water benefit (VWB) claims that advance ambitious water goals. This guidebook provides practical indicators, methods, and attribution plans to help companies quantify, track, report, and communicate VWBs from their stewardship activities. Drawing on expert insights and decades of experience, it outlines six steps for identifying activities and demonstrating measurable volumetric water benefits.

## HIGHLIGHTS

- Since its release in 2019, Volumetric Water Benefit Accounting (VWBA) has been widely adopted and is considered a best-practice resource that provides comparable, credible, and transparent methods for quantifying the volumetric benefits of water stewardship activities.
- This VWBA 2.0 guidebook is an improved version of VWBA that addresses a recognized need for expanded guidance related to volumetric water benefits (VWBs), based on lessons learned over the years that can help water stewardship professionals with real-world implementation.
- Developed through extensive partner consultation, this guidebook offers a six-step process and describes how to do the following: gain an understanding of the local context and shared water challenges; identify and evaluate potential projects and partners; credibly quantify volumetric water benefits; plan and agree to a project; implement projects and track progress; and communicate claims.
- This principle-based, voluntary, and nonprescriptive guidance is designed for water stewardship practitioners and companies seeking to make consistent, credible volumetric water benefit claims across diverse geographies and water stewardship activities.
- This guidebook is limited to volumetric water benefits, but many elements of the guidance are designed to help practitioners identify and implement the type of water stewardship activities that will be most relevant to the catchment context and therefore deliver the most value to the catchment and its relevant parties.

## Background

**VWBA is a common method that continues to evolve to meet the growing needs related to corporate water stewardship goals.** VWBA guidance released in 2019 by Reig et al. has become a best-practice resource for companies that invest in water stewardship activities, but as the complexity and scale of shared water challenges intensifies, there is increasing demand for expanded guidance with consistent, pragmatic, and science-based principles to guide companies in making credible VWB claims that support ambitious enterprise and value chain water goals. These principles and the steps outlined in VWBA 2.0 provide practitioners with guidance that increases the likelihood that VWBA outputs will generate sustainable and beneficial outcomes and impacts that complement sustainable business strategies and mitigate current and future water risks.

## About this guidebook

**VWBA 2.0 offers voluntary, principle-based, and nonprescriptive guidance that is applicable to a broad spectrum of water stewardship activities. The guidance is structured to help determine indicators, methods, and attribution plans that can be used to effectively quantify, track, report, and communicate the VWBs of water stewardship activities.** This publication was developed by WRI, LimnoTech, Bluerisk, Bonneville Environmental Foundation, with input from corporate partners and technical advisors, ensuring the guidance is practical, credible, and informed by best practices and methods. This guidebook may be applicable to a variety of audiences involved in water stewardship activities but was written with two in mind: corporate water stewardship practitioners and water stewardship project implementers.

## VWBA 2.0 application

**This guidebook describes six steps that companies can use to identify water stewardship activities and quantify, track, report, and communicate VWBs (Figure ES-1).**

1. **Understand the local catchment context.** Since water challenges are influenced by local factors that vary significantly across catchments, it is important to first understand the local context, which can help to identify and prioritize shared water challenges. This first step typically involves building an understanding of the political, hydrological, social, and governance conditions of the catchment as well as identifying relevant parties and their respective roles.
2. **Identify and evaluate potential project activities and partners.** Ensuring alignment between a company's stated commitments and goals and how and where VWBs are generated based on water stewardship activities is essential for making credible claims. Companies and practitioners can use VWBA 2.0 guidance to evaluate potential projects against a set of six eligibility criteria that should be met to ensure the project has the potential to generate a credible VWB. The guidebook also includes a

Figure ES-1 | **VWBA 2.0 six-step method**

1. Understand the local catchment context
2. Identify and evaluate potential project activities and partners
3. Quantify the VWBs of project activities
4. Plan and agree
5. Implement project and track progress
6. Confirm and prepare for VWB communications

*Note:* VWBA = Volumetric Water Benefit Accounting; VWB = volumetric water benefit.
*Source:* Authors.

set of 10 project selection considerations that can help practitioners identify, prioritize, and select projects to strengthen potential outcomes and impacts. Guidance is provided on strategies for partnering with reputable and experienced implementing partners who can help identify and evaluate meaningful water stewardship activities that deliver quantifiable VWBs.

3. **Quantify the VWBs of project activities.** After practitioners understand the local context and shared water challenge(s) and identify project activities that address those challenge(s), they can select a volumetric objective and associated indicators and methods and quantify the VWBs. The following principles are provided to help practitioners quantify VWBs:

    - Understand the primary objective of each project activity
    - Use practical and scientifically defensible methods
    - Identify, document, and apply conservative inputs and assumptions
    - Use an appropriate temporal scale
    - Avoid double counting VWBs

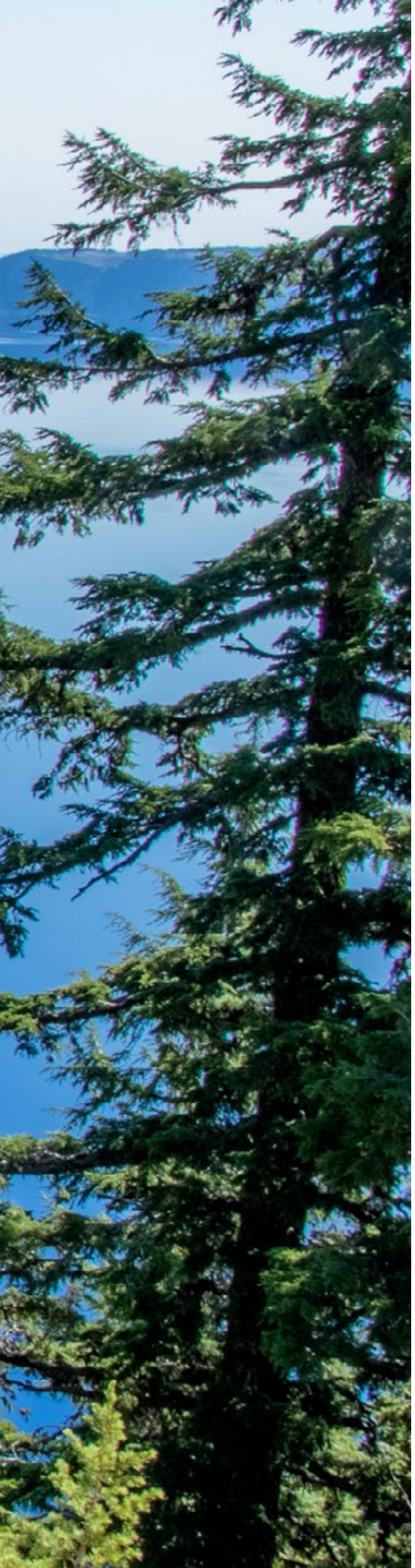
    A variety of methods and indicators are provided with guidance on scenarios for appropriate application.

4. **Plan and agree.** Companies partner with others in many ways to support water stewardship activities. Prior to final project selection and contracting, it is important for all parties (sponsors and implementers) to develop a shared understanding of the VWB attribution plan, implementation timeline, cost, and duration of the activity and associated VWBs, as well as the tracking and reporting plan. Where possible, when multiple project sponsors are involved, there should be alignment among all parties to apply a consistent method and approach for VWB quantification. By considering these components and including them in the agreement process, companies can help ensure they will be well positioned to track, report, and communicate VWBs following implementation.

5. **Implement project and track progress.** Once the project is contracted and the attribution and tracking and reporting plans are in place, corporate practitioners and project implementers can execute project activities and document VWB outputs with sufficient information to make VWB claims. Where possible, companies can work with project implementers and tie into existing monitoring efforts to evaluate broader desired outcomes and longer-term levels of impact.

6. **Confirm and prepare for VWB communications.** VWB claims are any statement, accounting, or communication regarding the delivery of existing or anticipated VWBs that result from voluntary actions taken by the entity making the claim. Before making claims, practitioners should confirm that VWBs being claimed are

    - delivered by activities that meet VWB eligibility criteria;
    - aligned with company goals;
    - representative of the activity's status and duration; and
    - representative of the company's contributions to the activity.



# Introduction

The introduction highlights the context in which this guidebook emerged, including building on the decades of experience companies have gained from balancing water use and addressing risks through investments in community and catchment projects. It identifies key objectives of VWBA 2.0 which aims to help companies and practitioners make consistent, credible volumetric water benefit claims across diverse geographies and water stewardship activities through the implementation of a six-step process. The guidance illustrates the impact pathway for VWBs as outputs that can be quantified and aggregated for water stewardship activities. The introduction identifies the limitations of the guidebook—namely, that VWBs are outputs—and they do not guarantee reductions in shared water challenges or delivery of social, economic, or environmental benefits.

## Background

The top four global risks, as reported by both private and public sector organizations, are water related (WEF 2024), and the shared nature of water challenges requires solutions at the catchment scale to meaningfully reduce risk. By addressing shared water challenges within a catchment, organizations across sectors can contribute to improving catchment conditions while lessening their exposure to physical, regulatory, and reputational water-related risks.

For more than a decade, an increasing number of companies have made public commitments to balance their water use and address their water-related risks and impacts through catchment and community investments outside the facility walls. The projects these investments support are designed to address shared water challenges and increase water resilience.

Volumetric Water Benefit Accounting (VWBA) guidance was published in 2019 (Reig et al.) to provide a common method for quantifying the volumetric water benefits (VWBs) of water stewardship activities. VWBA is used to evaluate progress toward water balance targets, also commonly referred to as water replenishment, restoration, or regeneration targets, and contextual water targets (Reig et al. 2021; UNGC et al. 2019). VWBs are defined as the volume of water resulting from water stewardship activities, relative to a unit of time, that modify the hydrology in a beneficial way and/or help reduce shared water challenges.

VWBA was also developed to guide companies in selecting activities that address water risks and shared water challenges, advance public policy objectives, and help meet the Sustainable Development Goal for water (SDG6). These activities take place in the communities and catchments where they have sites, suppliers, and/or consumers, and from which they source their water or have an impact on water sources, or that they otherwise prioritize. Since its publication, VWBA has been applied globally and is widely recognized as the industry best-practice resource for tracking progress toward voluntary corporate volumetric water goals. The *Volumetric Water Benefit Accounting 2.0: Guidance for implementing, evaluating, and claiming volumetric water benefits of water stewardship projects* (hereafter referred to as “the guidebook” and “VWBA 2.0.”) uses a six-step process to help corporate water stewardship professionals and practitioners better understand changing shared water challenges and offers comparable, credible, and transparent methods for quantifying the volumetric benefits of water stewardship activities.

Six years since the publication of the first VWBA guidance, many corporate volumetric water programs are well into the implementation phase, providing valuable lessons learned from early adopters of VWBA, including the need for the following:

- Greater clarity on how to select and vet project opportunities based on their potential to generate volumetric water benefits while contributing to broader catchment outcomes
- Standardized, consistent guidelines for tracking, reporting, and communicating the benefits of water stewardship projects to ensure that claims are credible, including clear and defensible principles on accounting for and attributing benefits
- Additional and updated guidance on selecting VWB indicators and quantification methods for various project activities

## Objective

Bluerisk, Bonneville Environmental Foundation, LimnoTech, and World Resources Institute (WRI) have come together to leverage their experience designing, implementing, and tracking the progress of corporate volumetric water goals to update VWBA and publish Volumetric Water Benefit Accounting 2.0. The intent of this guidebook is to help companies and other relevant parties with six principal tasks:

1. Understand the local context and identify shared water challenges
2. Identify and evaluate potential project activities and partners
3. Quantify the volumetric water benefits of project activities
4. Plan and agree
5. Implement project and track progress
6. Confirm and prepare for VWB communications

Given the diverse range of catchment conditions and multitude of water stewardship activities a company may support around the world, VWBA 2.0 has been developed as voluntary, principle-based, and nonprescriptive guidance. It provides recommendations for best practices intended to assist companies in making well-founded, robust, and substantiated water stewardship claims that reflect genuine efforts to reduce environmental impacts and promote sustainable practices and outcomes. Companies are also encouraged to consider their environmental impact and social responsibilities beyond the scope of this document's guidance. As climate change accelerates shared water challenges, the application of this guidebook should complement sustainable and just business strategies and water resource–management commitments that consider current and future water risks and impacts.

## Target audiences

VWBA 2.0 is intended for a variety of audiences interested in VWBA but is written with two specifically in mind:

- **Corporate water stewardship practitioners** involved in designing and implementing water stewardship programs with volumetric targets, and tracking progress against corporate water goals
- **Organizations implementing water stewardship projects**, including nongovernmental organizations (NGOs), local community and river basin associations, utilities, engineering companies, and other organizations that leverage corporate support to undertake project activities that generate volumetric water benefits

## How VWBA 2.0 was developed

VWBA 2.0 was developed by building on the learnings and experiences gained from applying the first VWBA guidance, and in close consultation with relevant parties, to ensure that it is

- **practical and applicable**, within the context of corporate decision-making and meeting the needs of the target audience;
- **trusted and credible**, informed by published scientific methods, practitioner experience, and current water stewardship practice; and
- **comparable and replicable**, using a standardized approach and set of indicators that can be applied across water stewardship activities, geographies, and organizations.

The process for updating VWBA was carried out in several steps, each of which involved interaction and communication with external partners and advisors. The project team carried out the work with input from corporate sponsors and multiple external reviewers from NGOs, civil society, and academia.

The project team drafted a series of four installments on a rolling basis throughout 2023 and 2024 to align corporate sponsors and external reviewers on key principles, terms, best practices, and new and updated guidance. Each installment covered a specific topic and provided recommendations based on experiences and insights gleaned from implementing water stewardship strategies, programs, projects, and activities:

- Installment 1: project eligibility criteria and selection considerations
- Installment 2: principles for making credible VWB claims
- Installment 3: principles for VWB tracking and reporting
- Installment 4: updated VWB calculation methods

Following the completion of these installments, the project team consolidated and synthesized the content documented herein for review and publication, guided by WRI's Research, Data, and Impact team and following WRI's extensive process of both internal and external peer review with topic experts, target audience members, and reviewers with opposing viewpoints.

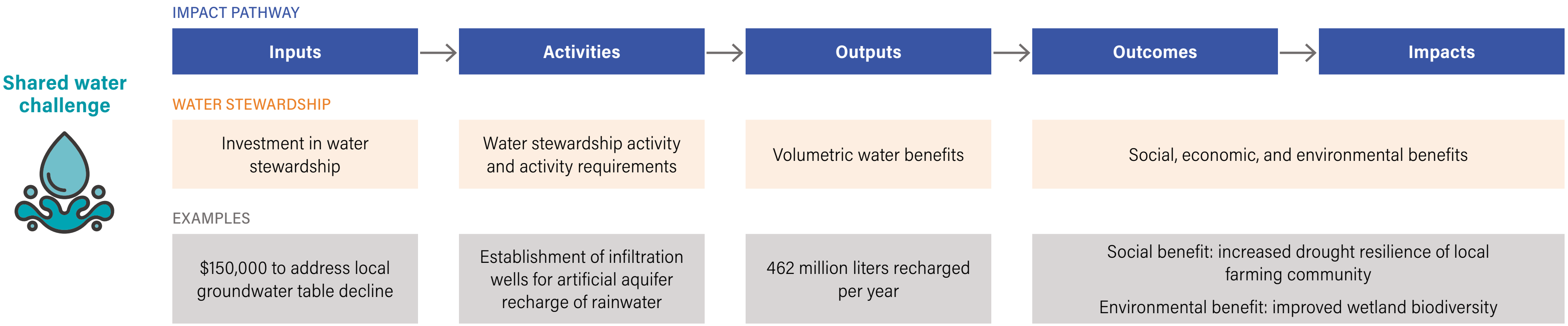
## The impact pathway of water stewardship activities

This guidebook provides organizations with a recommended approach to identifying water stewardship activities to invest in; selecting appropriate methods to quantify VWBs using different indicators, depending on the activity objective; and reporting and tracking results in units of volume of water over time. The resulting VWB "output" is based on a consistent approach informed by best practice and provides a unit of measurement to aid in tracking and communicating progress consistently toward volumetric water commitments, targets, and goals (Figure 1). By using a consistent unit, VWBA allows practitioners to compare and aggregate the VWBs of water stewardship activities anywhere across a value chain, provided the activity meets the project eligibility criteria outlined in this document.

Because VWBs are an output, not an outcome, they do not reflect the associated social, economic, and environmental benefits of water stewardship activities (Figure 1). Furthermore, because volume is only one dimension of water stewardship activities, VWBs should not be the only metric used to inform decisions or assess impact.

Figure 1 | **Water stewardship activity impact pathway**

**Impact pathway for water stewardship activities**



| | Inputs | Activities | Outputs | Outcomes | Impacts |
|---|---|---|---|---|---|
| IMPACT PATHWAY | Inputs | Activities | Outputs | Outcomes | Impacts |
| WATER STEWARDSHIP | Investment in water stewardship | Water stewardship activity and activity requirements | Volumetric water benefits | Social, economic, and environmental benefits | |
| EXAMPLES | $150,000 to address local groundwater table decline | Establishment of infiltration wells for artificial aquifer recharge of rainwater | 462 million liters recharged per year | Social benefit: increased drought resilience of local farming community<br>Environmental benefit: improved wetland biodiversity | |

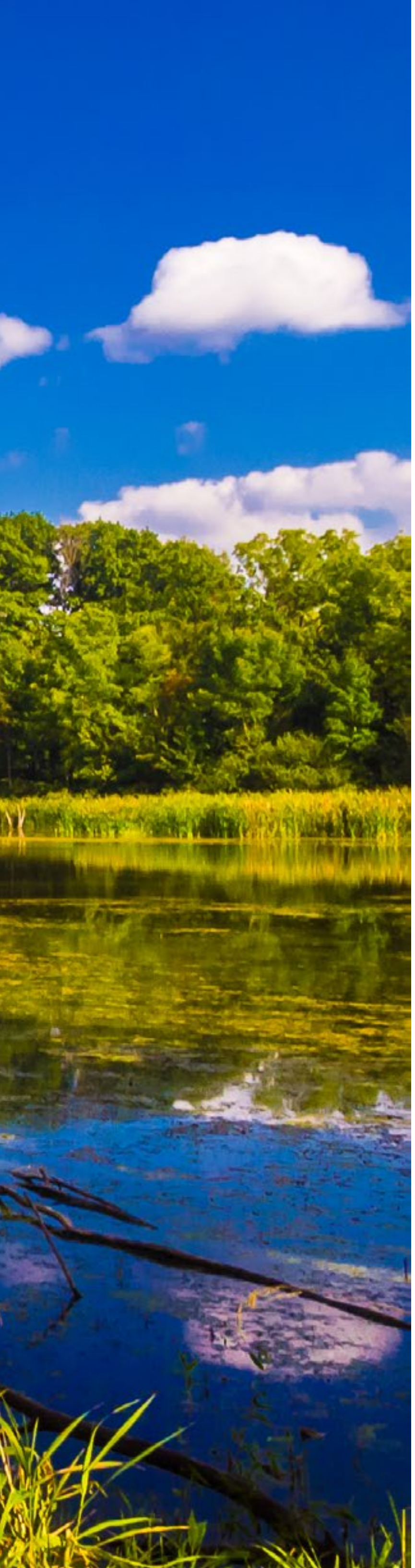
*Source:* Based on information from WBCSD (2019), modified by authors using the Social & Human Capital Protocol.

## Limitations

For successful implementation of VWBA, companies must have a deep understanding of their water use, exposure to risk, and catchment conditions. This guidebook will be most relevant to those companies with clear and well-defined corporate water stewardship goals and targets for priority basins. VWBA 2.0 should be used as a resource for selecting projects, estimating and comparing the volumetric water benefits of water stewardship activities, and tracking and communicating the progress attained by ongoing activities, as part of an organization's water stewardship strategy.

Although VWBs are typically aggregated across multiple projects to track progress toward water goals, achieving a volumetric water goal does not provide assurance that shared water challenges are reduced or that social, economic, and environmental benefits are delivered given other actors and activities in the basin that are also using water resources. The project eligibility criteria (see Appendix A) and project selection considerations (see Appendix B) presented in this guidebook help inform investment in water stewardship activities that not only generate VWBs, but also increase the likelihood that a water stewardship project generates social, economic, and environmental benefits that will contribute to addressing shared water challenges in the catchment.

Where feasible, quantifying environmental, social, or economic benefits is a useful step to ensure that water stewardship activities deliver intended impact and value; however, quantification may require extensive data and time, and outcomes and impacts may not be detectable until projects are implemented at scale. Extensive engagement with relevant parties suggests that quantifying VWBs is preferable for certain applications, not as an alternative to measuring environmental, social, or economic benefits but rather as an intermediate and practical step that can yield a consistent and standardized output measurement.



# Application

This section dives deeper into the kinds of actions and practices that should be followed to identify and implement relevant water stewardship activities and communicate associated claims. This section provides step-by-step guidance for carrying out water stewardship activities and communicating their benefits. It explains how to (1) understand the local catchment context, (2) identify and evaluate potential project activities and partners, (3) quantify the VWBs of project activities, (4) plan and agree to a project (5) implement project and track progress, and (6) confirm and prepare for VWB communications.

This section describes the VWBA 2.0 six-step method (see Figure 2), detailed guidance, and recommended resources that a corporate water stewardship practitioner can follow to identify water stewardship activities and quantify, track, report, and communicate the volumetric water benefits of these activities. These six steps are informed by decades of practitioner experience and industry best practice. The steps may be undertaken consecutively or in a different order. These steps are not meant to be prescriptive but rather illustrative of the kinds of actions and practices that should be followed to identify and implement relevant water stewardship activities and communicate associated claims.

## Step 1. Understand the local catchment context

This step guides practitioners through the process of understanding the local context by identifying shared water challenges and considering company interactions with water in the catchment. Water is influenced by factors within the local catchment. Because of this, the specific nature of shared water challenges can vary substantially among catchments. Therefore, in addition to considering a company's own impacts, water stewardship projects should be evaluated with an understanding of the local catchment context and shared water challenges by examining the primary socio-ecological-technical systems and their inter-related impacts within the watershed (McPhearson et al. 2021; UNGC et al. 2019).

Evaluating the local context requires understanding the catchment boundaries and physical characteristics, surface water and groundwater conditions, water governance, relevant parties, and known water challenges. When possible, engaging with relevant parties within the catchment, including those that are vulnerable and adversely impacted by water challenges, can provide a deeper understanding of the local context, including the social and governance context and the values and priorities of relevant parties. Desktop research or outreach to relevant parties may identify water-related efforts already in place or underway, to which the organization can potentially contribute or align with before starting new activities.

Figure 2 | **VWBA 2.0 six-step method**

1. Understand the local catchment context
2. Identify and evaluate potential project activities and partners
3. Quantify the VWBs of project activities
4. Plan and agree
5. Implement project and track progress
6. Confirm and prepare for VWB communications

*Note:* VWBA = Volumetric Water Benefit Accounting; VWB = volumetric water benefit.
*Source:* Authors.

Defining and aligning with strategic watershed objectives (Box 1) can help identify the type of water stewardship activities that will be most relevant to the catchment context and therefore deliver the most value to the catchment and its relevant parties.

Box 1 | **Strategic watershed objectives**

A strategic watershed objective refers to a common goal shared between the company and other relevant parties in the catchment that contributes toward meeting a shared vision for the catchment. A good strategic objective should aim to minimize or eliminate the root cause of one or more shared water challenges and describe the catchment outcomes it aims to achieve (i.e., the shared vision), considering changes in the catchment context over space and time. Strategic watershed objectives can be defined by considering two key elements: the local catchment context, shared water challenges, and relevant parties and their water-related values and priorities; and company interactions with water in that catchment, including the company's water-related dependency, risks, and impacts.

Many companies have benefitted from defining strategic watershed objectives prior to engaging in water stewardship activities to help guide and inform what water stewardship activities to support and ensure they deliver the most value to the company, the catchment, and relevant parties.

# Step 2. Identify and evaluate potential project activities and partners

Grounded in an understanding of the local context, companies can identify and evaluate projects that are in alignment with both company goals and local needs. This can be done using project eligibility criteria, as well as other considerations for ranking and selecting projects.

Project eligibility criteria (see Appendix A) are provided, as well as considerations for ranking and selecting projects (see Appendix B). This section aims to provide consistency and assurance to companies that their project investment decisions are aligned with current best practice.

## Step 2.1. Consider how and where VWBs may be generated to align with company goals

VWBs are mostly used to track and communicate progress against enterprise and/or site volumetric water goals, including claims that a company's goals have been met in line with the company's commitments. Because of this, companies should pay special attention to how and where VWBs are generated to ensure that the type, timing, and location of the VWBs and any claims are in line with the company's commitments stated in its goals. Identifying and implementing water stewardship activities aligned with company commitments and external expectations is essential for making robust and credible VWB claims. There are a few key considerations related to where VWBs are generated:

**Desired outcome of the goal.** A variety of enterprise- and site-level volumetric water stewardship goals exist, many of which specify where VWBs must be generated to meet the desired objective, such as the following:

- **Goals aiming to balance water withdrawals or consumption from a company's sites, suppliers, and/or consumers** (e.g., with water restoration, replenishment, or regeneration) or balance goals based on the water withdrawals or consumption each year from the company's sites, suppliers, and/or consumers. These goals should not be met by making changes in the operational water balance or withdrawals, consumption, or discharge of the company's sites, suppliers, or consumers. Instead, they should be met by VWBs resulting from activities that modify the hydrology in a beneficial way in the catchment in an amount equal to or greater than the company's water withdrawals or consumption at that location. An example of this type of goal is to replenish more water than what is used by the company in certain catchments (e.g., in water-stressed catchments).
- **Goals aiming to align a company's impacts on water availability with catchment sustainability thresholds**, such as water goals informed by a catchment surface water balance, groundwater recharge, or environmental flow requirements. These goals can be met by VWBs resulting from changes in the company's, suppliers', and/or consumers' water withdrawals, consumption, or discharge volumes and by VWBs resulting from activities implemented in the relevant catchment. Examples of these goals include contextual water targets, freshwater science-based targets, and other goals to close the gap to sustainable water-use levels.

**Geographic scope of the goal.** Volumetric water goals typically specify in what geography the VWBs must be delivered; two examples include the following:

- **Goals focused on addressing company risks** should be met with VWBs generated in areas facing water risks relevant to the company's value chain footprint.
- **Goals focused on addressing company impacts** should be met by VWBs generated in a catchment that is hydrologically connected to the location where the company affects water resources through its water withdrawals, consumption, or wastewater discharge.

## Step 2.2. Identify potential project activities and partners

The next step is to identify potential activities and partners. These may include activities driven by the public, private, Indigenous, or nonprofit sectors.

Project activities should have the potential to address shared water challenges and, where relevant, align with existing efforts to address water issues. Coordination with reputable and experienced implementing partners can improve the likelihood of success as they can help evaluate and minimize the likelihood of unintended negative impacts. Table 1 provides a water stewardship activity classification with example activities.

Table 1 | **Water stewardship activity classification**

| CATEGORY | EXAMPLE ACTIVITY |
|---|---|
| **Agricultural best management practices** | ▪ Cover crops, mulching, reduced till or no-till, laser leveling, terraced planting, contour planting, agroforestry, regenerative agriculture, grazing management<br>▪ Agricultural nutrient management, pesticide management, herbicide management, and others<br>▪ Irrigation efficiency, irrigation conversion |
| **Demand management** | ▪ Operational efficiency measures, water reuse and recycling, changes in agricultural practices that reduce demand, changes in water sources, low flow fixtures, or legal water transactions involving surface or groundwater<br>▪ Leak detection and repair<br>▪ Removal of invasive species, forest thinning, crop conversion, fallowing |
| **Green or gray infrastructure** | ▪ Rain gardens, bioswales, stormwater detention or retention ponds, pond dredging, pond desilting, drainage water management, blind inlets, and other interventions designed to capture runoff<br>▪ Constructed wetland treatment systems, bioretention basins<br>▪ Wastewater treatment plants and gray infrastructure for water reuse and recycling and other activities<br>▪ Well construction and rehabilitation, household water connections, piped water systems, rainwater harvesting, water reuse, point-of-use treatment, drinking water treatment facilities, and other activities that develop new or alternative sources of water supply for irrigation or domestic use (including handwashing, bathing, and cleaning)<br>▪ Instream barrier removal, dam reoperation, floodplain reconnection, levee or berm removal, side channel reconnection, riparian habitat improvements, process-based restoration, wet meadow restoration, beaver dam analogs, water level management for habitat, wetland or peat bog protection or restoration, wetland creation<br>▪ Sustainable drainage systems, check dams, infiltration basins, infiltration wells, infiltration trenches, infiltration shafts, and other activities that facilitate increased recharge<br>▪ Restoration and creation activities for wetlands or other aquatic habitats that store water, inclusive of invasive species removal, dredging<br>▪ Conservation easements or other activities that protect wetlands or other aquatic habitats that store water<br>▪ Washing stations, street sweeping, impervious area disconnection, and urban soil amendments |

Table 1 | **Water stewardship activity classification (cont.)**

| CATEGORY | EXAMPLE ACTIVITY |
|---|---|
| **Land conservation and restoration** | ▪ Forest conservation, meadow conservation, grassland conservation, and other activities that preserve land vegetation cover<br>▪ Reforestation, grassland restoration, and other activities that restore vegetation cover |
| **Water, sanitation, and hygiene (WASH)** | ▪ Activities that increase access to potable household and community water supply<br>▪ New water supply for domestic use<br>▪ Activities that increase access to sanitation facilities where excreta are safely disposed of in situ or removed and treated off-site |

*Note:* The classification above includes the most commonly implemented water stewardship activities by corporate water stewardship practitioners at the time this guidebook was written. This list is not comprehensive, and organizations are encouraged to also consider other activities that respond to local shared water challenges and relevant partners' priorities.

*Source:* Authors.

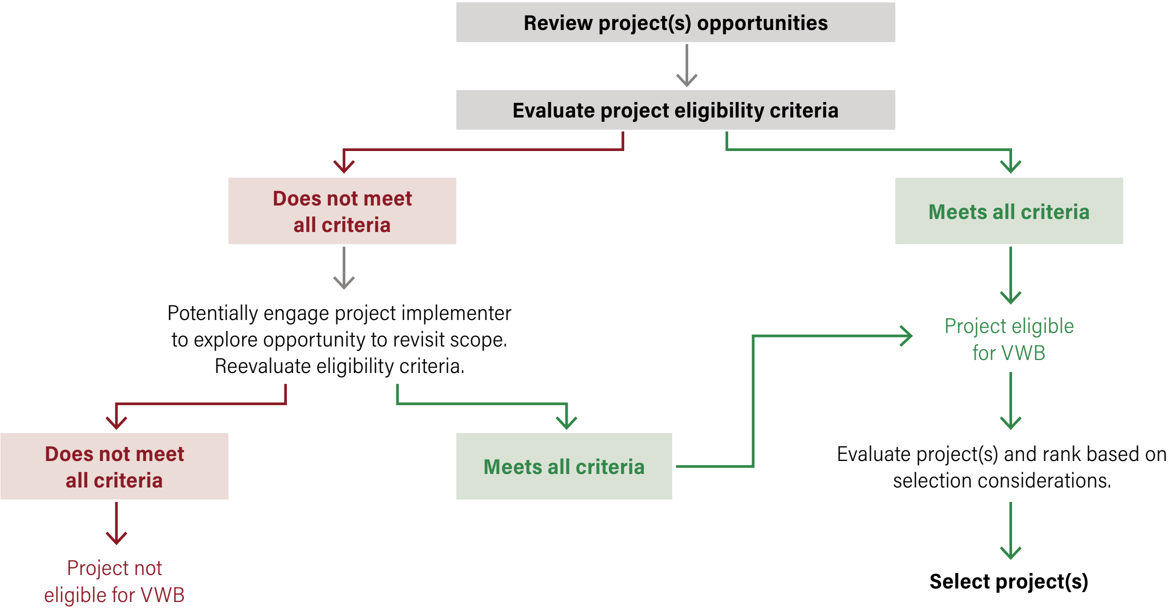
## Step 2.3. Apply eligibility criteria and selection considerations to evaluate potential project activities and partners

After considering how and where VWBs may be generated to align with company goals, identify a preliminary set of potential activities and partners using the following decision framework (Figure 3), which evaluates project eligibility criteria and selection considerations:

Project eligibility criteria (see Appendix A) are essential and should be met for a project to generate a quantifiable VWB.

Project selection considerations (see Appendix B) support practitioners in ranking and selecting projects based on additional considerations beyond project eligibility criteria. Project selection considerations can strengthen the outcomes and impacts of a water stewardship activity but are not required to generate VWBs.

Figure 3 | **Flow diagram outlining project selection process**

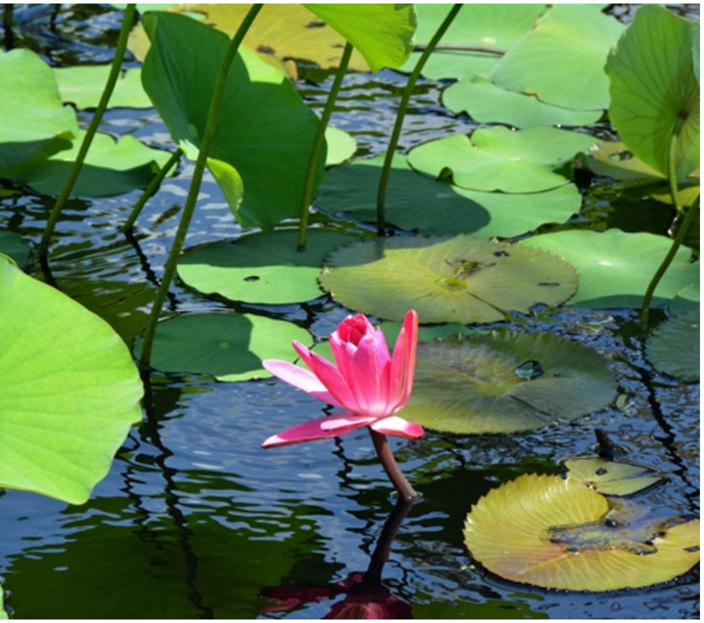


*Source:* Authors.

## Project eligibility criteria

Eligibility criteria are essential elements that should be met for a project to generate a VWB. They intentionally exclude requirements focused on how a VWB claim can be made, which is a topic covered in Step 6. The six criteria are described in Appendix A and aim to guide practitioners in selecting relevant projects; they include the following:

- The activity has an **established pathway to produce a quantifiable VWB**, backed by sound and consistent calculation methods and principles that align with best practice.
- The activity **addresses shared water challenges that are relevant** to the catchment or area of interest.
- The activity has **internal buy-in and general support** from external relevant parties, communities, and/or experts familiar with the basin context and shared water challenges.
- The activity **delivers change beyond the "without-project" conditions** (i.e., change that would not have happened without it), and it is not legally required by the project sponsor for compliance purposes.
- The activity includes an **established pathway to track VWB outputs** that can be evaluated in future years to ensure continued function and volumetric benefit for the intended duration of VWB claims.
- The activity **trade-offs have been assessed, understood, and minimized** to make sure the activity does not adversely affect one entity to the benefit of another or result in opposition that could lead to reputational risk for the project developers, sponsors, or benefactors.



## Project selection considerations

Project selection considerations can help practitioners prioritize and select projects that ensure the greatest likelihood of success and contribute to broader social, economic, and environmental outcomes and impacts that extend beyond VWB outputs. Elements listed below help ensure project value and success but are not required for a project to generate VWBs. The selection considerations are described in Appendix B and include the following:

- Minimal risk of project failure or underperformance
- Project implementer readiness and capacity
- Clarity on project costs and cost shares among funders
- Feasible project implementation timeline
- Anticipated duration of VWBs consistent with desired timeline
- Location relevant to water goals
- Opportunity to deliver multiple benefits
- Enabling projects
- Innovative strategies
- Opportunities for collaboration

These criteria and considerations are intended to serve as guidance for companies, and they are not listed in order of priority. It will be up to individual companies to apply criteria and considerations in their own decision-making processes for VWB project selection. The relevance of individual criteria and considerations may vary based on a company's exposure to risk, water goals, strategic watershed objectives, and project scale. For example, it may be challenging to independently evaluate all criteria and considerations for complex or long-term projects that involve activities on a very large scale. As a result, flexibility and adaptation may be needed for some criteria, particularly those related to community consultation or identification of potential trade-offs.

# Step 3. Quantify the VWBs of project activities

VWB quantification is guided by foundational principles and the four steps described below. Quantification can be implemented at the project planning phase (i.e., for the preliminary VWB estimate) and/or after project implementation.

Adherence to the following foundational principles is essential when quantifying VWBs:

- **Understand the objective of each project activity** to inform the selection of the appropriate VWB indicator and method
- **Use practical and scientifically defensible methods** that are relatively simple to apply
- **Identify, document, and apply conservative inputs and assumptions** to avoid overestimation and build trust in the results
- **Use an appropriate temporal scale** that can account for the variability in conditions associated with seasonality in shared water challenges
- **Avoid double counting of volumes**, keeping in mind that the same volume of water may provide multiple benefits, but each unit of volume should not be counted more than once

Steps 3.1–3.4 are meant to assist practitioners in selecting VWB indicators and methods to address activity-specific objectives and should be applied using Table C-1 in Appendix C as a guide to support the selection of indicators and methods. If needed, practitioners should engage a subject matter expert to support the selection of an appropriate VWB indicator and method.

These steps were developed recognizing that there is a wide range of potential activities that organizations may be interested in supporting and many ways that each of the methods can be applied. These range from simple estimates (typically used during early-stage project evaluation and cost-benefit analysis of the project cost versus VWBs generated) to more detailed, robust, and complex estimates or measurements (typically used to report progress, communicate publicly, and make claims associated with an organization's water stewardship activities associated with investing in water replenishment, regeneration, or restoration and watershed health more broadly).

## Step 3.1. Identify the primary volumetric objective

After selecting a project activity, identify the activity's volumetric objective (i.e., determine how the activity contributes to addressing a shared water challenge by altering the hydrology in a beneficial way). Although many water stewardship activities do not have a VWB output as the primary objective, and often have more than one objective, it is necessary to select a single volumetric objective to inform the selection of an appropriate VWB indicator.

Examples of common volumetric objectives include reduced water demand; increased water availability; improved or maintained water-related habitat; improved access to water, sanitation, and hygiene; and improved water quality.

Note that while the objective informs the selection of the indicator, and the indicator informs the method used to quantify the outputs of the activity, the scale of the activity may not be sufficient to result in a measurable change in a larger shared water challenge. For example, a single activity can result in reduced water withdrawals at a given location (i.e., the output) but not at a scale that would (by itself) lead to measurable changes in regional water stress.

## Step 3.2. Select the VWB indicator

After the volumetric objective is determined, select the appropriate VWB indicator. The selected indicator should consider the volumetric objective and how the activity helps reduce shared water challenges by modifying the hydrology in a beneficial way (e.g., by increasing groundwater recharge, reducing water demand, or improving water supply) or through other means (e.g., by providing safe drinking water or improving water quality) (Table 2).

Consider using additional indicators to quantify non-volumetric outputs, outcomes, or impacts resulting from the proposed project activities. Additional indicators could include but are not limited to those related to water quality benefits (e.g., reduced pollutant load, measured in volume of pollutant); biodiversity benefits (e.g., healthy fish populations due to improved watershed health); and socioeconomic benefits (e.g., improved livelihoods).

## Step 3.3. Select the VWB method

Select an appropriate method to quantify the VWBs from the list in Appendix D, based on the objective and VWB indicator. Appendix D describes VWB calculation methods, including example calculations and case study applications for certain methods.

When relevant, consider using other credible, well-documented, and scientifically defensible methods and approaches that are aligned with the principles listed above and that can support VWB calculation for the relevant indicator. Examples of such methods include local or regional land surface hydrological models and activity-specific empirical measurements or observations.

## Step 3.4. Gather required data and calculate VWBs

Lastly, define the time scale for measuring and communicating VWBs, gather the data, and calculate the VWB indicators for the with- and without-project conditions. When possible while evaluating what type of data to gather, partners should consider the context and relevance of available data. The VWBs can then be quantified based on the difference in volume between the with- and without-project conditions.

Special attention is required when quantifying the VWBs resulting from activities that aim to address seasonal shared water challenges, such as seasonal water scarcity or water quality impacts, to make sure that the VWBs reflect the volume of water improved at the corresponding time of year to address the shared water challenges.

Table 2 | **Volumetric water benefit indicators**

| **VWB INDICATORS (quantified in volume of water over unit of time)** |
|---|
| Avoided runoff |
| Reduced runoff |
| Reduced withdrawal |
| Reduced consumption |
| Increased recharge |
| Maintained recharge |
| Increased seasonal water storage |
| Maintained seasonal water storage |
| Increased inundation |
| Maintained inundation |
| Volume provided |
| Volume captured |
| Volume maintained |
| Volume treated |
| Volume improved |

*Note:* VWB = volumetric water benefit.
*Source:* Authors.

## Step 4. Plan and agree

In addition to considering the total projected VWBs generated by potential project activities, final project selection should be informed by an understanding of the attribution of those benefits across project sponsors and implementers, the implementation timeline, the anticipated duration of the activities and anticipated VWB claim, and the tracking and reporting plan. Where possible, when multiple project sponsors are involved, there should be alignment among all parties to apply a consistent method and approach for VWB quantification. By considering these components and including them in the agreement process, companies can help ensure they will be well positioned to track, report, and communicate VWBs following implementation.

### Step 4.1. Consider the cost, implementation timeline, and duration of the activity

Information on cost, implementation timeline, and activity duration will provide a preview to the resource requirements, cost-benefit ratio (i.e., project cost over VWB), and potential duration of future claims related to the activity, including how much of the VWBs can be attributed to each project sponsor as well as when to start claiming and for how long.

The timing of the claims and the duration of benefit claims will vary depending on the activity; details on how to communicate these claims is provided in Step 6.

### Step 4.2. Align on a VWB attribution plan

There are many ways companies can work with others to support water stewardship activities that yield VWBs, including bilateral engagements between a company and a project implementer; transactions between buyers and sellers within an environmental marketplace; and multilateral and collective action engagements among multiple companies, government agencies, and/or civil society groups.

Regardless of who is involved in supporting the water stewardship activity, clear, transparent, and conservative attribution of VWBs is foundational to making credible claims and communicating VWB results. Because of that, prior to supporting an activity, when possible, all parties should aim to align on the total VWB (i.e., indicator, method, value), and the approach for attributing VWBs should be determined and agreed upon between project sponsors and implementers. An approach for reporting VWBs in future years should also be determined. This will help ensure expectations are aligned and communications are clear between the project sponsors and implementers when communicating the resulting VWBs and help minimize the reputational risk associated with overclaiming.

When new project sponsors invest in a water stewardship activity that has been ongoing and previously supported by other sponsors, project sponsors and implementers should align on how to attribute VWBs moving forward by considering how the additional support from new sponsors expands the scope and results of the activity and/or otherwise modifies the activity, project cost, and resulting VWBs.

Independent of how many project sponsors are involved, companies claiming VWBs resulting from water stewardship activities should apply credible and transparent approaches to attributing VWBs being claimed.

Credible approaches to attributing VWBs can be defined as follows:

- **All parties involved can stand behind them.** The company making the claim, the other project sponsors, and the project implementers should all be able to stand behind the attribution of VWBs among the parties involved, based on their shared understanding of the cost, funding sources, calculation methods, and resulting VWBs.
- **Attributed VWBs are proportional to the contribution of the company making the claim.** The company making the claim should attribute VWBs in a way that reflects the company's overall contribution to the activity and resulting VWBs (e.g., monetary or in-kind).

The following common considerations should be kept in mind when exploring approaches to attributing VWBs:

**When there is clear visibility into the total project cost, and project outputs are primarily volumetric**

In these cases, VWBs resulting from a company's contribution to the project can be attributed using the cost-share approach. Following this approach, the total VWBs resulting from the project are attributed to each project sponsor based on the proportional contribution of each sponsor to the total cost of the project.

When following a cost-share approach, it is important for project sponsors financing the project and project implementers to agree on what is included in the total cost. For example, the total cost of a project could be determined based on the activity's capital expenditures (CAPEX) plus the project's operating expenditures (OPEX), in addition to any design, permitting, land acquisition, monitoring, and evaluation costs over the lifetime of the project or expected duration of the claim. The project's CAPEX refers to the capital expenditures required to implement the project in the first place; the project's OPEX should apply to any additional resources required to ensure essential day-to-day costs that are necessary to maintain the project over time. In-kind contributions of time and/or materials provided to a water stewardship project are often excluded but can also be quantified monetarily and included as part of the CAPEX or OPEX when relevant.

**When there is an unclear pathway for VWB attribution (e.g., new activity type, voluntary markets, credit-based environmental products).** Consider attributing and claiming VWBs when the following characteristics are in place:

- **Intentionality:** VWBs being claimed were intentionally created with a predefined purpose and specific water stewardship outcome that addresses shared water challenges and is documented as part of the transaction between a project funder or sponsor and a project developer or implementor (e.g., buyer and seller).
- **Additionality:** The creation of the VWBs and cost paid for the VWB-generating project reflects (and is directly relevant to) the cost, labor, or endeavor of generating the VWBs or multiple benefits that include VWBs being claimed.
- **Permanence:** The VWBs are retired and correspond with a retirement schedule or timeline that aligns with the duration of the claim.

VWBs should be quantified in line with recommendations outlined in this guidebook and documented in the bills of sale, contractual documents, or other documentation of changes in water rights, volume benefits, or conservation benefits to help demonstrate and substantiate the intentionality, additionality, and permeance of the VWBs.

In situations where project sponsors struggle to identify a credible and transparent approach to VWB attribution, companies should consider engaging a subject matter expert and/or consulting relevant parties to determine how best to support robust, credible, and transparent VWB claims.

## Step 4.3. Make a tracking and reporting plan

Prior to project implementation, VWBs are calculated based on the expected performance of a planned project given information known at that time. Because project scope, cost, and timeline may change during implementation, after all project implementation activities are completed, a project's performance and VWBs should be confirmed, documented, and tracked through the collection and assessment of information confirming the following: that the project was implemented as proposed; VWBs are being delivered; and key project performance factors necessary to generate VWBs are established and sustained (as described in Appendix E).

A wide range of water stewardship projects are implemented in diverse locations and circumstances. As a result, uniform or standardized monitoring and data collection to support performance tracking and reporting across all projects in all locations is not practical. Nevertheless, companies seek projects where tracking and reporting can provide credible information to substantiate VWB claims and progress against their water goals. In all cases it will be important that tracking and reporting plans are practical and feasible for project implementers to carry out, including developing realistic and manageable tracking and reporting strategies that can accommodate long-term, large-scale, and/or programmatic approaches that generate VWBs.

More detailed project tracking and reporting guidance is provided in Appendix E.

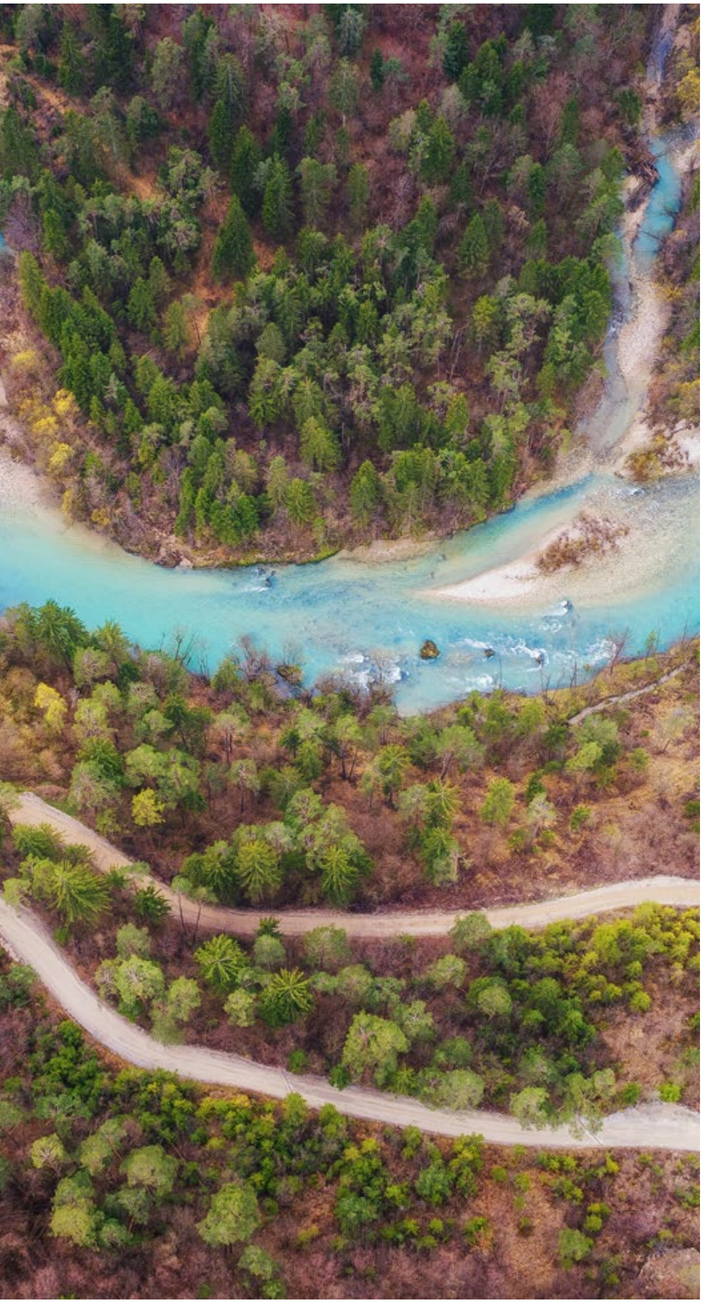
## Step 4.4. Formalize contribution, commitment, and support for water stewardship project

Once the steps above are complete, companies should jointly develop and execute agreements (e.g., contracts, memorandums of understanding, funding agreements) to specify and memorialize the roles and responsibilities of the company and key project implementation partners. Agreements provide a critical opportunity in the project development life cycle to confirm understanding and expectations among parties responsible for project funding, implementation, performance tracking, and reporting.

Project agreements can be used to memorialize expectations and may include the following:

- Implementation timelines and performance benchmarks
- Reporting and tracking timelines and responsibilities
- Funding amounts, matching funds, and disbursement steps
- Duration of project benefits and VWB generation
- Project maintenance needs and responsibilities
- Joint publicity language regarding VWB claims and partner roles
- Expectations regarding site visits
- Other key project details

Many of the activities noted above cannot be delivered or sustained without multiyear funding, and agreements will ideally clarify how desired activities (such as long-term reporting, site tours, and essential project maintenance) will be supported.



# Step 5. Implement project and track progress

Once project agreements are in place, partner roles have been defined, and resources for the project have been committed, project implementation can occur. Implementation can take many forms and may occur quickly in a single location or over many years across an array of sites. Companies should track and understand implementation progress in a way that aligns with the expectations established in Step 4.4. This may involve reviewing annual reports, visiting project sites, communicating on an ongoing basis with relevant parties, or using another method that can be used to track implementation progress.

Project tracking should confirm that key actions required to make a VWB claim (Step 6) are in place. Optionally, companies may reference Box 2 for guidance on tracking longer-term outcomes and impacts.

### Box 2 | **Tracking longer-term impacts and outcomes**

Some companies have interests that extend beyond project-level VWB outputs and may seek information regarding progress toward desired outcomes and long-term impacts (see Appendix E, Figure E-1). These interests may include the delivery of multiple benefits, such as water quality improvements, increased ecosystem biodiversity, or socioeconomic improvement. A company's involvement at this level requires a deeper and longer-term commitment with a higher degree of local interaction and sustained financial participation. Funding for long-term tracking and reporting that is focused on outcomes and strategy effectiveness is often difficult to secure. Companies with an interest in and understanding of the high level of sustained commitment required to accomplish this important but challenging task may be able to fund or participate in longer-term roles to help track outcomes or strategy effectiveness.

There are also situations where systems and funding may already be in place to track progress toward longer-term desired outcomes. Many catchment- or landscape-scale initiatives are supported by multiple public and private funders, each with their respective tracking and reporting needs and requirements. For example, regional water stewardship initiatives led by a partnership of project implementers (e.g., tribes, agencies, and nongovernmental organizations) will sometimes have long-term monitoring systems in place that are designed to evaluate strategy effectiveness and progress toward long-term goals. Where such information is available, companies should work with project implementers to obtain available reports and data that evaluate broader levels of impact. Such information can be used to improve understanding of strategies and challenges, inform future action, and augment project reporting.

# Step 6. Confirm and prepare for VWB communications

This section was developed to assist companies with making credible VWB claims, while incentivizing water stewardship activities that address long-term shared water challenges.

VWB claims are defined as any statement, accounting, or communication regarding the delivery of existing or anticipated VWBs that result from voluntary actions taken by the entity making the claim. As referred to herein, VWB claims exclude actions, statements, or communications needed to meet regulatory or externally imposed compliance requirements unless those clearly specify the need for VWBs as defined in this guidebook.

## Step 6.1. Confirm that VWBs being claimed are delivered by activities that meet VWB eligibility criteria

Ensuring that the six essential eligibility criteria outlined in Step 2 are met demonstrates that water stewardship activities can generate VWBs in ways that are credible and trusted by external entities.

**Checklist of evidence to support credible VWB claims:**

☐ Quantity of VWBs (total produced by the activity as well as fraction attributed to the company)

☐ VWB method, indicator, calculations, and data sources

☐ Evidence that the activity addresses one or more shared water challenges present in the catchment or area of interest

☐ Evidence that the activity has internal buy-in and general support from relevant parties

☐ Confirmation that the activity delivers positive change and/or prevents a negative impact beyond the without-project condition, and is not legally required by the project sponsor

☐ Confirmation that there is an established tracking and reporting plan

☐ Confirmation that trade-offs are assessed, understood, and minimized

## Step 6.2. Confirm VWBs claimed are aligned with company goals

Because VWB quantification is typically used to assess progress toward a company's water goals, the type and location of activities and resulting VWBs should be in line with those goals.

Consider any other programmatic factors that may be relevant for the claim, such as in the following examples:

- How do the VWBs contribute or link to other company business and sustainability objectives?
- How does the claim fit within the overall timeline and duration of the commitment?
- What was the role of the company and its partners in meeting the claim?
- How can the claim contribute to increasing brand value and visibility?
- What story does the company want to tell? What role in the project does it want to play? What sort of relationships does it want to build?

This list of questions is not exhaustive, and companies should also consider other relevant factors.

**Checklist of evidence to support credible claims related to where and how VWBs contribute to company goals:**

☐ Confirmation that the VWBs being claimed fit within the timeline, duration, and business and sustainability objectives of the company's commitment

☐ Confirmation that the VWBs being claimed align with the company's internal requirements for meeting the company's water goals

## Step 6.3. Confirm that VWBs being claimed are representative of the activity's status and duration

Before claiming a VWB, ensure that the project implementation activities have been completed and performance factors are in place, as outlined in Step 4.

For many types of activities, VWBs may not be generated for several years due to the time required to contract for, design, and implement an activity to the point where it can generate VWBs. During that time, project sponsors may communicate and claim anticipated VWBs or VWBs under contract to help convey progress toward goals while not overclaiming actual VWBs delivered.

Communicating and/or claiming anticipated VWBs or VWBs under contract may be a better indicator of progress against goals when a company is supporting longer-term activities or is required to report progress to internal or external relevant parties at a higher frequency than what is possible to deliver VWBs on the ground.

Anticipated VWBs or VWBs under contract can be defined as the VWBs expected to be delivered because of a company's contribution to an activity that is under contract within the reporting period but that have not yet been delivered. Anticipated VWBs or VWBs under contract should represent a realistic and credible quantification of the VWBs anticipated once all implementation activities and performance factors are in place.

The timing and duration of VWB claims will vary depending on the activity. Consider the status and duration of the activity, and based on that information, determine when to start claiming VWBs, how long to claim them for, and when to stop claiming them.

## When to start claiming VWBs

**For new or enhanced gray infrastructure.** The VWBs are expected to be delivered and can be claimed

- as soon as the project's implementation activities are completed *and*
- the project performance factors are in place.

**For new, enhanced, or protected green infrastructure.** Given the potential time frame for project maturity, the VWBs are expected to be delivered and can be claimed

- in full as soon as the project's implementation activities reach levels of expected or required hydrologic performance *or*
- in part, proportional to the status and performance of the activity, and
- the project performance factors are in place.

**For behavior and practice changes.** The VWBs are expected to be delivered and can be claimed

- as soon as the project's implementation activities are completed *and*
- the project performance factors are in place.

## How long should VWBs be claimed?

Engaging and investing in activities that reduce shared water challenges is important to decrease water-related risk and enhance a company's social license to operate. Sustained engagement and involvement to ensure that funded activities continue to function are encouraged for the duration of VWB claims.

Companies can claim VWBs as long as both of the following conditions are met:

- The implementation activities are functioning as designed, and there is reasonable evidence that the project performance factors tied to the generation of VWBs are in place (i.e., the activity continues to have an impact).
- The company making the claim is actively involved and/or supporting the ongoing functioning of the activity through the initial investment or ongoing investments (e.g., the company is engaged directly or indirectly in the activity's operation and maintenance, or the company has funded all requested years of tracking and reporting, making its claim credible and relevant and its contribution accountable). Active involvement could also include advocating for the project, participating in forums related to addressing shared water challenges in the catchment, discussing necessary next steps, and coordinating volunteer actions, among others.

To help incentivize new and innovative investments and engagements in water stewardship, companies may want to consider two conditions:

- Continuing to claim VWBs after a volumetric target is met only when the company's involvement in the activity continues to scale meaningful impacts across the catchment (e.g., when the activity was implemented shortly before the goal was met).
- Setting a duration limit to the claim to demonstrate to relevant parties an enduring commitment to participate in addressing shared water challenges and avoid reputational risk related to inaction for extended periods.

## When to stop claiming VWBs

Companies should consider no longer claiming VWBs when

- the company is no longer involved and/or supporting the ongoing functioning of the activity or working to address shared water challenges; or
- the company's initial capital investment is fully depreciated; or
- the implementation activities are no longer functioning as designed; or
- the status of project performance factors is unknown or cannot be confirmed.

**Checklist of evidence to support credible claims:**

☐ Status of the project's implementation activities (e.g., percentage of activity completed).

☐ Confirmation that the project implementation activities and performance factors are in place (e.g., performance monitoring or attestation report for the period being claimed).

☐ Confirmation of the company's ongoing tracking, support, and/or contribution to the project.

## Step 6.4. Confirm that VWBs being claimed are representative of the company's contributions to the activity

In alignment with Step 4.1, companies making VWBs claims should consider communicating the total VWBs resulting from an activity (i.e., the collective VWBs achieved because of all project sponsors) as well as the VWBs attributed to the company making claims (i.e., the fraction of the total VWBs proportional to the company's contribution to the activity). When total VWBs are communicated, it is important to be very clear that the total VWBs are not the same as the VWBs attributed to the company making claims.

This will help convey the collective impact of a company's participation in water stewardship activities while recognizing the company's individual contribution to the activity.

**Checklist of evidence to support credible claims:**

☐ Clear documentation of the agreed-upon attribution approach

☐ Total VWBs resulting from the activity

☐ VWBs attributed to the company making the claim (when there are multiple project sponsors involved)

# Appendices

The appendices offer more information referenced in the guidebook to help companies and practitioners while applying the guidance. This includes the project eligibility criteria, project selection considerations, guidance for selecting indicators and calculation methods for commonly implemented water stewardship activities. Finally, the appendices describe important considerations for developing a tracking and reporting plan.

**Appendix A.** Project eligibility criteria: guidance and recommendations for how a practitioner can evaluate and determine what is needed to meet the eligibility criteria

**Appendix B.** Project selection consideration: guidance and recommendations for how a practitioner can prioritize and select projects that ensure greatest likelihood of success and broader outcomes

**Appendix C.** Guidance for indicator and method selection: volumetric objectives and recommended VWB indicator and calculation methods for commonly implemented water stewardship activities

**Appendix D.** Calculation methods: descriptions of methods with example applications

**Appendix E.** Making a tracking and reporting plan: includes performance factors as recommended conditions or project-related elements needed to sustain a project's ability to deliver VWBs

# Appendix A. Project eligibility criteria

This appendix provides guidance and recommendations for how a practitioner can evaluate and determine what is needed to meet the eligibility criteria (elements that must be met for a project to generate a VWB). They intentionally exclude requirements focused on how a VWB claim can be made. The primary value is that the eligibility criteria will guide practitioners in selecting relevant projects that exhibit the following characteristics:

- They have the potential to generate VWBs that are backed by sound and consistent calculation methods and principles that are aligned with best practice.
- They have a contextual basis and deliver value to address shared water challenges beyond a condition that currently exists or would occur without the activity.
- They do not adversely affect one entity to the benefit of another or result in opposition that could lead to reputational risk.
- They do not lead to unintended negative outcomes that are problematic for those who rely on or advocate for the water resource.
- They can be evaluated in future years to ensure that they continue to function as designed and provide a volumetric benefit for the intended duration of VWB claims.

Six project eligibility criteria are provided below with a definition and recommendations for how a practitioner can evaluate and determine what is needed to meet each criterion.

## 1. Established pathway for a quantifiable VWB

The project modifies the hydrology in a beneficial way and/or helps reduce shared water challenges, and the change can be measured or estimated by comparing with- and without-project conditions according to the VWBA methodology or another method that is aligned with the principles of VWBA.

**How to meet this criterion?** Identify the objective of the activity and confirm the activity helps address a shared water challenge. Identify the indicator and confirm that the volumetric water benefit of the activity can be quantified using a VWBA method or another method that is aligned with the principles of VWBA.

## 2. Water challenges addressed relevant to the catchment or area of interest

The project addresses one or more shared water challenges present in the catchment or area of interest. Water-related challenges are documented and/or well-understood at the local, community, basin, and/or regional scale and should be relevant to the core desires, issues, and/or needs of communities, agencies, tribes, and/or other entities that rely on the water resource.

**How to meet this criterion?** Identify shared water challenges in the catchment or area of interest by mapping the project site and conducting desktop research on the shared water challenges or engaging with the local community or other entities that rely on or advocate for the water resource. The project objective and activity should relate to a relevant shared water challenge.

## 3. Internal buy-in and general support from external water resources entities

The project has positive buy-in internally (e.g., within the company), and there is general support of the proposed activity's hydrologic benefits from external entities, such as communities, agencies, Indigenous peoples, or other groups that rely on or advocate for the water resource.

**How to meet this criterion?** Conduct a community consultation or gather evidence through desktop research before starting a project to confirm its relevance for others. The depth of consultation will vary based on the local conditions and may be conducted by implementing partners or entities with local knowledge. If the project is high risk or is located in a region with reputational sensitivity, the consultation may warrant additional attention. Identify and understand any concerns, and consider the implications (e.g., who benefits, what values are supported). Work with project implementers to minimize trade-offs. Clearly communicate to interested parties the justification for the decision to support an action.

## 4. Change delivered beyond the without-project conditions (change that would not have happened without the activity)

The project delivers positive change and/or prevents a negative impact beyond the without-project condition. Activities that the project sponsor is legally required to conduct to generate a volumetric or other water-related benefit for compliance purposes do not qualify for VWBs. However, there are exceptions. If a project sponsor is legally required to contribute funding to environmental efforts through a broader corporate social responsibility program, this money could be directed to a project that provides a VWB given there is additionality and intentionality. Also, there may be situations where the project is legally required to be implemented by the site owner but there is no available capacity or engagement to implement the activity in a way that would produce a positive change beyond a without-project condition. In this case, a project sponsor could support this activity and consider a generated VWB.

**How to meet this criterion?** Confirm the project is not legally required by the project sponsor. Additionally, if the project is legally required by the site owner, document the reasons why compliance would not be possible without support from the project sponsor or why the proposed activity provides value beyond the legal requirement.

## 5. Established pathway to track project volumetric outputs

The project design includes a plan for tracking and reporting after project completion. Include a plan for sustained measures to track whether the project continues to function as designed for the duration of the intended VWB claims or, if desired, for the intended lifetime of the project.

**How to meet this criterion?** Establish a tracking and reporting plan alongside the project implementer during project selection or contracting to ensure the capacity and resources to support future project tracking and reporting with clearly identified outputs and outcomes. Both monetary and human resources may be required.

## 6. Trade-offs assessed, understood, and minimized

The project review should consider trade-offs and potential unintended consequences to ensure that projects are sustainable and minimize adverse and/or unintended outcomes. Review may occur before and/or after project implementation. Examples of potential trade-offs include decreases in farmer yields with changes in practices, reduced vegetation with the removal of invasives, reduced stream base flow with use of reclaimed wastewater, or water access projects that adversely affect one entity to benefit another.

**How to meet this criterion?** Conduct a desktop review, consult others, and/or gather technical evidence before starting a project to identify and understand trade-offs and consider their implications. The depth of this evaluation will vary based on the local conditions and project scale. If the project has a high risk of generating adverse outcomes or is located in a region with reputational sensitivity, this assessment may warrant additional attention. For large-scale activities that may create complex trade-offs, evaluate and communicate them to appropriate relevant parties prior to implementing the activities. Work with project implementers to minimize trade-offs. Clearly communicate to interested parties the justification for the decision to support an action. Consider additional flexibility for transformational projects that involve large-scale activities where it may be impractical or infeasible to understand all trade-offs.

# Appendix B. Project selection considerations

The following considerations can help practitioners identify, prioritize, and select projects that ensure the greatest likelihood of success and contribute to broader social, economic, and environmental outcomes that extend beyond volumetric benefits. These considerations are additional to the essential criteria described in Appendix A and are not requirements for a project to generate VWBs. Each consideration is provided below with a definition and description, the value of the consideration, and recommendations for how a practitioner can evaluate an opportunity based on this consideration. Considerations 1–5 capture attributes that contribute to the likelihood of success, and considerations 6–10 capture attributes that provide added impact or value.

The considerations are not listed in order of priority, as each company may weigh their importance differently.

## 1. Minimal risk of project failure or underperformance

Consider if the project design is sufficiently robust to generate a VWB over time. Identify potential risks of project failure or underperformance and confirm that measures are in place to address significant risks, including anticipated maintenance or repair needs that may arise.

**Why does the consideration matter?** Projects with a lower risk of failure, and those with measures in place to provide maintenance and repair, will have a higher probability of providing beneficial outputs and impacts and will allow practitioners to claim VWBs more confidently over time. Additionally, if a project fails and another funding source is needed for repair, then it may be necessary to revisit the attribution of benefits among funders—that is, original VWB claims may be reduced.

**How to evaluate an opportunity based on this consideration?** Communicate with project implementers to understand project design and assumptions, as well as planned measures for ensuring the project is sustainable over time.

## 2. Project implementer readiness and capacity

Evaluate the project implementer's readiness to implement a project based on whether it has an identified vehicle for contracting and receiving funding and can confirm that the necessary permits, approvals, and planning steps are under way and achievable. Confirm that the project implementer has the capacity to implement the project successfully in terms of staffing, knowledge, authorization, experience with similar projects, and skills. A history of strong relationships with other practitioners who have supported VWB project implementation may be another indication of readiness and capacity.

**Why does the consideration matter?** A lack of project implementer readiness and capacity to obtain necessary permits and approvals may lead to barriers that prevent or delay project implementation.

**How to evaluate an opportunity based on this consideration?** Consider and confirm the desired traits and conditions listed above.

## 3. Clarity on project costs and cost shares among funders

Confirm the total project cost, individual cost components (discovery, design, construction, long-term maintenance, tracking), and individual company contributions to understand if all financing needs are secured; evaluate the potential risks of sufficient financing not coming through; and identify the multiple parties involved. Develop an approach for VWB attribution among multiple funding parties. Communicate with the project implementer to understand whether costs may change in the future.

**Why does the consideration matter?** A lack of clarity on project costs and VWB attribution approach may lead to unanticipated funding gaps, delays in project implementation, or unintended double counting of VWBs. In addition, this information can be used to evaluate the potential for project scaling with additional funding and/or identify potential funding-related dependencies across project phases that may affect the delivery of VWBs.

**How to evaluate an opportunity based on this consideration?** Communicate with project implementers to obtain project cost information and potential funding gaps. Request information on other project sponsors and work with other sponsors to develop a defensible benefit attribution approach.

## 4. Feasible project implementation timeline

Communicate with the project implementer to ensure that the implementation timeline and key milestones are known and feasible, particularly when the company intends to use the resulting VWBs to make claims against time-bound goals. This may include both incremental and longer-term progress against goals.

**Why does the consideration matter?** A lack of clarity on a project implementation timeline and completion of key milestones may increase the likelihood of unanticipated delays in project implementation.

**How to evaluate an opportunity based on this consideration?** Communicate with project implementers to obtain the project implementation timeline and key milestone information, and understand the risks of implementation delay. Maintain regular communication to ensure progress is being made toward implementation milestones.

## 5. Anticipated duration of VWBs consistent with desired timeline

The duration of VWBs delivered by projects will vary based on activity type and funding structure. Nature-based solutions and infrastructure projects typically have a long timeline of expected VWBs whereas projects that involve payment for environmental services or modified agricultural practices may have a shorter (e.g., one-to-three-year) timeline of generating VWBs.

**Why does the consideration matter?** Projects expected to deliver VWBs for a long period—for example, 10 or more years—may be desirable for companies with time-bound goals in the future and those that seek to positively impact shared water challenges over a longer duration. Clarity about how long VWBs are expected to be delivered is critical to avoid misunderstandings between companies that are investing in a project and project implementers.

**How to evaluate an opportunity based on this consideration?** Communicate with project implementers to understand the project duration for a given activity and funding structure. Confirm that there is a pathway for reporting at desired frequencies throughout the intended duration of benefit claims. Consider the potential uncertainty of project delivery of the VWB over time in light of climate change and dynamic ecosystem conditions.

## 6. Location relevant to water goals

Ensure that the project location is relevant to stated water goals. For example, a company's goal may require that the project location have a direct or indirect hydrologic connection to a site's water source or be proximal to the site or local community affected. Alternatively, a goal may require the project to be directly connected to a company's value chain—that is, its consumer base or supply chain.

**Why does the consideration matter?** Water is local, and goals should be contextual based on local conditions. Projects with relevance to stated water goals will be required to make defensible claims of VWBs against these goals.

**How to evaluate an opportunity based on this consideration?** Conduct a desktop review of project attributes in the context of corporate water stewardship goals.

## 7. Opportunity to deliver multiple benefits

Consider whether the project has the potential to generate benefits beyond water volumes and the opportunity to deliver on other company goals related to water quality, water access, carbon, biodiversity, social, or economic impacts. Note that additional tracking may be needed to report these multiple benefits.

**Why does the consideration matter?** Projects that provide benefits in addition to VWBs will support shared water challenges in a more holistic way and may be more relevant to entities that rely on or advocate for the water resource. Some companies are setting goals that go beyond volumetric benefits and projects with multiple benefits may help meet those goals.

**How to evaluate an opportunity based on this consideration?** At the start of the project, communicate with project implementers to understand the potential multiple benefits associated with it. Project implementers should document the without-project condition and may need to expand monitoring for additional multiple benefits. Document the additional benefits qualitatively. If possible, use available methodologies to quantify the additional benefits.

## 8. Enabling projects

Enabling projects may catalyze actions with a larger overall potential for impact. These projects may be critical stepping-stones for larger-scale efforts that are transformational and provide bigger impacts to address shared water challenges. The projects may also provide opportunities to positively influence water governance. They may include early-phase activities, such as planning, design, permitting, or pilots, that set the stage for additional, larger-scale work to be implemented.

**Why does the consideration matter?** There is a need and opportunity for the corporate sector to support larger-scale efforts that are transformational and generate significant impacts to address shared water challenges. Many of these opportunities require an early-stage enabling investment to break down barriers and open pathways for scaled-up implementation. Additionally, enabling projects may be important in regions where few other water stewardship efforts exist.

**How to evaluate an opportunity based on this consideration?** Communicate with the project implementer to evaluate whether there are opportunities for enabling, replicable, or scalable projects.

## 9. Innovative strategies

Projects that generate VWBs but also incorporate innovative strategies related to financing, technology, and/or scalable market-driven systems may be considered with higher priority. Financing schemes that are sustainable, leveraged, and/or have the potential to unlock additional funding may offer new pathways to generate VWBs, increase scalability, and/or deliver higher impact. Pilot implementation of innovative technologies may lead to the market-driven deployment of new solutions and/or provide a favorable investment structure for an expanded range of project sponsors.

**Why does the consideration matter?** There is a need to expedite and unlock opportunities for the corporate sector to catalyze larger-scale efforts that are transformational and generate significant impacts to address shared water challenges.

**How to evaluate an opportunity based on this consideration?** Consider project opportunities with innovative finance and investment schemes (e.g., investment funds, microloans, revolving funds, repayments funneled back to project maintenance, projects that improve the policy landscape), innovative technologies, and/or market systems.

### 10. Opportunity for collaboration

Projects that generate VWBs but also provide opportunities for collaboration through collective funding and collective action (i.e., co-designing, co-funding a project) may be considered to be higher priority. Projects that include collaboration with multiple corporate funders and on-the-ground implementers deliver value in terms of greater impact, transparency, and storytelling. Collective action may allow a company to contribute to a broader suite of projects, resulting in increased engagement and a higher profile.

**Why does the consideration matter?** There is a need to expedite the implementation activities that provide basin-scale benefits. There is strength in numbers. With collaboration, more impact can be realized at a larger scale.

**How to evaluate an opportunity based on this consideration?** Consider project opportunities that involve collaboration. Join or help establish regional collective action groups to help identify and support project opportunities.

# Appendix C. Guidance for indicator and method selection

Table C-1 | **Volumetric objectives and the recommended VWB indicator and calculation methods for the most commonly implemented water stewardship activities**

| WHAT DIRECT BENEFIT ACTIVITY ARE YOU INTERESTED IN PURSUING? | | VOLUMETRIC OBJECTIVE (i.e., how is the activity addressing a local shared water challenge by modifying the hydrology in a beneficial way or through other means?) | VWB INDICATOR (i.e., what will you measure or estimate to determine the volumetric outputs?) | VWB METHOD (i.e., how will you determine the volumetric outputs?) | APPENDIX D SECTION INCLUDING CALCULATION METHODOLOGY |
|---|---|---|---|---|---|
| Agricultural practices | Agricultural best management practices including cover crops, mulching, reduced till or no-till, laser leveling, terraced planting, contour planting, agroforestry, regenerative agriculture, grazing management, and others | Improved water quality through nonpoint source pollution reduction | Reduced runoff | Curve Number method | D-1 |
| | | | Volume improved | Nonpoint Source Pollutant Reduction method | D-9 |
| | Agricultural nutrient management, pesticide management, herbicide management, and others | Improved water quality through nonpoint source pollution reduction | Volume improved | Nonpoint Source Pollutant Reduction method | D-9 |
| | Irrigation efficiency, irrigation conversion, and others | See "Demand management" | | | |
| Demand management | Legal water transactions involving surface water and groundwater, operational efficiency measures, water reuse and recycling, changes in agricultural practices that reduce demand including irrigation conversion and irrigation efficiency measures, changes in water sources, low flow fixtures, or other activities that reduce demand | Reduced water demand | Reduced withdrawal | Withdrawal and Consumption methods | D-2 |
| | | | Reduced consumption | Withdrawal and Consumption methods | D-2 |
| | Leak detection and repair | Reduced water demand | Reduced withdrawal | Withdrawal and Consumption methods | D-2 |
| | Removal of invasive species, forest thinning, crop conversion, fallowing, and others | Reduced water demand | Reduced consumption | Withdrawal and Consumption methods | D-2 |
| Green or gray infrastructure | Rain gardens, bioswales, stormwater detention or retention ponds, pond dredging, pond desilting, drainage water management, blind inlets, and other interventions designed to capture runoff | Improved water quality through nonpoint source pollution reduction | Volume captured | Volume Captured method | D-5 |
| | | Improved resilience through flood and drought mitigation | Volume captured | Volume Captured method | D-5 |
| | Green infrastructure activities including constructed wetland treatment systems, bioretention basins, and others | Improved water quality through nonpoint source pollution reduction | Volume treated | Volume Treated method | D-6 |

Table C-1 | **Volumetric objectives and the recommended VWB indicator and calculation methods for the most commonly implemented water stewardship activities (cont.)**

| WHAT DIRECT BENEFIT ACTIVITY ARE YOU INTERESTED IN PURSUING? | | VOLUMETRIC OBJECTIVE (i.e., how is the activity addressing a local shared water challenge by modifying the hydrology in a beneficial way or through other means?) | VWB INDICATOR (i.e., what will you measure or estimate to determine the volumetric outputs?) | VWB METHOD (i.e., how will you determine the volumetric outputs?) | APPENDIX D SECTION INCLUDING CALCULATION METHODOLOGY |
|---|---|---|---|---|---|
| Green or gray infrastructure (cont.) | Gray infrastructure including wastewater treatment plants and others | Improved water quality through point source pollution reduction | Volume treated | Volume treated method | D-6 |
| | Gray infrastructure for water reuse and recycling, and others | See "Demand management" | | | |
| | Well construction and rehabilitation, household water connections, piped water systems, rainwater harvesting, water reuse, point-of-use treatment, drinking water treatment facilities, and other activities that develop new or alternative sources of water supply for irrigation or domestic use (including handwashing, bathing, and cleaning) | Improved resilience through increased supply | Volume provided | Volume Provided method | D-3 |
| | Instream barrier removal; dam reoperation; floodplain reconnection; levee or berm removal; side channel reconnection; riparian habitat improvements; process-based restoration; wet meadow restoration; beaver dam analogs; water level management for habitat, wetland, or peat bog protection or restoration; wetland creation; and others | Improved or maintained water-related habitat | Increased inundation | Inundation method | D-7 |
| | | | Maintained inundation | Inundation method | D-7 |
| | | | Volume provided | Instream Habitat Volume method | D-8 |
| | | | Increased recharge | Recharge method | D-4 |
| | | | Maintained recharge | Recharge method | D-4 |
| | Sustainable drainage systems, check dams, infiltration basins, infiltration wells, infiltration trenches, infiltration shafts, and other activities that facilitate increased recharge | Increased water availability | Increased recharge | Recharge method | D-4 |
| | Restoration and creation activities for wetlands or other aquatic habitats that store water, inclusive of invasive species removal and dredging, among others | Improved or maintained water-related habitat | Volume captured | Volume Captured method | D-5 |
| | Conservation easements or other activities that protect wetlands or other aquatic habitats that store water | Improved or maintained water-related habitat | Volume maintained | Volume Captured method | D-5 |
| | Washing stations, street sweeping, impervious area disconnection, and urban soil amendments, among others | Improved water quality through nonpoint source pollution reduction | Volume improved | Nonpoint Source Pollutant Reduction method | D-9 |

Table C-1 | **Volumetric objectives and the recommended VWB indicator and calculation methods for the most commonly implemented water stewardship activities (cont.)**

| WHAT DIRECT BENEFIT ACTIVITY ARE YOU INTERESTED IN PURSUING? | | VOLUMETRIC OBJECTIVE (i.e., how is the activity addressing a local shared water challenge by modifying the hydrology in a beneficial way or through other means?) | VWB INDICATOR (i.e., what will you measure or estimate to determine the volumetric outputs?) | VWB METHOD (i.e., how will you determine the volumetric outputs?) | APPENDIX D SECTION INCLUDING CALCULATION METHODOLOGY |
|---|---|---|---|---|---|
| Land conservation and restoration | Forest conservation, meadow conservation, grassland conservation, and other activities that preserve land vegetation cover | Protected water quality through nonpoint source pollution prevention | Avoided runoff | Curve Number method | D-1 |
| | | Maintained water balance | Maintained recharge | Recharge method | D-4 |
| | | | Maintained seasonal water storage | Recharge method | D-4 |
| | Reforestation, grassland restoration, and other activities that restore vegetation cover | Improved water quality through nonpoint source pollution reduction | Reduced runoff | Curve Number method | D-1 |
| | | Increased water availability | Increased recharge | Recharge method | D-4 |
| | | | Increased seasonal water storage | Recharge method | D-4 |
| Water, sanitation, and hygiene (WASH) | Activities that increase access to potable household and community water supply<br>New water supply for domestic use | Improved WASH | Volume provided | Volume Provided method | D-3 |
| | Activities that increase access to sanitation facilities where excreta are safely disposed of in situ or removed and treated off-site | Improved WASH | Volume treated | Volume Treated method | D-6 |

*Note:* VWB = volumetric water benefit.

*Source:* Authors.

# Appendix D. Volumetric water benefit calculation methods

This appendix describes the various methods for calculating the volumetric water benefits associated with activities and provides example applications of their use.

## D-1. Curve Number method

### Objectives and indicators

The Curve Number method can be used to estimate the VWBs for activities, such as land cover restoration and agriculture interventions, that alter runoff and improve water quality by addressing nonpoint source pollution as shown in Table D1.1.

Example activities include a variety of agricultural best management practices, reforestation, grassland restoration, forest conservation, meadow conservation, and other activities that preserve or restore land vegetation cover.

### Methodology description

The Curve Number Runoff method (referred to in this document as the Curve Number method), as implemented in the Soil and Water Assessment Tool (SWAT) model (Neitsch et al. 2011), is an empirical method for estimating surface runoff quantities based on land cover, land use, soil, and slope, accounting for temporal changes in precipitation and soil water content.

Table D1.1 | **Curve Number method objectives and indicators**

| | |
|---|---|
| **OBJECTIVES** | ▪ Improved water quality through nonpoint source runoff reduction<br>▪ Protected water quality through nonpoint source runoff prevention |
| **OUTPUT INDICATORS** | ▪ Reduced runoff<br>▪ Avoided runoff |

*Source:* Authors.

The method calculates the annual runoff volumes for the with- and without-project conditions. Runoff quantities are computed on a daily time-step using a long-term climate dataset and aggregated to annual values. The VWB is calculated as the difference between the annual average runoff for the with- and without-project conditions:

$$\mathbf{VWB} = \mathbf{Runoff}_{\text{without-project}} - \mathbf{Runoff}_{\text{with-project}}$$

The daily runoff quantity can be estimated as follows:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Where:

$Q$ = runoff (millimeters)

$P$ = precipitation (millimeters)

$S$ = potential maximum retention after runoff begins (millimeters)

The retention parameter ($S$) is related to the curve number ($CN$) as follows:

$$S = \frac{25{,}400}{CN} - 254$$

The retention factor $S$ is calculated as a function of potential evapotranspiration and antecedent climate. The retention parameter varies spatially due to changes in soils, land use, and slope and temporally due to changes in soil water content. The complete set of equations related to this method is provided in Neitsch et al. (2011).

Runoff volume is calculated annually by multiplying the sum of daily runoff depth and surface area.

Note that several alternative approaches to estimate runoff quantities exist and could also be applied for these types of activities. The Rational method (Kuichling 1889), a very simple empirical procedure requiring a runoff coefficient and surface area, produces results with far greater uncertainty than the Curve Number method. Alternatively, complex process-based procedures such as the Green-Ampt method (Green and Ampt 1911) may be applied, but they require significantly more time and input data than does the Curve Number method.

### Example applications

#### LAND CONSERVATION ACTIVITIES

The conservation (protection or preservation) of grassland or forest to maintain native cover prevents the conversion of the land to another use (e.g., development, agriculture, grazing) and prevents the runoff and associated erosion that would have occurred if the land had not been conserved. The need for conservation and the likely future use of the land if not conserved should be established. This can be accomplished by communicating with local experts and reviewing zoning or land cover maps and available reports documenting the need for the protection project and indicating the without-project condition of the land if it were not conserved. The volume of surface runoff is quantified for two conditions: the without-project condition (the expected degraded condition of the land if it were not conserved) and the “with-project” condition (current condition with intact healthy land cover conserved). First, daily runoff volumes are calculated for each condition based on daily precipitation and other inputs as shown in Table D1.2. These values are summed to calculate the long-term annual average runoff volumes. The VWB is quantified as the difference in annual average runoff volume between the two conditions.

Table D1.2 | **Required inputs for land conservation activities**

| EQUATION | VARIABLE | INPUT |
|---|---|---|
| Runoff depth (*Q*) | *P* = precipitation | At least three years of daily data from a nearby representative station |
| | *S* = retention parameter | *CN* = curve number representing with-project and without-project conditions; the *CN* (unitless) values typically range from 30 to 98 depending on the soil type and land cover characteristics[a] |
| Retention parameter (*S*) | *CN* = curve number | Potential evaporation (*PET*): at least three years of daily data, matching the precipitation time series, from a nearby representative station<br>Slope (average across the project area) |
| Runoff volume | | Runoff depth (*Q*)<br>Surface area impacted by the project activity |

*Note:* [a] See Table 2:1-1 in Neitsch et al. 2011.
*Source:* Authors.

#### LAND COVER RESTORATION ACTIVITIES

Restoring native cover reduces the runoff and associated erosion that occurs due to a lack of vegetative cover. The volume of surface runoff is quantified for two conditions: the without-project condition (current degraded land cover condition before the project is implemented) and the with-project condition (restored condition with healthy, fully mature land cover). First, daily runoff volumes are calculated for each condition based on daily precipitation and other inputs as noted above. These values are summed to calculate the long-term annual average runoff volumes. The VWB is quantified as the difference in annual average runoff volume between the two conditions.

#### VEGETATED BUFFER STRIPS AND GRASSED WATERWAYS

For agricultural projects involving practices (e.g., cover crops, conservation tillage, rotational grazing), the VWB is calculated as described above for land restoration activities. The VWB of filter strips and grassed waterways is based on the extent to which these features reduce runoff received from upstream drainage by decreasing runoff velocity and increasing infiltration. First the runoff quantity ($Q_T$) from the contributing drainage area is calculated, then the runoff reduction quantity is estimated by applying a runoff reduction coefficient ($R_{coeff}$) based on literature values (Helmers et al. 2008; Sheridan et al. 1999; Fiener and Auerswald 2003):

$$\mathbf{VWB = Q_T \times R_{coeff}}$$

## D-2. Withdrawal and Consumption methods

### Objective and indicators

The Withdrawal and Consumption methods can be used to estimate the VWBs of activities that reduce water withdrawal, non-revenue water, or water consumption as highlighted in Table D2.1.

Table D2.1 | **Objective and output indicators for the Withdrawal and Consumption methods**

| | |
|---|---|
| **OBJECTIVE** | ▪ Reduced water demand |
| **OUTPUT INDICATORS** | ▪ Reduced withdrawal<br>▪ Reduced consumption |

*Source:* Authors.

Example activities include legal water transactions involving surface water and groundwater, operational efficiency measures, leak detection and repair, and consumer use efficiency measures such as low flow fixtures, agricultural water demand reduction measures involving surface water and groundwater resources, fallowing, forest thinning, and the removal of "thirsty" invasive species.

### Methodology description

The primary considerations in the selection of the appropriate indicator (reduced withdrawal or reduced consumption) and the associated method are the volumetric objectives and activity type as discussed below.

#### WITHDRAWAL METHOD

Several types of activities can reduce the volume of water withdrawn from a source (i.e., surface water or groundwater), including legal transactions (e.g., water rights leases or purchases), operational efficiency measures, leak repair, irrigation canal piping, and water reuse. The reduced withdrawal volume is calculated as the difference in withdrawal volume for the with-project condition compared to the without-project condition. The without-project condition represents the withdrawal before the activity is implemented. The with-project condition represents withdrawal after the activity is implemented. If metered or monitored data are not available, the withdrawal volume can be estimated.

$$\textbf{VWB} = \textbf{Withdrawal}_{\text{without-project}} - \textbf{Withdrawal}_{\text{with-project}}$$

### CONSUMPTION METHOD

For activities that reduce consumptive demand including agricultural activities such as crop conversion to low-water-use crops, irrigation efficiency improvement measures that convert from less efficient irrigation methods (such as flood irrigation) to more efficient irrigation methods (such as drip irrigation), or land cover restoration (such as the removal of invasive species), the reduced consumption is calculated as the difference in consumption for the with-project condition compared to the without-project condition:

$$\textbf{VWB} = \textbf{Consumption}_{\text{without-project}} - \textbf{Consumption}_{\text{with-project}}$$

Land cover restoration and the associated vegetation changes can affect water consumption by altering evapotranspiration (ET). Vegetation density, type, and climate govern the magnitude and timing of ET. Certain landcover restoration activities such as the removal of thirsty non-native or invasive vegetation species and forest fire management through thinning treatment (i.e., reducing canopy density or selective removal of trees) can reduce consumptive use (by reducing evaporation, transpiration, or both), thereby increasing local water availability. Crop conversion can also reduce consumption when crops with a higher ET rate are replaced with crops with a lower ET rate. For land cover restoration activities that reduce ET demand, the VWB can be estimated as the reduction in consumption based on the difference in ET between the without-project and with-project conditions.

## Example applications

### LEGAL TRANSACTIONS TO KEEP WATER INSTREAM

For activities that involve legal transactions, the VWB can be determined based on the water rights leased or purchased and the duration (e.g., 10 cubic feet per second of water rights are leased for instream flow between December and February). The VWB is based on the volume of water served by the water right and available instream. The diversion flow rate can vary over time. To account for this variability, a conservative estimate of diversion flows (i.e., diversion flows representative of the dry period) should be used with inputs shown in Table D-4. For example, when the objective is to reduce withdrawal to restore streamflow in a dewatered reach or enhance streamflow for a targeted fish population, the period of diversion or flow rate should be narrowed to focus only on the period of ecological significance, such as the spawning period and/or the flow rate providing that benefit. Application of this approach provides a more conservative VWB estimate:

$$\textbf{VWB} = \textbf{(Diversion flow rate reallocated for instream flow)} \times \textbf{(Duration of diversion)}$$

### AGRICULTURAL IRRIGATION EFFICIENCY MEASURES

Activities that involve agricultural irrigation efficiency measures are less straightforward and may encompass a wide range of projects with varying levels of complexity. Either the Reduced Consumption or Reduced Withdrawal method is applicable based on the local context. The following simple cases offer examples:

- **Case 1:** Irrigated cropland is in an area with competing demands for existing water resources and the water is tightly allocated. Improved irrigation efficiency measures are implemented with the objective of reducing irrigation water applied. In this context, the Reduced Withdrawal approach is applicable.
- **Case 2:** Irrigated cropland relies on a water source that is already scarce (e.g., depleted groundwater), and the existing irrigation method results in excessive non-beneficial consumption (i.e., water evaporated and not used by the crop). Improved irrigation efficiency measures are implemented to promote the sustainable use of the scarce water resource through a reduction in non-beneficial consumptive use. In this context, the Reduced Consumption approach is applicable.

Table D2.2 | **Required inputs for legal transaction activities**

| VARIABLE | INPUT |
|---|---|
| Diversion flow rate | Average monthly diversion flow rate (other time scales may be used, if available) |
| Duration of diversion | Number of days during which diversion occurs |

*Source:* Authors.

The above examples illustrate that improved irrigation efficiency measures are adopted in both cases, but either the Reduced Consumption or Reduced Withdrawal method is applicable depending on the project objective and local context. If the context is less clear, the Reduced Consumption method will provide a conservative estimate of the VWB.

For activities that involve improving agricultural irrigation efficiency at a farm, the withdrawal is based on the volume of irrigation water applied. The source of irrigation water can be either surface or groundwater.

$$\textbf{Withdrawal volume} = \textbf{Irrigation water applied}$$

Some irrigation efficiency improvements (e.g., lining of distribution canal) may reduce withdrawals at the point of irrigation diversion. For these types of activities, the VWB can be based on the withdrawal volumes at the point of diversion.

The withdrawal volume can be based on metered or monitored data or estimated if direct monitoring is not available. For surface water withdrawals, the water applied can be estimated based on the diversion flow rate and the duration of diversion. For groundwater withdrawals, the water applied can be estimated based on the pumping rate and the duration of pumping.

The reduced withdrawal is calculated as the difference in irrigation water applied between the without-project and with-project conditions. The VWB is calculated as the decrease in withdrawal volume.

The Consumption method adjusts the withdrawal volume to subtract return flows. Consumption is estimated based on withdrawal volume and adjusted to account for return flow fraction. Return flow fraction, expressed as a percentage, is the fraction of the withdrawal volume that is not consumed and is returned to the source. The reduced consumption volume is calculated as the difference in consumption volume between the with-project and without-project conditions. The VWB is calculated as the decrease in consumption volume:

$$\textbf{Consumed volume} = (\textbf{Withdrawal volume}) \times (1 - \textbf{Return flow fraction})$$

As noted above, return flows are the portion of water withdrawn that is returned to the source through percolation or surface runoff. The return flows may enter the same water body either at the location where the water is withdrawn or at another location downstream (or upstream); in this latter case (another location), the return flow fraction must be supported with available information as shown in Table D2.3. Return flows vary with crop and irrigation type and can be measured or estimated using other appropriate resources (i.e., literature, local studies, consultation with subject matter experts).

### FOREST MANAGEMENT

Forest landscapes are key resource areas for water supplies. Overgrown forests have an increased fire risk. Wildfires lead to vegetation loss, which increases runoff and flood risk. The sediment erosion due to flooding affects the capacity and water quality of reservoirs that are necessary for water supply. Forest management practices often involve mechanical thinning and/or prescribed burns to promote forest health, enhance wildlife habitat, and help reduce the risk of wildfires. The hydrologic impact of vegetation changes due to these forest management practices can decrease ET (i.e., consumptive use) and increase water availability. The VWB of forest management activities is estimated as the reduction in consumption based on the reduced ET as follows:

$$\textbf{VWB} = \textbf{Area affected} \times [ET_{\text{without-project}} - ET_{\text{with-project}}]$$

Applying the method requires specifying the area affected by the activity and the ET rates for the with-project and the without-project conditions. Table D-6 shows the required inputs. Direct ET measurements require advanced techniques and may not be practical. The ET rates corresponding to the with-project and without-project conditions should be obtained from the literature, from relevant local studies or modeling,

Table D2.3 | **Required inputs for agricultural irrigation activities**

| EQUATION | VARIABLE | INPUT |
|---|---|---|
| Withdrawal volume | Diversion flow rate or pumping rate | Average monthly diversion flow rate or pumping rate (other relevant time scales may be used, if available) |
| | Duration of diversion | Number of days during which diversion occurs |
| Consumed volume | Withdrawal volume | Calculated based on diversion flow rate or pumping rate and the duration of diversion volume |
| | Return flow fraction | Return flow fraction based on irrigation and crop type |

*Source:* Authors.

Table D2.4 | **Required inputs for forest management activities**

| VARIABLE | INPUT |
|---|---|
| Area affected | Surface area affected by the activity |
| $ET_{\text{without-project}}$ | Evapotranspiration rate for the without-project condition (i.e., before forest management treatment) |
| $ET_{\text{with-project}}$ | Evapotranspiration rate for the with-project condition (i.e., after forest management treatment) |

*Note:* ET = evapotranspiration.
*Source:* Authors.

or using relevant empirical equations reported in the literature. New tools that use remote sensing to measure ET (e.g., such as OpenET or other satellite tools) may provide data to support these calculations.

### INVASIVE SPECIES REMOVAL

Landscape restoration involving the removal of invasive and non-native plant species is considered a potential strategy for enhancing water supplies. Table D-7 outlines the required inputs. A common example of a water-thirsty invasive species is the *Arundo* reed (e.g., *Arundo donax*), which can infest semi-arid climates. *Arundo* is a densely vegetated reed that has high water consumption and is characterized by a rapid growth rate and vegetative reproduction. *Arundo* eradication measures can have a positive impact on the ecosystem including reduced ET, increased water availability, and restored habitat. The VWB of invasive species removal, such as *Arundo* eradication, is estimated as the reduced ET as follows:

$$\mathbf{VWB = Area\ Affected \times \%\ Cover \times [ET_{\text{without-project}} - ET_{\text{with-project}}]}$$

### LEAK DETECTION AND REPAIR PROJECTS

For activities involving leak detection and repair, the VWB is calculated based on the volume lost from leaks before and after leak detection and repair. For building-scale projects, this volume represents reduced withdrawal from the source. For utility-scale projects, this volume represents reduced non-revenue water. For the purpose of this method, non-revenue water refers to physical losses due to leaks in the distribution system. The VWB is calculated by comparing leak volume for the with-project and without-project conditions (the without-project condition describes the leak volume before project implementation and the with-project condition represents leak volume after detection and repair):

$$\mathbf{VWB = Leak\ volume\ reduction = Leak\ volume_{\text{without-project}} - Leak\ volume_{\text{with-project}}}$$

Table D2.6 shows that the leak volumes for the without-project and with-project conditions should be based on metered data where possible, particularly in large-scale utility distribution systems. When metering is not feasible, the leak volumes can be estimated based on the number of leaks and the average loss rate per leak.

Table D2.5 | **Required inputs for invasive species removal activities Variable**

| | INPUT |
|---|---|
| **Area affected** | **Surface area affected by the activity** |
| $ET_{\text{without-project}}$ | Evapotranspiration rate for the without-project condition (i.e., ET rate of the invasive species) |
| $ET_{\text{with-project}}$ | Evapotranspiration rate for the with-project condition (i.e., ET rate of land cover that replaces the invasive species) |
| % cover | Percentage of the area affected by the invasive species |

*Note:* ET = evapotranspiration.
*Source:* Authors.

Table D2.6 | **Required inputs for leak detection and repair projects**

| VARIABLE | INPUT |
|---|---|
| Leak volume$_{\text{without-project}}$ | Metered or estimated leak volume without the project (i.e., before leak detection and repair intervention) |
| Leak volume$_{\text{with-project}}$ | Metered or estimated leak volume with the project (i.e., after leak detection and repair intervention) |

*Source:* Authors.

## D-3. Volume Provided method

### Objectives and indicator

The Volume Provided method can be used to estimate the VWBs of activities that provide a volume of water that contributes to improving human health and/or livelihood, as well as social or economic security or resiliency. Table D3.1 highlights the objectives and indicator for this method.

Example activities include well construction and rehabilitation, household water connections, piped water systems, rainwater harvesting, water reuse, point-of-use treatment, drinking water treatment facilities, and other activities that develop new or alternative sources of water supply for irrigation or domestic use (including handwashing, bathing, and cleaning).

### Methodology description

The Volume Provided method is applied to estimate the annual volume of water coming from a new, alternative (e.g., water reuse, rainwater harvesting), restored, or improved water supply.

Table D3.1 | **Volume Provided method objectives and output indicator**

| | |
|---|---|
| **OBJECTIVES** | ▪ Improved resilience through increased supply<br>▪ Improved water, sanitation, and hygiene |
| **OUTPUT INDICATOR** | ▪ Volume provided |

*Source:* Authors.

The VWB for activities providing a volume of water is estimated as the following:

$$\textbf{VWB = Volume of water provided}_{\text{with-project}} - \textbf{Volume of water provided}_{\text{without-project}}$$

The following options, in order of preference, can be used to calculate the volume provided:

- Option 1: Estimate based on metered data, if available
- Option 2: Estimate based on appropriate methods such as the following:
  - The volume of water provided for irrigation (i.e., the withdrawal volume) can be estimated based on crop demand
  - The volume of rainwater harvested for direct use may be estimated based on the capacity of the rainwater harvesting system
  - For systems that rely on pipes and pumps, the volume provided may be estimated based on the design capacity of the system
  - The volume provided can be estimated based on the number of direct beneficiaries receiving reasonable access or limited access to water, the per-capita volume, and the number of days per year of access

## Example applications

### NEW WATER SUPPLY FOR IRRIGATION

Activities that provide water for irrigation supply should meet local irrigation quality standards. The following options, in order of preference, can be used to determine the volume provided with inputs shown in Table D3.2:

- Option 1: Calculation based on metered data, if available.
- Option 2: In the absence of metered flows, estimates of irrigation volumes can be based on observed surface water diversion flow rates and duration (e.g., for pumps submerged in rivers or dams) or groundwater pumping discharge rates and their operating hours, or assessed using other appropriate methods by considering crop type and the efficiency of the irrigation system.

The VWB is calculated as the average annual volume of irrigation water provided:

**VWB = Average annual volume of irrigation water provided**

### ACCESS TO HOUSEHOLD OR COMMUNITY WATER SUPPLY

For activities providing water access to households or communities, the water should be free from contamination and meet relevant local quality standards for the type of use. The beneficiaries should have reasonable access either in households or outside (e.g., public areas).

The following options, in order of preference, can be used to determine the volume provided with the inputs shown in Table D3.3:

- Option 1: Estimate based on metered data, if available.
- Option 2: Estimate based on system capacity
  - The volume of rainwater harvested for direct use may be estimated based on the capacity of the rainwater harvesting system and the average number of times it fills to capacity per year. Alternatively, it may be estimated based on the minimum of the available supply and storage potential. See D-4, "Recharge method," for details.

Table D3.2 | **Required inputs for new water supply for irrigation activities**

| VARIABLE | INPUTS |
|---|---|
| Measured withdrawals | Metered flows, if available, or pump discharge rates and operating times |
| Estimated irrigation requirements | Irrigation requirements can be obtained using computer models such as CropWat, or estimated based on the crop water requirement, adjusted for precipitation and irrigation system efficiency by considering the following inputs:<br>▪ Location<br>▪ Irrigated area<br>▪ Crop type<br>▪ Crop evapotranspiration<br>▪ Method of irrigation<br>▪ Irrigation efficiency |

*Source:* Authors.

Table D3.3 | **Required inputs for access to household or community water supply activities**

| VARIABLE | INPUTS |
|---|---|
| Measured water volume | Metered flows, if available, or pump discharge rates and operating times |
| Estimated water volume (i.e., for household or community water supply) | Number of beneficiaries with improved access to water<br>Information regarding required per-capita availability (locally relevant water consumption rates are preferred; default is 20 liters/capita/day for full access and 2 liters/capita/day for limited access)<br>If available, maximum delivery and pumping capacity of the new supply should be compared to beneficiary-based volume to ensure the volume provided is not overstated |
| Estimated water volume (i.e., for rainwater harvesting) | Minimum of available supply (i.e., precipitation) and storage potential (i.e., storage capacity and number of times filled to capacity) |

*Source:* Authors.

  - For systems that rely on pipes and pumps, the volume provided may be estimated based on the pumping or delivery design capacity of the system and the operating time at this capacity. If it is known that the system will be running at less than the design capacity, the average flow rate that is anticipated can be used instead of the design capacity.

- Option 3: Estimate based on the number of direct beneficiaries receiving reasonable access to water and a conservative estimate of per-capita volume provided, as described below.

When using the number of direct beneficiaries (Option 3), the VWB is calculated by multiplying the number of direct beneficiaries receiving reasonable access to water on a per-capita volume-of-water basis over the number of days of access (i.e., 365 days for full-access projects). The World Health Organization and United Nations Children's Fund (UNICEF) define reasonable access as the availability of at least 20 liters per person per day from a source within one kilometer of the user's dwelling (WHO and UNICEF 2000). In the case where relevant local data are available and/or locally relevant or national guidelines define "reasonable access to water" (or a similar concept like the minimum quantity required for basic needs) as more than 20 liters/person/day, the volume provided can be calculated based on the number of direct beneficiaries receiving this volume of "reasonable access to water." If the VWB is calculated using the beneficiary approach, and the supply capacity (based on delivery and pump capacity) is known, the VWB should be based on the minimum of the supply capacity or beneficiary-based volume to avoid overstating benefits.

For projects that provide limited water access (e.g., in schools or community centers), metering is preferred. If metering is not feasible, the volume provided can be calculated based on the number of beneficiaries, the number of days of access (typically fewer than 365 days per year for limited access projects), and the per-capita volume provided. For limited-access projects, a per-capita volume of 20 liters per person per day is likely too high. Practitioners should work with the local implementing partner to arrive at a reasonable per-capita estimate that reflects actual water use during the hours of operation. Another resource is *The Sphere Handbook*, which provides per-capita volume ranges for a number of uses, including 2–6 liters/person/day for basic hygiene practices and 3 liters/person/day for drinking and hand washing in schools (Sphere Association 2018). Note that these estimates are specific to humanitarian response and disaster management and may not be applicable in other contexts. In instances where project- or activity-specific monitoring data show that beneficiaries are receiving more (or less) than the reasonable or basic access volume, the volume provided can be calculated based on this project-specific volume.

Because it can be difficult to determine who is using a particular water source, it is recommended that someone familiar with the project determine the number of direct beneficiaries for water supply projects.

The VWB is estimated as follows:

**VWB = Average annual volume of household or community water provided**

## D-4. Recharge method

### Objectives and indicators

The Recharge method, as shown in Table D4.1, can be used to estimate the VWBs of activities that directly increase or maintain recharge or seasonal water storage or that create, restore, or protect water bodies where recharge is a hydrologic function impacted by the activity. Because activities that increase or maintain recharge often also capture water, it is important to ensure that VWBs are not double counted.

Example activities include rainwater harvesting for groundwater recharge (e.g., rooftop runoff harvesting for recharge), aquifer storage and recovery, infiltration wells, infiltration basins, infiltration trenches, infiltration shafts, check dams, ponds, floodplain restoration, wetland restoration, wetland creation, floodwater

Table D4.1 | **Recharge method objectives and output indicators**

| | |
|---|---|
| **OBJECTIVES** | ▪ Increased water availability<br>▪ Improved or maintained water-related habitat<br>▪ Maintained water balance |
| **OUTPUT INDICATORS** | ▪ Increased recharge<br>▪ Maintained recharge<br>▪ Increased seasonal water storage<br>▪ Maintained seasonal water storage |

*Source:* Authors.

supplied into an area to increase recharge, beaver dam analogs, conservation agreements to protect wetlands, land cover restoration (e.g., reforestation, grassland restoration, and other activities that restore vegetation cover), or land conservation (e.g., forest conservation, meadow conservation, and other activities that preserve vegetation cover).

## Methodology description

As noted above, there are many activities that increase or maintain recharge. Increased recharge is calculated as the difference in recharge volume between the with-project condition and the without-project condition (the without-project condition describes the recharge before an activity is implemented, and the with-project condition represents the recharge after an activity that increases or maintains recharge is implemented):

$$\mathbf{VWB = Recharge}_{\text{with-project}} - \mathbf{Recharge}_{\text{without-project}}$$

## Example applications

### RAINWATER HARVESTING AND INFILTRATION

Infiltration infrastructure such as rainwater harvesting for groundwater recharge, infiltration trenches, recharge shafts, pits, wells, aquifer storage and recovery, check dams, and ponds capture excess precipitation and runoff for groundwater recharge and for community, economic, and/or ecosystem use.

The VWB can be calculated as the difference in recharge volume between the with-project condition and the without-project condition. The without-project condition should be evaluated to determine if recharge is occurring. Typically, the without-project condition may have no recharge function, unless the project improves the recharge capability of an existing intervention (e.g., by desilting an existing pond). The with-project condition represents the construction of rainwater or runoff capture interventions to increase recharge.

The Recharge method is applied to calculate the volume recharged to groundwater, based on available supply (i.e., the volume draining from the catchment, which is calculated by multiplying the catchment area by the average annual precipitation [precipitation depth] and an appropriate catchment runoff coefficient), the volume captured by these interventions, and losses associated with evaporation (if any) and use (i.e., withdrawal). For projects that do not involve a catchment area, the available supply calculations do not apply, and a conservative estimate of storage potential can be considered equal to the volume captured. Table D4.2 outlines the inputs for rainwater harvesting and infiltration activities using the Recharge method. First, the method calculates the volume captured as the minimum of available supply and storage potential:

$$\textbf{Available supply} = \textbf{Catchment area} \times \textbf{Runoff coefficient} \times \textbf{Annual precipitation}$$

$$\textbf{Volume captured} = \textbf{Min [Available supply, Storage potential]}$$

Storage potential is based on the design storage capacity of the intervention and the number of times it fills to capacity. The number of times filled to capacity is a project-specific input that should be estimated by someone with knowledge of the system. This can be informed by the design specifications of the system, past experiences in the area or region, and average annual precipitation, among other variables. In instances where there is no way to estimate this input, and it is known that the rainwater harvesting system fills to capacity, the number of times it fills per year can be conservatively assumed to be once per year.

$$\textbf{Storage potential} = \textbf{Design storage capacity} \times \textbf{Number of times filled to capacity}$$

Recharge volume is calculated by subtracting evaporation and usage losses (where applicable) from the volume captured. For some features, such as infiltration pits and wells, the usage and evaporation losses may be negligible. The equation is as follows:

$$\textbf{Recharge volume} = \textbf{Volume captured} - \textbf{[Evaporation + Withdrawal]}$$

Note: For rainwater harvesting or aquifer storage and recovery projects, typically the without-project recharge volume can be assumed to be zero, and the equation simplifies to VWB = with-project recharge. The approach described above is most simply applied on an average annual basis. If data are available and more certainty is desired, sophisticated algorithms can be developed to support the application of this approach on a daily or monthly basis, or to support a variation of this approach based on infiltration rates corresponding to each intervention.

### Table D4.2 | Required inputs for rainwater harvesting and infiltration activities

| EQUATION | VARIABLE | INPUT |
|---|---|---|
| Available supply | Catchment area | ▪ Catchment area draining to the intervention |
| | Runoff coefficient | ▪ Catchment runoff coefficient |
| | Annual precipitation | ▪ Average annual precipitation from a representative weather station |
| Volume captured | Available supply | ▪ Catchment area draining to the intervention<br>▪ Catchment runoff coefficient<br>▪ Average annual precipitation from a representative weather station |
| | Storage potential | ▪ Design storage capacity<br>▪ Number of times filled to capacity |
| Storage potential | Design storage capacity | ▪ Design storage capacity of the intervention |
| | Number of times filled to capacity | ▪ Number of times the intervention fills to capacity |
| Recharge volume | Volume captured | ▪ Available supply<br>▪ Storage potential |
| | Evaporation | ▪ Evaporation from the intervention |
| | Withdrawal | ▪ Withdrawals from the intervention prior to recharge |

*Source:* Authors.

#### PLUGGING GULLIES OR CHANNELS OR INSTALLING WEIRS TO MAINTAIN OR IMPROVE GROUNDWATER LEVELS

Activities such as plugging gullies or channels or installing weirs may maintain and/or improve storage volume by preventing groundwater from being drained. The increased storage volume is a simple, conservative approach for estimating increased recharge from these activities, where increased recharge is estimated based on increased groundwater storage volume. Table D4.3 shows the required inputs. This groundwater storage volume method is applicable only to unconfined aquifers and projects where it can be demonstrated that groundwater levels have changed over time. Users are encouraged to apply other established approaches if they are available for a localized region.

The storage volume is quantified for two conditions: the without-project condition reflecting reduced storage capacity, and the with-project condition reflecting increased storage capacity. The VWB for increased recharge is quantified as the difference in recharge volume between the two conditions over an annual period, with the recharge volume estimated based on groundwater storage**:**

**Groundwater storage = Surface area × Average groundwater depth × Specific yield (%)**

### Table D4.3 | Required inputs for activities that maintain or improve groundwater levels

| VARIABLE | INPUT |
|---|---|
| Surface area | The surface area beneath which groundwater storage is increased or maintained |
| Average groundwater depth | Average groundwater depth in the saturated zone of the unconfined aquifer affected by the project |
| Specific yield (%) | Ratio of the volume of water that a saturated rock or soil will yield to gravity to the total volume of rock or soil |

*Source:* Authors.

#### WETLAND RESTORATION OR CREATION

Wetland restoration or creation activities such as beaver dam analogs or floodwater diversion onto farmland or floodplains can enhance recharge by ponding and recharging a portion of the increased volume of water stored or ponded. Where recharge occurs, the volume recharged is equal to the product of the wetland (or wetted) surface area, the infiltration rate based on the soil texture, and the duration of time the wetland is inundated. Table D4.4 shows the required inputs. If the volume supplied to the recharge area is known and the entire volume infiltrates, this volume can be used as a surrogate for recharge volume. This method is applicable for wetland types that provide recharge function.

**Volume recharged = Wetland surface area × Infiltration rate × Duration of inundation**

The method involves a simple calculation comparing the recharge volume for the with-project and without-project conditions and applies to both protected and restored wetlands.

Table D4.4 | **Required inputs for wetland restoration or creation activities**

| VARIABLE | INPUT |
|---|---|
| Surface area | Ponded surface area, reflecting average conditions |
| Duration | Average number of days each year that ponding occurs |
| Infiltration rate | Infiltration rate specific to the soil texture underlying the ponded area |

*Source:* Authors.

### WETLAND PROTECTION

When wetlands are drained and the land is converted to other uses such as cropland or residential development, this may lead to a reduction in or loss of recharge function. Wetland protection, accomplished through conservation easements or acquisition, protects the groundwater recharge capacity of the wetlands. The need for protection and the likely future use of the land if not protected should be established. This can be accomplished through communication with local experts, evaluation of maps or reports describing trends in wetland losses, or evaluation of aerial or satellite imagery over time.

The recharge volume is quantified for two conditions: the without-project condition (drained or degraded wetland) and the with-project condition (intact healthy wetland after the activity is implemented). First, the annual recharge volume is calculated for each condition based on the average ponded surface area, number of days of ponding, and infiltration rate. The VWB for maintained recharge is then quantified as the difference in annual recharge volume between the two conditions:

$$\mathbf{VWB = Recharge_{\text{with-project}} - Recharge_{\text{without-project}}}$$

### LAND COVER RESTORATION OR LAND CONSERVATION

Activities that involve the restoration or conservation of land cover may improve groundwater recharge and seasonal soil water availability. While land cover restoration is not always associated with an increase in groundwater recharge or seasonal soil water availability, this method is intended to estimate the change in these variables where relevant. When a land cover restoration activity is implemented to reduce runoff, the Curve Number method (described in D-1) is recommended.

This method estimates the water balance at the activity level, considering precipitation, evapotranspiration, runoff, infiltration, and groundwater recharge based on the soil water content. Table D4.5 shows the inputs for this method.

This method summarizes the key equations for a simplified water balance approach to estimating groundwater recharge and seasonal soil water availability for the purpose of VWB calculations. The use of a hydrologic model such as the SWAT (Neitsch et al. 2011) or similar approach is recommended to estimate these variables on a daily basis using local landcover, soil, geology, and climate characteristics, after which the volumes can be aggregated to an annual or seasonal scale, depending on the objective. For seasonal water availability, the annual estimate is based on the water made available during a season of interest. The season of interest is determined as the period (e.g., months before the beginning of the dry season) when it is critical for seasonal water availability to increase to address the shared water challenge.

$$\mathbf{SWA = SW \times \%\ available + R}$$

Where:

SWA = seasonal water availability (millimeters; mm) estimated for the season of interest

SW = soil water content (mm) aggregated over the season of interest

% available = factor (%) to account for the fact that not all soil water content is available for use due to soil characteristics

R = recharge (mm) aggregated over the season of interest

$$\mathbf{R = I \text{ if } SW \geq SW_{SAT};}$$

$$\mathbf{R = Rr \times I \text{ if } SW < SW_{SAT} \text{ and } SW > SW_{FC};}$$

$$\mathbf{R = 0, \text{ otherwise}}$$

Where:

R = recharge (mm)

I = infiltration (mm)

SW = soil water content (mm)

$SW_{SAT}$ = soil water content at saturation (mm)

$SW_{FC}$ = soil water content at field capacity (mm)

Rr = recharge rate (%)

The equation considers that if the soil water content is above the soil saturation, 100 percent of the water infiltrated is considered as water recharged. If the soil water content is between the soil saturation and field capacity, the recharge rate parameter is used to determine the percentage of water that is recharged.

$$\mathbf{I = P_{net} - ET - Q}$$

Where:

I = infiltration (mm)

$P_{net}$ = net precipitation (mm)

ET = evapotranspiration (mm)

Q = runoff (mm)

$$P_{net} = P_{gross} - CS$$

Where:

$P_{net}$ = net precipitation (mm)

$P_{gross}$ = gross precipitation (mm)

CS = canopy storage (mm)

Variables should be calculated every day to capture daily changes in the soil water content before aggregating to a seasonal or annual scale.

**INCREASED RECHARGE**

The VWB is equivalent to the volume of water recharged by the activity in comparison to the without-project condition:

$$\textbf{VWB} = \textbf{Recharge}_{\text{with-project}} - \textbf{Recharge}_{\text{without-project}}$$

**INCREASED SEASONAL WATER STORAGE**

The VWB is equivalent to the volume of seasonal water made available by the activity in comparison to the without-project condition. The VWB should be based on the specific weeks and/or months of the season of interest. The estimated VWB for the season represents the annual VWB from the activity.

$$\textbf{VWB} = \textbf{Seasonal water availability}_{\text{with-project}} - \textbf{Seasonal water availability}_{\text{without-project}}$$

Table D4.5 | **Required inputs for land cover restoration or land conservation activities**

| EQUATION | VARIABLE | INPUT |
|---|---|---|
| Seasonal water availability (*SWA*) | *SW* = soil water content | Soil water content calculated daily from precipitation, evapotranspiration, runoff, and soil characteristics |
| | % available | Factor (%) based on soil characteristics to conservatively account for the fact that not all soil water content is available for use |
| | *R* = recharge | Recharge calculated daily from infiltration and soil water content |
| Recharge (*R*) | *I* = infiltration | Infiltration calculated daily from precipitation, evapotranspiration, and runoff |
| | *SW* = soil water content | Soil water content calculated daily from precipitation, evapotranspiration, runoff, and soil characteristics |
| | $SW_{SAT}$ = soil water content at saturation | Water content fraction of total soil volume at saturation based on soil texture |
| | $SW_{FC}$ = soil water content at field capacity | Water content fraction of total soil volume at field capacity based on soil texture |
| Infiltration (*I*) | $P_{net}$ = net precipitation | Daily gross precipitation and canopy storage |
| | *ET* = evapotranspiration | Evapotranspiration calculated daily using climate inputs of at least three years of daily data from a nearby representative station |
| | *Q* | Runoff calculated daily |
| Net precipitation ($P_{net}$) | $P_{gross}$ = gross precipitation | At least three years of daily data from a nearby representative station |
| | *CS* = canopy storage | Calculated daily as water intercepted by vegetative surfaces |

*Source:* Authors.

## D-5. Volume Captured method

### Objectives and indicators

The Volume Captured method can be used to estimate the VWBs of activities that capture and/or store or protect a volume of water for flood or drought mitigation, water quality, and/or habitat benefits. Table D5.1 shows the objectives and output indicators for this method.

Example activities include stormwater detention or retention ponds, rain gardens, pond dredging, or desilting, where the objective is to improve water quality or resilience through flood or drought mitigation. Other relevant activities include invasive species removal to create open water and conservation easements to

Table D5.1 | **Volume Captured method objectives and output indicators**

| | |
|---|---|
| **OBJECTIVES** | ▪ Improved water quality through nonpoint source pollution reduction<br>▪ Improved resilience through flood or drought mitigation<br>▪ Improved or maintained water-related habitat |
| **OUTPUT INDICATORS** | ▪ Volume captured<br>▪ Volume maintained |

*Source:* Authors.

protect wetlands from being drained, where the objective is to improve or maintain water-related habitat due to the volume captured or volume maintained.

## Methodology description

The Volume Captured method can be applied to calculate the volume captured or volume maintained due to stormwater management, aquatic habitat restoration or protection, or other relevant activities listed above.

The VWB for activities that capture and/or store a volume of water is calculated using the following equation:

$$\textbf{VWB} = \textbf{Volume captured}_{\text{with-project}} - \textbf{Volume captured}_{\text{without-project}}$$

The VWB for activities that protect or maintain a volume of water is calculated using this equation:

$$\textbf{VWB} = \textbf{Volume maintained}_{\text{with-project}} - \textbf{Volume maintained}_{\text{without-project}}$$

## Example applications

### STORMWATER MANAGEMENT

Stormwater best management practices (BMPs) are commonly used to intercept and slow runoff, helping to reduce flooding risk and improve water quality. BMPs that are typically implemented for stormwater management include green roofs, permeable pavement, grass channels, bioretention, dry and wet swales, soil amendments, rain tanks, cisterns, ponds, and constructed wetlands.

The volume captured through stormwater management can be calculated using the Runoff Reduction method (Hirschman et al. 2018). Table D5.2 highlights the required inputs. This method involves two steps:

1. First, the volume of stormwater directed to a BMP is calculated. This supply volume is calculated by multiplying annual average precipitation by the runoff coefficients that correspond to the catchment land cover conditions:

   $$\textbf{Supply volume} = \textbf{Annual average precipitation} \times \textbf{Surface area} \times \textbf{Runoff coefficient}$$

   The proportional area of pervious (e.g., forest, turf) and impervious (e.g., concrete, metal) surfaces and their corresponding runoff coefficients should be considered in the supply volume calculations. This is done by calculating the supply volume associated with each surface's characteristics in the runoff contributing area and then adding to calculate the total supply volume.

2. The volume captured is then calculated by multiplying the supply volume estimated in Step 1 by a runoff reduction factor corresponding to the BMP. The BMP-specific runoff reduction factor can be obtained from relevant literature (e.g., Hirschman et al. 2018).

The VWB is calculated as the volume captured:

$$\textbf{Volume captured} = \textbf{Supply volume} \times \textbf{Runoff reduction factor (\%)}$$

Note: Small-scale BMPs, such as rainwater tanks and cisterns for capturing rainwater from residential rooftops, may be installed at multiple locations within the same project area. Because the individual rooftop areas may be small, the volume captured by each BMP may not be significant. In these cases, the rooftop areas can be aggregated, and multiple BMP installations can be represented as a single activity to calculate the total VWB.

For stormwater BMPs, typically the without-project volume captured can be assumed to be 0, and the equation simplifies to the following:

$$\textbf{VWB} = \textbf{With-project volume captured}$$

Table D5.2 | **Required inputs for stormwater management activities**

| EQUATION | VARIABLE | INPUT |
|---|---|---|
| Supply volume | Annual average precipitation | Annual average precipitation depth for a representative weather station |
| | Surface area | Total catchment area draining to the BMP |
| | Runoff coefficient | Land cover characteristics<br>Runoff coefficients corresponding to each land cover in the catchment draining to the BMP |
| Volume captured | Supply volume | Annual average precipitation<br>Total surface area draining to the BMP |
| | Runoff reduction factor | BMP-specific runoff reduction factor (%) |

*Note:* BMP = best management practices.
*Source:* Authors.

### WATER BODY RESTORATION

When water bodies such as lakes, reservoirs, ponds, or wetlands have lost capacity to hold water, they are unable to provide aquatic habitat, water quality, or recreational benefits. Capacity loss may be due to sedimentation, drainage, or invasive species.

The storage volume is quantified for two conditions: the without-project condition (reduced volume captured) and the with-project condition (increased volume captured). The annual average volume captured is calculated for each condition using the required inputs shown in Table D5.3. The volume captured can be calculated as follows:

$$\textbf{Volume captured} = \textbf{Surface area} \times \textbf{Average water depth}$$

The VWB is then quantified as the difference in volume captured between the two conditions over an annual period.

Another approach for estimating the volume captured for activities that involve desilting water bodies to restore storage capacity is shown here:

$$\textbf{Volume captured} = \textbf{Increased storage capacity based on the volume of sediment removed}$$

These approaches provide a conservative estimate of the volume captured. However, if information is available to calculate the volume of the water body and the number of times it refills then the benefit can be calculated based on the number of times the water body refills completely.

The basis for determining the surface area, the average water depth, and any other inputs should be documented.

### WATER BODY PROTECTION

Water body protection, such as through conservation easements, maintains the surface volume and associated benefits in water bodies such as lakes, wetlands, and ponds. The volume maintained (i.e., stored) is quantified for two conditions: the without-project condition (reduced volume) and the with-project condition (volume maintained). The volume may be calculated based on surface area and average water depth or site-specific studies.

The need for protection and the likely future use of the water body if not protected should be established. This can be accomplished through communication with local experts, evaluation of maps or reports describing trends in wetland losses, or evaluation of aerial or satellite imagery over time.

Table D5.3 | **Required inputs for water body restoration activities**

| VARIABLE | INPUT |
|---|---|
| Surface area | Surface area of the water body reflecting average conditions |
| Average water depth | Average depth of the impacted water body |
| Increased storage capacity | Volume of sediment removed by desilting or other means to increase storage capacity |

*Source:* Authors.

## D-6. Volume Treated method

### Objectives and indicator

The Volume Treated method can be used to estimate the VWBs of activities that have the primary objective of improving water quality (WQ). Table D6.1 shows the output indicator to meet multiple objectives for the Volume Treated method.

Example activities include a variety of natural and nature-based solutions that are designed to capture and treat nonpoint source runoff, such as constructed treatment wetlands and bioretention basins. This method applies to constructed treatment systems and other gray or nature-based infrastructure designed to intercept polluted water streams to improve WQ. It can also be applied to gray infrastructure such as wastewater treatment plants (WWTPs) and improved sanitation facilities.

### Methodology description

The VWB for activities treating a volume of water is estimated using the following equation:

$$\textbf{VWB} = \textbf{Annual volume of water treated} \times (1/N_{\text{challenges}}) \times \Sigma\,(\textbf{Fraction improved}_i)$$

Table D6.1 | **Volume Treated method objectives and indicator**

| | |
|---|---|
| OBJECTIVES | ▪ Improved water quality through point source pollution reduction<br>▪ Improved water quality through nonpoint source pollution reduction<br>▪ Improved water, sanitation, and hygiene |
| OUTPUT INDICATOR | ▪ Volume treated |

*Source:* Authors.

Where:

*Challenges* refer to water quality challenges, and *i* refers to pollutants

The fraction improved is specific to the relevant pollutant(s) of concern for the receiving water and is computed using the following equation:

**Fraction improved = Incremental improvement by activity/Total improvement needed**

If more than one WQ challenge is identified, then a fraction improved should be computed for each individual pollutant (*i*) and an appropriate number of challenges ($N_{challenges}$) should be assigned. If the treatment system does not impact one of the pollutants identified as a WQ challenge, then a fraction improved value of 0 percent must be assigned for that pollutant (*i*). The fraction improved is calculated by comparing the with-project WQ conditions relative to the without-project conditions and evaluating that change relative to the total improvement needed, such as a reduction in annual pollutant loading or in the average water-body pollutant concentration. Both the incremental improvement and the total improvement needed must be expressed in the same units so that the resulting fraction improved is a unitless number. If the incremental improvement achieved by the activity is greater than the total improvement needed, a maximum value of one (1.0) should be used for the fraction improved. The incremental improvement by the activity (i.e., the with-project condition relative to the without-project condition) can be measured or estimated in many ways, but it is recommended that a Water Quality Benefit Accounting (WQBA) method be used (WRI et al. 2025).

Example: An annual treatment volume of 1,000 cubic meters ($m^3$) is determined for a constructed wetland, and two pollutants of concern are identified as total suspended solids (TSS) and total phosphorus (TP), with influent concentrations of 200 milligrams of TSS per liter of water (mg-TSS/L) and 0.5 milligrams of phosphorus per liter of water (mg-P/L), effluent concentrations of 100 mg-TSS/L and 0.2 mg-P/L, and WQ targets of 50 mg-TSS/L and 0.1 mg-P/L, respectively. The fraction improved for TSS is (200 – 100)/(200 – 50) = 100/150 = 0.67 and for TP is (0.5 – 0.2)/(0.5 – 0.1) = 0.3/0.4 = 0.75 and $N_{challenges}$ is 2. The final VWB is calculated as 1,000 $m^3$/year × (1/2) × (0.67 + 0.75) = 708 $m^3$/year.

## Example applications

### CONSTRUCTED NATURAL OR NATURE-BASED TREATMENT SYSTEMS

This application is relevant to natural or nature-based structures that are designed to intercept polluted water volumes and discharge cleaner water. Example activities include those used in both agricultural and urban landscapes to intercept surface runoff such as constructed treatment wetlands, bioretention basins, rain gardens, retention and detention basins, buffers, filters, bioreactors, and grassed waterways. The method is applied in a stepwise fashion to calculate the volume of water treated and the fraction to which it is improved toward a defined target. Table D6.2 highlights the required inputs needed for applications of the Volume Treated method to natural or nature-based treatment systems.

- **Step 1:** The appropriate standard(s) or target(s) should address the project objectives and established impairments, and be based on locally relevant, established threshold(s) tied to the recognized uses of the receiving water (e.g., designated or actual uses). For example, an appropriate target for a constructed wetland designed to treat agricultural runoff contributing to high levels of nitrate in drinking water should bring the discharge WQ to an appropriate nitrate concentration standard, such as the US Environmental Protection Agency's (EPA's) maximum contaminant level of 10 mg/L for drinking water. If locally relevant numeric WQ criteria or quantitative guidelines do not exist, relevant guidelines or standards published by the World Health Organization (WHO), EPA, European Union, or another reputable organization may be applied. If the project objective is to provide clean water needed for irrigation, the treatment system should bring discharge water to an appropriate irrigation WQ target.
- **Step 2:** WQ data collected at the inlet(s) are evaluated to confirm that the incoming water is not meeting the target. If there is not a clearly defined inlet or if it is not practical to collect new measurements but published studies or other reliable documents are available confirming local water impairments, then estimates of incoming WQ from such studies may be used in place of site-specific measurements.
- **Step 3:** WQ data collected at the outlet(s) are evaluated to determine if the system is improving WQ from a condition of not meeting the target(s) to a condition of fully or partially meeting the target(s) for each challenge identified. This determination may not be needed if the system is designed according to a recognized standard based on demonstrated technologies that have been tested and proved to achieve the desired WQ.
- **Step 4:** The capacity of the natural or nature-based treatment system to fully or partially treat the volume intercepted to the appropriate WQ standard(s) or targets(s) should be evaluated to confirm the system is properly sized. The annual flow through the treatment system should be based on metering where feasible. In the absence of metered flow data, the flow through the treatment system can be computed based on site characteristics, including drainage basin area, precipitation, and a runoff model (see D-1, "Curve Number method"), recognizing that a different approach may be required for treatment systems intercepting flow volumes from artificial

subsurface (tile) drainage or systems receiving other forms of non-runoff inflow volumes.

$$\textbf{VWB} = \textbf{Annual volume of water treated} \times (1/N_{\text{challenges}}) \times \Sigma\,(\textbf{Fraction improved}_i)$$

$$\textbf{Fraction improved} = \textbf{Incremental improvement by activity/Total improvement needed}$$

**WASTEWATER TREATMENT PLANTS**

This application is relevant to the creation of new WWTPs or enhancements to existing WWTPs that remove pollutants from one or more effluent streams, resulting in cleaner water discharged to receiving water bodies. The method is applied in a stepwise fashion to calculate the volume of water treated and the fraction to which it is improved toward a defined target. Table D6.3highlights the required inputs needed for applications of the Volume Treated method to wastewater treatment plants.

- **Step 1:** The appropriate target(s) should address the project objectives and established impairments, and be based on a locally relevant, established WQ target(s) tied to the recognized uses of the receiving water (e.g., designated or actual uses). For example, if the treatment plant is being constructed to address fecal coliform bacteria, then the target should be based on effluent standards that are appropriate for the use of the receiving water (e.g., drinking, irrigation, swimming). If locally relevant numeric water quality criteria or quantitative guidelines do not exist, relevant guidelines or standards published by the WHO, EPA, European Union, or another reputable organization may be applied.
- **Step 2:** WQ data collected at the inlet are evaluated to confirm that the incoming water is not meeting the target. WQ data collected at the inlet may not be needed if it is known that the treatment plant is receiving raw sewage and accepted standards or design values can be used to define influent pollutant concentrations.
- **Step 3:** WQ data collected at the outlet are evaluated to determine if the system is improving water quality from a condition of not meeting the target to a condition of fully or partially meeting the target(s) for each challenge identified. Unlike the potential use of standard values for raw sewage to define influent concentrations, effluent concentration data should be measured to demonstrate attainment of the target and evidence that the WWTP is functioning as intended.
- **Step 4:** The annual flow through the WWTP should be based on metering. In the absence of sufficient metered flow data, the annual flow through a WWTP may be estimated based on the average annual percentage of the total design capacity of the plant that is realized, up to a maximum VWB of the design capacity, or the number of beneficiaries. Where both the design capacity and number of beneficiaries approaches apply, it is recommended that both are calculated and the more conservative or lower volume between the two is counted as the VWB to prevent overclaiming.

$$\textbf{VWB} = \textbf{Annual volume of water treated} \times (1/N_{\text{challenges}})\ \Sigma\,(\textbf{Fraction improved}_i)$$

Table D6.2 | **Required inputs for natural treatment system activities**

| VARIABLE | INPUT |
|---|---|
| Metered volume treated | Measurements of annual flow through the treatment system |
| Estimated volume treated (surface runoff approach where relevant) | Surface runoff calculations or other relevant method to estimate annual volume treated by natural or nature-based systems |
| Number of challenges | Number of WQ challenges identified, or the number of pollutants of concern for the receiving water; legacy pollutants can be included in this total if they are a primary pollutant of concern |
| Incremental improvement by activity | Incremental improvement by activity (calculated from the influent and effluent WQ) |
| Total improvement needed | Total improvement needed (calculated from the influent WQ and the WQ target[s]) |
| WQ standard or target | Locally relevant, numeric WQ criteria or guidelines, or in the absence of such criteria, relevant guidelines or standards published by reputable national or global organizations |
| Influent WQ | Monitoring data to demonstrate that the WQ of the influent water does not meet the WQ target(s) (before treatment) Samples should be collected at a defined system inlet<br>Published studies or other reliable documents may be used in place of site-specific measurements |
| Effluent WQ | Effluent WQ measurements, collected at a defined system outlet, to demonstrate that the WQ target(s) are fully or partially met as a result of treatment |

*Note:* WQ = water quality.

*Source:* Authors.

Table D6.3 | **Required inputs for wastewater treatment plan activities**

| VARIABLE | INPUT |
|---|---|
| Metered volume treated | Measurements of annual flow through the treatment system |
| Estimated volume treated (design capacity approach where relevant) | Pumping or treatment capacity of system<br>Average annual percentage of the design capacity that is realized |
| Number of challenges | Number of water quality challenges identified, or the number of pollutants of concern for the receiving water; legacy pollutants can be included in this total if they are a primary pollutant of concern |
| Incremental improvement by activity | Incremental improvement by activity (calculated from the influent and effluent WQ) |
| Total improvement needed | Total improvement needed (calculated from the influent WQ and the WQ target[s]) |
| WQ standard or target | Locally relevant, numeric WQ criteria or guidelines, or in absence of such criteria, relevant guidelines or standards published by reputable national or global organizations |
| Influent WQ | Monitoring data to demonstrate that the WQ of the influent water does not meet the WQ target(s) (before treatment)<br>Samples should be collected at a defined system inlet |
| Effluent WQ | Effluent water quality measurements, collected at a defined system outlet, to demonstrate that the WQ target(s) are fully or partially met as a result of treatment |

*Source:* Authors.

### IMPROVED SANITATION FACILITIES

This application is relevant to improved sanitation facilities that are not shared with other households and where excreta are safely disposed of in situ or removed and treated offsite (WHO and UNICEF 2023). This includes sanitation access activities that improve wastewater WQ (including sewage and fecal sludge, either on-site or off-site from where it was produced) to the point where it can be safely discharged or reused (i.e., connection to septic, sewage treatment, or fecal sludge treatment systems). While wastewater collection and conveyance systems do not directly treat wastewater, they provide a volume treated benefit in instances where it can be shown that the wastewater is delivered to a functioning treatment system that treats the water to relevant water quality targets.

The primary requirement for a volume of water to be considered treated relates to the quality of the effluent. The project activities should improve the quality of the wastewater so that it meets relevant discharge or reuse water quality targets. Because of this need to treat sanitary sewage or fecal sludge to acceptable levels, unlike the constructed natural or nature-based treatment system and wastewater treatment plant example applications, a fraction improved is not computed for improved sanitation facilities.

The method involves a four-step process for estimating the annual volume of water delivered to the treatment system using metered data, the design capacity of the system, or the number of direct beneficiaries.

- **Step 1:** It is not expected that data on specific pollutants will be available; instead, it should be demonstrated that the discharge is sent to a functioning treatment system that meets relevant requirements.
- **Step 2:** Water quality data for the without-project discharge from sanitation facilities are not needed if it is known that the sanitation system is producing raw sewage.
- **Step 3:** As described under the two applications noted above, confirm that the discharge from the treatment facility meets locally relevant water quality target(s) (i.e., for the with-project condition). Attainment of locally relevant water quality target(s) should be demonstrated with monitoring data where possible, or by following design specifications based on similar, well-proven demonstration systems.
- **Step 4:** Estimate the volume of water treated annually. The annual flow through the sanitation system should be based on metering. In the absence of sufficient metered flow data, the annual flow may be estimated based on the average annual percentage of the total design capacity of the plant that is realized, up to a maximum VWB of the design capacity, or the number of beneficiaries. Where either the capacity or beneficiaries approach applies, it is recommended that both are calculated and the more conservative or lower volume between the two is counted as the VWB to prevent overclaiming.

Estimation of volume treated based on design capacity:

**Volume treated = Design capacity of system × Time operating at capacity**

Estimation of volume treated based on number of beneficiaries:

**Volume treated = Number of direct beneficiaries × Per-capita volume (water treated per beneficiary per day) × Number of days of access per year**

Direct beneficiaries are defined as those people that are discharging wastewater to the system to be treated (not downstream beneficiaries). It is expected that these beneficiaries either were not connected to treatment before the project (and are thus discharging wastewater directly into the environment) or their wastewater was inadequately treated.

The number of beneficiaries, which can be disaggregated in many ways (e.g., gender, age), should be conservatively determined to prevent overcounting individuals who benefit from the activities. There are multiple ways to determine the number of beneficiaries, including but not limited to surveying the number of people receiving services from project activities; using reported data; or estimating the number of people benefitting based on the number of households with new sanitation services (e.g., based on household loans) and the average household size from census data (e.g., the United Nations' Database on Household Size and Composition; UN 2022). In accordance with the WHO and UNICEF's Joint Monitoring Programme definition of basic service, sanitation should be on premises and not shared with other households, and hygiene should be located on premises (WHO and UNICEF 2023).

Table D6.4 | **Guidance on the minimum per-capita water volumes**

| USE | TYPE | MINIMUM VOLUME FOR SURVIVAL (LITERS PER PERSON PER DAY)[a] |
|---|---|---|
| Basic hygiene practices | Hygiene | 2–6 |
| Handwashing (public) | Hygiene | 1–2 |
| Conventional flushing toilets | Sanitation | 20–40 |
| Pour-flush toilets | Sanitation | 3–5 |
| Toilet cleaning | Sanitation | 2–8 (per toilet) |

*Note:* [a] Sphere Association 2018.

*Source:* Authors.

Table D6.5 | **Required inputs for improved sanitation activities**

| VARIABLE | INPUT |
|---|---|
| Estimated volume treated (design capacity approach where relevant) | ▪ Pumping or treatment capacity of the system<br>▪ Average operating time per day<br>▪ Number of days active per year |
| Estimated volume treated (beneficiaries approach where relevant) | ▪ Number of direct beneficiaries<br>▪ Per-capita volume of water (average volume treated per beneficiary per day)<br>▪ Number of days of access per year |

*Source:* Authors.

Table D6.4 provides guidance on the minimum per-capita water volumes required for a variety of hygiene and sanitation-related uses that would produce wastewater. These volumes can be conservatively used to define the per-capita volume of water discharged for treatment based on the type of treatment provided. For example, the volume of 22 liters per person per day (minimum hygiene plus conventional flushing toilet) can be used for an activity where a household with a conventional flushing toilet is connected to a septic system.

In instances where relevant local data are available and/or locally relevant or national guidelines define reasonable or basic access to wastewater treatment (or a similar concept), the volume treated can be calculated based on that volume. Additionally, in instances where project-specific monitoring data show that beneficiaries are receiving treatment of more (or less) water, the volume treated can be calculated based on this project-specific volume. Table D6.5 highlights the inputs needed for improved sanitation activities.

## D-7. Inundation method

### Objective and indicators

The Inundation method can be used to estimate the VWBs for activities that create, restore, or protect areas where inundation is the primary hydrologic function provided or protected. These activities can result in flood attenuation, aquatic habitat, water quality, or recreational benefits. Table D7.1 shows the objective and output indicators for the Inundation method.

Example activities include but are not limited to the removal of levees, berms, or other obstructions to restore periodic inundation to floodplains, oxbow lakes, or wetlands, as well as floodwater application to

Table D7.1 | **Inundation method objective and output indicators**

| | |
|---|---|
| **OBJECTIVE** | ▪ Improved or maintained water-related habitat |
| **OUTPUT INDICATORS** | ▪ Increased inundation<br>▪ Maintained inundation |

*Source:* Authors.

create wetland habitat (e.g., for migrating birds). This method also applies to activities that protect floodplain inundation, such as incentives supporting floodplain livelihoods or agreements that protect floodplains from being disconnected.

### Methodology description

The VWB for projects that increase or maintain inundation volume is calculated using the following equation:

$$\textbf{VWB} = \textbf{Inundation volume}_{\text{with-project}} - \textbf{Inundation volume}_{\text{without-project}}$$

### Example applications

**FLOODPLAIN RECONNECTION**

The VWB of activities that restore inundation volume is quantified for two conditions: the without-project condition (disconnected floodplain) and the with-project condition (improved, reconnected condition of the floodplain). First, the annual inundation volume is calculated for each condition based on the average surface area inundated, average water depth, and average number of inundations. The VWB is then quantified as the difference in inundation volume between the two conditions over an annual period. Table D7.2 shows the inputs for the Inundation method activities. The inundation volume can be calculated as follows:

$$\textbf{Inundation volume} = \textbf{Surface area inundated} \times \textbf{Average water depth} \times \textbf{Average number of inundations}$$

The basis for determining the surface area inundated, the average depth of inundation, and the average number of inundations should be documented. In cases where floodwater is applied to an area to provide habitat, the inundation volume can be simply calculated based on the volume applied.

**FLOODPLAIN PROTECTION**

The VWB of activities that maintain inundation volume is quantified for two conditions: the without-project condition (disconnected floodplain) and the with-project condition (maintained, connected floodplain).

The need for floodplain protection and the likely future use of the land if not protected should be established. This can be accomplished through communication with local experts, evaluation of maps or reports describing trends in floodplain losses, or evaluation of aerial or satellite imagery over time.

First, the annual inundation volume is calculated for each condition based on the average surface area inundated, average water depth, and average number of inundations. The VWB is then quantified as the difference in inundation volume between the two conditions over an annual period.

## D-8. Instream Habitat Volume method

### Objective and indicator

The Instream Habitat Volume method can be used to estimate the VWBs for activities with the primary objective of creating, restoring, or protecting a volume of water for water-related habitat. These activities can also provide water quality and fire resilience benefits, among others. Table D8.1 highlights the Instream Habitat Volume method's objective and output indicator.

Example activities include side channel reconnection, instream barrier removal, dam reoperation, process-based restoration, and water level management for habitat.

### Methodology description

The Instream Habitat Volume method is applied to calculate the volumetric water benefit from activities that protect or restore flows to aquatic habitats containing species that are considered as threatened and/or endemic to the area. The benefit is calculated based on the long-term average annual (or seasonal, when

Table D7.2 | **Required inputs for Inundation method activities**

| VARIABLE | INPUT |
|---|---|
| Surface area inundated | Surface area inundated, reflecting average conditions |
| Average water depth | Average depth of water within the area inundated, based on measurements, project design, or a hydraulic model in the absence of measurements |
| Average number of inundations | Average number of inundations each year based on project design, local hydrology, or a hydraulic model |

*Source:* Authors.

### Table D8.1 | Instream Habitat Volume method objective and output indicator

| | |
|---|---|
| **OBJECTIVE** | Improved or maintained water-related habitat |
| **OUTPUT INDICATOR** | Volume provided |

*Source:* Authors.

relevant) increased volume providing critical aquatic habitat benefits.

The volume provided is calculated as a function of the ecology of the target species:

$$\textbf{VWB} = \textbf{Volume provided}_{\text{with-project}} - \textbf{Volume provided}_{\text{without-project}}$$

Where:

$$\textbf{Volume provided} = \textbf{Minimum flow during period of ecological significance for target species} \times \textbf{Flow duration}$$

This method requires that the user determine the relevant period of ecological significance based on the local context. For example, the period may be based on the provision of critical low flows during the dry season to maintain enough water in the habitat to sustain the local biodiversity or provide minimum flows needed for spawning, rearing, or overwintering. Documentation should be provided from a credible source to justify the selected period of ecological significance and the volume of water required to sustain the habitat. To minimize subjectivity when identifying the period of ecological significance, the user should focus on the most critical threshold for the species and/or habitat being restored.

This method applies when the status of the habitat under the without-project conditions is insufficient to sustain the identified species of concern (e.g., identified threatened, endemic, or sensitive species in the watershed) and/or the habitat for the relevant time period according to the local context and guidelines. The activity under the with-project conditions must also demonstrate a positive change to the status of the habitat that provides sufficient water volume to sustain the identified species and/or habitat according to the local context and guidelines.

Target species can be identified by local or regional experts (e.g., fisheries scientists, researchers) or published studies or literature. Similarly, appropriate resources may be consulted to determine the minimum flows. For example, if the project improves habitat for migratory fish, the local context and guidelines could be determined by subject matter experts or other credible local institutions to help inform the minimum flow requirements for the fish species to travel upstream. In some cases, the restoration project may benefit more than one species. The VWB calculation can consider a longer period of ecological significance to encompass multiple species.

## Example applications

### AQUATIC HABITAT RESTORATION

For activities that restore aquatic habitat (e.g., barrier removal, reconnection of side channels, dam reoperation, or process-based restoration) the VWB can be determined based on the volume provided for aquatic habitat.

First, the annual average volume provided is calculated for the without-project and with-project conditions. If the period of ecological significance is for a subset of the year (e.g., a season, particular month, or number of days), the volumetric benefit should be based only on the volume during this period, with that volume considered the annual volume. Table D8.2 highlights the inputs required for using the Instream Habitat Volume method for aquatic habitat restoration activities. The VWB is then quantified as the difference in volume provided between the two conditions over an annual period.

### BARRIER REMOVAL

For activities that involve removing a barrier to free up an impounded volume and contribute to the natural flow and habitat function, a simple pathway to assess

### Table D8.2 | Required inputs for aquatic habitat restoration activities

| VARIABLE | INPUT |
|---|---|
| Critical habitat | The aquatic habitat protected or restored, which supports species that are considered as threatened and/or endemic to the area |
| Minimum flow | Minimum flow associated with optimal depth or velocity for critical habitat |
| Period of ecological significance | The period during which the minimum flows provide critical habitat for target species benefitting from the project |
| Flow duration | Duration of period of ecological significance |

*Source:* Authors.

the VWB is to calculate the volume of water no longer impounded. Table D8.3 shows the inputs required for using the Instream Habitat Volume method for barrier removal activities. This conservative approach may be used when data are not readily available to support a more detailed quantification.

$$\textbf{VWB} = \textbf{Volume provided} = \textbf{Impounded volume}_{\text{without-project}} - \textbf{Channel volume}_{\text{with-project}}$$

Table D8.3 | **Required inputs for barrier removal activities**

| VARIABLE | INPUT |
|---|---|
| Impounded volume | The volume of water impounded behind the barrier |
| Channel volume | The volume in the portion of the channel in the same footprint of the impounded volume, following barrier removal |

*Source:* Authors.

## D-9. Nonpoint Source Pollution Reduction method

### Objective and indicator

The Nonpoint Source Pollutant Reduction method can be used to estimate the VWBs of activities that improve WQ by avoiding or controlling nonpoint source pollutant loading. See Table D9.1 for the Nonpoint Source Pollution Reduction method objectives and output indicator.

The Volume Treated method described in D-6 may be adapted to estimate the VWBs from additional activities with an objective of reducing nonpoint source pollutant loading to groundwater or surface water where one or more WQ impairments are a shared water challenge. While the Volume Treated method emphasizes projects such as wastewater treatment plants and constructed treatment wetlands that are designed to intercept polluted water volumes and clean them to a relevant standard, the Nonpoint Source Pollutant Reduction method expands on the Volume Treated method to include landscape activities that seek to avoid elevated pollutant levels in nonpoint source runoff or control nonpoint source pollutant levels at the source, prior to entering a water body. This differs from the Volume Treated method, which is focused on point source treatment or other solutions that intercept and treat polluted water volumes.

Example activities that avoid nonpoint source pollution may include improved fertilizer and manure management, precision agriculture, reduced pesticide application, land retirement, conservation crop rotation or the use of alternative crops, habitat restoration or preservation, and pet waste control programs, among others. Example activities that control nonpoint source pollution may include the use of blind inlets, washing stations, pollutant storage equipment, pasture and grazing management, street sweeping, impervious area disconnect, and urban soil amendments, among others. Although the method applies to project-scale quantifications, its intended use is for land uses clearly linked to known impairments in receiving water bodies and for activities known to help mitigate those receiving water body impairments. The method can be applied to any location with a known hydrologic linkage to the impaired water body.

Table D9.1 | **Nonpoint Source Pollution Reduction method objective and output indicator**

| | |
|---|---|
| **OBJECTIVE** | Improved water quality through nonpoint source pollution reduction |
| **OUTPUT INDICATOR** | Volume improved |

*Source:* Authors.

### Methodology description

This method applies to nonpoint source pollution and is used to estimate the VWBs associated with reducing pollutants entering water bodies (such as rivers, lakes, ponds, and groundwater) for activities being funded with the primary purpose of improving WQ when impairment(s) are known. Volumes of water resulting from water stewardship activities that help address shared water challenges related to WQ (SDG Target 6.3) are considered a VWB. The method involves a five-step process:

- **Step 1:** Identify known WQ concerns in the receiving water body, including those that are not addressed by the activity, and the relevant WQ pollutants (if available).
- **Step 2:** Identify locally relevant WQ threshold(s) for each pollutant identified. If locally relevant numeric WQ criteria do not exist, relevant guidelines or standards published by the WHO, EPA,

European Union, or another reputable organization may be applied.

- **Step 3:** Confirm that the without-project conditions of the water body do not meet the local WQ threshold for the pollutant(s) of concern that are addressed by the activity, either annually or seasonally depending on the local context and guidelines. Ideally, this step should be done using available WQ data or documents synthesizing real-world WQ measurements that confirm the water body impairment.
- **Step 4:** Confirm that the proposed activity will improve the WQ of the water body by targeting a known source of the pollutant(s) of concern. Improvement should be demonstrated with monitoring data, information from local and relevant studies, or use of a WQBA method (WRI et al. 2025), or by following design specifications based on similar, well-proven practices.
- **Step 5:** Estimate the volume of water improved annually or seasonally, depending on the local context and guidelines, based on the change in the pollutant(s) of concern. This step involves accounting for any relevant pollutants with a known impairment linked to the source where the activity occurs, where changes to the without-project condition are impacted (improved) after the activity is implemented.

## Example application

### NONPOINT SOURCE POLLUTION REDUCTION

For activities that reduce nonpoint source pollution, the VWB can be determined based on the volume improved, as described below. See Table D9.2 for the inputs required for Nonpoint Source Pollution Reduction method activities.

### EQUATION 1. VOLUMETRIC WATER BENEFIT

For situations where water quality impairments to surface water bodies (streams, rivers, lakes) are the primary WQ concern and nonpoint sources contribute to impairment, the VWB is computed using the following equation:

**Volume improved = With-project runoff × Average fraction improved × Fraction challenges addressed**

The fraction improved and fraction challenges addressed are described in the next sections. The with-project runoff should be computed using the Curve Number method, the Runoff Coefficient method, or a similar approach for the activity's landscape. Though the with-project runoff is typically applied annually, for situations where the primary WQ impairment of concern is a seasonal occurrence, then the with-project runoff should be calculated using an appropriate method and applied only to those seasonal conditions and that timeframe to avoid overclaiming the VWB.

For situations where impairments to groundwater are the primary WQ concern, the VWB is computed using the following equation:

**Volume improved = With-project recharge × Average fraction improved × Fraction challenges addressed**

The with-project recharge should be computed using the Recharge Method, Water Balance Modeling, or a similar approach to estimating the amount of annual precipitation that eventually infiltrates from the activity's landscape into the groundwater aquifer that is impaired. Groundwater WQ impairments typically do not vary by season, so only annual recharge volumes should apply.

### EQUATION 2. FRACTION IMPROVED

The second variable in the volume improved equation is computed using the following equation:

**Average fraction improved = Average (Incremental improvement by activity/Total improvement needed)**

The fraction improved is specific to the relevant pollutant(s) of concern for the activity. If more than one pollutant is targeted by the activity, then a fraction improved should be computed for each pollutant impacted by the activity and an appropriate fraction challenges addressed should be computed. The fraction improved is calculated by comparing the with-project WQ conditions relative to the without-project conditions and evaluating that change relative to the total improvement needed, such as a reduction in annual pollutant loading or average water body pollutant concentration.

The incremental improvement by the activity (i.e., the with-project condition relative to the without-project condition) can be measured or estimated in many ways, but it is recommended that a WQBA method be used (WRI et al. 2025). For WQBA methods that can also be used to estimate runoff, the with-project runoff and incremental WQ improvement should both be computed using a WQBA method for consistency. Examples of WQBA methods include Pollution Reduction Efficiency method, Modified Simple method, Simple or Mechanistic Modeling, the Treatment System method, or using a Region-Specific method. The total improvement needed, based on the locally relevant water quality threshold identified in Step 2, may be expressed as an absolute pollutant load reduction target attributable to the source, a percent pollutant load reduction target for the source, or an absolute pollutant concentration target for the water body and relevant period (i.e., average annual, seasonal, flow based). Both the incremental improvement and the total improvement needed must be expressed in the same units so that the resulting fraction improved is a unitless number. If the incremental improvement achieved by the activity is greater than the total improvement needed, a maximum value of one (1.0) should be used for the fraction improved.

### EQUATION 3. FRACTION CHALLENGES ADDRESSED

The third variable in the volume improved equation is computed using the following equation:

**Fraction challenges addressed = Number of WQ challenges impacted by activity/Number of WQ challenges caused by land use**

The share of WQ challenges addressed is used to partition the total volume improved available for improvement based on the number of distinct and reasonably identifiable WQ challenges caused by the land use practice. This factor should include only the WQ challenges that are linked to the source and exclude WQ challenges where the landscape being improved by the activity is known not to be a pollutant source or linked to the impaired condition. The factor is estimated to conservatively allocate a portion of the full water volume that can be claimed by addressing a specific WQ challenge with an activity. To quantify this factor, the main WQ challenges should be identified (e.g., sedimentation, eutrophication, ecotoxicity from chemicals), as defined by the local guidelines and the known causes of those WQ challenges or the extent to which the landscape being improved by the activity is linked to the WQ impairments. If multiple pollutants are linked to a single WQ challenge, such as nitrogen and phosphorus both linked to eutrophication, it may be necessary to explicitly account for these as two separate challenges especially when separate WQ standards, targets, or goals have been established for the separate pollutants.

Table D9.2 | **Required inputs for Nonpoint Source Pollution Reduction method**

| EQUATION | VARIABLE | INPUT |
|---|---|---|
| Volume improved | With-project runoff | Runoff computed using Curve Number method, Runoff Coefficient method, a WQBA method, or other relevant surface runoff method that adequately models the runoff for the period of interest |
| | With-project recharge | Recharge computed using the Recharge method, Water Balance Modeling, a WQBA method, or another relevant recharge method |
| Average fraction improved | Incremental improvement by activity | Incremental reduction (improvement) in pollutant loads or concentrations, computed using a WQBA method |
| | Total improvement needed | The difference between the without-project WQ load or concentration condition and the pollutant threshold or WQ standard that must be met to achieve the desired outcome |
| Fraction of challenges addressed | Number of WQ challenges impacted by activity | Number of WQ challenges meaningfully impacted by the activity, via full or partial attainment of the desired WQ outcome |
| | Number of WQ challenges caused by land use | The total number of WQ challenges linked to the landscape or land use; legacy pollutants can be included in this total if they are a primary pollutant of concern |

*Note:* WQBA = Water Quality Benefit Accounting; WQ = water quality.
*Source:* Authors.

# Appendix E. Making a tracking and reporting plan

The following information is intended to guide efficient, effective, and credible project-level tracking and reporting to substantiate VWB claims and make progress toward goals. Four components are described below:

## Determine primary tracking and reporting requirements to claim VWBs

A project that meets the eligibility criteria outlined in Step 2 offers assurances that it is eligible to generate expected VWB outputs that contribute to desired outcomes. For such projects, primary project tracking and reporting is required to make a VWB claim and can focus on implementation activities and VWB outputs when a clear theory of change demonstrates how the supported activities will address shared water challenges and contribute to desired impacts (Figure E-1).

As illustrated in Figure E-1, primary tracking and reporting to confirm VWBs requires confirming the following:

**Successful completion of implementation activities.** Implementation activities are essential project implementation tasks that must be completed before the project can deliver its intended VWB outputs. Tracking and reporting of these activities confirms that the essential project activities have been successfully completed and that the project is positioned to deliver expected VWB outputs.

AND EITHER

**Measured VWB outputs.** In cases where directly measuring annual VWB outputs is feasible or practical (e.g., annual measure of water delivered for wetland water supply or groundwater recharge), initial confirmation of completed implementation activities and subsequent annual tracking and reporting of measured volume delivery is sufficient.

OR

**Modeled VWB outputs and key performance factors necessary to sustain project function over the claim period.** In cases where directly measuring annual VWB outputs is not feasible or practical (e.g., measuring reductions in nonpoint source runoff), VWBs should be modeled using relevant climate, environmental, project, and/or hydrologic data. Tracking and reporting should confirm both completion of implementation activities and the performance factors (see Table E-1) on which VWB calculation methods are based, and on which sustained project function and viability depend. Performance factors are conditions or key project-related elements that should remain in place (year over year) to sustain a project's ability to deliver VWB outputs over the claim period. The type or relative importance of performance factors is project- and context-specific.

## Determine if secondary tracking and reporting of other outputs as well as broader outcome and impact metrics are desired and achievable.

Secondary tracking and reporting of other outputs, outcomes, and long-term impacts may also be desired but is not required to make a VWB claim. If such tracking is desired, it is important to communicate these needs with implementing partners and assess cost and feasibility prior to contracting so that pre-project and/or long-term tracking systems can be developed, funded, and supported over an appropriate period to capture desired information. Step 5 in the guidebook includes additional discussion of this topic.

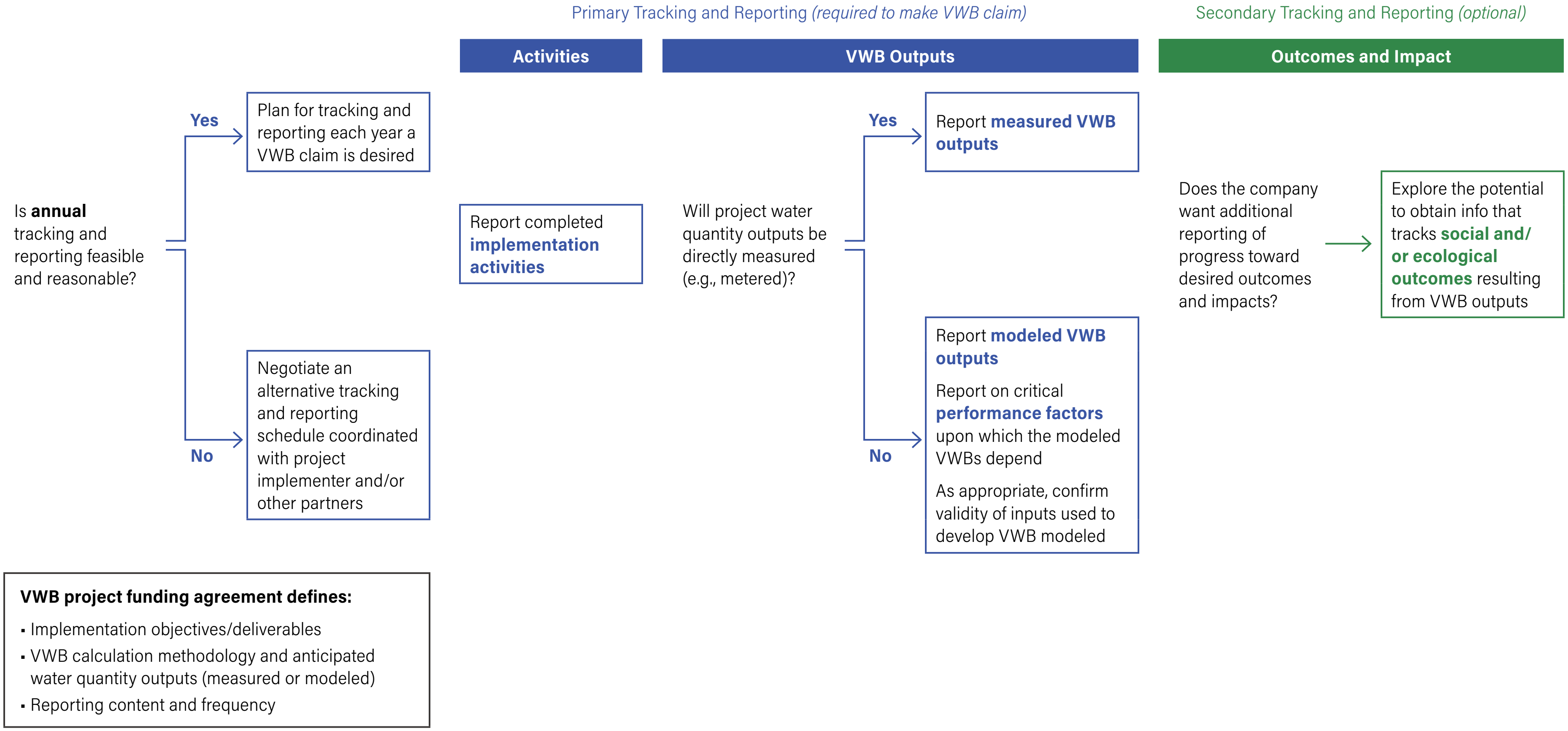
## Determine the necessary duration and frequency of project tracking and reporting to align with desired annual VWB claims.

Following project implementation and for each year in which a VWB claim is made, companies should obtain key tracking and reporting information to help meet the communication requirements provided in Step 6. Although annual tracking and reporting often provides the best way to confirm ongoing project performance, there are circumstances under which it may not be useful, practical, or feasible to obtain certain key information each year. For example, funding availability, project implementer capacity, access to project sites, project type, weather, and other factors may limit or preclude the collection of annual tracking and reporting information.

Based on case-by-case circumstances, companies should work closely with project implementers to define the nature, frequency, and duration of tracking and reporting to meet the needs of the company and reflect the project circumstances and capacity of parties responsible for tracking and reporting.

For example, tracking information for a project that will be in operation for 10 years may be collected and reported annually for a predetermined period (e.g., three to five years) up to a point at which a project is expected to reach a state of stable function (e.g., new or enhanced gray or green infrastructure that is built and operated in a manner that demonstrates stable performance and meets original design criteria). At that point, the company and project implementer can reevaluate the nature and terms of tracking and reporting to determine if a less frequent or reduced level of tracking and reporting can provide sufficient assurance of continued project performance for the balance of a 10-year claim period.

Figure E-1 | **VWBA 2.0 primary and secondary tracking and reporting**



Is **annual** tracking and reporting feasible and reasonable?

Plan for tracking and reporting each year a VWB claim is desired

Negotiate an alternative tracking and reporting schedule coordinated with project implementer and/or other partners

Report completed **implementation activities**

Will project water quantity outputs be directly measured (e.g., metered)?

Report **measured VWB outputs**

Report **modeled VWB outputs**

Report on critical **performance factors** upon which the modeled VWBs depend

As appropriate, confirm validity of inputs used to develop VWB modeled

Does the company want additional reporting of progress toward desired outcomes and impacts?

Explore the potential to obtain info that tracks **social and/ or ecological outcomes** resulting from VWB outputs

**VWB project funding agreement defines:**

- Implementation objectives/deliverables
- VWB calculation methodology and anticipated water quantity outputs (measured or modeled)
- Reporting content and frequency

*Note:* VWB = volumetric water benefit.

*Source:* Authors.

Table E-1 | **Performance factor types and example performance factors that may be tracked to determine whether a project is delivering volumetric water benefits**

| PERFORMANCE FACTOR TYPE | | | |
|---|---|---|---|
| **Legal/governance/agreement** | **Hydrologic/biophysical** | **Structural** | **Operational/behavioral** |
| Is the project's ongoing volumetric performance contingent upon certain legal, policy, authorization, permitting, or enforcement elements that may or may not be approved, renewed, or assured each year? | Is there significant hydrologic or environmental variation that directly affects annual volumetric performance and/or are historical hydrologic data increasingly less predictive of current conditions due to climate change or other factors? | Does the project require certain structural (natural or non-natural) components that may be subject to failure, underperformance, and/or require annual maintenance to sustain performance? | Does the project rely extensively on ongoing management, behavior, maintenance, and/or human inputs to sustain function? |
| **Example performance factors that can influence VWB outputs** | | | |
| ▪ Time restricted permits<br>▪ Water lease agreements<br>▪ Conservation easement compliance<br>▪ Land management agreements | ▪ Biophysical processes critical to fulfill project function such as survival of planted trees or wetland vegetation<br>▪ Hydrologic conditions needed to fulfill project function such as adequate precipitation or runoff | ▪ Control structures or irrigation infrastructure used to divert and deliver water<br>▪ Rainwater or stormwater delivery and catchment systems<br>▪ Well systems used to deliver water for WASH | ▪ Agriculture producer's application of management practices<br>▪ Irrigation district's management of water diversions<br>▪ Water conservation practices implemented by users |

*Source:* Authors.

## Work with project implementers to make a tracking and reporting plan.

Companies should work with project implementers to define the timing and scope of tracking and reporting requirements needed to meet the company's information needs; account for cost and feasibility of collecting and documenting key information; and realistically evaluate the project implementer's capacity to carry out tracking and reporting actions over the desired term.

Many project implementers operate with limited resources and often lack capacity and funding to carry out tracking and reporting activities beyond those that directly inform their own progress toward strategic goals. If desired tracking and reporting requirements represent an added financial and/or capacity burden, companies should integrate those costs into the project budget to ensure that tracking and reporting activities are supported over the duration of the VWB claim period. If desired reporting and tracking requirements are realistically beyond the capacity of project implementers (or not aligned with their priorities), companies should identify and use other agents, tools, or pathways to perform key tracking and reporting functions over the duration of the VWB claim period.

Adopting a tracking and reporting approach that provides value to both the company and project implementers is a useful objective, and it is desirable to base company tracking and reporting needs on reporting systems that may already be funded and in place.

# Glossary

**activity:** The interventions whose effects on natural and social capital are considered "outputs" and can be analyzed and quantified (adapted from WBCSD 2017). A water stewardship project may encompass multiple activities.

**attribution:** The distribution of volumetric water benefits among organizations where more than one organization shares a common volumetric water benefit.

**basin:** See "**catchment**."

**catchment:** The area of land from which all surface runoff and subsurface waters flow through a sequence of streams, rivers, aquifers, and lakes into the sea or another outlet at a single river mouth, estuary, or delta (adapted from AWS 2019). Also referred to as a "watershed." It's important to consider that catchments

- include associated groundwater areas, but surface and subsurface waters often have different catchment boundaries and degrees of connection;
- may include the totality or portions of water bodies, such as lakes or rivers;
- are also referred to as watersheds, basins, or subbasins; and
- may be interconnected with infrastructure, so interventions in one can result in benefits or detriments in another.

**claim:** To state or declare the creation of volumetric water benefits.

**collective action:** Coordinated engagement among interested parties within an agreed-upon process in support of common objectives. Water-related collective action refers to specific efforts to advance sustainable water management, whether through encouraging reduced water use, improved water governance, pollution reduction, river restoration, or other efforts.

**gray infrastructure:** Built structures and mechanical equipment, such as reservoirs, embankments, pipes, pumps, water treatment plants, and canals. These engineered solutions are embedded within watersheds or coastal ecosystems whose hydrological and environmental attributes profoundly affect the performance of the gray infrastructure (Browder et al. 2019).

**goal:** A description of a desired objective, set at the enterprise or site level, against which the company and other entities can evaluate progress (adapted from CEO Water Mandate 2014). This term is used synonymously with other commonly used language to describe desired objectives, such as targets and commitments.

**green infrastructure:** Also sometimes called natural infrastructure, or engineering with nature, green infrastructure intentionally and strategically preserves, enhances, or restores elements of a natural system, such as forests, agricultural land, floodplains, riparian areas, coastal forests (such as mangroves), among others, and combines them with gray infrastructure to produce more resilient and lower-cost services (Browder et al. 2019).

**impact:** Changes in the well-being of those affected over the longer term (WBCSD 2017). In the context of water stewardship, *impact* refers to the positive or negative long-term social, economic, and environmental effects resulting from the implementation of a project or activity, either directly or indirectly, intentionally or unintentionally. Impacts, which are the ultimate result, derive from outcomes. Impacts may be beneficial and called benefits (those impacts that directly or indirectly, intentionally or unintentionally, generally benefit relevant parties and/or the environment) or adverse (those impacts that directly or indirectly, intentionally or unintentionally, are generally harmful to relevant parties and/or the environment) (adapted from AWS 2019).

**indicator:** A quantitative factor or variable that provides reliable means to quantify the achievement of outputs.

**outcome:** Changes in the lives of the target population and/or environment (WBCSD 2017). In the context of water stewardship, the Alliance for Water Stewardship Standard contains four outcomes: (1) good water governance, (2) sustainable water balance, (3) good water-quality status, and (4) healthy status of important water-related areas. Outcomes derive from outputs and lead to impacts (adapted from AWS 2019).

**output:** A unit of measurement for the results of an activity that aids in tracking and communicating progress consistently toward volumetric water commitments, targets, and goals. In the context of VWBA, VWBs are considered outputs that derive from water stewardship activities and lead to broader social, economic, and environmental outcomes and ultimately impacts.

**performance factor:** The conditions or elements that are required to be in place to sustain a project's ability to deliver VWBs over the claim period.

**practitioner:** General term to refer to anyone in the corporate water stewardship space.

**project:** A single water stewardship activity or multiple activities implemented in a specific site or range of sites.

**reporting:** The formal development and sharing of information to communicate a project or program's progress toward pre-defined objectives (or targets). The content and frequency of reporting is usually defined in a formal agreement.

**root cause:** the fundamental reason and underlying driver for the occurrence of a problem (e.g., shared water challenge).

**shared water challenge:** The water-related issues that are of interest or concern in the catchment or area of interest (e.g., aquifer, municipality, town, state) and which, if addressed, will provide positive impacts or prevent negative impacts. Shared water challenges are not necessarily unique and may be the same for multiple sites or relevant parties (adapted from AWS 2019).

**spatial scale:** Refers to the size or extent of the area being studied (i.e., consideration of physical dimensions in space, such as the size of a watershed, catchment, or river basin).

**sponsor:** The organization (e.g., a corporation) that funds some or all of the water stewardship project activity, with the intent of making volumetric water benefit claims based on its investment.

**strategic watershed objective:** Refers to a common goal shared between the company and other relevant parties in the catchment that contributes towards meeting a shared vision for the catchment.

**temporal scale:** Refers to the timeframe over which hydrological processes are observed and analyzed (i.e., considerations of time intervals, such as hours, days, months, or years).

**tracking:** Measurement of key metrics to evaluate progress toward defined targets.

**volumetric objective:** Description of how the activity will contribute to addressing a shared water challenge and/or modify the hydrology in a beneficial way.

**Volumetric Water Benefit Accounting (VWBA):** method for quantifying the volumetric water benefits of water stewardship activities, and associated guidance related to planning, project selection, tracking, and reporting and communication.

**volumetric water benefits (VWBs):** volume of water resulting from water stewardship activities, relative to a unit of time, that modify the hydrology in a beneficial way and/or help reduce shared water challenges.

**VWB claim:** To state or declare the creation of volumetric water benefits. These include any statement, accounting, or communication regarding the delivery of existing or anticipated VWBs that result from voluntary actions taken by the entity making the claim.

**water balance goal or target:** Organizational goal or target to balance a volume of water equal to what is consumed or withdrawn by the organization, through interventions in catchments and communities outside the four walls of the organization.

**water risk:** The effect of water-related uncertainty on an organization's objectives. It is important to note that water risk is felt differently by every sector of society and the organizations within them and thus is defined and interpreted differently (even when they experience the same degree of water scarcity or water stress or when it affects the same area of interest) (AWS 2019).

**water stewardship:** The use of water that is socially and culturally equitable, environmentally sustainable, and economically beneficial, achieved through an inclusive process with relevant parties that involves site- and catchment-based actions (adapted from AWS 2019).

**watershed:** See "**catchment**."

**with-project conditions:** The circumstances or points after a project is implemented that an organization or activity can use to evaluate progress or make comparisons (adapted from AWS 2019).

**without-project conditions:** The beginning points at which an organization or activity will be monitored and against which progress can be assessed or comparisons made (adapted from AWS 2019).

# Abbreviations

| | |
|---|---|
| **AWS** | Alliance for Water Stewardship |
| **BMP** | best management practices |
| **CAPEX** | capital expenditure |
| **CN** | curve number |
| **EPA** | US Environmental Protection Agency |
| **ET** | evapotranspiration |
| **NGO** | nongovernmental organization |
| **OPEX** | operational expenditure |
| **SDG** | Sustainable Development Goal |
| **SW** | soil water |
| **SWA** | seasonal water availability |
| **SWAT** | Soil and Water Assessment Tool |
| **TSS** | total suspended solids |
| **TP** | total phosphorus |
| **UNICEF** | United Nations Children’s Fund |
| **VWB** | volumetric water benefit |
| **VWBA** | Volumetric Water Benefit Accounting |
| **WASH** | water, sanitation, and hygiene |
| **WQ** | water quality |

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# About the authors

Authors are listed alphabetically and by organization affiliation.

## World Resources Institute

**Natasha Collins** is Manager, Cities4Forests and Natural Infrastructure Initiative, at WRI. Contact: natasha.collins@wri.org

**Marc Dettmann** is Manager, Corporate Water Engagement, at WRI. Contact: marc.dettmann@wri.org

**Todd Gartner** is Director, Cities4Forests and Natural Infrastructure Initiative, at WRI. Contact: todd.gartner@wri.org

**Sara Walker** is Director, Corporate Water Engagement, at WRI. Contact: sara.walker@wri.org

## LimnoTech

**Wendy Larson** is Senior Principal at LimnoTech. Contact: wlarson@limno.com

**Penelope Moskus** is Principal at LimnoTech. Contact: pmoskus@limno.com

**Pranesh Selvendiran** is Senior Environmental Engineer at LimnoTech. Contact: pselvendiran@limno.com

**Laura Weintraub** is Vice President at LimnoTech. Contact: lweintraub@limno.com

## Bluerisk

**Paul Reig** is Founder and Chief Executive Officer of Bluerisk. Contact: paulreig@blueriskintel.com

**Jenna Stewart** is Senior Analyst at Bluerisk. Contact: jennastewart@blueriskintel.com

## Bonneville Environmental Foundation

**Sara Hoversten** is Senior Director, Business for Water Stewardship, at BEF. Contact: shoversten@b-e-f.org

**Scott McCaulou** is Director, Water Stewardship Project Portfolio, at BEF: Contact: smccaulou@b-e-f.org

**Todd Reeve** is Chief Executive Officer of BEF. Contact: treeve@b-e-f.org

**Robert Warren** is Program Director, Watersheds, at BEF. Contact: rwarren@b-e-f.org

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WRI is a trusted partner for change. Using research-based approaches, we work globally and in focus countries to meet essential needs, protect and restore nature, stabilize the climate, and build resilient communities. Founded in 1982, WRI has over 2,000 staff worldwide, with country offices in Brazil, China, Colombia, India, Indonesia, Mexico, and the United States, and regional offices in Africa and Europe.

## About LimnoTech

LimnoTech, established in 1975, is an employee-owned water science and environmental engineering firm. We have a passion for clean, sustainable water and work alongside our clients and partners who share our vision for building thriving ecosystems and better places to live. LimnoTech's science-based body of work and contributions as thought leaders, including co-authoring Volumetric Water Benefit Accounting (VWBA), WASH benefit accounting, and Water Quality Benefit Accounting (WQBA), allow us to help guide corporations through every step of a water stewardship journey. We support our clients with basin diagnostics, water risk assessments and mapping, development of water stewardship strategies, goals and targets, project scoping, decision support tool development, water benefit accounting (VWBA, WQBA, WASH), tracking and reporting, Alliance for Water Stewardship Standard implementation, and CDP water disclosure. The foundation of our work is the common goal of helping to ensure availability of and access to clean water for all, protect ecosystems, promote public health, support economic stability, adapt to climate impacts, and foster social equity.

## About Bluerisk

We are water strategy and data experts focused on enhancing resilience and reducing risk in the face of emerging water challenges. We are committed to creating simple and practical solutions tailored to a deep understanding of our clients' needs. Bluerisk's primary services include water valuation and risk quantification, at the intersection of nature, people, and energy across corporate value chains; corporate water strategy development and target setting; and water strategy implementation, including decision-support tools and guidance, as well as cost-benefit analysis, Volumetric Water Benefit Accounting, project review, and attestation. Bluerisk was founded in 2019 by Paul Reig, after spending nine years at World Resources Institute, where he advised many of the world's largest companies and co-led the development of the Aqueduct Water Risk Atlas and Volumetric Water Benefit Accounting method, two of the most widely used open-source resources and de facto standards for corporate water management.

## About Bonneville Environmental Foundation

Bonneville Environmental Foundation (BEF) brings together partners across all sectors of society to co-create entrepreneurial solutions that address climate challenges by restoring freshwater ecosystems and catalyzing a renewable energy future for all. BEF's Business For Water Stewardship™ (BWS) helps businesses work collaboratively with community and policy stakeholders to advance solutions that ensure people, wildlife, economies, and ecosystems have enough clean water to flourish. BWS is a trusted water partner for the world's biggest companies, innovative start-ups, mission-driven B Corps, family foundations, and nonprofit leaders. We provide deep expertise, strategic vision, connections to on-the-ground projects, and innovative solutions for our complex water challenges.

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