

GEF-8 REQUEST FOR CEO ENDORSEMENT/APPROVAL

TABLE OF CONTENTS

GENERAL PROJECT INFORMATION	3
Project Summary	4
Project Description Overview	5
PROJECT OUTLINE	9
A. PROJECT RATIONALE	9
B. PROJECT DESCRIPTION	19
Institutional Arrangement and Coordination with Ongoing Initiatives and Project	60
Core Indicators	64
Key Risks	67
C. ALIGNMENT WITH GEF-8 PROGRAMMING STRATEGIES AND COUNTRY/REGIONAL PRIORITIES	69
D. POLICY REQUIREMENTS	72
Gender Equality and Women's Empowerment	73
Stakeholder Engagement	73
Private Sector	73
Environmental and Social Safeguards	74
E. OTHER REQUIREMENTS	74
Knowledge management	74
Socio-economic Benefits	74
ANNEX A: FINANCING TABLES	75
GEF Financing Table	75
Project Preparation Grant (PPG)	76
Sources of Funds for Country Star Allocation	76
Focal Area Elements	76
Confirmed Co-financing for the project, by name and type	76
ANNEX B: ENDORSEMENTS	79
Record of Endorsement of GEF Operational Focal Point (s) on Behalf of the Government(s)	79
ANNEX C: PROJECT RESULTS FRAMEWORK	80
ANNEX D: STATUS OF UTILIZATION OF PROJECT PREPARATION GRANT (PPG)	103
ANNEX E: PROJECT MAP AND COORDINATES	104
ANNEX F: ENVIRONMENTAL AND SOCIAL SAFEGUARDS SCREEN AND RATING	107
ANNEX G: BUDGET TABLE	108
ANNEX I: RESPONSES TO PROJECT REVIEWS	119

General Project Information

Project Title

Towards a better understanding of the Amazon Aquifer Systems for its protection and sustainable management

Region	GEF Project ID
Regional	11108
Country(ies)	Type of Project
Regional	FSP
Bolivia	
Brazil	
Colombia	
Ecuador	
Guyana	
Peru	
Suriname	
Venezuela	
GEF Agency(ies):	GEF Agency Project ID
UNEP	
IADB	
Project Executing Entity(s)	Project Executing Type
Amazon Cooperation Treaty Organization (ACTO)	Others
GEF Focal Area (s)	Submission Date
International Waters	8/29/2024
Type of Trust Fund	Project Duration (Months)
GET	60
GEF Project Grant: (a)	GEF Project Non-Grant: (b)
13,461,468.00	0.00
Agency Fee(s) Grant: (c)	Agency Fee(s) Non-Grant (d)
1,211,532.00	0.00
Total GEF Financing: (a+b+c+d)	Total Co-financing
14,673,000.00	174,463,442.00
PPG Amount: (e)	PPG Agency Fee(s): (f)
300,000.00	27,000.00

Total GEF Resources: (a+b+c+d+e+f)

15,000,000.00

Project Tags

CBIT: No NGI: No SGP: No Innovation: No

Project Sector (CCM Only)

Taxonomy

Gender Mainstreaming, Gender Equality, Knowledge Generation, Capacity, Knowledge and Research, Focal Areas, International Waters, Transboundary Diagnostic Analysis and Strategic Action Plan Preparation, Freshwater, Aquifer, Stakeholders, Private Sector, Indigenous Peoples, Civil Society, Community Based Organization, Academia, Beneficiaries, Local Communities, Communications, Awareness Raising, Public Campaigns, Strategic Communications, Type of Engagement, Participation, Sex-disaggregated indicators, Gender-sensitive indicators, Gender results areas, Participation and leadership, Knowledge Generation and Exchange, Capacity Development, Workshop, Training, Knowledge Exchange, Field Visit, Conference, Targeted Research

Rio Markers

Climate Change Mitigation	Climate Change Adaptation	Biodiversity	Land Degradation
No Contribution 0	Significant Objective 1	Significant Objective 1	Significant Objective 1

Project Summary

Provide a brief summary description of the project, including: (i) what is the problem and issues to be addressed? (ii) what are the project objectives, and if the project is intended to be transformative, how will this be achieved? iii), how will this be achieved (approach to deliver on objectives), and (iv) what are the GEBs and/or adaptation benefits, and other key expected results. The purpose of the summary is to provide a short, coherent summary for readers. (max. 250 words, approximately 1/2 page)

Beneath much of the Amazon basin lies the Amazon Aquifer Systems (AAS). While presumably it underlies parts of Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela, its actual extent and dynamics are not well understood, and it is anticipated that it could extend much further than is currently known. The demand for safe water has increased in the Amazon Basin and, despite the large volume of surface water in the region, all countries use groundwater extensively as an alternative source of safe water. Groundwater in the Amazon basin plays a major role in the hydrological and ecological cycles and largely influences rainforest ecosystems and climate variability, especially during the dry season, where the understanding of surface-groundwater interactions is important. Groundwater is locally threatened by global changes such as climate change and extreme events affecting aquifer levels, recharge, and changes in groundwater regimes, as well as anthropogenic activities affecting water quality of aquifers. Global changes combined to population and economic activities growth and occurrence of diseases (Covid-19), dependency on groundwater supply increases, demanding sustainable and transboundary management strategy.

The project seeks to tackle four barriers: 1) *the insufficient transboundary aquifer knowledge*: the limits, the hydraulic behavior and interconnections between the regional geological formations, between surface and groundwater flows and potential hazards to groundwater are poorly understood, 2) *the lack of agreements for shared groundwater governance*: there is a gap in the different political, legal, regulatory, and institutional frameworks between countries for the management of groundwater systems, as well as the lack of understanding of the importance of cooperation to address the challenges that affect the AAS, 3) *the lack of a common protection strategy*: countries have advanced in the protection of groundwater through national

strategies, plans, projects, and technical studies, but so far, no common strategy exists that is coordinated among those countries at the AAS scale, and 4) *the lack of public awareness related to AAS's protection and sustainable use*: there is a limited appreciation for the multiple services that the AAS provide at all levels (ecosystems, society, scientific community, etc.).

The project activities were designed to develop a science-based Transboundary Diagnostic Analysis (TDA), to develop a White Paper that includes improvements to the technical, regulatory, and institutional frameworks of the countries, to develop lessons learned from eight pilots where good management practices to reduce stress on the aquifer systems, and to strengthen institutional capacity. As a consequence, the Strategic Action Program (SAP) will be developed and endorsed to create mutual trust through joint fact findings, facilitating the consensus on a common long-term vision for the shared AAS, and assisting key stakeholders from multiple sectors with relevant management strategies and actions to promote water security.

This project will provide direct environmental and water supply benefits to approximately 271,012 direct people and expects to achieve 132,650 ha under improved sustainable practices and aquifer protection plans, under a collaborative management approach for the Amazon Basin, understanding the Amazon Aquifers as an integrated system. By enhancing multi-state cooperation to understand and characterize the threats to the aquifer systems and hence reducing its degradation from several hazards (e.g. overexploitation, land use change, pollution, among others), the project will propose programs to improve water security, through the enhancement of the resilience of ecosystems and vulnerable communities that depend on groundwater and ecosystems. This project is considered transformative since it will deliver significant changes and global environment benefits at a regional scale in an area of global environmental concern such as the Amazon Region, also advancing the SDG agenda, in particular SDG 6 which is related to groundwater.

The project design incorporates science-based communication and gender-responsive outcomes throughout all components. The project will strategically engage key stakeholders and mainstream a gender perspective through institutional actions that strengthen the leadership of the competent entities and programmatic actions that contribute to reducing gender gaps, in strict compliance with national regulations and international commitments on gender and women's rights in the countries.

Project Description Overview

Project Objective

To get a common understanding of the Amazon Aquifer Systems (AAS) (TDA) -the invisible giant-, to strengthen existing regional governance, and to develop and endorse an integrated groundwater management approach (SAP) for its protection and sustainable use, thereby enhancing water security and ecosystem resilience in the Amazon region.

Project Components

Component 1 Consolidation and expansion of the current understanding in the functioning of and threats to the Amazon Aquifer Systems (AAS).

Component Type	Trust Fund
Technical Assistance	GET
GEF Project Financing (\$)	Co-financing (\$)
6,000,000.00	77,761,255.00

Outcome:

Outcome 1: Improved technical-scientific knowledge about the AAS and drivers of change to inform decision making for resource planning and sustainable groundwater management considering each country's context.

Output:

Output 1.1: An assessment of current state of the groundwater resources building *inter alia* on geological, geophysics, hydraulics, hydrodynamic, hydro-chemical, isotopic hydrology, and hydrogeological studies (UNEP).

Output 1.2: A geo-referenced base map of the Amazon Aquifer Systems supported by a GIS infrastructure including specific vulnerability maps based on available or new information from each country (IDB).

Output 1.3: A water security analysis and hydrological and hydrogeological scenario modeling of aquifer behavior, with focus on cross-border zones of the Amazon Aquifer Systems (AAS), under different climate change and socio-economic development scenarios (UNEP).

Output 1.4: Documented targeted research studies on:

- Hydraulic interconnection with surface water with a focus on border areas, including a study of recharge mechanisms (UNEP).
- Understanding pollution threats to groundwater (i.e., As, Pb, Hg, and others to be determined by member countries) (UNEP).

Output 1.5: An agreed AAS Transboundary Diagnostic Analysis **by the RADA (Network of Water Authorities)** (UNEP).

Component 2 Towards a multilevel management system for the AAS.

Component Type	Trust Fund
Technical Assistance	GET
GEF Project Financing (\$)	Co-financing (\$)
520,446.00	6,745,089.00

Outcome:

Outcome 2: Agreed elements for promoting transboundary cooperation and coordinated groundwater management at regional and national level.

Output:

Output 2.1: Assessment and gap analysis of legal, regulatory frameworks and institutional capacities for groundwater management in the region and countries including model policies and regulations toolkits for necessary reforms (UNEP).

Output 2.2 A gender responsive White Paper with recommendations for (i) improving national legal, technical, and institutional frameworks on groundwater management and regional coordination, and (ii) strengthening ACTO's cooperation role on groundwater resources management (UNEP).

Output 2.3 Design of a sustainable regional groundwater monitoring network interoperated with the Amazon Regional Observatory (ARO) and validated by each member country (IDB).

Output 2.4: A proposed road map for sustainable groundwater management and for strengthening policy and legal context in Suriname and Guyana (IDB).

Component 3 Pilots for improved transboundary groundwater management

Component Type	Trust Fund
Technical Assistance	GET
GEF Project Financing (\$)	Co-financing (\$)
4,300,000.00	55,728,900.00

Outcome:

Outcome 3: Demonstrated strategies for improved groundwater management and water security in transboundary critical areas

Output:

Output 3.1: A series of eight (8) pilots testing good management practices to reduce stress on the aquifer systems and increase water security in the face of climate change variability, with a gender responsive approach:

- (i) Innovative approaches for groundwater well management between Bolivia and Brazil (Cobija, Brasília/Epitaciolândia) (IDB).
- (ii) Strategy to evaluate the impacts of gold alluvial mining on aquifers and ecosystems of the Madre de Dios basin in Bolivia (IDB).
- (iii) Promotion of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in 3 municipalities, Puerto Asis, Valle del Guamuez and San Miguel, Putumayo region (Colombia) (IDB).
- (iv) Thematic mapping, vulnerability, identification, and protection of the Aquifer System, as well as recharge zones in Napo River Basin (Ecuador) (IDB).
- (v) Testing innovative approaches for the sustainable management and protection of transboundary sedimentary aquifers (Guyana and Suriname) (IDB).
- (vi) Hydrogeological evaluation to determine protection and sustainability measures in order to reduce vulnerability and risk in the water supply for population purposes in the districts of Callería and Manantay of the province of Coronel Portillo, Ucayali region (Peru) (IDB).
- (vii) Identification of best practices for promoting drinking water security through groundwater protection in small indigenous communities in Suriname (IDB).
- (viii) Promotion of natural recharge areas and aquifer protection through integrated water management and environmental management for enhanced water security in San Carlos de Rio Negro-Casiquiare (Venezuela) (UNEP).

Component 4 Development of a Strategic Action Program for the AAS, including the country's action plan

Component Type	Trust Fund
Technical Assistance	GET
GEF Project Financing (\$)	Co-financing (\$)
1,100,000.00	14,256,230.00

Outcome:

Outcome 4: Agreed and endorsed strategy for the protection and rational use of the shared aquifer systems

Output:

Output 4.1: AAS SAP developed and endorsed at ministerial level with a gender responsive approach (UNEP)

Output 4.2: Agreed regional technical guidelines for the protection and sustainable use of the AAS (IDB)

Output 4.3: A financial strategy for implementing SAP strategic actions (IDB)

Component 5 Reinforced institutional capacity, gender mainstreaming, communication and awareness raised on the AAS

Component Type	Trust Fund GET
GEF Project Financing (\$)	Co-financing (\$)
400,000.00	5,184,084.00

Outcome:

Outcome 5: Strengthened institutional capacity, gender mainstreaming, communication and awareness raised

Output:

Output 5.1: Training and capacity building activities with gender mainstreaming focus for strengthening groundwater management at regional (including ACTO) national, municipal, and local levels (benefiting > 38,000 people) (IDB).

Output 5.2: Groundwater and gender action plan adopted by countries and ACTO (UNEP).

Output 5.3: Communication strategy and knowledge management plan for enhanced awareness and understanding on the AAS across multiple stakeholders (IDB).

Output 5.4: Documented participation in IW LEARN activities, creation of a project website, and preparation of experience notes (1% of project budget) (UNEP).

M&E

Component Type	Trust Fund
Technical Assistance	GET
GEF Project Financing (\$)	Co-financing (\$)
500,000.00	6,480,105.00

Outcome:

Outcome: Effective project oversight and appropriate monitoring & evaluation of project implementation progress and assessment of its results

Output:

Output M&E1: Documented monitoring and reporting process throughout the entire project execution life cycle ensuring successful project delivery.

Output M&E2: Independent evaluations to assess the progress, success, and effectiveness of the project undertaken and recommendations reflected in project implementation

Component Balances

Project Components	GEF Project Financing (\$)	Co-financing (\$)
Component 1 Consolidation and expansion of the current understanding in the functioning of and threats to the Amazon Aquifer Systems (AAS).	6,000,000.00	77,761,255.00
Component 2 Towards a multilevel management system for the AAS.	520,446.00	6,745,089.00
Component 3 Pilots for improved transboundary groundwater management	4,300,000.00	55,728,900.00
Component 4 Development of a Strategic Action Program for the AAS, including the country's action plan	1,100,000.00	14,256,230.00
Component 5 Reinforced institutional capacity, gender mainstreaming, communication and awareness raised on the AAS	400,000.00	5,184,084.00
M&E	500,000.00	6,480,105.00
Subtotal	12,820,446.00	166,155,663.00
Project Management Cost	641,022.00	8,307,779.00
Total Project Cost (\$)	13,461,468.00	174,463,442.00

Please provide Justification

PROJECT OUTLINE

A. PROJECT RATIONALE

Describe the current situation: the global environmental problems and/or climate vulnerabilities that the project will address, the key elements of the system, and underlying drivers of environmental change in the project context, such as population growth, economic development, climate change, sociocultural and political factors, including conflicts, or technological changes. Describe the objective of the project, and the justification for it. (Approximately 3-5 pages) see guidance here

Beneath much of the Amazon basin lies the Amazon Aquifer Systems (AAS). It comprises the hydrogeological province/unit of the Amazon, where various types of aquifers made up of unconsolidated and consolidated sediments are located (United Nations, 2022). While it is understood that it underlies parts of Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela, its actual extent and dynamics and surface-

groundwater interactions are not well understood and could extend much further than is currently known (Rosario et al., 2016).

Currently, it is estimated that the AAS has an extension of approximately 3,950,000 km², of which 2,000,000 km² are from the Alter de Chão Formation and 1,200,000 km² from Içá (UNESCO, 2007). The geometrical characterization of the AAS in each of the Amazon sub-basins is still preliminary. The initial calculations of aquifer reserves indicate water volumes between 45,000 and more than 160,000 km³ (Matos et al., 2013; Galán & Herrera, 2015), placing it thus among the largest aquifers systems in the world (Matos et al., 2013).

Initial estimates suggest that as much as 123,838 km³ of water may be found in the AAS in Brazil alone with a potential extraction yield of 250 km³/annum (ANA, 2015). A more detailed estimate of the Içá-Solimões aquifer in Urucu indicates that a sustainable extraction rate could be as much as 3 x 10⁻³ km³/yr over a 120 km² study area (Galvão et al., 2020).

For many indigenous peoples and other local communities living in riverine environments, groundwater is the only alternative water supply of acceptable quality, due to natural and anthropic contamination of surface waters (UNESCO, 2007). For instance, the Brazilian states of Pará^[1] and Amapá, frequently affected by droughts^[2], both rely on groundwater for more than 50% of their freshwater withdrawals (UNESCO, 2007; United Nations, 2022). In Bolivia, the city of Santa Cruz is supplied almost exclusively from deep wells located in the north of the city^[3]. In Colombia, groundwater is used in several municipalities and states such as Amazonas, Putumayo and Caquetá^[4]. In Perú, main cities, small towns and indigenous communities located near the Ucayali River, use groundwater for human consumption (Tovar et al., 2006).

Water scarcity and unsafe water resources disproportionally affect women and children. Worldwide, when access to water is limited, women and children spend more than 125 million hours daily collecting water, in containers that can weigh up to 20 kg (Monje et al., 2016^[5]). This significantly limits the available time they could spend in productive activities, education, or recreation. Analysis shows that school enrollment increases by 15% when communities have drinking water and sanitary facilities (Monje et al, 2016). Peru (Amazon region) and Brazil have 11% (WHO and UNICEF, 2019) and 54% (Santos et al., 2018) of the population with access to safe water, respectively. CEPAL^[6] shows additional regional statistics regarding SDG 6. Women and girls do not have access to preventive and timely education and health, adolescent pregnancy is very high, and they are vulnerable to intrafamily gender violence, as well as in the labor and social spheres (USAID, 2013^[7]).

Groundwater is also critical for food security since it is used for irrigation in agriculture, for industrial supply^[8] (e.g., Pucallpa and Iquitos in Peru) and in rural population centers for drinking water (Tovar et al., 2006; UNESCO, 2007). Intervention Project 2.4.1 (Leticia in Colombia and Tabatinga in Brazil), GEF Project 9770 described that 59% of groundwater was used for domestic water supply, 76% of the total area presented mid-level (23% with high-level) vulnerability to aquifer contamination.

Several studies (Frappart et al., 2019; Fan & Miguez-Macho, 2010; Ferreira et al., 2016; Miguez-Macho & Fan, 2012; Pokhrel et al., 2013; Pfeffer, 2014; Lin, 2015; Porter et al., 2020; Fassoni-Andrade et al., 2021; ter Steege et al., 2023; Bagheri et al., 2024; Jasechko et al., 2024; Kuang et al., 2024) suggest that groundwater in the Amazon basin, plays a major role in the hydrological and ecological cycles (Castello et al., 2013; Caldas et al., 2023), and largely influence the rainforest ecosystems and climate variability, especially during the dry season, where the increasing frequency of unprecedented droughts are indicating a potential tipping point (Bagheri et al., 2024; Flores et al., 2024; Espinoza et al., 2024). Droughts affect economic activities such as navigability and transportation, agriculture and power supply^[9]. However, to better understand these relationships and better manage this transboundary resource, in response to an altered climate and landscape, more targeted studies are required (Frappart et al., 2019; Porter et al., 2020; Miguez-Macho & Fan, 2012).

Groundwater in the Amazon region is locally threatened by changes (anthropogenic and climate) in a global context (atmospheric-surface-groundwater interactions). Among anthropogenic activities that could impact groundwater resources are: forest degradation and deforestation (Bagheri et al., 2024), fires^[10] (Asner and Alencar, 2010), infrastructure development such as hydropower dams (Flecker et al., 2022), uncontrolled exploitation, pollution (urban and from economic activities). Climate change expected impacts can also affect aquifer levels, recharge and changes in groundwater regimes.

In the last decades, an increasing number of groundwater wells have been constructed for drinking water purposes in the Amazon region. However, the chemical quality of the groundwater resources is poorly studied (de Meyer, 2017; de Meyer et al., 2023), and guidelines for wells construction do not follow the groundwater sustainable use concept. Groundwater is accessed mainly through shallow wells that are susceptible to contamination around water extraction points. In urban areas, where the aquifer has a high-water table close to the surface, there is a high potential for contamination (Gauthier et al., 2019) due to poorly constructed wells, absence or poor protection measurements for sanitation^[11] (UNESCO, 2007).

For example, in Manaus (Amazonas state, Brazil), groundwater samples showed high contamination by thermotolerant coliforms (UNESCO, 2007). Another study conducted in schools in the Santarém region (Pará state, Brazil), where the population is fully supplied by groundwater, showed that most water samples were contaminated with total coliform and with *E. coli*, which could cause serious intestinal disorders for children (Meschede et al., 2018). In the study conducted by ANA (2015) some wells (e.g., in Rio Branco Aquifer) presented abnormal values of calcium, magnesium and sulfate, attributable to agricultural practices and use of fertilizers (ANA, 2015). Near the Belo Monte hydropower dam, septic tank discharges can cause contamination of water wells, inducing risks on health and population (Gauthier et al., 2019).

In Iquitos and Pucallpa (Peru), groundwater for human consumption in unconfined aquifers has aluminum, arsenic, or manganese at levels harmful to human health (De Meyer, 2017). Thus, De Meyer (2017) recommends determining the minimal and maximal depths of wells construction corresponding to non-contaminated aquifers, to avoid aquifers with geogenic contaminants to protect people's health (de Meyer, 2017). De Meyer et al. (2023) correlated the distribution of arsenic contaminated wells with fluvial geomorphology along the Ucayali and Marañón rivers, where mobilization and accumulation of aqueous arsenic and manganese are found in aquifers with poorly weathered sediments deposited by sediment-rich rivers. Groundwater pumping may contribute to the release of geogenic pollutants (such as arsenic) from the rock matrix and to their subsurface transport (UNESCO, 2007), and therefore it should be carefully studied where to place and how to build and monitor wells.

In Ecuador, despite the low populations around Limoncocha, a study showed that 30% of the 11,000 ha area surveyed of the unconfined aquifer were considered as “high risk” to pollution due to agriculture, oil exploitation, tourism, and municipal services (Jarrín et al., 2017).

In Guyana, groundwater is an invaluable resource for domestic and industrial purposes, unfortunately the lack of relevant, up to date data and essential policies have a significant impact on the protection understanding, and hence protection and management of groundwater resources (EPA Guyana, 2016).

Mining, agriculture, pasture ranching and oil exploration activities in the Amazon basin have increased in recent years, but the effects on groundwater quality are yet unknown (Andrade et al., 2018; Mestanza-Ramón et al., 2022). Significant groundwater mercury (Hg) concentrations in the Amazon region of Ecuador are found at sites where illegal gold mining activities are occurring (Passarelli et al., 2024). Groundwater pollution is a practically irreversible and very costly process, which is why it must be avoided with proper management of the activities that cause negative impacts (United Nations, 2022).

Regarding infrastructure development, hydropower dams alter flow fluctuations caused by operations that can affect the surface-groundwater interactions (Basilio Hazas et al., 2022; Shuai et al., 2019), even up to 100 Km downstream of dams (Ferencz et al., 2019). Thus, surface-groundwater interactions are considered to be complex feedback between hydrology and water management (Basilio Hazas et al., 2022). The same type of infrastructure development is occurring in the Amazon basin, especially in the western Amazon region (Flecker et al., 2022); therefore, it is important to be studied, specially into the context of groundwater recharge since hydrographs could be modified.

Climate change impacts are becoming increasingly pronounced (IPCC, 2023) as extreme weather events are becoming more frequent in the Amazon region, the “new norm for the Amazon” as described by Grossman (2024). Indeed, flooding and drought events over a 10-year period between 2005 and 2016 produced similar impacts as events over the 65-year period between 1926-1989 (Marengo et al., 2016). The Amazon basin may experience warmer but drier dry seasons. Grossman (2024) mentioned that annual maximum flows will increase by 50%, while the minimum will decrease by 20%. This increase in flow amplitude could threaten the existence of the forest, including its biodiversity and climate control functions (Grossman, 2024). Indeed, Cobija in Bolivia (Pilot i) has suffered from flooding in 2024^{[12]¹²}. More frequent and intense El Niño and La Niña events are occurring in the Amazon basin (Chen et al., 2010; Davidson et al, 2002; Toreti et al., 2023), modulating the terrestrial water storage (that includes groundwater) during these events (Chen et al., 2010);

thus, describing the high vulnerability of some aquifer of the AAS to climatic threats (Satizabal-Alarcon et al., 2024).

Pokhrel (2014) conducted a study to find out whether the groundwater buffering effect could reduce the anticipated water stress under future climate scenarios projected by IPCC climate model simulations. They found that “the slow soil drainage constrained by shallow groundwater can buffer soil water stress, particularly in the southeastern Amazon dry season”. Therefore, it seems that groundwater could influence positively by reducing water stress in the Amazon basin (Pokhrel et al., 2014). More studies are however needed at systemic level to establish the role and relationship between atmospheric processes, groundwater, surface water and the biome.

Climate change generally affects water availability which impacts men and women differently due to their socially constructed roles and responsibilities^{[13]¹³}. International tensions over AAS groundwater resources (Adams et al., 2022) have revolved around overexploitation and transboundary pollution which need to be better understood including through improved monitoring and additional studies including on the limits, characteristics, management, reserves, flow, etc. of the aquifer systems (Villar, 2016).

The protection of groundwater resources is a great challenge in the Amazon region, especially when considering global changes and the availability of groundwater for humans and ecosystems (Condon et al. 2021). As in many parts of the world, groundwater in the Amazon riparian countries is not the focus of policy and decision-makers as it is not “seen” and poorly understood in comparison to surface water resources. Additional emphasis is however needed to protect and sustainably use this “*invisible giant*” in the Amazon region. Protection requires: 1) crossed-disciplined scientific studies tackling short-, medium-and long-term monitoring activities to understand AAS underlying processes, hazards, vulnerabilities, thus to describe the gaps and opportunities of combined monitoring, and how the AAS drives not only surface processes but also impact to the Amazon biodiversity; 2) transboundary cooperation and collaboration among countries to develop common strategies for groundwater protection and conservation; and 3) engagement with key stakeholders with a gender responsive approach to implement pilots and co-produce knowledge on effective groundwater management strategies.

Hazards threatening groundwater resources, such as overexploitation and pollution, may have adverse effects on vulnerable and exposed communities (traditional communities and indigenous peoples) and socio-ecological systems, and the loss of important reserves for present and future generations. In the case of transboundary aquifers, states need to identify their zones of high vulnerability and take joint protection measures, especially in the boundary areas (Villar, 2016). In the context of increasing water scarcity in many parts of the world, it is imperative to recognize the importance and functions of groundwater systems, and the need to manage them properly to ensure human and ecosystem well-being (United Nations, 2022).

The below section highlights the main barriers to the protection and sustainable use of the AAS.

Barrier 1: Insufficient knowledge at transboundary level

In the 1980s, UNESCO, with the support of all South American countries, developed and published the Hydrogeological Map of South America (1:5,000,000) forming the basis for the definition of the Hydrogeologic Unit-Provinces of the Continent. In 2000, the UNESCO/OAS developed an assessment on transboundary groundwater in Americas under the scope of the International Shared Aquifer Resources

Management Program (ISARM program^[14]¹⁴) that was created to promote recognition and knowledge in relation to the transboundary aquifers of the world. One of the conclusions in this study is that “in general, the problems that affect transboundary groundwaters in the Americas are related to the lack of information. Data that is vital to water management is often fragmented or unavailable. Lack of information affects how politicians and the public perceive this valuable underground resource, and limits understanding of its importance for food security and poverty alleviation. This generally translates into fragmented policies and the absence of long-term integrated water resource management strategies” (UNESCO, 2007).

Nowadays, much of what is known about the AAS comes from studies carried out in the Aquifers of Sedimentary Basins of the Amazon Hydrogeological Province in Brazil (ANA, 2015). The level of information and data management in relation to AAS between country members is very uneven. To better understand and facilitate a consolidated common knowledge base and sustainable use and management of the AAS, it is necessary to carry out technical studies and on-the-ground pilot projects where supposedly the aquifer systems lie. Downscaling techniques will be used to link the AAS scale with pilot scales.

The limits, the hydraulic behavior, the interconnections between the regional geological formations and the structural stratigraphic characteristics of the transboundary aquifers, the geo-chemistry, the water quality, among other processes are poorly understood. At the same time, the present and future demands of the resource (induced by population growth, Ferreira et al., 2021; Martin, 2023) by different stakeholders need to be estimated, under adverse effects of variability and climate change. Understanding and quantifying the different hazards (e.g., degradation of quality due to pollution from various sources) in the AAS, and identifying their root causes is also fundamental for the sustainable use of groundwater, and to guarantee water security in the region.

Barrier 2: Lack of agreements for shared groundwater governance

The Amazon Cooperation Treaty, signed by the eight Amazonian countries in 1978, seeks to promote actions in favor of the development of the region and, at the same time, ensures a balance between economic development and environmental conservation. The Amazon Cooperation Treaty Organization (ACTO) was established as an intergovernmental organization in 1998, which functions as a platform for political and regional cooperation dialogue.

Countries are seeking to conduct groundwater studies focused on environmental protection and sustainable development of groundwater resources in the sedimentary aquifers of the region, and to build multilateral partnerships. In 2013, member countries have discussed a first project proposal to strengthen cooperation in matters of transboundary groundwater resources among Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela, with the participation of Guyana and Suriname^[15]¹⁵, in a regional meeting in Manaus. Since then, some countries have begun to study their groundwater resources, however there is still a gap in the different political, legal, regulatory, and institutional frameworks between countries for the management of groundwater systems, as well as the lack of understanding of the importance of cooperation to address the challenges that affect the AAS.

Under the lead of ACTO, the Amazon SAP Implementation GEF IW Project (GEF ID #9770) is looking at a regional water governance mechanism, focused on surface resources^{[16]¹⁶}. Building on the ACTO existing governance structure, this project would provide further inputs to promote national and regional frameworks for the protection and sustainable use of the AAS. This would be achieved by supporting discussions and agreements to coordinate, harmonize and exchange information; to create and maintain well monitoring networks; to continuously update hazard, vulnerability and risk maps, to improve groundwater management, and to propose recommendations concerning groundwater allocation and protection, according to each country's priorities. These efforts will be materialized in the agreed and endorsed strategy for the protection and rational use of the shared aquifer systems (TDA/SAP). The AAS SAP will build upon the experience of the Amazon watershed TDA/SAP development process (GEF ID 2364) and will merge into the Amazon watershed SAP implementation project (GEF ID 9770).

This project will help to diagnose and address institutional inconsistencies and gaps through promoting a revision of legislations and an analysis of institutional capacities, to improve them. This project will promote public awareness on groundwater management and improving technical capacity for groundwater assessment and regional/national stakeholder's decision-making. Including gender-responsive elements as an input to improved water security and transboundary cooperation for the AAS will also generate opportunities for more socially equitable groundwater management.

Barrier 3: Lack of a common protection strategy for the AAS

Countries, to a greater or lesser extent, have advanced in the protection of groundwater through national strategies, plans, projects, and technical studies (Appendix 1 and section C) at a national level, but so far, no common strategy exists that is coordinated among those countries. The project will interact with and complement national initiatives and existing projects in the area of influence and will promote a common strategy between the countries to address the main problems affecting the AAS. As part of the SAP, guidelines will be identified and agreed to manage sustainably the AAS.

Barrier 4: Low public awareness related to AAS's protection and sustainable use

There is a limited appreciation for the multiple services that the Amazon Aquifer Systems provide at all levels (ecosystems, society, scientific community, etc.). This represents a barrier promoting efficient policies and limits the engagement of stakeholders. A greater understanding of the importance of the AAS will help enhance political will – and, consequently, public awareness – at regional, national and sub-national levels to address the current threats, considering the different roles and responsibilities of men and women in the management of this resource.

Justification

The project objective is to get a common understanding of the Amazon Aquifer Systems (AAS) (TDA) -*the invisible giant*- to strengthen existing regional governance and to develop an integrated groundwater management approach (SAP) for its protection and sustainable use, and thereby enhancing water security and ecosystem resilience in the Amazon region.

Without an adequate and updated assessment on the main characteristics of the AAS to help define sustainable strategies for its use and management, and without national and joint legal, regulatory and institutional frameworks for groundwater, the globally shared goals (SDG 6.4 and 6.6, Bocanegra, 2021; Guppy et al., 2018) of social and economic development might not be possible to achieve, and the degradation of groundwater resources and their aquifer systems will be irreversible especially as in recent years the contribution of groundwater to aquatic ecosystems has become increasingly important as the Amazon basin continues to experience drought periods.

The long-term sustainability of water resources and the health of ecosystems in the Amazon Basin cannot be achieved without an adequate and shared understanding of regional groundwater (main characteristics and threats) across multiple scales and stakeholders. At the same time, the establishment of a multi-level cooperation framework for this important transboundary aquifer, one of the largest in the world, is of vital importance to ensure water security for populations dependent on this resource, and the Amazon dependent eco-hydrosystems and livelihoods. Moreover, ensuring water security conditions and improving access to quality water is key in a post-COVID19 recovery context (Costa et al., 2020), particularly considering the essential role that groundwater plays in securing water supply for isolated vulnerable communities. In addition, due to the COVID-19 pandemic, governments have faced strong pressures to allocate national budget resources to the attention of the most urgent economic and health matters, thereby making scarce public resources even more difficult to allocate towards scientific and climate-resilient initiatives that are needed to inform planning and investments in water management and use. In this regard, this project offers a fundamental keystone to support the development and design of sustainable upstream planning for water-related investments in the Amazon.

The proposed project will build on the regional governance structure (strengthened through ACTO), and further support specific regional governance mechanisms for groundwater. It will be based upon both GEF and non GEF regional and national initiatives that were undertaken or are in progress in the Amazonian region, serving as baseline for the proposed project. Mainly, the GEF support to the *“Implementation of the Strategic Action Programme to Ensure Integrated and Sustainable Management of the Transboundary Water Resources of the Amazon River Basin Considering Climate Variability and Change”* (GEF ID 9770), initiated in February 2020, can be highlighted. This project focused on the AAS will coordinate activities and outcomes with the four Amazon SAP groundwater interventions included under GEF ID 9770 (structured in its Output 2.4), particularly in terms of helping to develop policy and best practices for management at the regional level (Components 2 and 4). Synergies as with the “Red de Autoridades de Agua” (“Network of Water Authorities” - RADA), technical and political focal points working together since 2020, and the development of logistical channels, will be strengthened through ACTO as executing agency and UNEP as implementing agency for both projects.

Moreover, this proposal is highly synergetic and coordinated with the IDB’s Programme *“Improving Climate Resilience by Increasing Water Security in the Amazon Basin”* approved by the Green Climate Fund (GCF) as a Concept Note in June 2023 and recently submitted as a Funding Proposal by the IDB. It is an ambitious program seeking to increase the resilience of vulnerable communities and key socio-ecological ecosystems in the Amazon Basin under a systematic approach, to anticipated impacts of climate change on water availability and quality, its temporal and spatial distribution, and the ecosystems’ capacity to provide key hydro-environmental services. As a complement, the GCF Programme aims to improve the preparedness and response to extreme events, as well as promoting low-carbon and climate resilient investments in water, sanitation and waste services. It will help riparian countries to advance on their climate action commitments

and to build adaptive capacities in the region. Information produced by this project focused on the AAS can feed the design and execution of potential interventions (targeting mainly nature-based solutions and ecosystem-based adaptation for aquifer recharge) to be funded by the GCF facility and vice versa. In this context, the GEF funded proposal will introduce a deeper focus on groundwater management and protection, which will feed as a complement the studies that are foreseen to be developed as part of the GCF Programme, aiming to better understand climate change impacts for water security in the Amazon. During the development of both projects at a later stage, and being IDB the implementing agency for both initiatives, further synergies and opportunities will be identified and assessed, with the purpose of maximizing the strategic partnership towards achievement of the highest possible positive impacts and taking advantage of blended finance and innovative financing and governance structures in place.

Strengthening knowledge about the aquifer dynamics, relevance, problems, and possible solutions at both regional, national and sub-national levels, is essential to make informed decisions based on science and local stakeholders' needs and concerns, and incorporating gender responsive approach to protect and sustainably manage the AAS in a coordinated manner.

This project directly benefits 271,012 inhabitants (50% women) of different communities involved in the pilot projects (Component 3). These pilot projects are significant for the cross-border management of the AAS. By preventing degradation from overexploitation and pollution, the project will improve water security conditions, through strengthening the resilience of groundwater-dependent ecosystems, ecosystem services and sustainable food production systems.

The project will advance sustainable groundwater management policies through the Amazon region, which is an important tool for a sustainable use of vulnerable natural resource from the regional and global perspective. Current understanding indicates that the groundwater resources of the Amazon Basin likely exceed the renewable surface water resources and provide important waterflow to the rivers and tributaries during dry seasons and particularly through droughts which help maintain the aquatic ecosystems during these times of water stress. As the Amazon Basin is the most biodiverse area in the world (Hoorn et al., 2010; Jézéquel et al, 2020), the importance of maintaining and supporting the fragile aquatic ecosystems in times of water stress must not be disregarded.

The project will play a critical role in delivering on-the-ground “best practices” to promote water security through coordinated groundwater management of the Amazon region in collaboration with key stakeholders from multi-scale level (regional, national, sub-national) sectors. The project will contribute to data generation and sharing at local, national, and regional levels, filling knowledge gaps, and providing a better understanding of the significance of the aquifer systems and their role at supporting aquatic biodiversity. The project will also test a range of interventions and solutions contributing to sustainable groundwater management at local levels, considering the gender responsive implementation through the pilot projects.

Stakeholders

The success of the project depends on the technical and institutional capacity, as well as the support and active participation of key stakeholders. A clear process for stakeholder participation, along with gender integration and effective communication, is essential to efficiently achieve the objectives established by the project, impacting the identified GEF Global Environmental Benefits, avoiding duplication of efforts and maximizing the existing capacity.

The involvement of various actors requires different strategies for stakeholders from regional stakeholders, national and sub-national government authorities, academic/scientific stakeholders, civil society and non-governmental organizations, business and private sector organizations, and Indigenous People and Local Communities (IPLCs).

The project seeks to establish effective interaction with these stakeholders to leverage their expertise and resources, ensuring their contribution. This will be done based on the mapping of interested parties (first approach in the Appendix 3B Stakeholder Matrix), the design of engagement strategies for the various interest groups (developed in the Appendix 3A Stakeholders Engagement Plan) and the continuous commitment to the Strategic Actions Program (SAP) that is being implemented in all member countries of the Amazon Cooperation Treaty Organization (ACTO). Both Appendixes (3A and 3B), constitute living instruments that will be refined.

The role and the contribution of the different actors in achieving the project objectives and the GEF Global Environmental Benefits are detailed below:

- **Regional stakeholders** (like ACTO and RADA) have a vital role in supporting in-country organizations, as often provide financial and technical support, generate knowledge and research tools, and support the decision-making process based on technical data. ACTO for example, will be crucial to facilitate the political dialogue and regional cooperation (component 4) to address issues identified in the Amazon aquifers (component 1). The RADA will help to coordinate authorities and develop regional protocols for projects and initiatives on surface and groundwater, strengthening the Amazon countries' technical, technological, and institutional capacities, technological innovation, and intercultural dialogue (components 1, 2, 3 and 4).
- **National and sub-national authorities** are pivotal in the integrated management of water resources and Amazon Basin projects. Their role is paramount in shaping public policy, fostering consensus, and driving decision-making on tools, processes, and pilot projects. Active participation in high-level discussions and agreements is essential, as is capacity building and evidence-based decision-making. While their overall contribution is crucial, their leadership is particularly significant in Component 3.
- **Academic/scientific stakeholders** will be engaged to contribute to the development of knowledge and understanding to promote the sustainable management of groundwater and water security. They will have a fundamental contribution in components 1 and 3.
- **Civil society and non-governmental organizations** have a fundamental role in promoting and disseminating knowledge and good practices for the management of natural resources in the basin. It is required to coordinate research and local awareness actions, share knowledge and experience and work collaboratively in the implementation of pilot projects. Even though their contribution will address most components, will be essential to obtain the objectives of components 3 and 5.
- **Business organizations and private sector stakeholders**, identified as one of the main drivers of change in the Amazon basin involved in diverse activities, will be included in social responsibility initiatives and blended financing options related to aquifer protection and sustainable use. They will have an important contribution in Component 4.

Indigenous people and local communities will be actively engaged in all steps of the project life cycle. Even though their contribution will address most components, will be essential to obtain the objectives of components 3 and 5.

- [1] <https://news.mongabay.com/2023/12/prolonged-drought-brings-unprecedented-changes-to-amazonian-communities-in-para/>
- [2] <https://www.nytimes.com/2024/01/24/climate/amazon-drought-low-water.html>
- [3] https://cebem.org/revistaredesma/vol10/pdf/informacion/recursos_hidricos_bol.pdf
- [4] https://www.corpoamazonia.gov.co/files/Planes/PAT/2020-2023/PAT_2020-2023.pdf
- [5] Monje, Andrea; Nuñez, Anamaria y Subiza, Dolores (2016). ¿Tiene género el agua? Infografía BID. Disponible: <https://publications.iadb.org/publications/spanish/document/%C2%BFTiene-g%C3%A9nero-el-agua.pdf>
- [6] https://www.cepal.org/sites/default/files/static/files/ods6_c1900677_press_3.pdf
- [7] USAID (2013). Diagnóstico de Género en la Amazonía: Amazonas, Loreto, Madre de Dios, San Martín y Ucayali. Lima, Perú: Autor. Disponible: https://pdf.usaid.gov/pdf_docs/pnaec707.pdf
- [8] Pucallpa, https://www2.produce.gob.pe/RepositorioAPS/2/jer/PRODUCTIVIDAD_COMPETITIVIDAD/Informes/analisis_ucayali.pdf
- [9] <https://valorinternational.globo.com/economy/news/2023/10/05/amazon-drought-affects-everything-from-agriculture-to-power-supply.ghml>
- [10] <https://www.wwf.org.br/?87183/With-22-thousand-fire-outbreaks-the-Amazon-has-the-worst-month-of-October-in-15-years>
- [11] <https://news.mongabay.com/2022/03/pharmaceutical-water-pollution-detected-deep-in-the-brazilian-amazon/#:~:text=Experts%20explain%20that%20a%20major,solvable%20problem%20if%20properly%20funded.>
- [12] <https://www.ifrc.org/es/article/bolivia-el-reto-acceder-agua-potable-entre-sequias-e-inundaciones>
- [13] https://unfccc.int/sites/default/files/resource/sbi2019_inf8.pdf
- [14] <https://isarm-americas.org/%ef%bb%bfel-programa-isarm/>
- [15] <http://otca.org/en/wp-content/uploads/2021/01/Newsletter-no-7-GEF-Amazon-Project-1.pdf>
- [16] Outcome 1.1: Institutional strengthened water governance at regional (ACTO) and national level, leading to improved basin management, ecosystem status and livelihoods

B. PROJECT DESCRIPTION

This section asks for a theory of change as part of a joined-up description of the project as a whole. The project description is expected to cover the key elements of good project design in an integrated way. It is also expected to meet the GEF's policy requirements on gender, stakeholders, private sector, and knowledge management and learning (see section D). This section should be a narrative that reads like a joined-up story and not independent elements that answer the guiding questions contained in the guidance document. (Approximately 3-5 pages) see guidance here

The project supports the principles of “*The law of transboundary aquifers*” resolution adopted by the UN General Assembly on 16 December 2013, and it is aligned with the SDG 6.1 (Equitable access to safe and affordable drinking water), SDG 6.2 (access to adequate and equitable sanitation), SDG 6.3 (improve water quality by reducing pollution), SDG 6.4 (Water use and scarcity), SDG 6.5 (implementing integrated water resources management at all levels, including through transboundary cooperation), and 6.6 (Water-related ecosystems), while fifty-three (53) targets show interlinkages with groundwater use, management and/or sustainability; sustainable utilization of groundwater resources is critical to achieving sustainable development and UN Agenda 2030 (UNU-INWEH, 2018).

The Framework for Action^{[1]¹⁷} to achieve the goals of the Shared Global Vision for Groundwater Governance 2030^{[2]¹⁸}, as part of the GEF Global Groundwater Governance Project, will also guide the project design and execution, “to ensure control, protection and socially sustainable utilization of groundwater resources for the benefit of humankind and dependent ecosystems”^{[3]¹⁹}.

The project seeks to promote a common understanding of the importance and functioning of the Amazon Aquifer Systems (AAS) to promote regional governance and management of groundwater for its protection and sustainable use, thereby enhancing water security and ecosystem resilience in the Amazon region.

The project implementation will be highly participatory, gender responsive, and collaborative, fully involving all key stakeholder groups (regional institutions, national and sub-national government authorities, academic/scientific organizations, civil society and non-governmental organizations, business and private sector organizations, and indigenous peoples and local communities), seeking to build consensus actions to manage the AAS sustainable and equitably. The project will build upon the experience of the Amazon watershed TDA/SAP development process (GEF ID 2364), and currently the Amazon watershed SAP implementation project (GEF ID 9770). In both previous projects, key stakeholders dealing with surface and groundwater have been identified and engaged, as well as the complexities of the gender approach involved. Best practices from both projects in engaging with relevant stakeholders’ groups (e.g. national, and sub-national government authorities, NGOs/CSOs and private sector bodies, particularly those related to the water supply and sanitation, and well drilling) and promoting a gender responsive approach will be continued, with special emphasis on those that specifically deal with groundwater management under different circumstances.

A Problem Tree for the issues impacting the AAS (Figure 1) identifies a preliminary assessment of the main problems, their causes and their effects. It was used to identify the priority activities that are required to achieve the agreed outcomes and objectives of this GEF project. The Problem Tree then supported the definition of the project Theory of Change (ToC) (Figure 2).

The Problem Tree identifies the main problems that will be addressed by this project to tackle the remaining barriers (see section A. Project Rationale) and solving the root causes to reduce ecosystem and socioeconomic impacts. The main problems identified are: 1) limited knowledge about the aquifer, its functioning and transboundary problems, 2) lack of transboundary cooperation and governance for AAS management, 3) overexploitation of groundwater resources, 4) increase of human-induced hazards without adequate planning and management for groundwater resources, 5) uncertainty of surface and groundwater interactions in the context of climate change and extreme events, 6) groundwater pollution, 7) domestic sewage runs superficially and enter into a well without proper protection, 8) uncertainty of the impacts of more frequent and intense droughts, 9) uncertainty of the impacts of mining activities, and 10) uncertainty of the impacts of anthropogenic activities.

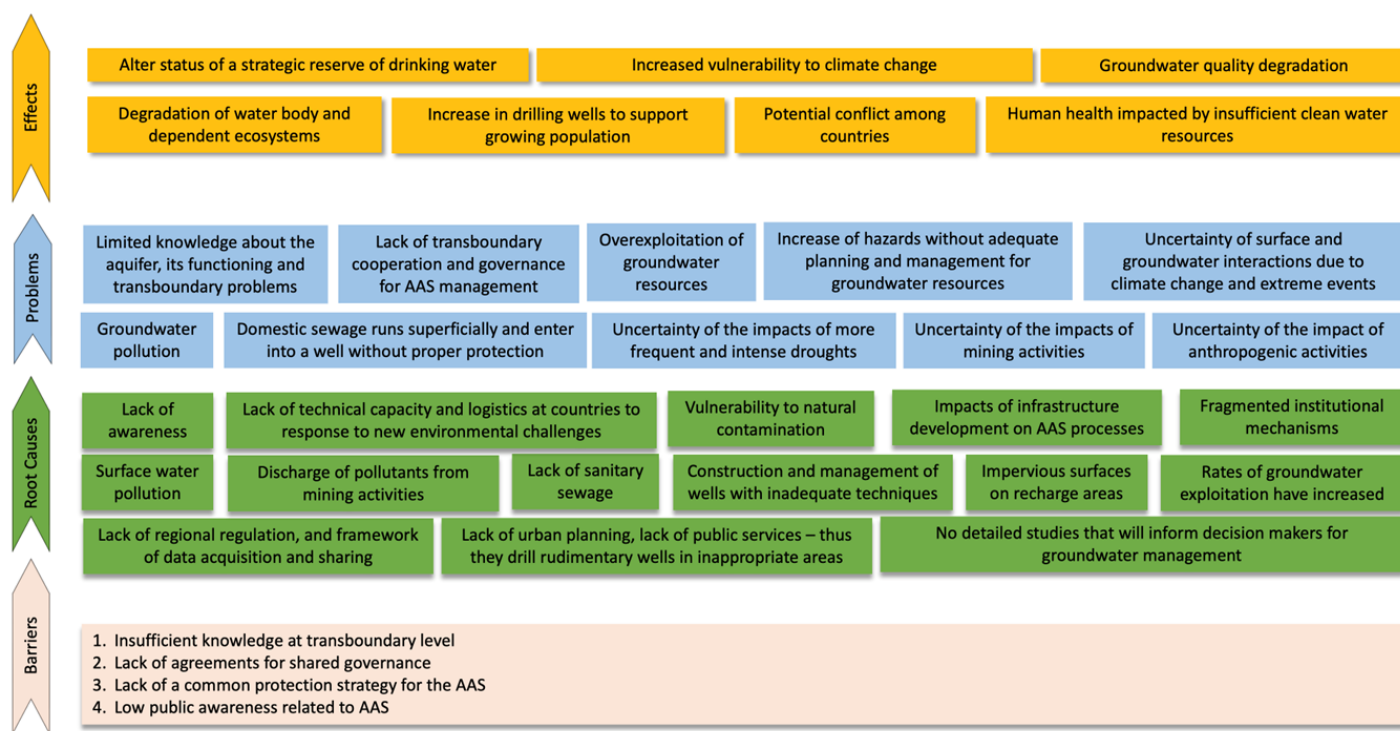


Figure 1. AAS - Problem Tree

The Theory of Change (Figure 2) illustrates the logic of the project in tackling the above problems through a suite of planned outcomes and their expected outputs. Through the implementation of the project's five interlinked components, it is expected that it will generate a long-term impact to the “sustainable, integrated management and use of the Amazon Aquifer Systems to improve water security”. The ToC is also associated with the barriers previously discussed.

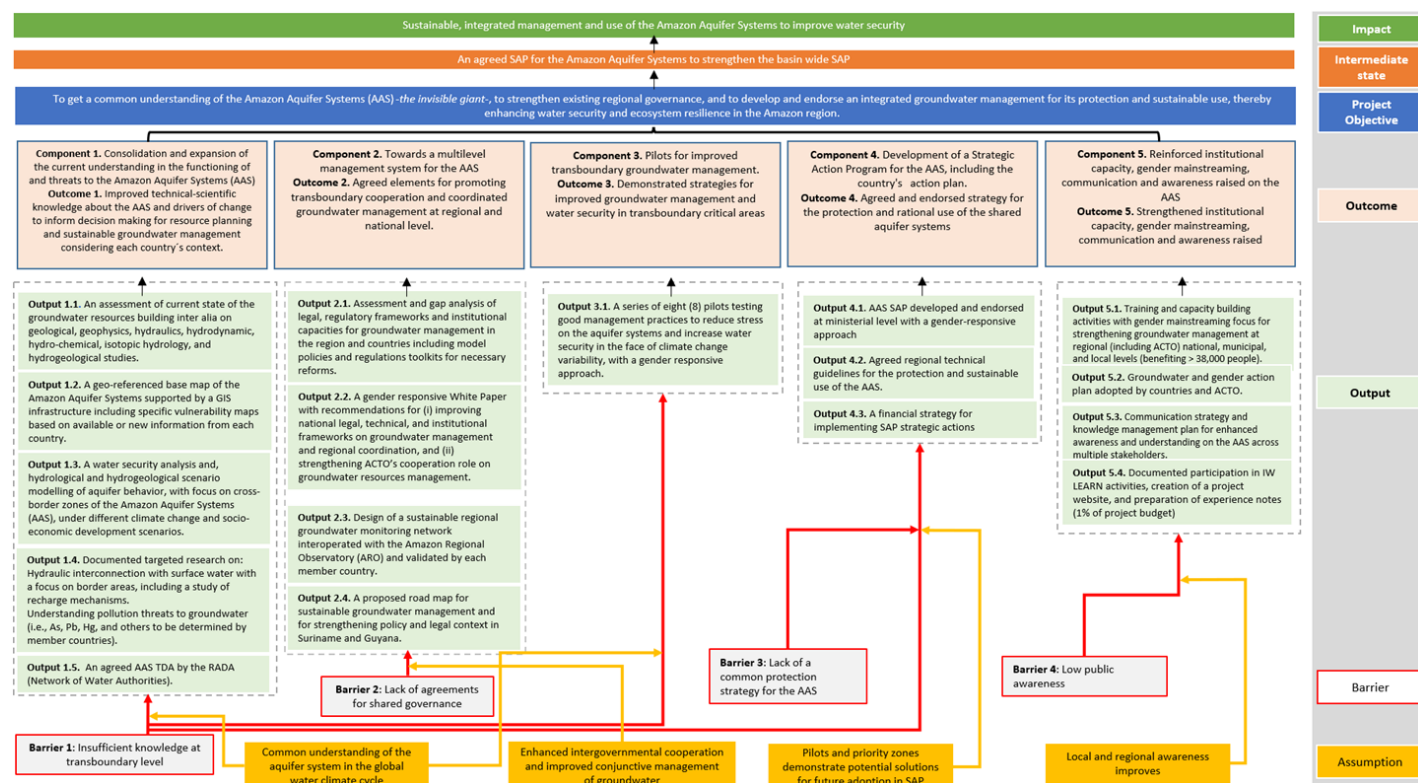


Figure 2. AAS - Theory of change

Project Components

The project is divided into five interlinked components designed to deliver five outcomes aimed at achieving the project objective. As outlined in Figure 3 and further explained in Appendix 7 (Workplan), some activities can start simultaneously and others in a sequential configuration (TDA-SAP). As time progresses the interdependencies of the results and objectives intertwine and become more relevant.

The strength of the project lies in these interdependencies where the components feed into each other to strengthen the outcomes and products. For instance, **Component 1** develops science-based studies using *in-situ*- and remote sensing-based methodologies, considering global changes (climate and human-induced), considering socio-economic development scenarios, and using global models (atmospheric, surface and groundwater) to have a better understanding not only on the AAS's processes, but also of the major threats. For example, based on the physical characterization and human-induced hazards, priority zones will be identified (in terms of vulnerability, protection, data importance, potential unknown hazard to aquifer, etc.) for developing in-situ field measurements that will contribute to the AAS understanding. Three main features complementing Component 1 are: 1) provision of continuous training and capacity building to countries and ACTO with gender mainstreaming focus (linked to Output 5.1), where a certification in Amazon Aquifer Systems, groundwater knowledge and governance will be organized using the PRIC (Regional Platform for the Exchange of Information and Knowledge) - ARO platform, 2) provision of science-based communications products, visualization and decision support tools/models that feed directly into Output 5.3, 3) development of Citizens Science initiatives that will provide engagement and awareness of local communities and sharing educational/communicational products, also linked to Output 5.3. The potential sites for these initiatives will be defined when developing the hierarchical analysis (Output 1.2)^{[4]²⁰}. Most of the results of Component 1 will provide data (that will feed into the project website and later into the Amazon Regional Observatory - ARO) and lessons learned used for at least fifteen (15) submitted peer-reviewed journal articles (see Annex C). Based on the hierarchical analysis (using physical and hazard information), priority zones will be defined following science-based criteria (with participation of countries and ACTO) to downscale the scientific analysis (hydrogeology, hydrochemistry, isotopic analysis, etc.) into these zones. Similar downscaling analysis will be developed for the pilots (Component 3). Output 1.5 develops the TDA and feeds directly into the SAP (Component 4). The results from this component will advance barrier 1.

Component 2 focuses on developing a diagnostic analysis of existing legal, regulatory framework and institutional capacities for groundwater management to elaborate a White Paper, considered a key input (together with the TDA) to the SAP (Component 4). This White paper will also reflect the dynamics of groundwater information management in each country, as well as the sociocultural and gender aspects related to groundwater management, proposing opportunities for improvement. Output 2.3 will be developed at the initial stages of the project to inform the scientific studies, priority zones (Component 1) and pilots (Component 3) on agreed regional protocols for groundwater monitoring, which also includes the guidelines for the inter-operability of the monitoring system into ARO. Output 2.4 seeks to develop an institutional, public policy and a legal roadmap focused on Suriname and Guyana, thus, to complement the strengthening work on groundwater management in both countries initiated by the SAP referred to in GEF 9770. Based on Output 2.1 and 2.2, this project will develop the roadmap that will feed into SAP (Component 4). This effort seeks to advance barriers 1 and 2.

Component 3 is related to the development of pilots, with direct coordination from the countries. As described by Figure 8, the pilots will: test innovative analysis (e.g. isotopic analysis) to develop vulnerability mapping and to define aquifer protection zones; evaluate gold mining effects on aquifers and ecosystem to implement protection measures; test multi-municipal cooperation mechanisms for groundwater management (including different city sizes) and aquifer protection; identifying natural recharge areas (including oil exploitation areas) and aquifer protection through integrated water management and environmental management; identify best practices for promoting drinking water security in small indigenous communities, among others. Pilots are complemented by priority zones (from Component 1) to define conservation/protection regions for the SAP (Component 4). Some of the activities to be executed at these priority zones are: developing *in-situ* and remote sensing-based analysis (water storage, water table, withdrawal, surface deformation, among others) at downscaled priority zones for their protection; developing hydrological/hydrogeological modeling at downscaled level; developing surface-groundwater interaction monitoring including pollution threats to groundwater at downscaled priority zones to implement protection measures; developing isotopic analysis near ARO stations to complement surface-groundwater data and processes, and developing Citizen Science initiatives for protection measures and awareness. All these activities at the pilot and priority zone scale will be upscaled to the entire AAS, therefore, this effort seeks to advance barriers 1, 2, 3, and 4.

To successfully implement the pilots, it will be fundamental to communicate with and engage key stakeholders with gender-responsive lenses. This will require at the onset: 1) the detailing of the Stakeholder Engagement Plan (Appendix 3A) to the pilot context, to capture the specificities of each site's social and institutional networks; 2) audience mapping of each site in order to structure solid comms actions aligned to the communication strategy (Appendix 12); and 3) develop a gender situational analysis within the Gender Action Plan framework (Appendix 2) to specify how gender perspective and equitable benefit sharing between women and men will be incorporated during interventions.

Component 4 proposes to address present and future views regarding the management of groundwater. On the one hand, it will propose immediate guidelines for the protection and sustainable use of aquifers that are adopted at the regional level (by using pilots and priority zones). On the other hand, it will develop a gender responsive AAS Strategic Action Program (SAP) that, with the research developed in components 1 and 3, as well as the analysis developed in Component 2, supports addressing the management of the AAS based on science and proposing to improve institutional and normative issues. This document will be endorsed by high level authorities and will have a financial strategy that will be developed to allow its implementation incorporating a gender perspective. This effort will advance barrier 3.

Component 5 develops training and capacity building in the countries and ACTO, as well as certifications in AAS knowledge and governance through the ACTO educational platform (PRIC), considering a gender balance participation. This effort addresses the identified barriers transversally, with emphasis on 1 and 4. Similarly, the communication plan is developed transversally by the implementation of communication products that nurture awareness and understanding on the AAS. The low public understanding regarding AAS' protection and sustainable use (barrier 4) must be reversed through the appropriation by the various stakeholders regarding the importance of aquifers to ensure access to safe water, in addition to contributing to food security and the health of the ecosystems that provide us with their environmental services. Therefore, the communications strategy goes hand in hand with the stakeholder engagement plan to facilitate the involvement of key stakeholders from multiple social sectors, public and private sectors, academia, civil society, indigenous peoples and other local communities, among others, to be involved. Certainly, this project

will produce unique contributions to IW-LEARN on the issue of aquifers (especially in the Amazon region) and will contribute to the community of practice to seek more sustainable practices and agreements between countries that share the use of groundwater.

A Gender Action Plan, focusing on groundwater and complementing Amazon SAP's Gender Action Plan was developed during the PPG phase and will be implemented during project execution. It will be built considering GEFs gender policies, IDB and UNEP Operational Policy on Gender Equity in Development and gender mainstreaming policies, on internal gender guidelines of ACTO, as well as national strategies when applicable. The Gender Action Plan will not only assist the advancement of women's empowerment within the context of the project, but also will serve to promote a gender policy in the water sector of those countries currently lacking one. A distinctive feature of the project is that gender-responsive approaches and gender mainstreaming are carried out transversally along all five components (Figure 3) but monitored from Output 5.2.

All the connections discussed among components and outputs are shown in Figure 3.

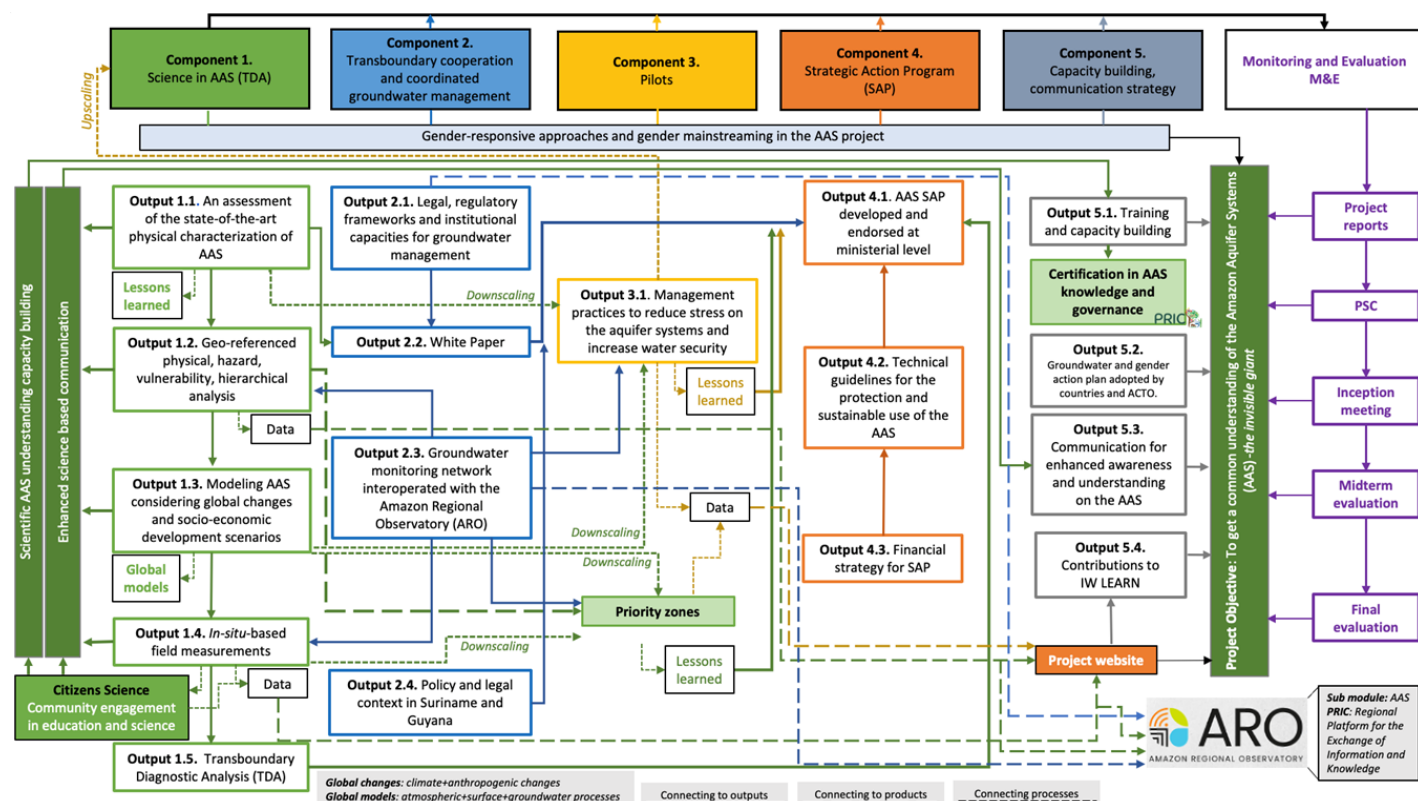


Figure 3. Flowchart of project outputs and components and their connections

The specific components and activities of the project are described below.

Component 1: Consolidation and expansion of current understanding of the functioning and threats on the Amazon Aquifer Systems (AAS)

This key component aims at expanding the existing knowledge of the Amazon Aquifer Systems based on the standardization of information including e.g., on the issue of scale and geological formation classification which differ amongst each participating country, and to achieve common understanding among countries on key transboundary and national concerns affecting the AAS. Figure 4 shows all the activities for the different

outputs, Appendix 7 (Workplan) shows the timeline and Annex C shows the indicators (including the scientific ones related to peer-reviewed journal articles).

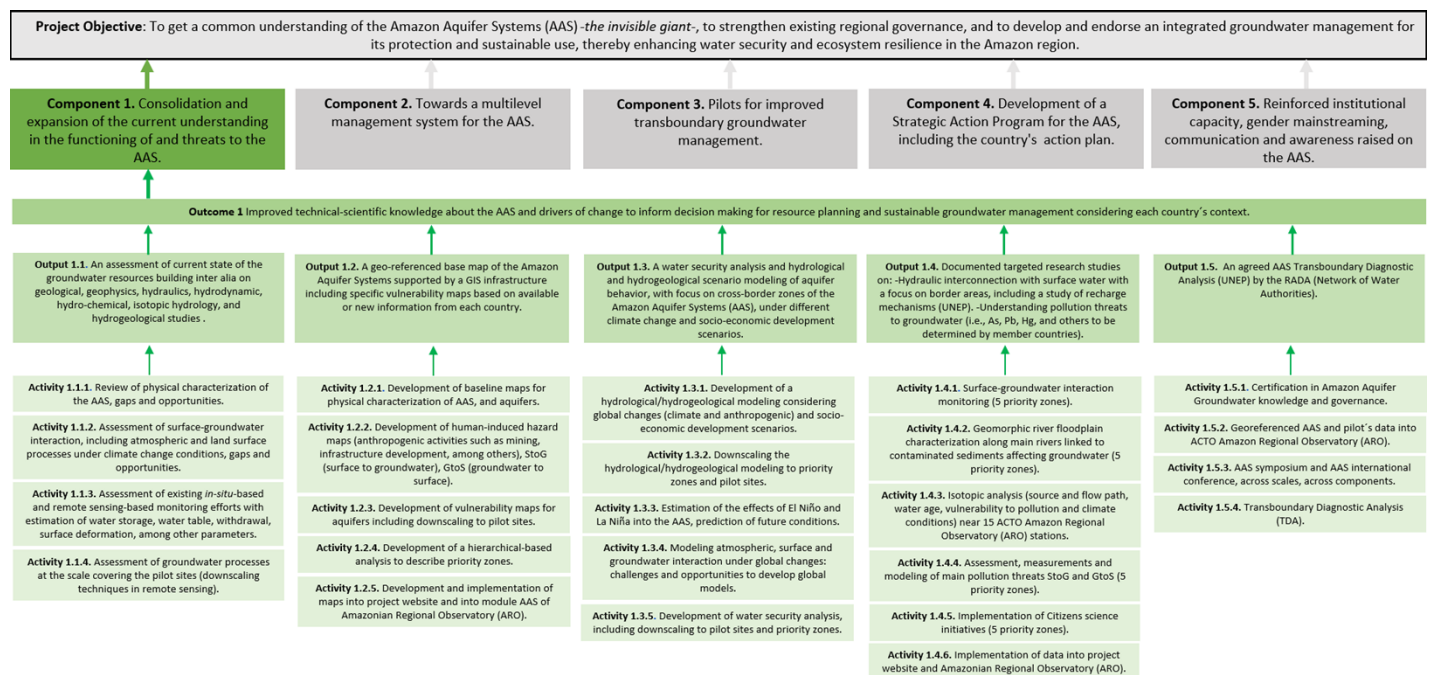


Figure 4. Activities for Component 1

Outcome: Improved technical-scientific knowledge about the AAS and drivers of change to inform decision making for resource planning and sustainable groundwater management.

It is expected to have a gender balance participation during the dissemination and science-based capacity building activities to be developed in this outcome.

Outputs:

1.1 An assessment of current state of the groundwater resources building *inter alia* on geological, geophysics, hydrodynamic, hydro-chemical and hydrogeological studies.

Different studies will be carried out to develop a sound scientific and technical basis for the determination of the main characteristics of the AAS, including existing *in-situ*- and remote sensing-based monitoring efforts and delineation of gaps and opportunities.

The following activities are anticipated to be undertaken:

Activity 1.1.1: Review of physical characterization of the AAS, gaps and opportunities. *This activity will perform an assessment of the state-of-the-art scientific understanding using geological, geophysics, hydraulics, hydrodynamic, hydro-chemical, isotopic hydrology, and hydrogeological studies. Gaps and opportunities for performing research will be delineated.*

Activity 1.1.2: Assessment of surface-groundwater interaction, including atmospheric processes under land surface processes under climate change conditions, gaps and opportunities. *This activity will include atmospheric processes such as the flying rivers [\[57\]](#) (Pearce, 2020) of the Amazon Rainforest (an important*

factor that modulates precipitation patterns) under land surface processes and climate change conditions (IPCC, 2023).

Activity 1.1.3: Assessment of existing *in-situ*-based and remote sensing-based monitoring efforts with estimation of water storage, water table, withdrawal, surface deformation, among other parameters. *Inventory of ongoing monitoring infrastructure and data (aquifer geometry, aquifer recharge and discharge identification, lithology and soil type, porosity, permeability, transmissivity and vertical conductivity, flow direction, pH, salinity, among others). Remote sensing-based analysis will be performed to estimate groundwater storage, groundwater storage anomaly, trend and seasonal adjustments, as well as changes due to hydrologic stages.*

Activity 1.1.4: Assessment of groundwater processes at the scale covering the pilot sites (downscaling techniques in remote sensing). *The remote sensing-based analysis of Activity 1.1.3 will be downscaled from the AAS to pilot's scale.*

1.2 A geo-referenced base map of the Amazon Aquifer Systems supported by a GIS infrastructure including localized vulnerability maps based on available or new information from each country.

One of the key elements of the project will be the creation of an aquifer base map and its translation into a user-driven geographic information system for decision making, including data on water abstraction, potential abstraction, recharge, aquifer depth, yield, permeability, aquifer thickness, pollution levels, etc., these maps can be overlaid to show priority areas for action. Hazard maps (land use change, agriculture (diffusive source), households and industries (point source), water use, wastewater management, landfills, deforestation, oil pipelines, dams, roads, among others) from StoG (surface to groundwater) and from GtoS (groundwater to surface) will be developed. The hazard maps will be developed based on existing information. This analysis will be integrated into a GIS database, which will be used to produce vulnerability maps and hierarchical-based risk analysis.

The following activities are anticipated to be undertaken:

Activity 1.2.1: Development of baseline maps for physical characterization of AAS, and aquifers. *Based on Activities 1.1.1 and 1.1.4's parameters, hydrogeologic [\[6\]](#) georeferenced maps will be developed, considering ORA protocols for data uploading.*

Activity 1.2.2: Development of human-induced hazard maps (anthropogenic activities such as mining, infrastructure development, among others), StoG (surface to groundwater), GtoS (groundwater to surface). *This activity includes an extensive compilation and interpretation of data related to anthropogenic activities (e.g. deforestation, infrastructure development, alluvial mining, land cover change, among other) affecting groundwater will be developed (including georeferenced maps).*

Activity 1.2.3: Development of vulnerability maps for aquifers including downscaling to pilot sites. *Vulnerability indexes will be developed based on aquifer parameters and potential contamination from surface sources of pollution. In collaboration with countries executing the pilots, a downscaling vulnerability analysis will be performed at the pilot scale.*

Activity 1.2.4: Development of a hierarchical-based analysis to describe priority zones. *Using the physical, hazard and vulnerability information, and describing the appropriate weighted factors, a hierarchical-*

based analysis will show priority zones for conservation, where more detailed analyses will be carried out. Depending on the selection criteria, targeted topics [\[7\]²³](#) could be incorporated.

Activity 1.2.5: Development and implementation of maps into project website and into module AAS of Amazonian Regional Observatory (ARO). *Activity 5.3.4 will develop the project visual identity and project website, the science-based georeferenced maps will be uploaded into the project website and then into the AAS sub-component that will be developed inside of Amazon Regional Observatory – ARO.*

1.3 A water security analysis and hydrological and hydrogeological scenario modeling of aquifer behavior, with a focus on cross-border zones of the Amazon Aquifer Systems (AAS), under different climate change and socio-economic development scenarios.

Hydrological and hydrogeological models will be developed to characterize, simulate, and analyze the groundwater dynamics under varying conditions, including climate change, population growth, demographics (including gender analysis), dams, and land cover change due to deforestation. These models will help to identify gender-responsive strategic recommendations for sustainable management and utilization of the selected shared aquifers under changing conditions.

Groundwater security indicators will be developed [\[8\]²⁴](#). The modeling will include climate scenarios as well as future water and land use scenarios which will be evaluated based on water (and groundwater) security indicators, and gender. The indicators will be developed in collaboration with the on-going SAP Implementation project (Component 4).

The following activities are anticipated to be undertaken:

Activity 1.3.1: Development of a hydrological/hydrogeological modeling considering global changes (climate and anthropogenic) and socio-economic development scenarios. *Estimation of future hydrogeologic processes depend on climate change, well documented surface-related hazards (Activity 1.2.2) that might affect groundwater variables, and socio-economic development in the Amazon rainforest (Nobre et al. 2016; Banerjee et al. 2021).*

Activity 1.3.2: Downscaling the hydrological/hydrogeological modeling to priority zones and pilot sites. *Using results from Activity 1.3.2, downscaling analysis will be performed for priority zones and pilots to inform countries and the SAP (Component 4).*

Activity 1.3.3: Estimation of the effects of El Niño and La Niña into the AAS, prediction of future conditions. *More frequent and intense high and low flows are observed along the Amazonian rivers (a future of extremes, Grossman, 2024). Indeed, Espinoza et al. (2024) correlated the 2023 drought anomaly to the impacts of the June-September El Niño on the Walker circulation. From atmospheric processes of El Niño and La Niña to precipitation patterns into the surface, to runoff along the floodplain and water discharge along the rivers, and their interaction to groundwater processes, prediction of extreme events and their influence of hydrogeologic processes will be developed.*

Activity 1.3.4: Modeling atmospheric, surface and groundwater interaction under global changes: challenges and opportunities to develop global models. *As discussed by Activities 1.1.2 and 1.3.4, not only surface*

water and groundwater interactions are required, but also the understanding of atmospheric processes, therefore, global models for the AAS will be developed.

Activity 1.3.5: Development of water security analysis, including downscaling to pilot sites and priority zones. *This analysis carried at the AAS scale and then at the scale of pilots and priority zones will allow to define the potential risks affecting the availability of, access to, and safe use of water for different populations and demographics. Groundwater security indicators will be developed including future water and land use scenarios, thus, to inform the SAP (Component 4).*

1.4 Documented targeted research for improving the understanding of the (i) hydraulic interconnection with surface water, and (ii) pollution threats to groundwater^{[9]²⁵}. Such understanding is essential to help determine and quantify the level of natural recharge, the interactions with the aquifer during dry and wet seasons, interactions, and the groundwater relations with the environment and aquatic ecosystem, the so-called groundwater-dependent ecosystems (Werstak et al., 2010; Eamus et al, 2015). Concentrations of arsenic (from natural sources^{[10]²⁶}) on shallow wells have been found that are potentially harmful to human health in some areas; however, research is needed to identify *hotspots* where levels of toxicity are especially high, in areas that rely heavily on wells for drinking water and where vulnerable groups are present. These criteria will be used in the hierarchical analysis (Activity 1.2.4) to define the priority zones. As per the TDA/SAP methodology, as to formulate a strong TDA, in addition to analyzing and assembling existing information, based on the gap in the knowledge base, one can also focus the research on key issues, hence the “Targeted Research” label under Output 1.4 which will indeed contribute to the TDA, being a complement to the pilots (Component 3).

The following activities are anticipated to be undertaken:

Activity 1.4.1: Surface-groundwater interaction monitoring (5 priority zones). *Based on Activity 1.2.4, five priority zones will be used to study the interaction of surface water and groundwater processes, which will inform not only at the scale of the zones, but also serve to the AAS scale.*

Activity 1.4.2: Geomorphic river floodplain characterization along main rivers linked to contaminated sediments affecting groundwater (5 priority zones). *In the same zones from Activity 1.4.1, groundwater wells (existing or by drilling new ones) will be used to monitor contaminated sediments, where contaminants such as As and Mn were observed (De Meyer et al., 2023) along the river floodplain.*

Activity 1.4.3: Isotopic analysis (source and flow path, water age, vulnerability to pollution and climate conditions) near fifteen (15) of ACTO Amazon Regional Observatory (ARO) stations. *Including the second phase of gaging stations in the entire Amazon basin (GEF Project 9770, Amazon Basin Project), more than 300 stations will be used to monitor surface water quantity and quality. In around 5% of these stations, and linked to Activities 1.4.1 and 1.4.2, isotopic analysis (for low and high-water stages, for three years) along the groundwater wells will be developed to complement the surface information (based on existing monitoring infrastructure that is already mapped into ARO's platform).*

Activity 1.4.4: Assessment, measurements and modeling of main pollution threats StoG and GtoS (5 priority zones). *Detailed water quality measurements and groundwater modeling will be performed to describe*

potential contaminant sources and their transport and fate processes. This information will help to inform the SAP (Component 4).

Activity 1.4.5: Implementation of Citizens Science initiatives (5 priority zones). *Citizens Science projects have shown to be complementary approaches for understanding hydrology and water resources (Buytaert et al., 2014), hydrogeologic processes and groundwater quality monitoring (Baalbaki et al., 2019; Nath and Kirschke, 2023), and subterranean biodiversity by using environmental DNA metabarcoding (Couton et al., 2023). Based on priority zones, Citizens Science initiatives will be targeted for providing complementary data and creating opportunities for local stakeholders' participation. These initiatives will incorporate local and ancestral knowledge.*

Activity 1.4.6: Implementation of data into project website and Amazonian Regional Observatory (ARO). *Data will be uploaded into the project website and AAS sub-module inside of ARO.*

1.5 An agreed AAS Transboundary Diagnostic Analysis by the RADA (Network of Water Authorities).

The TDA of the AAS will be developed, based upon jointly conducted science-based assessments of the current state of groundwater resources (1.1), and related modelling of regional behavior and evaluation of future scenarios (1.2) considering the AAS interconnection with surface water, and natural pollution due to arsenic and other pollutants (1.3) and additional information emanating from output 1.4.

The TDA will consolidate the agreement between countries on the main issues of transboundary concern requiring joint remedial and/or protection actions, and on those under national responsibility only. The preparation of the TDA will follow a gender responsive approach.

The following activities are anticipated to be undertaken:

Activity 1.5.1: Certification in Amazon Aquifer Systems, groundwater knowledge and governance: Based on the scientific activities, contiguous virtual training courses will be developed using the Regional Platform for the Exchange of Information and Knowledge, PRIC-ORA [\[11\]](#). 10 to 12 MOOCs will be organized jointly with a regional University (ies) and UNESCO partnership. Participants from ACTO, CM and other invited personnel can register freely for the courses and obtain a certification based on covering 70% of the available MOOCs. This activity will be coordinated by Component 5 (Output 5.1: Capacity building), considering the gender balance participation and the gender responsive approach of the topics discussed.

Activity 1.5.2: Georeferenced AAS and pilot's data into ACTO Amazon Regional Observatory (ARO). *Based on regional protocols (Output 2.3), the processed data from Component 1 will be formatted and uploaded into the ARO's AAS module.*

Activity 1.5.3: AAS symposium and AAS international conference, across scales, across components. *Component 1 includes the development of scientific studies, therefore scientific products such as peer-reviewed journal articles are expected (see GEF Annex C). At mid-term period a regional scientific symposium will be organized to share the ongoing understanding, as well as developing training sessions. This activity will be coordinated by Component 5 (Output 5.1: Capacity building), considering the gender balance participation and the gender responsive approach of the topics discussed.*

Activity 1.5.4: Transboundary Diagnostic Analysis (TDA). *National and regional meetings will be held to have an agreement on the TDA, that will feed into SAP (Component 4). The National meetings will be held*

at each country where detailed discussion on the activities for Component 1 will be done, especially those concerning the country pilots. After, obtaining consensus and input from each country, a RADA (Network of Water Authorities) regional meeting will be held to seek a regional agreement on the TDA.

Component 2: Towards multilevel cooperation of the AAS

This component seeks to improve groundwater management by proposing recommendations at different management levels (e.g., national and regional levels) by (i) evaluating the existence and scope of policies and regulations at the national and regional levels; (ii) analyzing the strengths and gaps of the institutions in charge of groundwater management; and (iii) developing a joined-up groundwater data monitoring and reporting guidelines. Figure 5 shows all the activities for the different outputs and Appendix 7 (Workplan) shows the timeline.

Outcome: Agreed elements for promoting transboundary cooperation and coordinated groundwater management at regional and national level.

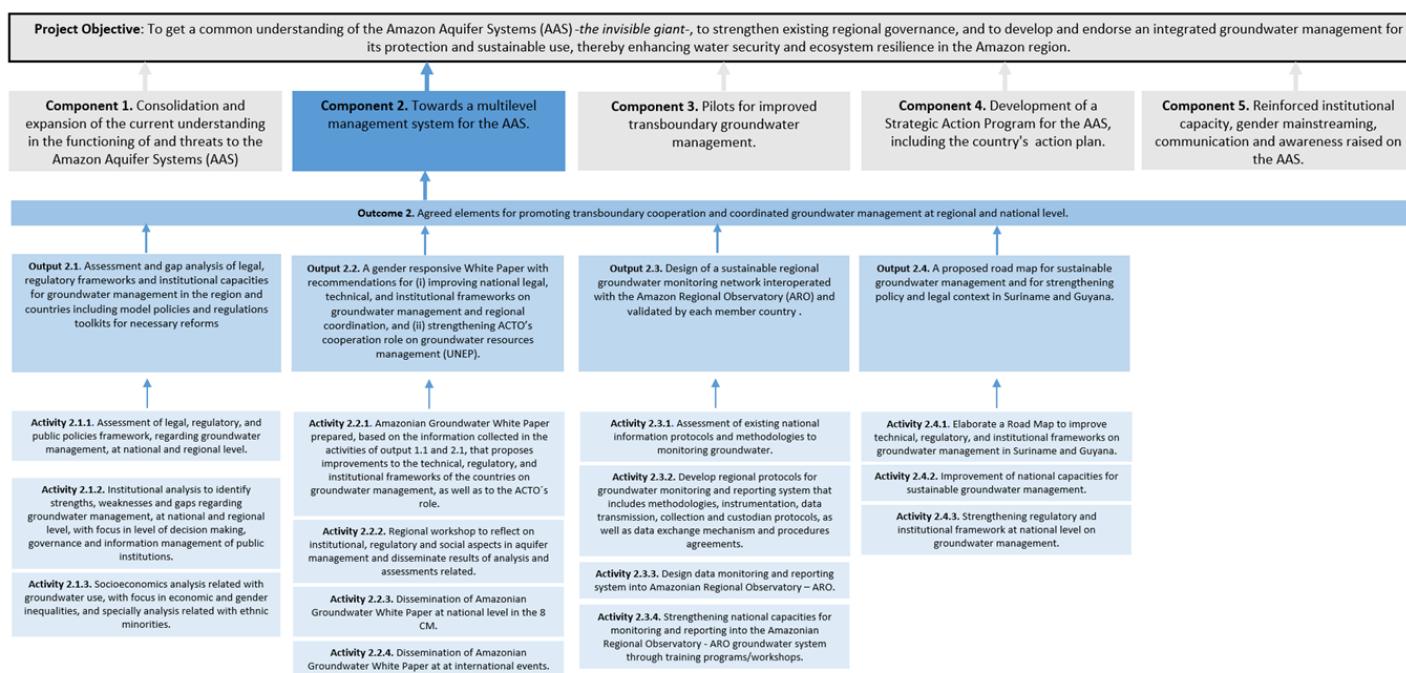


Figure 5. Activities for Component 2

Outputs:

2.1 Assessment and gap analysis of legal, regulatory frameworks and institutional capacities for groundwater management in the region and countries, including model policies and regulations toolkits for necessary reforms. This assessment will include *inter alia* governance, socio-economic, legal, institutional and gender aspects; being the latest key since gender studies have been identified as a data gap at regional level after bibliographic revision in the eight riparian countries (ACTO, 1999^{[12]²⁸}, Appendix 2). This assessment will also include, but not be limited to: (i) the review of existing legislative and policy frameworks related to groundwater; (ii) the capacity building evaluation of existing institutions in charge of groundwater

administration and the gaps for its efficient management; (iii) an analysis of socio-economic considerations on groundwater management, with focus on poverty, ethnic minorities, and gender inequalities.

The following activities are anticipated to be undertaken:

Activity 2.1.1: Assessment of legal, regulatory, and public policies framework, regarding groundwater management, at national and regional level. *Detailed identification of public policies, legal and regulatory framework (including gender perspective) that refer to the protection, conservation and management of groundwater at the subnational, national and supranational (e.g., Andean Community of Nations) levels. Identify if, in the absence of higher-level standards, there are regulatory and legal standards that should be considered. Develop a list of findings, conclusions and recommendations.*

Activity 2.1.2: Institutional analysis to identify strengths, weaknesses, opportunities and gaps regarding groundwater management, at national and regional level, with focus in decision making level, governance and information management of public institutions. *Detailed identification of national and regional institutional functions, capacities, responsibilities, strengths, weaknesses and gaps regarding groundwater management, with emphasis on decision-making and inter-institutional and multi-actor governance. Identify the management of information related to the knowledge, conservation and monitoring of groundwater, by national and regional public institutions. Develop a list of conclusions and recommendations.*

Activity 2.1.3: Socioeconomics analysis related to groundwater use, focusing on economic and gender inequalities, as well as the conditions of social and environmentally vulnerable communities. *Identify socioeconomic aspects related to the conservation and use of groundwater in Amazonian areas, highlighting the economic inequities that this entails. Identify the role and gender inequalities related to the conservation and use of groundwater in Amazonian areas. Identify the cultural perspective in relation to the conservation and use of groundwater by indigenous peoples and other local communities across the Amazon. Develop a list of conclusions and recommendations.*

2.2 A gender responsive White Paper with recommendations for (i) improving national legal, technical, and institutional frameworks on groundwater management and regional coordination, and (ii) strengthening ACTO's cooperation role on groundwater resources management.

Based on results from Activity 2.1.1, recommendations will be made to i) strengthen and articulate legal and institutional frameworks of member countries, to promote protection and sustainable conjunctive use of surface and groundwater resources (in coordination to GEF 9770 project); and ii) strengthen ACTO's role to support coordination for the regional management of groundwater resources.

The following activities are anticipated to be undertaken:

Activity 2.2.1: Elaboration of an Amazonian Groundwater White Paper prepared, based on the information produced in the activities of output 1.1 and 2.1, that proposes improvements to the technical, regulatory, and institutional frameworks of the countries on groundwater management, as well as to the ACTO's role. *Prepare an Amazonian Groundwater White Paper that considers (i) compiling of the information obtained from the implementation of the activities in Outputs 1.1. and 2.1, (ii) carrying out an exhaustive analysis regarding the information obtained, (iii) coordinating with member countries regarding findings and opportunities for improvement, (iv) making concrete proposals for improvement to the technical, regulatory and institutional frameworks related to the conservation, protection and sustainable management of aquifers at the national and transboundary level, preparing in each case a roadmap that*

allows the implementation of the proposals, filling the groundwater sustainable management frameworks gaps identified, (v) considering equity and gender perspective in the interventions, in addition to the importance of having the participation of key multi-stakeholders, (vi) specifying the role of ACTO as a transboundary coordination platform for the regional management of the Amazon Aquifer Systems. Prepare a digital version of the document with a consistent executive summary. Prepare 8 digital version policy briefs (one for each country) reflecting the proposed road map.

The GAPS of governance and information management of the CMs are envisioned to be addressed through the implementation of the SAP AAS (next stage), for which not only the SAP but the countries themselves will require financing to overcome the GAPS.

Activity 2.2.2: Regional workshop to reflect on institutional, regulatory and social aspects in aquifer management and disseminate results of analysis and assessments related. *Prepare a high-level regional workshop with the participation of the authorities responsible for groundwater protection and sustainable management, as well as those authorities and agencies related to the socioeconomic, gender and cultural aspects of the project.*

Activity 2.2.3: Dissemination of Amazonian Groundwater White Paper at national level in the 8 country members (CM). *Disseminate the Amazonian Groundwater White Paper among technical and political authorities at the national/state level of the 8 CM. These meetings will be held through virtual national dialogues that allow discussion of the proposed improvement opportunities. Promote virtual national dialogues, based on Amazonian Groundwater White Paper proposals to improve institutional and regulatory frameworks, with the participation of a diversity of stakeholders (academics, civil society, indigenous organizations, etc.). This activity will be coordinated by Component 5 (Output 5.3: Communication strategy and knowledge management plan) considering the gender balance participation and the gender responsive approach of the topics discussed.*

Activity 2.2.4: Dissemination of Amazonian Groundwater White Paper at international events. *Submit the results of Amazonian Groundwater White Paper to international events as World Water Forum, World Water Week, UN Climate week, Climate Change Conferences, etc. as complete document endorsed by the countries, executive summary and policy brief. Participate in person and virtually in panels and discussion sessions at international events. This activity will be coordinated by Component 5 (Output 5.3: Communication strategy and knowledge management plan).*

2.3 Design of a sustainable regional groundwater monitoring network (1) interoperated with the Amazon Regional Observatory (ARO) and validated by each member country. As an essential tool for groundwater management, a data monitoring and reporting system will be developed, under the new AAS submodule into the Amazon Regional Observatory (ARO) platform. Analytical methodologies, instrumentation, data transmission, collection and custodian protocols will be further defined, as well as data exchange mechanism and procedures agreements. It is envisioned that the monitoring system will be linked to AAS submodule in ARO which will provide information on groundwater aspects (hydrogeologic characterization, remote sensing analysis, pollutant threads to aquifers, among others) for decision making and will use innovative satellite monitoring methodologies.

The following activities are anticipated to be undertaken:

Activity 2.3.1: Assessment of existing national information protocols and methodologies to monitoring groundwater. *Based on Activity 2.1.2, Identify national and subnational institutional bodies, responsible for collecting, processing and managing information related to groundwater. Based on meetings with CM,*

identify at national level, the protocols and methodologies to monitoring groundwater, as well as its limitations or current implementation challenges. Carry out a CM's comparative assessment of protocols and methodologies to monitor groundwater processes, as well as the inter-institutional coordination required for the adequate flow and systematization of information. Develop a list of conclusions and recommendations that contribute to the formulation of a regional protocol, while at the same time strengthening the groundwater monitoring systems of the 8 member countries, leveling up monitoring capabilities.

Activity 2.3.2: Develop regional protocols for groundwater monitoring and reporting system that includes methodologies, instrumentation, data transmission, collection and custodian protocols, as well as data exchange mechanism and procedures agreements. *Considering Activities 2.1.2, 2.3.1 and together with national officials and technicians, carry out an exhaustive analysis regarding the national monitoring protocols and methodologies, relating them to the existing international monitoring protocols. Design regional protocols for groundwater monitoring, including the application of analytical methodologies, collection and custodian of samples, mechanism and procedures for data exchange, transmission and reporting system. Train technicians from ACTO and CM about the groundwater regional protocols, thus pilots (Component 3) should adopt these protocols. Prepare a digital version of the document with a consistent executive summary. A working group inside of RADA (Network of Water Authorities) will be formed to facilitate the adoption of the groundwater monitoring protocols that should be accorded with the countries and states involved.*

Activity 2.3.3: Integrate data monitoring and reporting system into Amazonian Regional Observatory – ARO. *Using existing ARO'S guidelines, develop the AAS module which will include the structure, functionality and visual identity of the project. Define the variables from the regional groundwater monitoring (Activity 2.3.2) to be included into the AAS module. This activity will consider its interoperability with existing national groundwater monitoring systems.*

Activity 2.3.4: Strengthening national capacities for monitoring and reporting into Amazonian Regional Observatory - ARO groundwater system through gender balanced training programs/workshops. *Carry out specific training workshops to support national capacities to monitor and report according to the requirements of the ORA platform (at least two trained technical people per country), that will allow the strengthening of capacities for the monitoring activities carried out in the countries. Implement the ARO's monitoring and report system as an integrated tool for groundwater governance assessment at national and regional levels. Close collaboration with GEF 9770 project will be developed.*

2.4 A proposed road map for sustainable groundwater management and for strengthening policy and legal context in Suriname and Guyana. Based on data and information from Output 3.1 and lessons learned from GEF 9770 project, a road map for developing sustainable use and protection of groundwater in Guyana and Suriname will be developed. Moreover, given the current state of affairs in Suriname and Guyana and the need to bring all countries on the same page first before envisaging regional coordination, this activity builds on the information gathered in Output 2.1. While Output 2.2 focuses on regional coordination, this activity will focus on developing a technical, regulatory, legislative and policy framework to strengthen groundwater governance in Suriname and Guyana. It will build on the information generated in Outputs 2.1 and 2.2 highlighting practical approaches to groundwater use.

The following activities are anticipated to be undertaken:

Activity 2.4.1: Elaboration of a Road Map to improve technical, regulatory, and institutional frameworks on groundwater management in Suriname and Guyana. *Assessment of current institutional and legal IWRM framework (based on GEF ID 9770 results) related to the protection, conservation and management of groundwater systems in Guyana and Suriname (based on results from Outputs 2.1 and 2.2). Assessment of national technical capacities in groundwater management considering, among other aspects, the results of the pilot projects referred to in Outcome 3.1. Meetings with national officials to share information related to best practices on institutional structures and water frameworks (laws and policies) in the region, to contribute to the joint construction of the Road Map process. Documented set of context specific tools to improve the legal and institutional IWRM frameworks in both countries, including model legislations and policies and a set of recommendations for institutional reforms. Elaborate a Road Map to improve technical, regulatory, and institutional frameworks on groundwater management in Suriname and Guyana complementing the efforts made by both countries to improve their IWRM.*

Activity 2.4.2: Improvement of national capacities for sustainable groundwater management. *Workshops to share and exchange knowledge and experiences within Amazonian countries related to sustainable groundwater management, highlighting technical aspects. Train technicians from Guyana and Suriname on technical aspects of groundwater management, considering a gender balance participation.*

Activity 2.4.3: Strengthening regulatory and institutional framework at national level on groundwater management. *Workshops to share and exchange knowledge and experiences within Amazonian countries related to sustainable groundwater management, highlighting legal and institutional aspects. Support legal and institutional reforms to improve groundwater management, considering information from Outputs 2.1 y 2.2.*

Component 3: Pilots for improved transboundary groundwater management

Pilot	Country (Countries)	Main physical parameters at pilot locations						Brief description	
		Annual precipitation (mm/year) ¹	Recharge rate (level) ²	Water table (m) ³	Max. amplitude variation - ΔTWS (mm) ⁴	Soil map ⁵	Integrated drought index (IDI) ⁶		
i	Bolivia Cobija, Porvenir	~ 2000	H	130-150	486-633	AC,FR ,NT	MD,SD	Lack of inventory of groundwater wells in a shared aquifer. Levels of contamination in shallow wells from lack of sanitation. Promoting data and knowledge exchange, thus to develop transboundary management strategies.	i: the locations have similar physical parameters, comparable and complementary High recharge rate with significant ΔTWS
	Brazil Brasileia, Epitaciolândia	~ 2000	H	130-150	486-633	AC,FR ,NT	MD,SD		
ii	Bolivia Beni, La Paz, Pando	~ 2000	H,VH	140-160	315-486	FR,GL	N,MD	Lack of knowledge of impacts of alluvial mining activities into groundwater resources. Pilot will inform to areas with higher degree of alluvial mining operations and will develop conservation strategies and communication awareness.	ii: alluvial mining where land is not as degraded as upstream regions Initial stages of extensive alluvial mining
iii	Colombia Puerto Asís, Valle del Guamuez, San Miguel	~ 3500	VH	220-240	118-315	AC,C M,GL	N,MD	Lack of technical local capacity, low awareness to protect aquifers. Pilot will provide comprehensive support to improve knowledge and management of groundwater in cross-border municipalities including monitoring, supply, demand, quality and risk factors for groundwater deterioration, to develop conservation under water governance schemes.	iii & iv: the locations have similar physical parameters, comparable and complementary Very high recharge rate regions with normal to moderate IDI, with smaller ΔTWS
iv	Ecuador Orellana, Sucumbios	~ 3500	VH	220-240	118-315	AC,C M,GL	N	Lack of technical local capacity, lack of technical data and protocols. Pilot will develop technical guidelines for the comprehensive management of an aquifer that allows reducing its vulnerability, guaranteeing and preserving quality and quantity conditions.	
v	Guyana Coastal aquifer	~ 2200	M	-	-	AC,FR	SD,ED	To conduct a comprehensive assessment of the transboundary coastal aquifer system to enhance understanding, promote sustainable management, and ensure effective protection of groundwater resources.	v: coastal aquifer Medium recharge rate, severe and extreme IDI
vi	Peru Coronel Portillo	~ 1800	H	200-240	315-486	CM,G L	MD,SD,ED	Assessment of vulnerability to contamination in groundwater wells, development of protection strategies to secure sustainable drinking water.	vi: aquifer near to one of the most dynamic rivers in the world High recharge rate with moderate to extreme IDI
vii	Suriname Kawemhakan, Kwamalasamutu	~ 2200	SA	-	-	AC,FR	N (SD,ED)	The pilot will impact on the quality of water and the accessibility of water for villagers, resulting in better health and sanitation of the villages. Community engagement, awareness for sustainable management and ownership of the water distribution systems will be created with indigenous communities.	vii & viii: inland shallow aquifers, comparable Shallow water table
viii	Venezuela San Carlos de Río Negro	~ 3800	SA	60-80	486-633	AR,FR	N,MD	Provide better understanding and reduction of potential pollutants across borders, data exchange, capacity development. The pilot will develop strategies for aquifer conservation.	

¹Fassoni-Andrade et al (2021)

²UNESCO (2008): M: medium, H: high, VH: very high, SA: shallow aquifers

³Rosario et al (2016)

⁴Ferreira et al (2021): DTWS: Maximum amplitude variation (D) for TWS (Total Water Storage)

⁵Ferreira et al (2021): AC: Acrisols, CM: Cambisols, FR: Ferrasols, GL: Gleysols, NT: Nitosols

⁶Toreti et al. (2023): IDI calculated using Aug-Oct, 2023, N: Normal, MD: Moderate drought, SD: Severe drought, ED: Extreme drought, ExD: Exceptional Drought.

Figure 6. Design of pilots based on physical parameters

Figure 6 shows the eight pilots (i to viii) considered for Component 3. By using publicly available and published scientific documents, the annual precipitation, recharge rate, water table, max. amplitude variation for total water storage, soil map and 2023 integrated drought index (IDI) were estimated at each pilot site. Each pilot was also designed at the national level by member countries, all of them addressing local concerns, use of groundwater resources, contamination to aquifers, lack of data and knowledge, enhanced groundwater management, unstudied hazards to groundwater, among others. Component 3 prioritizes the testing at the local scale that can be upscaled to AAS in different ways (data, science, methodologies, governance, etc.), in other words, developing interdisciplinary lessons learned that can be shared in the project website and IW:LEARN. Therefore, each pilot was selected to tackle a specific theme that could be scaled to the entire AAS, as follows:

Pilot i: Bolivia (Cobija, Porvenir) and Brazil (Brasileia, Eptaciolandia) will be working in the transboundary aquifer shared by the two countries (see Annex E), where spatially homogeneous parameters are described (see Figure 6). *This pilot will inform groundwater processes in a high recharge rate area with significant variation of the total water storage. At the same time, this pilot includes the design of binational activities (from technical, capacity building to enhancing groundwater awareness to a diverse group of people) as described in Appendix 11.i. Both countries will produce joint reports.*

Pilot ii: Bolivia (Beni, La Paz, Pando) will work on obtaining a Strategy to evaluate the impact of gold mining on aquifers and ecosystems in the Madre de Dios River basin. This impact is related to the use of mercury and landscape degradation. *This pilot will inform about the potential impacts of alluvial mining activities on aquifer resources, especially those related to water quality, which will be upscaled to other regions where mining is occurring (see Appendix 11.ii).*

Pilots iii and iv: Colombia (Puerto Asís, Valle del Guamuez, San Miguel) and Ecuador (Orellana, Sucumbíos) will be working in nearby regions (see Annex E), where physical parameters are similar (see Figure 6). *At these pilot sites, very high recharge rates, normal to moderate IDI, and smaller variation of the total water storage are documented. Therefore, both pilots will inform about the local hydrogeologic processes near the limits of the AAS (defined by UNESCO, 2007). Both countries will produce comparable reports to be scaled up to the AAS (see Appendix 11.iii and 11.iv).*

Pilot v: Guyana (Georgetown) and Suriname will be working in the coastal aquifer outside of the surface Amazon basin and AAS (as defined by UNESCO 2007) but inside of the biogeographic region (see

Annex E). *The pilot site is located in a region with a medium recharge rate, but with severe and extreme IDI. This pilot is mainly driven by Guyana, but binational activities are planned (see Appendix 11.v) and will provide good practices with the binational management of an aquifer.*

Pilot vi: Peru (Coronel Portillo) will be working along the floodplains of one of the most dynamic rivers in the world (the Ucayali River, see Annex E). *The pilot site is located in a region of high recharge rate with moderate to extreme IDI (see Appendix 11.vi).*

Pilots vii and viii: Suriname (Kawemhakan and Kwamalasamutu) and Venezuela (San Carlos de Río Negro) will be working in inland shallow aquifers outside of the AAS (as defined by UNESCO 2007). *Both countries will produce comparable reports to be scaled up to the AAS regarding shallow water table conditions (see Appendix 11.vii and 11.viii).*

As discussed previously, this component aims at gaining on-the-ground experience of the feasibility and effectiveness of groundwater characterization using innovative solutions, best management practices, broader collaboration and joint action. Pilots will provide opportunities for learning exchange and capacity building at the local, state, and national level, and between the countries with gender responsive approach. Lessons learned from pilots and priority zones resulting from execution will be integrated in the TDA and SAP formulation for potential scalability. Lessons learned will be shared through IW:LEARN and project website as well as at international venues and symposium and international conferences (see Activity 1.5.3). Figure 7 shows all the activities for the pilots related to the different outputs (see Appendix 11), where Appendix 7 (Workplan) shows the timeline.

Figure 8 showcases the relation between the pilots and priority zones and how they will contribute to each component, ultimately representing how they will be considered in the SAP development. The project aims to scale these pilots throughout the project area to achieve, pursuing their scalability transformative change. Figure 9 shows conceptual scalability from activities into components and into AAS knowledge and management. As observed scalability is expected not only on technical themes but also capacity learning, national and regional benefits and objectives.

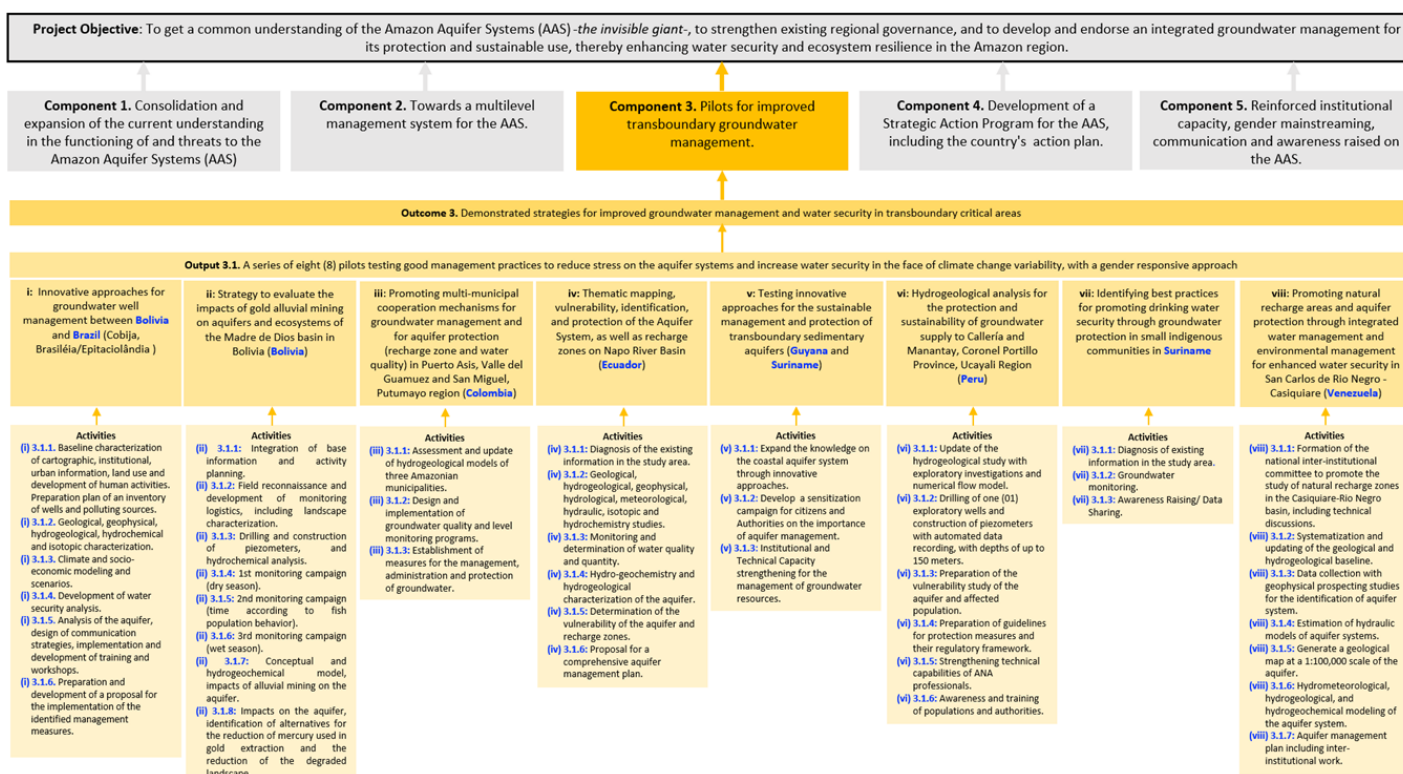


Figure 7. Activities for Component 3

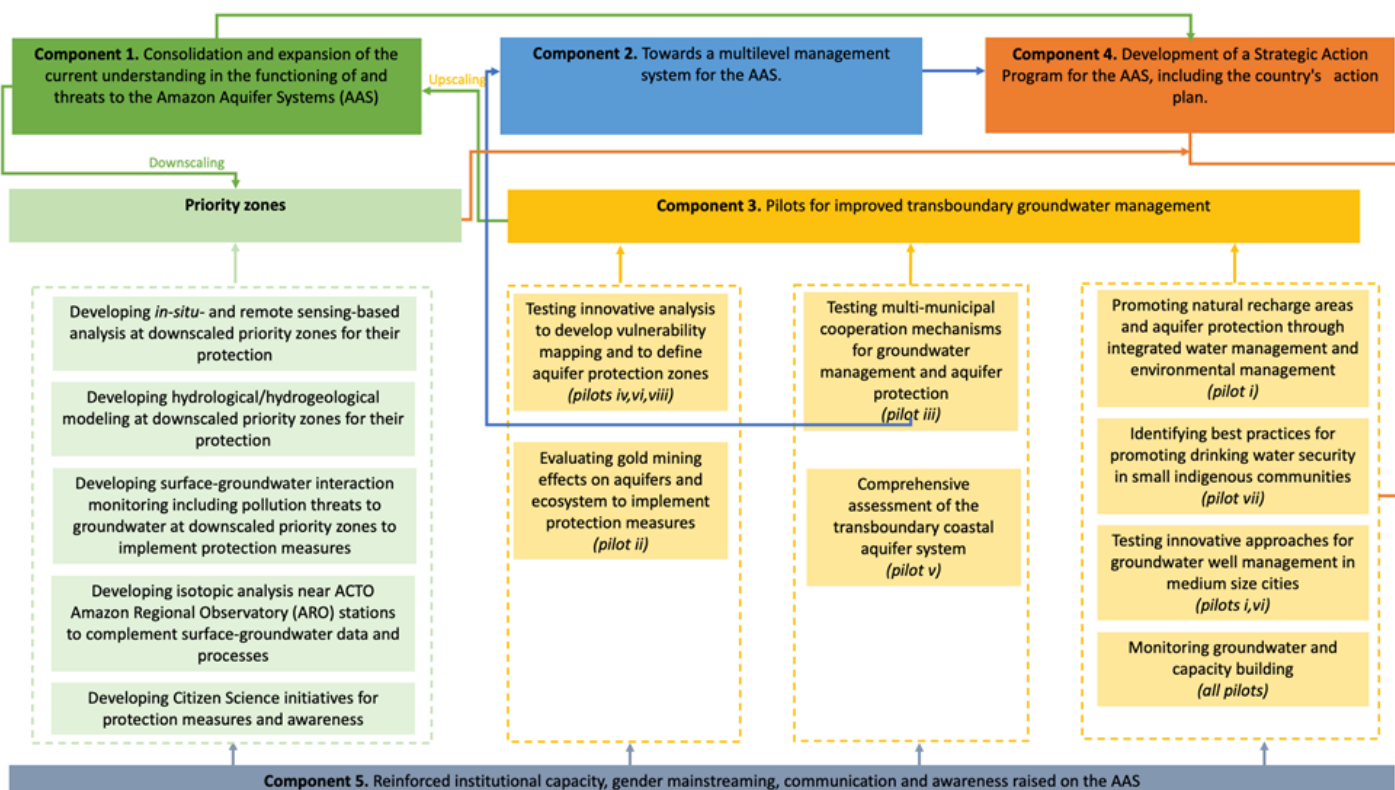


Figure 8. Contributions of the pilots and priority zones to components

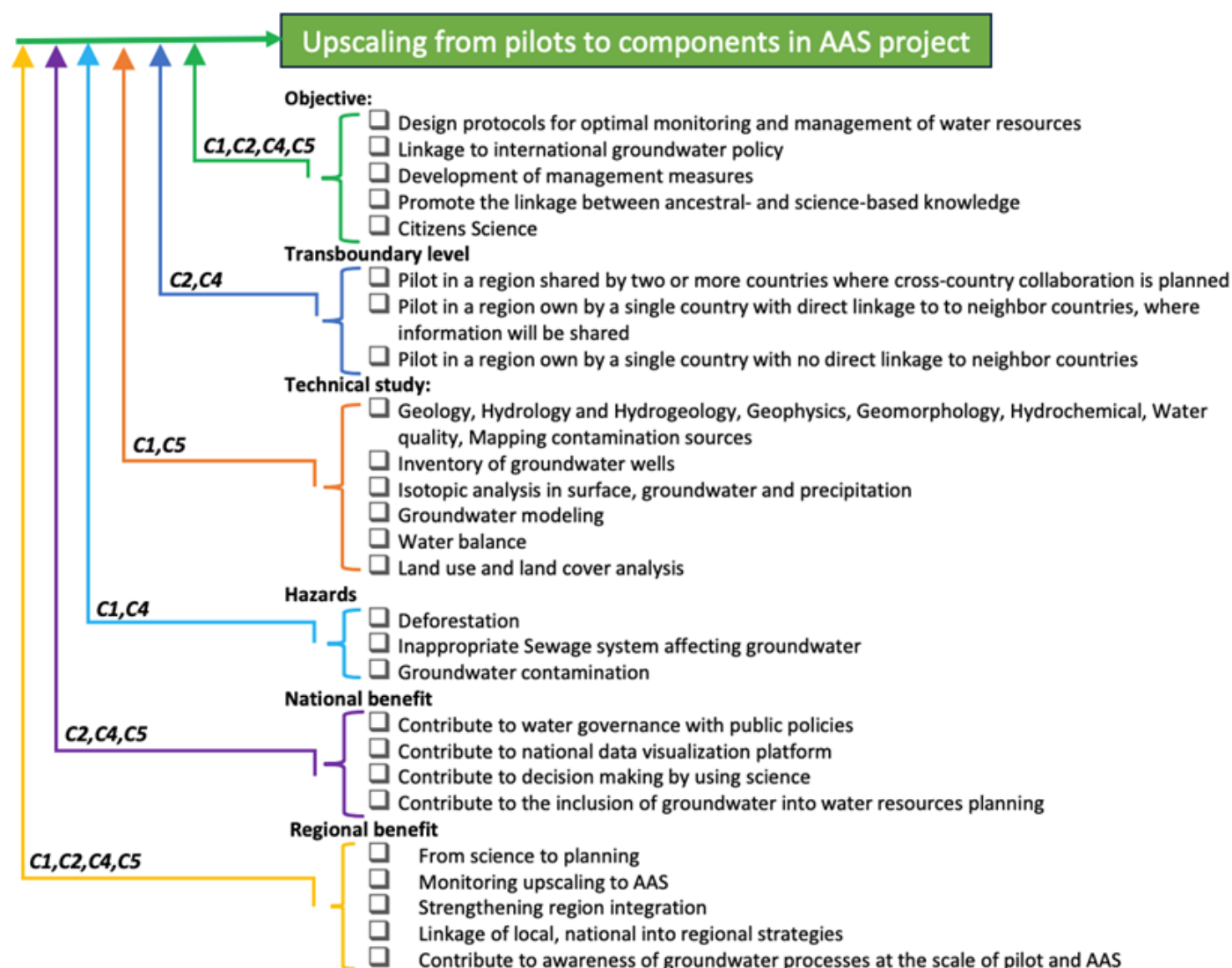


Figure 9. Contributions from activities to components and AAS

Outcome: Demonstrated on the ground strategies for improved groundwater management and water security in transboundary critical areas.

It is expected to have a gender balanced participation during the dissemination and capacity building activities to be developed in this outcome.

Outputs:

3.1 A series of eight (8) pilots testing good management practices to reduce stress on the aquifer systems and increase water security in the face of climate change variability, with a gender responsive approach. Pilots will facilitate testing and demonstrating in selected transboundary areas novel approaches and their benefits to a range of stakeholders. The results and lessons learnt will help to develop the SAP (Component 4). Detailed scope and geographic focus for each pilot are developed based on consultation with the countries and considering critical issues such as gender gaps, environmental and social safeguards and private sector engagement. As a result of the extensive participatory consultation and construction process with the countries, pilots and their locations (see Annex E) have been identified as follows (details of the pilots are presented in Appendix 11):

i. *Innovative approaches for groundwater well management between **Bolivia and Brazil** (Cobija-Brasileia/Epitaciolândia). Appendix 11.i.*

The demonstration project is located around the tri-municipalities of Brasileia and Epitaciolândia in Brazil, and the city of Cobija, capital of the Province of Nicolás Suárez in Bolivia, with an estimated combined population of 123,312 inhabitants. Currently, there are no detailed hydrogeological studies but there is an urgent need manifested by the countries to develop joint groundwater monitoring and management practices. The project will build on existing well data and implement new monitoring wells, and prepare a consolidated hydrogeological overview (including hydrodynamic studies and innovative approach such as isotope analysis: ^{222}Rn , $\delta^{18}\text{O}$, $\delta^2\text{H}$, carried out at both countries). It will identify potential recharge zones for protection of aquifers; and advance governance mechanisms for transboundary groundwater management (including developing a Drilling, Operation and Maintenance Manual for Deep Tube Wells), capacity building and promote public awareness. The project will be a showcase for replication throughout the region for medium size cities.

The following activities are anticipated to be undertaken:

Activity i.3.1.1: Baseline characterization of cartographic, institutional, urban information, land use and development of human activities. Preparation plan of an inventory of wells and polluting sources.

Activity i.3.1.2: Geological, geophysical, hydrogeological, hydrochemical and isotopic characterization.

Activity i.3.1.3: Aquifer modeling and development of climatic and socio-economic scenarios.

Activity i.3.1.4: Integrated water balance elaboration.

Activity i.3.1.5: Analysis of the aquifer, design of communication strategies, implementation and development of training and workshops.

Activity i.3.1.6: Preparation and development of a proposal for the implementation of the identified management measures.

ii. *Strategy to evaluate the impacts of gold alluvial mining on aquifers and ecosystems of the Madre de Dios basin in Bolivia. (**Bolivia**). Appendix 11.ii.*

Gold production through alluvial mining has spread to the upper basin of Madre de Dios, Peru^{[13]²⁹}, and the highlands of Beni, Bolivia. The pilot includes several municipalities inside of Beni, La Paz and Pando states, with a combined population of 144,538 inhabitants. Currently, thousands of small-scale miners are in operation and mercury has contaminated the waters and created considerable environmental problems and concerns to aquifers. The impacts of alluvial mining and the effect of mercury and other metals on the aquifer systems are unknown. The pilot will determine the effects of mining on groundwater quality and model contaminant pathways in the shallow aquifers in a region with initial stages of mining operations as opposed to upstream regions (Peru)^{[14]³⁰}. The information will be used to map out the aquifer and ecosystem vulnerability, and to scale up to other regions where alluvial mining are occurring.

The following activities are anticipated to be undertaken:

Activity ii.3.1.1: Integration of base information and activity planning.

Activity ii.3.1.2: Field reconnaissance and development of monitoring logistics, including landscape characterization.

Activity ii.3.1.3: Drilling and construction of piezometers, and hydrochemical analysis.

Activity ii.3.1.4: 1st monitoring campaign (dry season). Hydrochemical, geochemical and well monitoring, including water and sediments.

Activity ii.3.1.5: 2nd monitoring campaign (time according to fish population behavior). Hydrochemical, and well monitoring, including water and sediments.

Activity ii.3.1.6: 3rd monitoring campaign (wet season). Hydrochemical, and well monitoring, including water and sediments. Fish monitoring.

Activity ii.3.1.7: Conceptual and hydrogeochemical model, impacts of alluvial mining on the aquifer.

Activity ii.3.1.8: Impacts on the aquifer, identification of alternatives for the reduction of mercury used in gold extraction and the reduction of the degraded landscape.

iii. *Promoting of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in Puerto Asis, Valle del Guamuez and San Miguel, Putumayo region (Colombia). Appendix 11.iii.*

The demonstrative project will emphasize multi-municipal collaboration^{[15]³¹} (with a combined population of 130,000 inhabitants), piloting approaches to develop an appropriate management, protection, and sustainable use mechanism for groundwater resources. It will update the existing conceptual hydrogeological models; identify priority pollution sources (including domestic and sanitary waste); identify areas of special hydrogeological importance and their relationship with the wetland system such as recharge areas, hydraulic interconnection with surface water, or protection perimeters of public wells, among others; develop management and protection measures; conduct public awareness and engagement; and conduct institutional strengthening and training.

The following activities are anticipated to be undertaken:

Activity ii.3.1.1: Assessment and update of hydrogeological models of three Amazonian municipalities.

Activity ii.3.1.2: Design and implementation of groundwater quality and level monitoring programs.

Activity ii.3.1.3: Establishment of measures for the management, administration and protection of groundwater.

iv. *Thematic mapping, vulnerability, identification and protection of the Aquifer System, as well as recharge zones in the Napo River Basin, applying innovative measures (Ecuador). Appendix 11.iv.*

The Napo River basin is shared with Ecuador and Peru. The study area has been experiencing deforestation and oil exploration. The pilot involves the Orellana and Sucumbíos provinces, with a combined population of 81,531 inhabitants near the pilot site. The project will pilot innovative measurements to define protection and recharge areas through thematic and vulnerability mapping.

The following activities are anticipated to be undertaken:

Activity v.3.1.1: Diagnosis of the existing information in the study area.

Activity v.3.1.2: Geological, hydrogeological, geophysical, hydrological, meteorological, hydraulic, isotopic and hydrochemistry studies.

Activity v.3.1.3: Monitoring and determination of water quality and quantity.

Activity v.3.1.4: Hydrogeochemistry and hydrogeological characterization of the aquifer.

Activity v.3.1.5: Determination of the vulnerability of the aquifer and recharge zones.

Activity v.3.1.6: Proposal for a comprehensive aquifer management plan.

v. *Testing innovative approaches for the sustainable management and protection of transboundary sedimentary aquifers (Guyana and Suriname). Appendix 11.v.*

The pilot will focus on the multiple northern and coastal aquifer systems of Guyana^{[16]³²} with transboundary impacts in Suriname, a region with a combined population of 60,000 inhabitants. The pilot will focus on prioritizing monitoring and modelling needs to create management and awareness building tools targeted at decision makers and the water supply sector. The project will involve developing monitoring system; advancement of the accreditation for the Government Laboratories, i.e. Water Quality Laboratory and Water Inc. Laboratory; and sensitization campaigns on the revised legislation for Government Ministers, stakeholders, private and public sector (linked to output 2.4). Both countries will develop joint capacity building workshops and awareness campaigns for groundwater protection.

The following activities are anticipated to be undertaken:

Activity vi.3.1.1: Expand the knowledge on the coastal aquifer system through innovative approaches.

Activity vi.3.1.2: Develop a sensitization campaign for citizens and Authorities on the importance of aquifer management.

Activity vi.3.1.3: Institutional and technical capacity strengthening for the management of groundwater resources.

vi. *Hydrogeological evaluation to determine protection and sustainability measures in order to reduce vulnerability and risk in the water supply for population purposes in the districts of Calleria and Manantay of the province of Coronel Portillo, Ucayali region (Peru). Appendix 11.vi.*

The pilot will be implemented in the medium size city of Pucallpa^{[17]³³} and strongly linked to groundwater supply to Calleria and Manantay (combined population of 237,524 inhabitants). It will focus on the use of hydrogeological analysis for developing vulnerability mapping at pilot scale; the identification and delineation of aquifer protection zones; the development of management plans; and creation and implementation of community awareness building tools.

The following activities are anticipated to be undertaken:

Activity iv.3.1.1: Update of the hydrogeological study with exploratory investigations and numerical flow model.

Activity iv.3.1.2: Drilling of one (01) exploratory well and construction of piezometers with automated data recording, with depths of up to 150 meters.

Activity iv.3.1.3: Preparation of the vulnerability study of the aquifer and affected population.

Activity iv.3.1.4: Preparation of guidelines for protection measures and their regulatory framework.

Activity iv.3.1.5: Strengthening technical capabilities of ANA professionals to topics related to groundwater knowledge and governance.

Activity iv.3.1.6: Awareness and training of populations and authorities on topics related to groundwater supply.

vii. *Identifying best practices for promoting drinking water security through groundwater protection in small indigenous communities (Suriname). Appendix 11.vii.*

Treatment of surface water is becoming increasingly costly and difficult due to contamination from gold mining and development especially for small indigenous border communities in Suriname. The pilot will support the design of a monitoring system for drinking water wells for the communities of Kwamalasmutu and Kawemhakan (combined population of 2,000 inhabitants) and develop baseline information and management practices. These activities will have relevance for the many indigenous communities in the Amazon which are, or will be, in transition from surface water to groundwater as drinking water sources.

The following activities are anticipated to be undertaken:

Activity vii.3.1.1: Diagnosis of existing information in the study area.

Activity vii.3.1.2: Groundwater monitoring.

Activity vii.3.1.3: Awareness Raising/ Data Sharing.

viii. *Promoting natural recharge areas and aquifer protection through integrated water management and environmental management for enhanced water security in San Carlos de Rio Negro (Venezuela). Appendix 11.viii.*

The pilot will map aquifers and recharge areas using satellite technology as those are important domestic water supply for the communities including indigenous groups living in the San Carlos area (with 10,000 inhabitants approximately). Furthermore, the pilot will generate data by performing field measurements in small communities and at the same time, it will build awareness tools tailored to local rural communities.

The following activities are anticipated to be undertaken:

Activity iii.3.1.1: Formation of the national inter-institutional committee to promote the study of natural recharge zones in the Casiquiare-Rio Negro basin, including technical discussions.

Activity iii.3.1.2: Systematization and updating of the geological and hydrogeological baseline.

Activity iii.3.1.3: Data collection with geophysical prospecting studies for the identification of aquifer system.

Activity iii.3.1.4: Estimation of hydraulic models of aquifer systems.

Activity iii.3.1.5: Generate a geological map at a 1:100,000 scale of the aquifer.

Activity iii.3.1.6: Hydrometeorological, hydrogeological, and hydrogeochemical modeling of the aquifer system.

Activity iii.3.1.7: Aquifer management plan including inter-institutional work.

Component 4: Development of a Strategic Action Program for the AAS, including the country's action plan

This component seeks to obtain political commitment of the countries to a strategic agenda of actions with matching investments as well as their commitment to the implementation of the identified priority actions for the protection and equitable utilization of the shared AAS. Figure 10 shows all the activities for the different outputs and Appendix 7 (Workplan) shows the timeline.

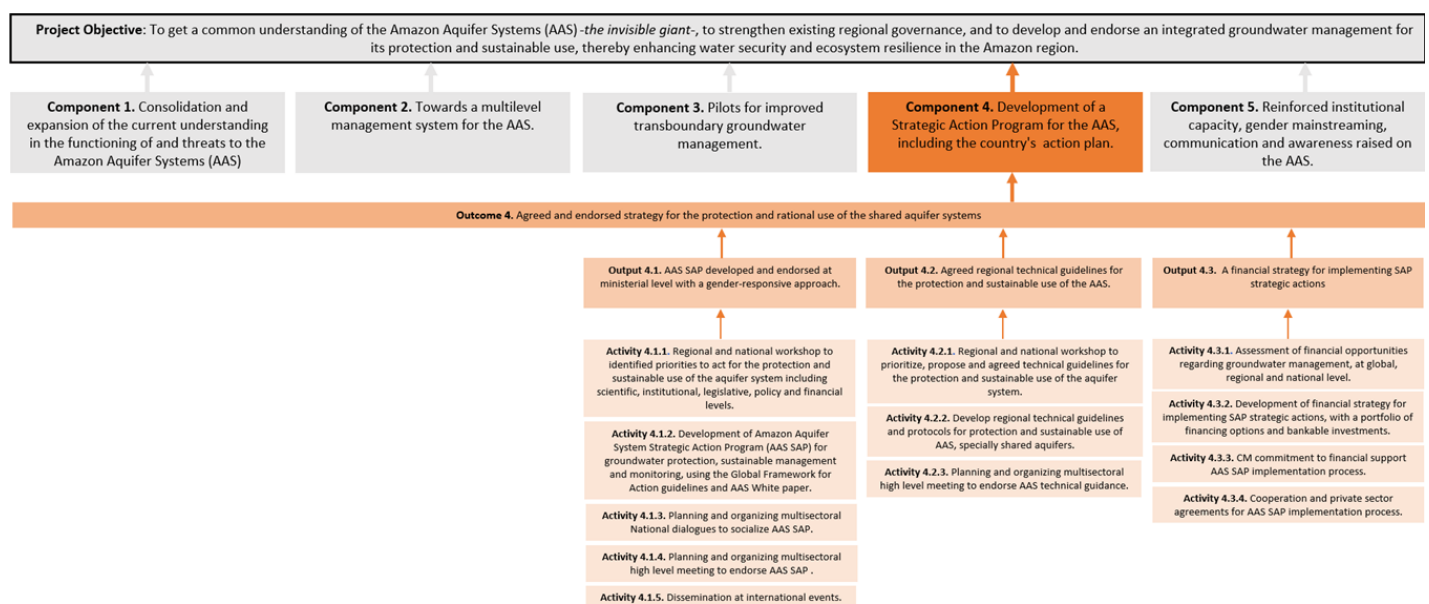


Figure 10. Activities for Component 4

Outcome: Agreed and endorsed strategy for the protection and equitable utilization of the shared aquifers

Outputs:

4.1 AAS SAP developed and endorsed at ministerial level with a gender responsive approach. The gender responsive (by using Appendix 2) AAS SAP will be consistent with the shared vision and TDA recommendations and the Amazon SAP. It will include clear priorities for action (e.g. policy, legal and institutional reforms, investments, etc.) to deal with problems identified in the TDA distinguishing actions with purely national benefits, and those with regional/global benefits. This negotiated document will be further endorsed at the highest level by all relevant sectors of government and will serve as the groundwater chapter of the updated Amazon basin SAP.

The following activities are anticipated to be undertaken:

Activity 4.1.1: Regional and national workshop to identify priorities to act for the protection and sustainable use of the aquifer system including scientific, institutional, legislative, policy and financial levels. *Conduct eight (8) National workshops to share challenges related to sustainable groundwater management that were identified through assessments, White Paper recommendations, pilots and priority zone projects identified by Components 1 and 3; as well as the progress of the countries prioritizing the roadmap activities identified in the White Paper. Based on the information, develop a prioritization for action*

regarding conservation regions. The National workshops will be used to propose specific reforms, whether they are normative, institutional or of another type, aligned with the roadmap proposed in the White Paper and its necessary implementation. Conduct a regional workshop to share and exchange results from national workshops and propose a regional prioritization for action, regarding sustainable groundwater management. Measures will be taken to ensure a gender balanced participation during this activity.

Activity 4.1.2: Development of Amazon Aquifer Systems Strategic Action Program (AAS SAP) for groundwater protection, sustainable management, and monitoring, using the Global Framework for Action guidelines and AAS White paper. The groundwater SAP will be complementary to the surface SAP (GEF 9770 project). *Prepare a gender responsive Amazon Aquifer Systems Strategic Action Program (AAS SAP), consistent with the shared vision and TDA recommendations and the Amazon SAP, that includes clear priorities for action. Priorities for action must include policy, legal and institutional reforms, technical guidelines, and the required investments. Prepare a digital version of the document with a concise executive summary.*

Activity 4.1.3: Planning and organizing multistakeholder national dialogues to socialize AAS SAP. *Disseminate the Amazon Aquifer Systems Strategic Action Program (AAS SAP) through eight (8) virtual national dialogues with national policy makers. This is an opportunity for the AAS SAP to be considered in the internal planning of the countries and the processes required to carry out the proposed reforms, which can be discussed and programmed. It is expected to have a gender balance participation during this activity. Additionally, disseminate the AAS SAP (virtual format) to a diverse audience such as academics, civil society, indigenous peoples and other local communities, representative organizations, private sector, and others. This activity will be coordinated by Component 5 (Output 5.3: Communication strategy and knowledge management plan).*

Activity 4.1.4: Planning and organizing multisectoral high level meetings to endorse AAS SAP. *Prepare a high-level regional meeting with the participation of Head of States and the authorities responsible for groundwater protection and sustainable management, as well as those authorities related to the socioeconomic and cultural aspects that the AAS SAP addresses.*

Activity 4.1.5: Dissemination at international events. *Submit the Amazon Aquifer Systems Strategic Action Program (AAS SAP) to international events such as World Water Forum, World Water Week, UN Climate week, Climate Change Conferences, etc. as complete document, executive summary and policy brief. Participate in person and virtually in panels and technical sessions at international events, including regional ones as regional scientific workshops related with Activity 1.5.3. This activity will be coordinated by Component 5 (Output 5.3: Communication strategy and knowledge management plan).*

4.2 Agreed regional technical guidelines for the protection and sustainable use of the Amazon aquifer systems. Policy and institutional guidelines, recommendations and best practices designed to improve groundwater management at country/local level, and groundwater governance at local, national and transboundary levels from the Global Framework for Action^{[18]³⁴} will be tailor made and adopted. Technical guidance for shared aquifers will cover *inter alia* measures for the construction and management of new wells; registration and permit guidelines for new and in used wells; approaches for the closure and abandonment of wells; aquifer recharge, extraction levels and sustainable yield, water quality protection, and conservation of groundwater dependent aquatic ecosystems in the face exacerbated drought events.

The following activities are anticipated to be undertaken:

Activity 4.2.1: Regional and National workshops to prioritize, propose and agree technical guidelines for the protection and sustainable use of the aquifer system. *Identify at national and subnational level guidelines, recommendations and good practices related to protection and sustainable use of aquifers. This identification could start with state-of-art literature review and complemented with Activity 2.2.1, having discussion not only about technical issues such as construction, management, closure or abandonment of wells, among others, but also in relation to governance, institutionalism and public policies. Conduct first national and then regional multistakeholder workshops to prioritize, propose and agree technical guidelines for the protection and sustainable use of the aquifer system considering gender responsive approaches.*

Activity 4.2.2: Develop regional technical guidelines and protocols for protection and sustainable use of AAS, specially shared aquifers. *Develop technical guidelines and protocols for protection and sustainable use of AAS, specially shared aquifers, based on the information produced by Outputs 2.1., 2.2. and 3.1., as well as the national and regional workshops of Activity 4.2.1. National officials will be part of the process.*

Activity 4.2.3: Planning and organizing multisector high-level meetings to endorse AAS regional technical guidelines. *Prepare a high-level regional workshop with the participation of the authorities responsible for groundwater protection and sustainable management.*

4.3 A financial strategy for implementing SAP strategic actions. The financial strategy will include a portfolio of blended financing options and prioritized bankable multisector investments for the protection and sustainable use of groundwater resources. The strategic finance plan will be initiated in parallel with the TDA and will engage prospective donors and the private sector in aligning investment plans with objectives and goals of the project. The financial strategy will outline a robust prioritized investment program and support governments in aligning the forthcoming needed investments within national investment plans for both source water protection (e.g., in recharge areas) and groundwater management, protection and monitoring. The financial strategy will also incorporate existing financing instruments, such as IADB Invest and the IADB Capital Lab for smaller-scale investments.

The following activities are anticipated to be undertaken:

Activity 4.3.1: Assessment of financial opportunities regarding groundwater management, at global, regional and national level. *Identify in detail the public budget available for protection, conservation and management of groundwater, as well as for investments related to the exploitation and sustainable use of aquifers. Identify non-governmental and financial institutions involved in the protection, conservation and management of groundwater, or in the promotion of investments related to aquifers. Identify regional or institutions involved in the protection, conservation and management of groundwater. Develop a list of opportunities for national public and private financing, as well as bilateral, regional or global cooperation and investment, in matters of protection, conservation and sustainable management of aquifers*

Activity 4.3.2: Development of financial strategy for implementing SAP strategic actions, with a portfolio of financing options and bankable investments. *Identify among the prioritized actions in the AAS SAP (related to Activity 4.3.1.), those that can form a portfolio of short-term financing options and bankable investments. For those with a medium- or long-term implementation, a detailed financing list can be prepared.*

Activity 4.3.3: CM commitment to financial support AAS SAP implementation process. *Commit the member countries, which already channel public funds to the protection, conservation and sustainable management of aquifers, continue doing so and those who do not, commit to prioritizing it.*

Activity 4.3.4: Cooperation and private sector agreements for AAS SAP implementation process.

Component 5: Reinforced institutional capacity, gender mainstreaming, communication and awareness raising on the AAS

This component will focus on strengthening institutional capacity at the national and sub-national levels. It will seek the systematic participation of stakeholders, including IPCLs, the inclusion of gender perspectives throughout all project activities, and the dissemination of project activities, results and lessons learned to raise awareness and promote behavioral change for aquifer protection and its sustainable management. This component will cut across the whole project to support the sound use and protection of the AAS. Figure 11 shows all the activities for the different outputs and Appendix 7 (Workplan) shows the timeline.

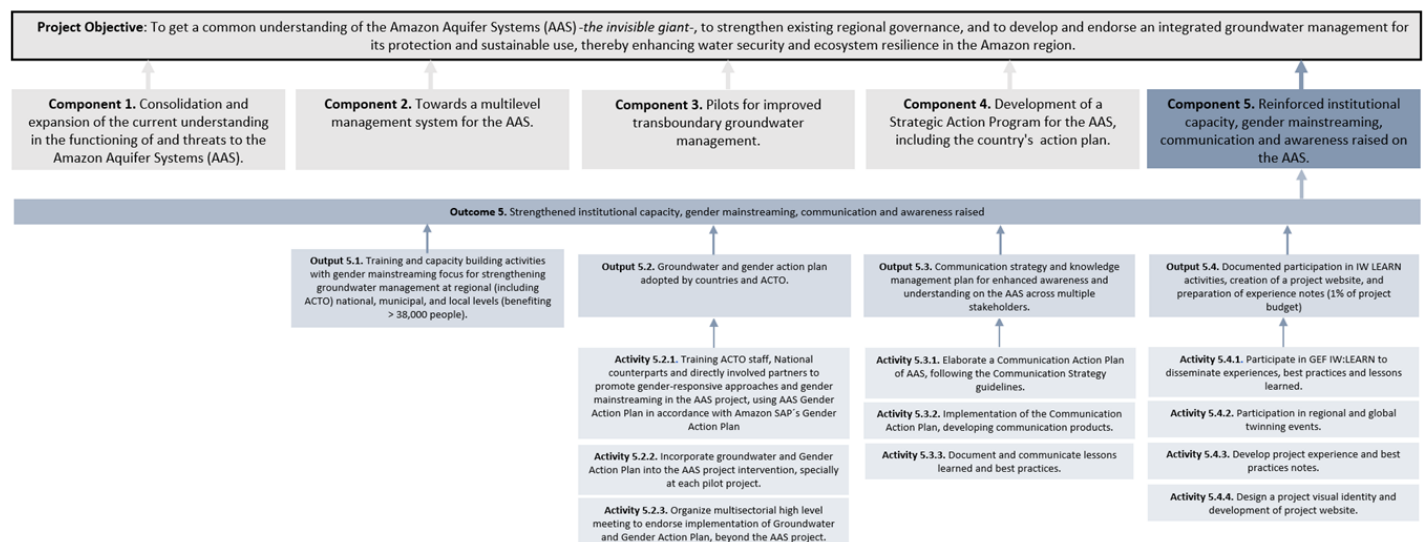


Figure 11. Activities for Component 5

Outcome: Strengthened institutional capacity, gender mainstreaming, communication and awareness raised.

Outputs:

5.1 Training and capacity building activities with gender mainstreaming focus for strengthening groundwater management at regional (including ACTO), national, municipal, and local levels (benefiting > 38,000 people).

Targeted capacity building for institutional strengthening, including with ACTO and national agencies, and structured capacity building in groundwater governance for decision makers and other stakeholders at national and regional levels (ensuring gender balance), designed following the guiding principles of the Groundwater Governance GEF project Training. Training would include *inter alia* environmental education for groundwater operators and municipalities; development programs for public participation, training of technical personnel; institutional knowledge sharing at a regional level, best practices and lessons learned in advancing gender equality shared on the IW:LEARN platform; and addressing infrastructure needs.

The following activities are anticipated to be undertaken:

Activity 5.1.1: Development of capacity building for institutional strengthening at national and subnational level technical personnel. *Prepare training courses appropriate to the needs of each country, based on institutional gaps (Outputs 2.1 and 2.2). Prepare training courses in environmental education for groundwater operators and municipalities with a gender responsive approach. Develop programs for public participation. Technical training will be coordinated with the scientific studies in Component 1.*

Activity 5.1.2: Development of capacity building for groundwater management governance to decision makers and other relevant stakeholders. *Prepare training courses at national and subnational level for decision-makers and other stakeholders related to groundwater governance based in GEF principles.*

Activity 5.1.3: Strengthen ACTO as a regional cooperation platform and coordination mechanism.

5.2 Groundwater and gender action plan adopted by countries and ACTO.

A Gender Action Plan, focusing on groundwater and complementing Amazon SAP's Gender Action Plan was developed (see Appendix 2) and it will be implemented during the project. Capitalizing on work previously done in Amazon SAP, the AAS gender analysis update information related to the progress of Amazon countries in the matter, recognizing that there is still a way to go. Despite progress in promoting integrated water resources management with the participation of the entire population, it is urgent to join forces to strengthen gender capacities, disseminate existing regulations and incorporate a gender perspective into the planning, implementation, and monitoring of actions to improve groundwater management.

The Gender Action Plan was built on GEFs gender policies, IADB and UNEP Operational Policy on Gender Equity in Development and gender mainstreaming policies, on internal gender guidelines of ACTO, as well as national strategies. The Gender Action Plan will not only assist advancement of women's empowerment within the context of the project, but also serve to promote a gender policy in the water sector of those countries currently lacking one. Conceptually, the project includes gender mainstream transversally into all components (see Figure 3).

The Gender Action Plan seeks to mainstream gender approach through the AAS Project to achieve or improve results that guarantee gender equality in the management of the groundwater system in the local and regional context of the Amazon region in the short and medium term.

The following activities are anticipated to be undertaken:

5.2.1: Training ACTO staff, National counterparts and directly involved partners to promote gender-responsive approaches and gender mainstreaming in the AAS project, using AAS Gender Action Plan in accordance with Amazon SAP's Gender Action Plan. *Training on gender mainstreaming in the management of the AAS for institutions at national and subnational level at each country, training on practical methodologies for gender mainstreaming in the context of groundwater systems for National Focal Points, and training for practical methodologies for gender mainstreaming in the context of groundwater systems for project staff.*

5.2.2: Incorporate groundwater and Gender Action Plan into the AAS project intervention, specially at each pilot project. *Elaborate a diagnostic study to identify and analyze gender gaps in the groundwater system in the Amazon to eight (8) countries, draw up a gender action plan for each pilot context (Output 3.1), and incorporate a gender perspective into the AAS project pilots.*

5.2.3: Organize multisectoral high level meeting to endorse implementation of Groundwater and Gender Action Plan, beyond the AAS project. *Participate in high-level regional meeting for groundwater protection*

and sustainable management and introduce AAS gender perspective, asking to endorse implementation of Groundwater and Gender Action Plan, beyond the AAS project.

5.3 Communication strategy and knowledge management plan for enhanced awareness and understanding on the AAS across multiple stakeholders.

The communication strategy will aim at enhancing local and regional awareness of groundwater importance as a key resource for water security in the basin in a socio-cultural manner. The main findings of the project, the agreements reached between the countries, the results and lessons learned on the management and conservation of groundwater, will be disseminated through different media and communication products in a socio-cultural appropriate manner, among decision makers, civil society, communities and others relevant stakeholders, such as indigenous peoples and local communities according with project's needs. This component will incorporate gender-responsive communication strategies and the various approaches for gender mainstreaming across knowledge products. Where appropriate, it will include local language versions.

The following activities are anticipated to be undertaken:

Activity 5.3.1: Elaborate on the existing Communication and Knowledge Management Action Plan of AAS, following the developed Communication Strategy (Appendix 12). *Elaborate a detailed communication action plan, including objectives, key messages, clear roles in communication management, a governance for decision-making on communication topics, processes, and benefits for key target audiences at community, national and regional levels, and a rapid assessment of comms capacity to ensure that is specific, measurable, achievable, relevant and time-bound.*

Activity 5.3.2: Implementation of the Communication Action Plan, developing communication products. *Create and manage a multimedia database during the project implementation. Hold meetings to share progress of the project's implementation. Establish a relationship strategy and action plan with mass and specialized media and digital influencers and develop communication products for distribution. Plan and deliver educational and awareness-raising activities on different AAS-related thematic areas and critical groundwater management issues related to stakeholders in the Amazon basin.*

Activity 5.3.3: Document and communicate lessons learned and best practices. *Elaborate and release overall project information and comms products: notes, policy briefs, audiovisual products. Create an audiovisual series on the role of women in the protection of AAS.*

5.4 Documented participation in IW:LEARN activities, creation of a project website, and preparation of experience notes (1% of project budget). Project knowledge captured will be disseminated through an internet-based platform and project website, sharing experiences through IW:LEARN, IWCs and COPs. Participation in IW:LEARN activities will be systematic in terms of contributing to the freshwater IW COPs, sharing lessons learnt (at least 3 Experience Notes), attendance to, and organization of webinars, participation to the IWCs. A project website, according to IW:LEARN standards, will be established and linked to the ACTO.

Apart from being used as an information provision hub, the website will be an instrument supporting the implementation of the project activities. It will support and incorporate a range of tools such as project management team working space, information database, interactive maps, forum discussions etc. Part of the IW:LEARN activities will be related to twinning with similar projects in other regions. Additionally, project monitoring will be conducted to inform adaptive management of the project. This includes establishment of a

Project Steering Committee and annual PSC meetings, reports (PIR), and Mid-term review and final evaluation.

The following activities are anticipated to be undertaken:

Activity 5.4.1: Participate in GEF IW:LEARN to disseminate experiences, best practices and lessons learned. *Production and dissemination of experience notes, scientific notes, key lesson learned (especially those related to advancing gender equality), submission of project stories for IW:LEARN newsletter, exposure notes and story maps, development of an IW:LEARN compliant webpage.*

Activity 5.4.2: Participation in regional and global fora and twinning events. *Participation in biennial GEF International Waters Conferences, Participate and support, regional workshops and capacity building activities promoted by IW:LEARN. Prepare and implement a suite of learning exchanges, knowledge - sharing activities, joint demonstration activities, and related capacity-building information. Defining and implementing twinning activities, with support from IW:LEARN at the regional level*

Activity 5.4.3: Develop project experience and best practices notes. *Systematize and disseminate experiences, best practices and lessons learned from the project implementation.*

Activity 5.4.4: Design a project visual identity and development of project website. *Design a project visual identity, develop a project website.*

Monitoring & Evaluation (M&E)

The project Monitoring and Evaluation Plan is consistent with the GEF Monitoring and Evaluation policy and is fully detailed in Appendix 5. The Project Results Framework presented in Annex C includes Specific, Measurable, Achievable, Relevant and Time-bound (SMART) indicators and targets for each expected outcome and output. Data collection, processing and reporting services will be hired to guide the implementation of the Monitoring and Evaluation Plan.

Project-level monitoring and evaluation will be undertaken in compliance with GEF requirements in accordance with the GEF Policy on Monitoring, Project and Program Cycle Policy, Guidelines on the Project and Program Cycle Policy (2020 update), and other relevant GEF policies.

The Monitoring and Evaluation Plan will be revised at project start and presented during the first meeting of the Project Steering Committee to ensure that project stakeholders understand their roles and responsibilities vis-à-vis project monitoring and evaluation. The PSC will be responsible for proposing to the IAs any necessary amendments to the Monitoring and Evaluation Plan during project implementation. ACTO will be responsible for monitoring day-to-day project activities under the guidance of UNEP and IDB as the implementing agencies.

The expected **M&E outcome** is “effective project oversight and appropriate monitoring & evaluation of project implementation progress and assessment of its results” and will be achieved through two outputs that are described below.

Output M&E.1: Documented monitoring and reporting process throughout the entire project execution life cycle ensuring successful project delivery.

Project-level monitoring involves the following activities, among others:

- Execute Inception Workshop and elaborate an Inception Report.

- Baseline, mid-point, and final monitoring of GEF Core Indicators/GEBs.
- Prepare yearly Project Implementation Review (PIR) to the IAs and GEF
- Prepare yearly Co-financing Reports.
- Prepare quarterly progress and financial reports.
- Monitor the Environmental and Social Safeguards risks.
- Undertake monitoring visits to pilot sites.
- Prepare the Final Project Operational Completion Report.

Output M&E.2: Independent evaluations to assess the progress, success, and effectiveness of the project undertaken and recommendations reflected in project implementation.

In line with the IAs policies all projects are subject to a performance assessment (review or evaluation) at mid-term when required, and at the end of the project when they reach operational completion. These performance assessments will be either independent evaluations or a management-led reviews. The IAs evaluation offices will decide whether a management-led Mid-term Review (MTR) or Terminal Review (TR) commissioned and managed by the Project Coordinator is sufficient, or whether an independent Mid-Term Evaluation (MTE) or Terminal Evaluation (TE), managed by the Evaluation Office is required. The Evaluation Office will provide tools, templates and guidelines for all management-led reviews.

Mid-Term Review

A Mid-Term Review/Evaluation is required for all Full-Sized Projects (FSP). The MTR/MTE will be carried out using a participatory approach whereby parties that may benefit or be affected by the project will be consulted. The members of the Project Steering Committee could be interviewed as part of the process and the Project Coordinator will develop a management response to the recommendations along with an implementation plan. The results of the MTR/MTE will be presented to the Project Steering Committee. It is the responsibility of the UNEP and IDB Task Managers to monitor whether the agreed recommendations are being implemented.

Terminal Evaluation

The Terminal Evaluation (TE) will provide an independent assessment of project performance (in terms of relevance, effectiveness and efficiency), and determine the likelihood of impact and sustainability. The project performance will be assessed against standard evaluation criteria using TE performance ratings (relevance, effectiveness and efficiency), which will form a part of the final report document. It will have two primary purposes: (i) to provide evidence of results to meet accountability requirements, and (ii) to promote learning, feedback, and knowledge sharing through results and lessons learned among IDB and UNEP staff and implementing partners. The TE will be initiated within 6 months of the project's operational completion.

The draft TE report will be sent to project stakeholders for comment. The evaluation report will be publicly disclosed and will be followed by a recommendation compliance process.

The table below shows the main activities and budget associated.

Type of M&E activity	Responsible Parties	GEF budget (USD)	Co-financing budget (USD)	Time Frame
Inception Meeting (M&E part)	Executing agency (ACTO), PMC, IAs, countries and executing partners	34,000	440,647	Within 6 months of project start-up
Measurement of project progress and performance indicators	PMC, technical specialist on M&E	195,900	2,538,905	Quarterly and annually
Project Steering Committee (PSC) meetings and National Steering Committee meetings	Executing agency (ACTO), PMC, IAs, countries, technical national focal point, and executing partners	120,900	1,566,889	Once a year
Reports of PSC meetings, materials and equipment	Materials and printing Data collection, processing and reporting	49,200	637,642	Annually
Mid Term Review	Mid-Term review consultant	40,000	518,408	At mid-term of project implementation
Terminal Evaluation	Terminal evaluation consultant	60,000	77,613	Initiated after the project's operational completion
TOTAL (USD)		500,000	6,480,105	

During project implementation, the PIRs, the MTE and the TE will include a review and reporting of the GAP and relevant gender dimensions of the project.

Incremental Cost Reasoning

The GEF Grant will strengthen the organizational and institutional capacity of ACTO member countries at different levels (regional, national and local), being fundamental to get a common understanding of the AAS to improve existing regional governance and the integrated management of groundwater for its protection and sustainable use.

The incremental funding requested from the GEF is needed to harness the benefits that will materialize through the consolidation and expansion of the current understanding in the functioning of and threats of the AAS (agreed TDA); on-the-ground implementation of a series of pilots to showcase good management practices to reduce stress on the aquifer systems and increase water security in the face of climate change variability; and an agreed Strategic Action Program (SAP) with its financial strategy for implementing the agreed actions.

Countries have long realized that the lack of accurate data has proved to be an impediment to the sustainable management of groundwater. For this reason, despite having a well-funded and organized Water Agency and a National Geological Service, Brazil amongst other countries has endeavored to finance some

hydrogeological explorations as to better understand the aquifer and to close the data gaps. These activities are however expensive and smaller and/or poorer countries like Guyana and Suriname or Venezuela, where groundwater plays a major role for sanitation and consumption, have not been able to study the aquifer systems at the same rate nor with the same scientific depth, owing to more pressing national priorities. Existing studies (see Project Rationale section) have all concluded that the paucity of information and the insufficient transboundary aquifer understanding has proved to be the number one barrier to its sustainable management. The Aquifer is, however, subject to increasing pressures, and for the riparian communities it has become an increasingly important water and food security issue.

The GEF resources are building on an extensive baseline of completed and ongoing national and regional initiatives, and the existing institutional capacity that participating countries will provide as a resource to this project. This baseline of current actions and resources includes multiple regional cooperation efforts, national activities, and GEF-funded projects. Specifically, the GEF investment will build upon the GEF Project ID 2364 that formulated the watershed TDA and SAP and the project ID 9770 which is looking into initiating SAP implementation. This proposed project will facilitate implementation of the SAP general groundwater directives by developing a specific action agenda on groundwater (component 4) as well as a complementary and robust quantified TDA (component 1). It is thus a direct response to those two projects. This proposal will include lessons learned from the specific few activities that TDA/SAP project has related to groundwater and will build on tools developed in previous projects, such as the Amazon Regional Observatory (output 2.3).

Co-financing, coming from individual countries, current projects lead by ACTO and the IDB, will be enhanced by the GEF funding that will focus on understanding the current functioning and threats to the AAS, developing greater coordination at the regional level. It is also highly synergetic with the recently submitted Concept Note to the [Green Climate Fund \(GCF\)](#), an IDB proposal which aims to increase the resilience of vulnerable communities and key ecosystems (socio-ecological systems) in the Amazon basin to anticipated impacts of climate change on water availability and quality. Both projects target systemic and long-term improvements in water security conditions in the Amazon Region and, at the end, aim to enhance climate adaptation and reduce socio-ecological vulnerability. These proposals also seek to enable private and public investments, promote nature-based solutions interventions and will work towards capacity building and the institutional strengthening of regional, national and sub-national sectoral agencies in the Amazon Basin. When implemented, GEF & GCF funds will advance in transboundary cooperation, strengthening existing platforms, such as the Amazon Regional Observatory, and water governance.

Even though they share the same transformative paradigm, it is expected that this blending finance will serve as a vehicle to address existing barriers under distinct but complementary approaches. For instance, the GCF proposal will be focused on climate resilience at transboundary level with a strong focus on early warning system and climate-resilient investments, while the PIF will target scientific progress understanding groundwater resources for its protection and management. In other words, the GEF resources will advance in the knowledge and understanding of the groundwater system while piloting innovative solutions, while the GCF funds will expand the resources needed to grant access to data, information and decision support-systems to inform the holistic and systemic management of the system/watershed while scaling-up some of these innovative approaches by providing additional concessional and blended finance to support sectorial investments and project implementation.

With Component 1, the GEF proposal will provide relevant scientific data about the Amazon Aquifer Systems dynamics, feeding Component 1 of the GCF proposal, which is focused on understanding climate change impacts. Best practices and the results of on-the-ground pilots to be implemented in GEF Component 2 and

their scaling-up potential will be strategic for GCF Component 2, targeted to catalyzing investments and innovative financing mechanisms. Moreover, successful lessons in terms of transboundary governance (regional guidelines, data sharing protocols, among others) will also be relevant for both proposals.

The proposed actions will ensure the SAP is implemented in a coordinated fashion and that sufficient capacity is established in the participating countries and in ACTO to support long-term integrated basin wide water resources management. Consultation with a wide range of basin stakeholders is critical in jointly developing harmonized and compatible governance mechanisms at all levels in support of ‘community-to-cabinet’ management of the Amazon Region for the benefit of the ecosystem and livelihoods of the Amazon society. This project will continue to support such key basin wide dialogues and involve all sectors of society, including traditional peoples, CSOs/NGOs, the private sector, academia and government authorities.

Bibliography

- Adams, K. H., Reager, J. T., Rosen, P., Wiese, D. N., Farr, T. G., Rao, S., et al. (2022). Remote sensing of groundwater: Current capabilities and future directions. *Water Resources Research*, 58, e2022WR032219. <https://doi.org/10.1029/2022WR032219>
- ANA. (2015). Volume XII – Resumo Executivo. Em Avaliação dos Aquíferos das Bacias Sedimentares da Província Hidrogeológica Amazonas no Brasil (escala 1:1.000.000) e Cidades Pilotos (escala 1:50.000). Brasília
- Andrade, C., Lucia, F. d., Berhan, Y., Pereira, M., Santos, V. D., & Márcia, E. (2018). Modelling the Effects of Historical and Future Land Cover Changes on the Hydrology of an Amazonian Basin. *Water*.
- Asner, G.P. and Alencar, A. (2010), Drought impacts on the Amazon Forest: the remote sensing perspective. *New Phytologist*, 187: 569-578. <https://doi.org/10.1111/j.1469-8137.2010.03310.x>
- Bagheri, Omid & Pokhrel, Yadu & Moore, Nathan & Phanikumar, Mantha. (2024). Groundwater dominates terrestrial hydrological processes in the Amazon at the basin and subbasin scales. *Journal of Hydrology*. 628. 130312. [10.1016/j.jhydrol.2023.130312](https://doi.org/10.1016/j.jhydrol.2023.130312).
- Baalbaki R, Ahmad SH, Kays W, Talhouk SN, Saliba NA, Al-Hindi M. (2019). Citizen science in Lebanon—a case study for groundwater quality monitoring. *Royal Society Open Science*, 6: 181871. <http://dx.doi.org/10.1098/rsos.181871>
- Banerjee, O., Cicowiez, M., Macedo, M., Malek, Z., Verburg, P. H., Goodwin, S., Vargas, R., Rattis, L., Brando, P. M., Coe, M.T., Neil, C., Marti, O. D. (2021). An Amazon Tipping point: the economic and environmental fallout. IDB Working paper series No. IDB-WP-01259, <http://dx.doi.org/10.18235/0003385>
- Basilio Hazas, M., Marcolini, G., Castagna, M., Galli, M., Singh, T., Wohlmuth, B., & Chiogna, G. (2022). Drought conditions enhance groundwater table fluctuations caused by hydropower plant management. *Water Resources Research*, 58, e2022WR032712. <https://doi.org/10.1029/2022WR032712>
- Bocanegra, E. (2021). Cross-Cutting Role of Groundwater in Achieving the SDGs and an Ethical Approach. In: Abrunhosa, M., Chambel, A., Peppoloni, S., Chaminé, H.I. (eds) *Advances in Geoethics and*

- Groundwater Management: Theory and Practice for a Sustainable Development. Advances in Science, Technology & Innovation. Springer, Cham. https://doi.org/10.1007/978-3-030-59320-9_6
- Buytaert, Wouter & Zulkafli, Zed & Grainger, Sam & Acosta, Luis & Bastiaensen, Johan & De Bièvre, Bert & Bhusal, Jagat & Alemie, Tilashwork & Clark, Julian & Dewulf, Art & Foggin, Marc & Hannah, David & Hergarten, Chris & Isaeva, Aiganysh & Karpouzoglou, Timos & Pandey, Bhopal & Paudel, Deepak & Sharma, Keshav & Steenhuis, Tammo & Munavar, Zhumanova. (2014). Citizen science in hydrology and water resources: Opportunities for knowledge generation, ecosystem service management, and sustainable development. *Frontiers in Earth Science*. 2. 10.3389/feart.2014.00026.
- Caldas, B., Thieme, M.L., Shahbol, N., Coelho, M.E., Grill, G., Van Damme, P.A., Aranha, R., Cañas, C., Fagundes, C.K., Franco-León, N., Herrera-Collazos, E.E., Jézéquel, C., Montoya, M., Mosquera-Guerra, F., Oliveira-da Costa, M., Paschoalini, M., Petry, P., Oberdorff, T., Trujillo, F., ... de Brito Ribeiro, M. C. L. (2023). Identifying the current and future status of freshwater connectivity corridors in the Amazon Basin. *Conservation Science and Practice*, 5(1), e12853. <https://doi.org/10.1111/csp2.12853>
- Castello, L., McGrath, D.G., Hess, L.L., Coe, M.T., Lefebvre, P.A., Petry, P., Macedo, M.N., Renó, V.F. and Arantes, C.C. (2013), The vulnerability of Amazon freshwater ecosystems. *Conservation Letters*, 6: 217-229. <https://doi.org/10.1111/conl.12008>
- Charity, S. D. (2016). Living Amazon Report 2016: A regional approach to conservation in the Amazon. WWF Living Amazon Initiative. Brasilia and Quito.
- Chen, J., Tapley, B., Rodell, M., Seo, K.-W., Wilson, C., Scanlon, B. R., et al. (2020). Basin-scale river runoff estimation from GRACE gravity satellites, climate models, and in situ observations: A case study in the Amazon basin. *Water Resources Research*, 56, e2020WR028032. <https://doi.org/10.1029/2020WR028032>
- Chen, J. L., C. R. Wilson, and B. D. Tapley (2010), The 2009 exceptional Amazon flood and interannual terrestrial water storage change observed by GRACE, *Water Resour. Res.*, 46, W12526, doi:10.1029/2010WR009383.
- Condon, L. E., Kollet, S., Bierkens, M. F. P., Fogg, G. E., Maxwell, R. M., Hill, M. C., et al. (2021). Global groundwater modeling and monitoring: Opportunities and challenges. *Water Resources Research*, 57, e2020WR029500. <https://doi.org/10.1029/2020WR029500>
- Costa, Jamerson & Rodrigues, Liange & Silva, Aline & Neto, Ruben & Batista, Ieda & Albuquerque, Carlossandro & Melo, Maria & Astrid, Liberato. (2020). Water, sanitation and the COVID-19 in the Amazon. *HOLoS*. 8. 1-23. 10.15628/holos.2020.10803.
- Couton, Marjorie & Studer, Angela & Hürlemann, Samuel & Locher, Nadine & Knüsel, Mara & Alther, Roman & Altermatt, Florian. (2023). Integrating citizen science and environmental DNA metabarcoding to study biodiversity of groundwater amphipods in Switzerland. *Scientific Reports*. 13. 10.1038/s41598-023-44908-8.

- Davidson, E., de Araújo, A., Artaxo, P. et al. (2012). The Amazon basin in transition. *Nature* 481, 321–328, <https://doi.org/10.1038/nature10717>
- de Meyer, Caroline & Wahnfried, Ingo & Rodríguez, Juan & Kipfer, Rolf & Garcia, Pilar & Deza, Edward & Berg, Michael. (2023). Hotspots of geogenic arsenic and manganese contamination in groundwater of the floodplains in lowland Amazonia (South America). *Science of The Total Environment*. 860. 160407. 10.1016/j.scitotenv.2022.160407.
- de Meyer, C. M. (2017). Arsenic, manganese and aluminum contamination in groundwater resources of Western Amazonia (Peru). *Science of the Total Environment*.
- Durango Cordero, Juan & Saqalli, Mehdi & Ferrant, Sylvain & Maurice, Laurence & Bonilla-Bedoya, Santiago & Arellano, Paul & Elger, Arnaud. (2022). Risk assessment of unlined oil pits leaking into groundwater in the Ecuadorian Amazon: A modified GIS-DRASTIC approach. *Applied Geography*. 139. 10.1016/j.apgeog.2021.102628.
- Eamus, Derek & Zolfaghar, Sepideh & Villalobos-Vega, Randol & Cleverly, Jamie & Huete, Alfredo. (2015). Groundwater-dependent ecosystems: Recent insights from satellite and field-based studies. *Hydrol. Earth Syst. Sci.* 19. 4229-4256. 10.5194/hess-19-4229-2015.
- Espinoza, J.C., Jimenez, J.C., Marengo, J.A. et al. (2024). The new record of drought and warmth in the Amazon in 2023 related to regional and global climatic features. *Sci Rep* 14, 8107. <https://doi.org/10.1038/s41598-024-58782-5>
- Fan, Y., & Miguez-Macho, G. (2010). Potential groundwater contribution to Amazon evapotranspiration. *Hydrology and Earth System Sciences Discussions*, 7, 5131–5170.
- Fassoni-Andrade, A. C., Fleischmann, A. S., Papa, F., Paiva, R. C. D. d., Wongchuig, S., Melack, J. M., et al. (2021). Amazon hydrology from space: Scientific advances and future challenges. *Reviews of Geophysics*, 59, e2020RG000728. <https://doi.org/10.1029/2020RG000728>
- Fenzl, N. & Mathis, A. (2004). Pollution of natural water resources in Amazonia: sources, risks and consequences. In: *Issues of local and global use of water from the Amazon*. Ed. Luis E. Aragón, Miguel ClüsenerGodt, 57-76. Montevideo: UNESCO.
- Ferencz, S. B., Cardenas, M. B., & Neilson, B. T. (2019). Analysis of the effects of dam release properties and ambient groundwater flow on surface water-groundwater exchange over a 100-km-long reach. *Water Resources Research*, 55, 8526–8546. <https://doi.org/10.1029/2019WR025210>
- Ferreira, F., Custodio, E., & Cardoso, G. (2016). Hydrogeology of the Western Amazon Aquifer System (WAAS). *Journal of South American Earth Sciences*, 72, 375-386.
- Ferreira, Sávio & Pinel, Sebastien & Ríos-Villamizar, Eduardo & Miranda, Sebastião & Pascoaloto, Domitila & Vital, Ana & Monteiro, Maria & Silva, Maria & Cunha, Thaís & Santos, Almir & Bender, Steffen & Cunha, Hillândia. (2021). Impact of rapid urbanization on stream water quality in the Brazilian Amazon. *Environmental Earth Sciences*. 80. 10.1007/s12665-021-09621-7.

- Flecker, Alexander & Shi, Qinru & Almeida, Rafael & Angarita, Hector & Gomes Selman, Jonathan & Garcia-Villacorta, Roosevelt & Sethi, Suresh & Thomas, Steven & Poff, N. & Forsberg, Bruce & Heilpern, Sebastian & Hamilton, Stephen & Abad, Jorge & Anderson, Elizabeth & Barros, Nathan & Bernal, Isabel & Bernstein, Richard & Cañas, Carlos & Dangles, Olivier & Gomes, Carla. (2022). Reducing adverse impacts of Amazon hydropower expansion. *Science*. 375. 753-760. 10.1126/science.abj4017.
- Flores, B.M., Montoya, E., Sakschewski, B. et al. (2024). Critical transitions in the Amazon forest system. *Nature* 626, 555–564. <https://doi.org/10.1038/s41586-023-06970-0>
- Frappart, Frédéric & Papa, Fabrice & Güntner, Andreas & Tomasella, Javier & Pfeffer, Julia & Ramillien, G. & Emilio, Thaise & Schietti, Juliana & Seoane, L. & Carvalho, J. & Moreira, Daniel & Bonnet, Marie-Paule & Seyler, Frédérique. (2019). The spatio-temporal variability of groundwater storage in the Amazon River Basin. *Advances in Water Resources*. 10.1016/j.advwatres.2018.12.005.
- Galán, C., & Herrera, F. (2015). Ríos subterráneos y acuíferos kársticos de Venezuela: Inventario, situación y conservación. Em *Ríos en Riesgo de Venezuela*. Douglas Rodríguez.
- Galvão, P., Lopes, E., Demétrio, J., & Martins, M. (2020). Estimating groundwater resources of the Içá-Solimões Aquifer System in the Urucu Oil Province Central Amazon Region, Brazil, focused on a balance between availability and water demand. *RBRH* vol.25.
- Gauthier, C., Lin, Z., Peter, B. G., & Moran, E. F. (2019) Hydroelectric Infrastructure and Potential Groundwater Contamination in the Brazilian Amazon: Altamira and the Belo Monte Dam, *The Professional Geographer*, 71:2, 292-300, DOI: 10.1080/00330124.2018.1518721
- Grossman, D. (2024), A River in flux, *Science*, 383, 6684: 692-697.
- Guppy, L., Uyttendaele, P., Villholth, K. G., Smakhtin, V. (2018). Groundwater and Sustainable Development Goals: Analysis Of Interlinkages. UNU-INWEH Report Series, Issue 04. United Nations University Institute for Water, Environment and Health, Hamilton, Canada.
- Hoorn, Carina & Wesselingh, Frank & ter Steege, Hans & Bermudez, Mauricio & Mora, Andrés & Sevink, Jan & Sanmartin, Isabel & Sanchez Meseguer, Andrea & Anderson, Cajsá Lisa & Figueiredo, Jorge & Jaramillo, Carlos & Riff, D. & Negri, Francisco & Hooghiemstra, H. & Lundberg, John & Stadler, Tanja & Särkinen, T & Antonelli, Alexandre. (2010). Amazonia Through Time: Andean Uplift, Climate Change, Landscape Evolution, and Biodiversity. *Science* (New York, N.Y.). 330. 927-31. 10.1126/science.1194585.
- IPCC. (2018). Summary Report: Global Warming of 1.5 °C.
- IPCC. (2023): Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 35-115, doi: 10.59327/IPCC/AR6-9789291691647.

- Jarrín, A., Salazar, J., & Martínez-Fresneda, M. (2017). Evaluación del riesgo a la contaminación de los acuíferos de la Reserva Biológica de Limoncocha, Amazonía Ecuatoriana. *Ambiente & Agua - An Interdisciplinary Journal of Applied Science*, vol 12, 652 - 665.
- Jasechko, S., Seybold, H., Perrone, D. et al. (2024), Rapid groundwater decline and some cases of recovery in aquifers globally. *Nature* 625, 715–721. <https://doi.org/10.1038/s41586-023-06879-8>
- Jasechko, S. (2019). Global isotope hydrogeology—review. *Reviews of Geophysics*. 57, 835–965. <https://doi.org/10.1029/2018RG000627>
- Jézéquel, C., Tedesco, P.A., Bigorne, R. et al. (2020) A database of freshwater fish species of the Amazon Basin. *Sci Data* 7, 96, <https://doi.org/10.1038/s41597-020-0436-4>
- Kuang, Xingxing & Liu, Junguo & Scanlon, Bridget & Jiao, Jiu & Jasechko, Scott & Lancia, Michele & Biskaborn, Boris & Wada, Yoshihide & Li, Hailong & Zeng, Zhenzhong & Guo, Zhilin & Yao, Yingying & Gleeson, Tom & Nicot, Jean-Philippe & Luo, Xin & Yiguang, Zou & Zheng, Chunmiao. (2024). The changing nature of groundwater in the global water cycle. *Science* (New York, N.Y.). 383. eadf0630. 10.1126/science.adf0630.
- Lin, Y. L. (2015). Potential negative effects of groundwater dynamics on dry season convection in the Amazon River basin. *Clim Dyn* 46, 1001–1013.
- Macedo, M. a. (2015). *State of the Amazon: Freshwater Connectivity and Ecosystem Health*. Brasília, Brazil: WWF Living Amazon Initiative. 136pp: D. Oliveira, C. C. Maretti and S. Charity.
- Marengo, Jose & Williams, Earle & Alves, Lincoln & Soares, Wagner & Rodriguez, Daniel. (2016). Extreme Seasonal Climate Variations in the Amazon Basin: Droughts and Floods. 10.1007/978-3-662-49902-3_4.
- Martin, S. T. (2023). Population growth and deforestation in Amazonas, Brazil, from 1985 to 2020. *Population and Environment*, 45 (27). <https://doi.org/10.1007/s11111-023-00438-z>.
- Matos, F., Cavalcante, I., & Silva, M. (2013). O sistema aquífero grande Amazônia – SAGA: um imenso potencial de água subterrânea no Brasil. III Intenational Congresso on Subsurface Environmet, (pp. 1-4). São Paulo.
- Meschede, M., Figueiredo, B., Alves, R., & Segura-Muñoz, S. (2018). Drinking water quality in schools of the Santarém region, Amazon, Brazil, and health implications for school children. *Ambiente e Agua - An Interdisciplinary Journal of Applied Science*.
- Mestanza-Ramón, C., Cuenca-Cumbicus, J., D’Orio, G., Flores-Toala, J., Segovia-Cáceres, S., Bonilla-Bonilla, A., & Straface, S. (2022). Gold Mining in the Amazon Region of Ecuador: History and a Review of Its Socio-Environmental Impacts. *Land*.
- Miguez-Macho, G., and Y. Fan (2012), The role of groundwater in the Amazon water cycle: 1. Influence on seasonal streamflow, flooding and wetlands, *J. Geophys. Res.*, 117, D15113, doi:10.1029/2012JD017539.
- Miguez-Macho, G., & Fan, Y. (2012). The role of groundwater in the Amazon water cycle: 2. Influence on seasonal soil moisture and evapotranspiration. *Journal of Geophysical Research*, Vol. 117.

- Nagy, L. F. (2016). Interactions Between Biosphere, Atmosphere and Human Land Use in the Amazon Basin. SpringerLink (Online service).
- Nath, S. and Kirschke, S. (2023), Groundwater Monitoring through Citizen Science: A Review of Project Designs and Results. *Groundwater*, 61: 481-493. <https://doi.org/10.1111/gwat.13298>
- Nobre, Carlos & Sampaio, Gilvan & Borma, Laura & Castilla-Rubio, Juan & Silva, José & Cardoso, Manoel. (2016). Land-use and climate change risks in the Amazon and the need of a novel sustainable development paradigm. *Proceedings of the National Academy of Sciences of the United States of America*. 113. 10.1073/pnas.1605516113.
- OTCA. (2018). Aguas Amazónicas: 10 Investigaciones sobre la cuenca hidrográfica más grande del mundo. Brasilia.
- Passarelli, I.; Villacis Verdesoto, M.V.; Jiménez-Oyola, S.; Flores Huilcapi, A.G.; Mora-Silva, D.; Anfuso, G.; Esparza Parra, J.F.; Jimenez-Gutierrez, M.; Carrera Almendáriz, L.S.; Avalos Peñafiel, V.G.; et al. (2024). Analysis of Mercury in Aquifers in Gold Mining Areas in the Ecuadorian Amazon and Its Associated Risk for Human Health. *Toxics*, 12, 162. <https://doi.org/10.3390/toxics12020162>
- Pearce, F. (2020). Weather makers. *Science*. 368. 1302-1305. 10.1126/science.368.6497.1302.
- Pfeffer, J. F.-P. (2014). Low-water maps of the groundwater table in the central Amazon by satellite altimetry. *Geophysical Research Letters*, 41, 1981–1987.
- Pimentel, E., & Hamza, V. (2012). Indications of regional scale groundwater flows in the Amazon Basins: Inferences from results of geothermal studies. *Journal of South American Earth Sciences*, 37, 214-227.
- Pokhrel, Y., Fan, Y., & Miguez-Macho, G. (2014). Potential hydrologic changes in the Amazon by the end of the 21st century and the groundwater buffer. *Environmental Research Letters*.
- Pokhrel, Y., Fan, Y., Miguez-Macho, G., Yeh, P., & Han, a. S. (2013). The role of groundwater in the Amazon water cycle: 3. Influence on terrestrial water storage computations and comparison with GRACE. *Journal of Geophysical Research: Atmospheres*, 118, 3233–3244.
- Porter, B., Kendall, A., Coe, M., & Hyndman, D. (2020). Trends in streamflow, evapotranspiration, and groundwater storage across the Amazon Basin linked to changing precipitation and land cover. *Journal of Hydrology: Regional Studies*, 32.
- Ramírez, Manuel & Barrantes, Juan & Thomas, Evert & Gamarra Miranda, Luis & Pillaca, Martin & Denise, Lily & Peramas, Tello & Ruben, Luis & Tapia, Bazán. (2020). Heavy metals in alluvial gold mine spoils in the Peruvian Amazon. *Catena*. 10.1016/j.catena.2020.104454.
- Rosario, F., Custodio, E., & Cardoso, G. (2016). Hydrogeology of the Western Amazon Aquifer System (WAAS). *Journal of South American Earth Sciences*, Volume 72, 375e386.
- Ruiz, C. N. (2020). Land use planning in the Amazon basin: challenges from resilience thinking. *Ecology and Society*, 25(1):8.

- Sabogal, C. (2018). Informe Regional sobre la situación de los bosques en la Región Amazónica. Brasília: OTCA - GIZ.
- Santos D, Mosaner, M., Celentano, D., Moura, R., Veríssimo, A. (2018). Índice de Progreso Social na Amazônia brasileira: IPS Amazônia. <https://amazon.org.br/wp-content/uploads/2021/12/EXECUTIVE-SUMMARY-IPS-Amazonia-2018.pdf>
- Santos Correa, W., Yoshinaga Pereira, S., Bernardes Ayer, J. E., & Brum Pereira, P. R. (2022). Hydrogeochemical evaluation of groundwater and surface water interactions in an alluvial plain, Southeast Brazil. *Land Degradation & Development*, 33(15), 2911–2931. <https://doi.org/10.1002/ldr.4364>
- Satizábal-Alarcón, D., Suhogusoff, A., & Ferrari, L. (2024). Characterization of groundwater storage changes in the Amazon River Basin based on downscaling of GRACE/GRACE-FO data with machine learning models. *Science of The Total Environment*. 912. 168958. 10.1016/j.scitotenv.2023.168958.
- Shuai, P., Chen, X., Song, X., Hammond, G. E., Zachara, J., Royer, P., et al. (2019). Dam operations and subsurface hydrogeology control dynamics of hydrologic exchange flows in a Regulated River reach. *Water Resources Research*, 55, 2593–2612. <https://doi.org/10.1029/2018WR024193>
- ter Steege, H., Pitman, N.C.A., do Amaral, I.L. et al. (2023). Mapping density, diversity and species-richness of the Amazon tree flora. *Commun Biol* 6, 1130. <https://doi.org/10.1038/s42003-023-05514-6>
- Toreti, A., Bavera, D., Acosta Navarro, J., Arias Muñoz, C., Barbosa, P., Branco, A., Cunha, A. P., de Jager, A., Fioravanti, G., Grimaldi, S., Hrašt Essensfelder, A., Libertà, G., Maetens, W., Magni, D., Marengo, J.A., Masante, D., Mazzeschi, M., McCormick, N., Meroni, M., Oom, D., Rembold, F., Salamon, P., San Miguel, J. Drought in the Amazon basin - November 2023, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/756827, JRC136439.
- Tian, C., Wang, L., Kaseke, K.F. et al. (2018). Stable isotope compositions ($\delta^2\text{H}$, $\delta^{18}\text{O}$ and $\delta^{17}\text{O}$) of rainfall and snowfall in the central United States. *Sci Rep* 8, 671. <https://doi.org/10.1038/s41598-018-25102-7>
- Tovar, J., Sayán, J., Pérez, G., & Guzmán, A. (2006). Estado del conocimiento de la hidrogeología en Perú. *Boletín Geológico y Minero*, 117 (1), 147-161.
- UNESCO. (2007). Sistemas Acuíferos Transfronterizos en la Américas – Evaluación Preliminar, Serie ISARM Américas N°1. Montevideo, Uruguay.
- United Nations. (2022). The United Nations World Water Development Report 2022: Groundwater: Making the invisible visible. Paris: UNESCO.
- Villar, P. (2016). International cooperation on transboundary aquifers in South America and the Guarani Aquifer case. *Revista Brasileira de Política Internacional*, vol. 59, núm. 1, 1-20.
- Werstak, C.E. Jr.; Housman, I.; Maus, P.; Fisk, H.; Gurrieri, J.; Carlson, C.P.; Johnston, B.C.; Stratton, B.; Hurja, J.C. (2010). Groundwater-dependent ecosystem inventory using remote sensing. RSAC-10011-RPT1. Salt Lake City, UT: U.S. Department of Agriculture, Forest Service, Remote Sensing Applications Center. 20 p, https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5405946.pdf

WHO and UNICEF (2019). Progress on household drinking water, sanitation and hygiene 2000-2017. Special focus on inequalities. New York: United Nations Children's Fund (UNICEF) and World Health Organization.

WWF. (2018). Healthy Rivers Healthy People. Dalberg.

[1] <https://groundwaterportal.net/sites/default/files/Governance2.pdf>

[2] <https://groundwaterportal.net/sites/default/files/Governance1.pdf>

[3] Idem

[4] A potential site is Intervention Project 2.4.1 in Leticia (Colombia) and Tabatinga (Brazil), GEF Project 9770.

[5] <https://riosvoadores.com.br/english/>

[6] Including hydraulic properties such as transmissivity or hydraulic conductivity, storage coefficients, permeability, aquifer characteristics, current and estimated future water abstraction.

[7] Such as alluvial mining, pollution in small-, medium- and large-populated towns

[8] https://iah.org/wp-content/uploads/2021/08/IAH-Water-Security_Groundwater-July-2021.pdf

[9] Pollutants will be determined by activity 1.2.2.

[10] The Solimoes River presents 1.5 mg/m³ of dissolved arsenic and in the Madeira River, samples show 18.6 mg/m³ of particulate arsenic

[11] <https://oraotca.org/pric/en>

[12] Amazon Cooperation Treaty Organization, 1999. *Guía Metodológica para el diseño de políticas de desarrollo con enfoque de género, en la Región Amazónica*.

[13] <https://news.mongabay.com/2023/12/peru-crackdown-on-illegal-gold-mining-a-success-but-only-briefly-study-shows/>

[14] <https://www.maaproject.org/2023/mining-deforest-peru/>

[15] Orito (population 38,744), Puerto Asis (population 67,200) and Valle del Guamuez (population 34,600).

[16] Potential affected population is 120,000 people. Potential area: 150,000 ha.

[17] Population 324,513. Potential study area of 150,000 ha.

[18] <https://www.fao.org/3/i5705e/i5705e.pdf>

Institutional Arrangement and Coordination with Ongoing Initiatives and Project.

Please describe the Institutional Arrangements for the execution of this project, including financial management and procurement. If possible, please summarize the flow of funds (diagram), accountabilities for project management and financial reporting (organogram), including audit, and staffing plans. (max. 500 words, approximately 1 page)

Overall Project Governance

The preliminary project governance and internal communication mechanism for the project is detailed in Figure 12. The general oversight of project activities will be undertaken by the Project Steering Committee (PSC) composed by country focal points representing the governments, and the Implementing Agencies (IAs) (UNEP and IDB). The Project Coordination Unit (PCU) and the Executing Agency (EA) (ACTO) will be observers and act as secretariat for the PSC.

UNEP and IDB as GEF agencies, will be responsible for overall project supervision to ensure consistency with GEF, IDB and UNEP policies and procedures, and will provide guidance on linkages with other IDB, UNEP and GEF-funded projects and activities.

The Project Steering Committee (PSC) will meet twice a year (in person and via conference call) to monitor progress in project execution, to provide strategic and policy guidance, and to review and approve annual work plans and budgets. The PSC will be composed of participating countries' representatives and additional national experts as appropriate. The PSC will endorse annual operation plans and budgets, technical and financial reports, and will assist in providing project oversight. If required, the PSC may establish advisory groups for any identified need (i.e. technical advisory group). The IDB and UNEP would co-chair the first meeting. Thereafter, the chair will be undertaken on a rotational basis among participating countries. The PCU will serve as the secretariat of the PSC.

ACTO will serve as Executing Agency (EA) for the project. In accordance with UNEP and IDB agreements and guidelines, the EA will coordinate the execution of the project providing overall technical management to project implementation and manage the funds provided to the project by UNEP and IDB on behalf of the GEF, in a manner consistent with their financial reporting requirements. ACTO and the PCU will be observers and act as secretariat for the PSC.

The Regional Project Coordination Unit (PCU) will be in charge of day-to-day project coordination, management of all activities including financial planning, budget and contracts oversight.

The National activities (Component 3) will be coordinated by National Project Coordinator Units (NPCUs) that will act as an interface between the PCU and national partners, National Technical Working Groups and national TDA/SAP Task Forces and liaise with CSOs and local communities as appropriate.

An interagency coordination group, composed of UNEP and IDB as the IA, PSC/ACTO as the EA, and the PCU, will be formed to best coordinate project activities and act as progress review mechanism. Finally, a Regional Technical Advisory Group (R-TAG), composed of national experts, will be established to provide technical advice to the PSC and the PCU as required.

External communication from the project is further supported by Component 5, which includes focus on monitoring and knowledge sharing, communication and awareness raising.

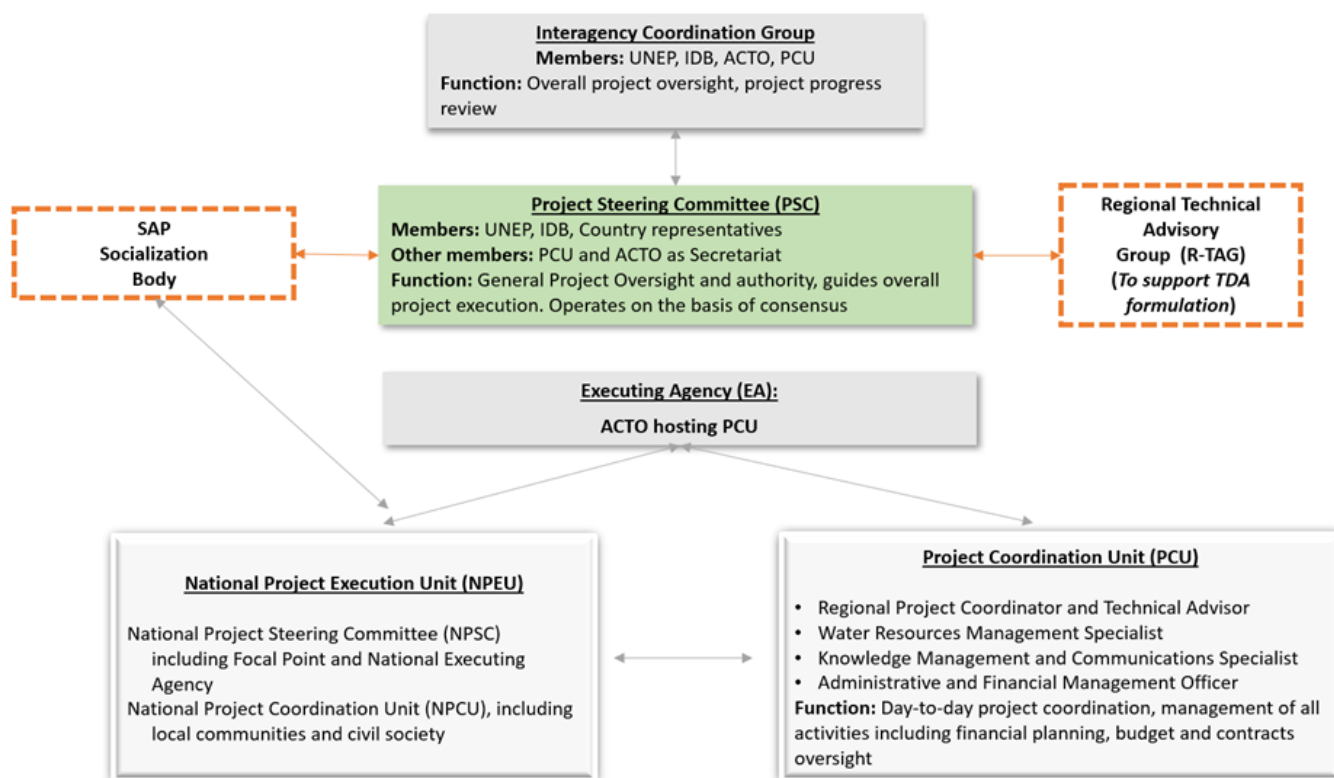


Figure 12. Indicative organogram

The implementation of the project will be supported by an M&E strategy based on measurable and verifiable outcomes and adaptive management principles and knowledge management. Such M&E strategy will clearly define the expected outcomes, the expected time frames for their achievement, and their confirmation using objective indicators and means of verification. Annual working plans and their corresponding budgets will also be developed based on the expected results and their progress, including the gradual steps and milestones required for measurable achievements. To this end, annual working plans will be articulated with annual progress indicators in a participatory manner for each outcome. Mid-term evaluations will be carried out at the end of the period at strategic intervals, to inform and guide the project implementation in a constructive manner, paying attention to sustainability considerations, articulating a coherent exit strategy, and applying adaptive measures, if necessary.

Will the GEF Agency play an execution role on this project?

If so, please describe that role here and the justification.

Also, please add a short explanation to describe cooperation with ongoing initiatives and projects, including potential for co-location and/or sharing of expertise/staffing (max. 500 words, approximately 1 page)

Cooperation with ongoing initiatives and projects

Strong linkages and synergies with the below listed projects will be analyzed and secured during project implementation. The interaction and coordination with other relevant GEF and non-GEF financed initiatives

will be done through the project coordination unit, information sharing and joint activities and events. Moreover, taking advantage of ACTO as the regional organization coordinating and/or executing several of those activities and programs.

The following is a list of identified complementary GEF Projects:

- “Implementation of the Strategic Action Programme to Ensure Integrated and Sustainable Management of the Transboundary Water Resources of the Amazon River Basin Considering Climate Variability and Change” (GEF ID: 9770). There will be very close ties and linked activities where possible, as the overall goal of implementation of the SAP is to promote an integrated water resources management program in the basin and this proposal will provide key data about the inter-dynamics among surface and groundwater interfaces ruling aquifer recharge and eco-hydrologic functionalities. Consequently, the inclusion of groundwater resources is critical.
- “Water Funds: A Conservation Climate Resilient Model for Stressed Watersheds in Latin America and the Caribbean” (GEF ID: 10048). The objective of this project, implemented by IADB, is developing and supporting water fund mechanisms for five Latin American cities by enhancing governance and connecting water users in urban areas with upper watershed land stewards that produce important hydrologic benefits through healthy watersheds. Since water funds have tested on-the-ground nature-based solutions and innovative financing mechanisms involving the private sector and other stakeholders, there is potential for learning exchange.
- “Integrated watershed management of the Putumayo-Içá river basin” (GEF ID 10531). The project is being implemented by the World Bank through the Wildlife Conservation Society and is addressing water management in the Putumayo basin in Brazil, Colombia, Ecuador and Peru. The project focuses on reducing pollution and in particular mercury from legal and illegal activities and improving multi-level and multi-sectoral governance.
- “Adaptation to the Impacts of Climate Change in Water Resources for the Andean Region” (GEF 5384 WB/CAF). The knowledge and best practices generated by the Project (Bolivia, Colombia, Ecuador, and Peru.) will contribute to specific FSP intervention projects related to building community resilience and aquatic ecosystem protection to address climate change impacts (Component II), including water use efficiency and alternative water supply solutions in Andean communities and/or urban centers dependent on retreating glaciers and increasing the resilience of infrastructures.
- “Implementation of the Guarani Aquifer Strategic Action Program: Enabling Regional Actions” (GEF ID:10139). The project was approved for implementation in December 2019 and will focus on delivering actions laid out within the Guarani Aquifer SAP. There will clearly be a strong linkage between this project and the Implementation of the Guarani Aquifer SAP not only on a substantive level, the later having already developed detailed action items, but also from a procedural level. Likely, Brazil’s involvement will help to transfer knowledge from one project to the other.
- “Amazon Sustainable Landscapes Program” (GEF 9272 WB/MFA). This project aims to protect globally significant biodiversity and implement policies globally significant land use and restoration of native vegetation cover in Brazil, Colombia and Peru.

The following is a list of the main non-GEF projects and initiatives with which the project will seek relationships to strengthen short- and long-term results.

Bolivia: Arroyo Bahía Basin Master Plan; National Water Quality System; National Water Balance.

Brazil: Institutional strengthening, gender inclusion, socio-environmental management and tourism in Parintins, State of Amazonas (BR-L1615); National Network for Water Quality in the Amazon Basin; National Hydrometeorological Network in the Amazon Basin; RIMAS - Groundwater Monitoring Network; Hydrogeological Studies of the Urban and Periurban Regions of Manaus/AM - Subsidies for the Sustainable Use of Water Resources; Hydrogeological Studies of the Metropolitan Region of São Luís/MA - Subsidies for the Sustainable Use of Water Resources

Colombia: Projects and programs related to water management and biodiversity, promoted by the Corporation for the Sustainable Development of the Southern Amazon - Corpoamazonía and by the Amazon Institute of Scientific Research SINCHI.

Ecuador: Implementation of a Situation Room and Technical Training for the Integrated Management of Water Resources in Ecuador; Project: 'Implementation of the Conservation, Protection and Recovery of Water Resources, through the Establishment and Management of Water Protection Areas (APH) as a Preventive Guarantee for Water for Human Consumption and Irrigation that Guarantees Food Sovereignty'; ARCAL 5079 Project: Radio Analytical and Complementary Technical Application for the Monitoring of Contaminants in Aquaculture; Project: Establishment and Management of Water Protection Areas (APH) as a preventive guarantee for water for human consumption, Irrigation that guarantees food sovereignty and other uses and exploitation; Project: National Plan for Integrated Management of Water Resources by Hydrographic Basins of Ecuador and at the National Level- CISPDR Study.

Regionally: The Amazon Regional Platform of indigenous peoples and other local communities within the ACTO framework; Amazon Regional Observatory: Water Resources Situation Room; Strengthening and Expansion of the Regional Amazon Observatory in the axes of climate change, forestry and climate change biodiversity; Development of a Regional Hydrological Platform and a Multisectoral Nexus model for the Amazon Basin (RG-T3489-P001); Improving Climate Resilience by Increasing Water Security in the Amazon Basin (GCF).

The **International Atomic Energy Agency** (IAEA) has national technical cooperation projects with Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela to advance in water resources management from the perspective of both surface and groundwater systems and using isotope hydrology techniques and methods. In addition, IAEA supports countries by strengthening their capacities with training courses including topics such as conceptual models' development, data management, analytical methods as well as advanced modelling approaches.

Core Indicators

Indicate expected results in each relevant indicator using methodologies indicated in the GEF-8 Results Measurement Framework Guidelines. There is no need to complete this table for climate adaptation projects financed solely through LDCF and SCCF.

Indicator 3 Area of land and ecosystems under restoration

Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)
0	0	0	0

Indicator 3.1 Area of degraded agricultural lands under restoration

Disaggregation Type	Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)

Indicator 3.2 Area of forest and forest land under restoration

Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)

Indicator 3.3 Area of natural grass and woodland under restoration

Disaggregation Type	Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)

Indicator 3.4 Area of wetlands (including estuaries, mangroves) under restoration

Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)

Indicator 4 Area of landscapes under improved practices (hectares; excluding protected areas)

Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)
3950	132650	0	0

Indicator 4.1 Area of landscapes under improved management to benefit biodiversity (hectares, qualitative assessment, non-certified)

Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)

Indicator 4.2 Area of landscapes under third-party certification incorporating biodiversity considerations

Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)

Type/Name of Third Party Certification

Indicator 4.3 Area of landscapes under sustainable land management in production systems

Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)

Indicator 4.4 Area of High Conservation Value or other forest loss avoided

Disaggregation Type	Ha (Expected at PIF)	Ha (Expected at CEO Endorsement)	Ha (Achieved at MTR)	Ha (Achieved at TE)
High Conservation Value Forest	3,950.00	132,650.00		

Indicator 4.5 Terrestrial OECMs supported

Name of the OECMs	WDPA-ID	Total Ha (Expected at PIF)	Total Ha (Expected at CEO Endorsement)	Total Ha (Achieved at MTR)	Total Ha (Achieved at TE)

Documents (Document(s) that justifies the HCVF)

Title

Indicator 7 Shared water ecosystems under new or improved cooperative management

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Shared water Ecosystem	Amazonas	Amazonas		
Count	1	1	0	0

Indicator 7.1 Level of Transboundary Diagnostic Analysis and Strategic Action Program (TDA/SAP) formulation and implementation (scale of 1 to 4; see Guidance)

Shared Water Ecosystem	Rating (Expected at PIF)	Rating (Expected at CEO Endorsement)	Rating (Achieved at MTR)	Rating (Achieved at TE)
Amazonas	2	3		

Indicator 7.2 Level of Regional Legal Agreements and Regional management institution(s) (RMI) to support its implementation (scale of 1 to 4; see Guidance)

Shared Water Ecosystem	Rating (Expected at PIF)	Rating (Expected at CEO Endorsement)	Rating (Achieved at MTR)	Rating (Achieved at TE)

Indicator 7.3 Level of National/Local reforms and active participation of Inter-Ministeral Committees (IMC; scale 1 to 4; See Guidance)

Shared Water Ecosystem	Rating (Expected at PIF)	Rating (Expected at CEO Endorsement)	Rating (Achieved at MTR)	Rating (Achieved at TE)
Amazonas	1	2		

Indicator 7.4 Level of engagement in IWLEARN through participation and delivery of key products(scale 1 to 4; see Guidance)

Shared Water Ecosystem	Rating (Expected at PIF)	Rating (Expected at CEO Endorsement)	Rating (Achieved at MTR)	Rating (Achieved at TE)
Amazonas	1	4		

Indicator 11 People benefiting from GEF-financed investments

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Female	1,105	135,506		
Male	1,150	135,506		
Total	2,255	271,012	0	0

Explain the methodological approach and underlying logic to justify target levels for Core and Sub-Indicators (max. 250 words, approximately 1/2 page)

Core Indicator N°4 (Area of landscapes under improved practices = 132,650 ha) was estimated considering that practices and plans implemented under Component 3, through selected pilots in strategic areas in each country (Appendix 11). These pilots will lead to improved environmental conditions, aquifer protection and/or sustainable management practices. There are four pilots which highlight the mapping and the sustainable management of recharge areas for aquifers and avoiding landscape degradation by alluvial mining activities. Bolivia's pilot in the Madre de Dios basin, has identified areas of potential mercury contamination and landscape degradation in the departments of Beni, La Paz and Pando, where protection plans to avoid landscape degradation will be developed to target 2% of total pilot area or 63,495 ha. Ecuador's pilot has identified a study area of approximately 24,059 km² in the Napo River basin which has been experiencing both deforestation and oil exploration. It is anticipated that land management changes over the 48-month pilot duration (Appendix 7) may occur over 1% of the area, or 24,059 ha. Peru's pilot is looking for protection measures in shallow aquifer areas of Coronel Portilla, Pucallpa, and it is anticipated that the pilot will benefit an area of 13,596 ha. The other, in Venezuela, will take place in a region of approximately 315,000 ha next to the Rio Negro. It is assumed that approximately 10% of this area will experience improved land management (31500 ha).

Core Indicator N°7 (Number of shared water ecosystems under new or improved cooperative management) is one since it refers to the Amazon Basin with the understanding that the Amazon Aquifers are a single system part of the Amazon Basin as an integrated system.

Core Indicator N°11 (Number of direct beneficiaries) strictly covers the direct beneficiaries within national and local government agencies as well the ACTO, who will be directly impacted by the improved ground water management practices engendered through this project. The direct beneficiaries total is 271,012 (50% women). Capacity building beneficiaries are approximately 38,125 people, which include technical-based activities, AAS Certification, AAS Symposium, and International Conference (Component 1), training workshops in all pilot projects (Component 3), and workshops across components (from technical to governance) and gender responsive workshops (Component 5). Dissemination activities will reach 39,430 people communicating the TDA (Component 1), the White Paper (Component 2), the pilot's lessons learned (Component 3), and the SAP (Component 4). A population impacted by the execution measured throughout the different pilot projects (Component 3, considering between 20 to 25% of the local population) will reach 193,458 people.

Key Risks

	Rating	Explanation of risk and mitigation measures
CONTEXT		
Climate	Low	Climate may be affected by land use change and change of evapotranspiration regimes, that will result in increased groundwater use, at the detriment of the ecosystem. Improved understanding of the AAS will result in improved management and regulations of the AAS, in the face of climate change.
Environmental and Social	Low	Some pilots might work with indigenous communities. An Indigenous Peoples Plan will be developed at inception phase. On-the-ground interventions will develop E&S assessments and development of ESMP once the locations for the pilots are defined.
Political and Governance	Low	There is currently limited regional governance of the shared aquifer systems. However, this project captures the region's willingness to strengthen the regional management mechanism for the shared aquifer. The project will support countries

		and ACTO to consolidate a regional management approach. The political situation at the national level in some participating countries where pilots are scheduled to take place will be monitored during the execution phase. A potential risk could be that one of the countries approves a policy that promotes deforestation, or the construction of infrastructure related to the Amazon basin (e.g. hydropower dams in the Upper Marañón River). Component 2 will develop a road map for legal framework and institutional capacities improvement per country and Component 4 will develop national/regional action plans to tackle the aquifer sustainability.
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INNOVATION

Institutional and Policy	Low	Current regulations and policies while limited are implemented at the local level. It is intended to support the strengthening of the national and regional regulatory and policy frameworks for improved groundwater management and use.
Technological	Low	The components related to technical activities (Component 1 and 3) rely on the application of technological methods such as remote sensing, in-situ analysis (isotopic, geophysical, groundwater and others) that have been developed previously for the AAS and other aquifers around the world. The risk is identified to the application of the large domain, that's why, detailed activities were designed to monitor their appropriate application of these methodologies. Country agencies that have experience on these methodologies will be contacted during the inception and execution phases.
Financial and Business Model	Low	When planning the implementation of the environmental groundwater project in the Amazon, the concept of financial risk emerges as a critical consideration, given the logistical complexity and inherent environmental challenges of the region. To mitigate this risk and ensure effective and low-risk financial management, a comprehensive financial and business management model is proposed. In this model, the Amazon Cooperation Treaty Organization (ACTO) would assume the role of project administrative manager, leveraging its regional expertise and commitment to environmental conservation. The United Nations Environment Programme (UNEP) will play a key role as a financial partner, providing financial resources for comprehensive groundwater management and sharing its technical expertise for research, policy generation on this new topic, promoting development, and training the indigenous population of the region to improve their quality of life without affecting future generations. UNEP will also assist with project monitoring and the implementation of cross-cutting themes such as knowledge management and learning, gender equality. On the other hand, the Inter-American Development Bank (IDB) not only provides financing but also offers full support and technical expertise on the implementation of pilot projects with the necessary infrastructure and technologies for sustainable groundwater management, social development, environmental protection, regional integration, and institutional strengthening. This model would ensure equitable and efficient distribution of financial resources, minimizing financial risk and maximizing the positive impact of the project on the conservation and protection of groundwater resources in the Amazon.

EXECUTION

Capacity	Low	ACTO has experience in the implementation of GEF projects and is executing several initiatives related to water management together with the eight countries. Nonetheless, the project design includes measures for (i) capacity building, (ii) knowledge, data and information sharing, (iii) intersectoral collaboration and (iv) public – private constructive dialogues.
Fiduciary	Low	To ensure effective financial and procurement management ACTO will apply UNEP and IDB procedures. The EA is well experienced in the implementation of GEF projects.
Stakeholder	Low	While the sustainable management of the aquifer is contingent on stakeholder engagement, this project will provide a platform for soliciting stakeholder groups inputs (TDA) and recommendations (SAP) for improved management of the AAS. The SAP will be endorsed at the highest political level in each of the countries.
Other	Low	There is still a risk of new variants of COVID emerging which could impact the project through higher infection rates and its consequences. The project will be responsive to conditions in the region and will adapt the implementation approach (e.g. remote meetings) if COVID: infection levels increase, being guided by national authorities and WHO recommendations. In this context, water security is essential as part of the post COVID-19 response, keeping water & sanitation as top development priority for guaranteeing access to quality water, mainly for vulnerable communities highly groundwater-dependent. Besides, there are endemic areas of Dengue that could affect the development of project activities. During the execution phase, health risks will be monitored, and appropriate decisions will be made to overcome the challenges and keep developing the project.
Overall Risk Rating	Low	This is a low-risk project. An Indigenous Peoples Plan will be developed for the whole project and on-the-ground interventions.

C. ALIGNMENT WITH GEF-8 PROGRAMMING STRATEGIES AND COUNTRY/REGIONAL PRIORITIES

Explain how the proposed interventions are aligned with GEF- 8 programming strategies and country and regional priorities, including how these country strategies and plans relate to the multilateral environmental agreements.

For projects aiming to generate biodiversity benefits (regardless of what the source of the resources is - i.e., BD, CC or LD), please identify which of the 23 targets of the Kunming-Montreal Global Biodiversity Framework the project contributes to and explain how.

Confirm if any country policies that might contradict with intended outcomes of the project have been identified, and how the project will address this. (max. 500 words, approximately 1 page)

This project is aligned with Objective 3 of the **GEF-8 Programming Directions Framework** for the International Waters Focal Area: “*Enhanced water security in freshwater ecosystems*”^{[1]³⁵}. Specifically, the project will support regional priority setting and fact findings by contributing to an updated Amazon basin

TDA/SAP nuancing its chapter on groundwater; and will facilitate implementation of the regional authorities approved Amazon basin SAP promoting groundwater management. In addition, the project will contribute to improving the groundwater policy context at regional and national levels; build capacity to gather and synthesize scientific, local and people science information into a consolidated state of the aquifer overview for improved decision-making processes (particularly through Components 1 and 5). It will also test integrated water management solutions to protect key aquifer recharge zones. Moreover, the project will provide nuanced information for a more accurate water security overview and through pilots will provide information on innovative technologies and approaches for aquifer protection and sustainable management.

Regarding the Kunming-Montreal Global Biodiversity Framework, this project contributes to the reduction of pollution sources from the surface (Target 7, aligned with SDG 6.3) that could affect biodiversity and groundwater environments.

In terms of **regional priorities** (Figure 13), the project is aligned with the mandate of the Amazon Cooperation Treaty supporting integrated sustainable development of the region and fostering a regional cooperation dialogue. In the *Strategic Agenda for Amazon Cooperation* (ACTO, 2010) two main priority areas are identified, which are fully aligned with the project namely: a) natural resources conservation and sustainable management; and b) sustainable development (understood as improving living conditions for people in the basin). Within those main lines of intervention, water resources management is prioritized. The project will target those regional short- and medium-term objectives by contributing to: the promotion of an integrated approach for water resources management with a focus on adapting to climate change scenarios; the promotion of transboundary groundwater agreed actions, improving the technical understanding of the AAS and giving recommendations for legal and institutional frameworks; the participation and involvement of stakeholders in trainings and capacity building activities at different levels (regional, national, municipal and local) and the creation of space for technical discussion in order to agree on regional criteria for the protection and sustainable use of the AAS.

Amazonia Forever, a holistic umbrella program for the sustainable development of the region, promoted by IADB, which aims to work together on forest and climate conservation and to improve people's quality of lives, offering economic alternatives.

The *Belem Declaration*^{[2]⁸⁶} shares common actions with the project such as the institutional strengthening of ACTO, as well as promoting contact networks that articulate research and teaching institutions in the Amazon Region. In addition, governance for the sustainable management of the region's water resources, with the objective of establishing regional protocols for monitoring, cooperation and mutual support in the management of the water resources of the Amazon by the member countries of ACTO. The *Amazon Basin Monthly GRACE Data* could help in monitoring project results. GRACE (Gravity Recovery and Climate Experiment) measures mass distribution and in this instance is used to demonstrate water storage and movement in the basin. Also, **regional programs** like USAID Amazon Regional Environment Program have connections to the conservation of the Amazon basin articulated with the population that lives in these areas.

Planning instruments with respect to aquifer management differ from one country to the other in function of their **national priorities** (Figure 13). **Bolivia**, for example, in the *Economic and Social Development Plan 2021-2025*^{[3]⁸⁷}, identifies “Sustainable and Balanced Environment, in harmony with Mother Earth” as one of

the 10 priority working areas aiming at “*Strengthening the integrated management of surface and groundwater resources, in order to achieve water security*”. In **Brazil**, the project is aligned with the *Strategic Institutional Plan 2019-2022*^{[4]³⁸} (ANA, 2021), which maps out the action’s agenda in terms of water resources, supporting its mission to guarantee water security for sustainable development. In particular, it will contribute to the following strategic objectives: a) Regulation of water resources (identified as OE-02A); b) Hydrological data (OE-03), having a specific initiative for groundwater monitoring; c) Integrated and Planned Management (OE-06), having a specific project for promoting international cooperation in the Amazon Basin; d) Institutional Governance (OE-08); and e) Innovation (OE-13). Moreover, it is aligned with the *National Water Security Plan* and the governance challenges identified for groundwater for the country (ANA, 2022). The project is aligned with **Colombia**’s National Development Plan: ‘*Colombia World Power of Life*’^{[5]³⁹}, where the Amazon is one of the prioritized territories to develop territorial planning and governance programs around the water cycle. In **Ecuador**, the project is aligned with the *National Plan for Integrated and Integral Water Resources Management of hydrographic basins and micro-basins in Ecuador* (CISPDR, 2016)^{[6]⁴⁰}, its proposed water protection measures and rational use of groundwater resources. Regarding **Guyana**, it is aligned with the objectives set in the Guyana Water Incorporated Strategic Plan 2021-2025 and the proposed Groundwater Management Plan of Guyana Water Inc. While in **Perú** it supports the *Water Resources Policy and National Strategy*^{[7]⁴¹} (ANA, 2013) and the *National Water Resources Plan* (updated in 2018 to include water security concept). In **Venezuela**, the project aligns with the *National Plan for Integrated Water Resources Management* (Groundwater Program) and in **Suriname** it is aligned with the *Multi-Year Development Plan 2022-2026*, identifying water security and green growth as priority areas.

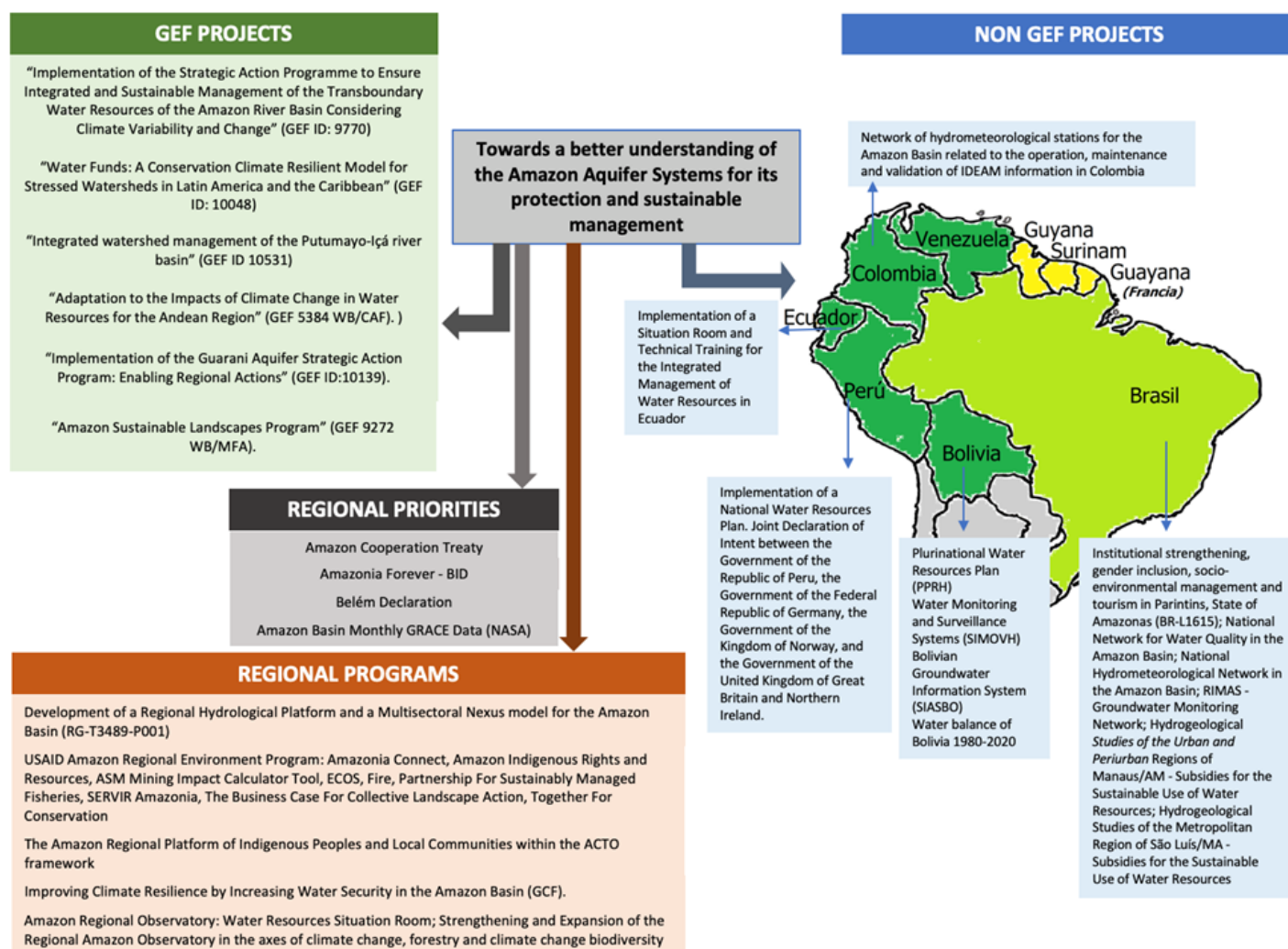


Figure 13. Alignment with others regional priorities, programs and projects.

[1] Refer to GEF-8 Programming Directions, GEF/R.8/17 https://www.thegef.org/sites/default/files/documents/2022-01/GEF_R.08_17_GEF-8_Programming_Directions.pdf

[2] <https://otca.org/en/wp-content/uploads/2023/10/Declaration-of-Belem.pdf>

[3] https://observatorioplanificacion.cepal.org/sites/default/files/plan/files/PDES_2021-2025a_compressed.pdf

[4] https://www.gov.br/ana/pt-br/todos-os-documentos-do-portal/documentos-gges/Plano_Estrategico_Reviso_2021_v11_compressed2.pdf

[5] https://www.dnp.gov.co/Prensa/_Podcast/Paginas/plan-nacional-de-desarrollo-colombia-potencia-mundial-de-la-vida.aspx

[6] <http://suia.ambiente.gob.ec/files/MEMORIA%20PLAN%20NACIONAL%20DEL%20AGUA.pdf>

[7] http://www.ana.gob.pe/sites/default/files/default_images/politica_y_estrategia_nacional_de_recursos_hidricos_ana.pdf

D. POLICY REQUIREMENTS

Gender Equality and Women's Empowerment

We confirm that gender dimensions relevant to the project have been addressed during Project Preparation as per GEF Policy and are clearly articulated in the Project Description (Section B).

Yes

1) Does the project expect to include any gender-responsive-measures to address gender gaps or promote gender equality and women's empowerment?

Yes

If the project expects to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment, please indicate in which results area(s) the project is expected to contribute to gender equality:

Closing gender gaps in access to and control over natural resources;

Improving women's participation and decision-making; and/or

Yes

Generating socio-economic benefits or services for women.

Yes

2) Does the project's results framework or logical framework include gender-sensitive indicators?

Yes

Stakeholder Engagement

We confirm that key stakeholders were consulted during Project Preparation as required per GEF policy, their relevant roles to project outcomes has been clearly articulated in the Project Description (Section B) and that a Stakeholder Engagement Plan has been developed before CEO endorsement.

Yes

Select what role civil society will play in the Project

Consulted only;

Member of Advisory Body; Contractor; **Yes**

Co-financier; **Yes**

Member of project steering committee or equivalent decision-making body ;

Executor or co-executor;

Other (Please explain)

Private Sector

Will there be private sector engagement in the project?

Yes

And if so, has its role been described and justified in section B project description?

Yes

Environmental and Social Safeguards

We confirm that we have provided information regarding Environmental and Social risks associated with the proposed project or program, including risk screenings/ assessments and, if applicable, management plans or other measures to address identified risks and impacts (this information should be presented in Annex E).

Yes

Please provide overall Project/Program Risk Classification

Overall Project/Program Risk Classification

PIF	CEO Endorsement/Approval	MTR	TE
Low	Low		

E. OTHER REQUIREMENTS

Knowledge management

We confirm that an approach to Knowledge Management and Learning has been clearly described during Project Preparation in the Project Description and that these activities have been budgeted and an anticipated timeline for delivery of relevant outputs has been provided.

Yes

Socio-economic Benefits

We confirm that the project design has considered socio-economic benefits to be delivered by the project and these have been clearly described in the Project Description and will be monitored and reported on during project implementation (at MTR and TER).

The impacts derived from the project intervention will generate regional, national and local socioeconomic benefits within the Amazon basin. The sustainable management of the territory and water resources includes the promotion of ecosystem services, contributing to the improvement and sustainability of the livelihoods of men and women, mainly indigenous, who depend on the aquatic ecosystems in the scope of the Project.

At the regional level in the Amazon, the project will generate learning and improve the tools and capacities of decision makers and other national actors for the management of the territory, in order to replicate models generated by the pilots and promote financial mechanisms for the conservation of water ecosystem services in other Amazonian landscapes, which in turn provide benefits to the local population.

These benefits at the local and national level are linked to the protection and better management of protected areas with high conservation value and integrated management of water resources, which will translate into

adaptation to the effects of climate change on vulnerable populations, as well as reducing the dangers to freshwater resources.

In the Amazon basin, the project will strengthen cooperation for the valuation and conservation of biodiversity and effective governance in the use of water resources, which until now have not been sufficiently strengthened. It will also contribute to international and national agreements aimed at ensuring that the ecosystem is healthy and functional.

The socioeconomic benefits derived from the project's interventions will be assessed through periodic evaluations, with data collection to measure progress. Annual reports will summarize the impacts on biodiversity conservation, governance, and climate change adaptation, with detailed analysis provided in the Project Results Framework and M&E annex. These reports will ensure that the outcomes of the project are systematically tracked and that the benefits to the Amazon basin are clearly documented and communicated to stakeholders.

Environment Benefits

The actions proposed by the project will bring environment benefits, including:

- Enhanced institutional capacity at ACTO and countries to strengthen baseline and develop local, regional, national and regional strategies for groundwater management and conservation.
- A better understanding of the groundwater processes coupled to surface and atmospheric processes will allow to develop a global overview of the water balance, not only for the Amazon basin, but also with important impacts for the planet.
- Improved understanding of physical processes by remote sensing, in-situ field measurements and modeling activities will allow stakeholders to make science-based decisions, thus, promoting the conservation of aquifers.
- Each pilot will inform on groundwater processes, delimitation of potential pollution sources into aquifers, management of groundwater use for water supply to local communities.

ANNEX A: FINANCING TABLES

GEF Financing Table

Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Programming of Funds	Grant / Non- Grant	GEF Project Grant(\$)	Agency Fee(\$)	Total GEF Financing (\$)
UNEP	GET	Regional	International Waters	International Waters: IW-3	Grant	6,865,349.00	617,881.00	7,483,230.00
IADB	GET	Regional	International Waters	International Waters: IW-3	Grant	6,596,119.00	593,651.00	7,189,770.00
Total GEF Resources (\$)						13,461,468.00	1,211,532.00	14,673,000.00

Project Preparation Grant (PPG)

Was a Project Preparation Grant requested?

true

PPG Amount (\$)

300000

PPG Agency Fee (\$)

27000

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Programming of Funds	PPG(\$)	Agency Fee(\$)	Total PPG Funding(\$)
UNEP	GET	Regional	International Waters	International Waters: IW-3	153,000.00	13,770.00	166,770.00
IADB	GET	Regional	International Waters	International Waters: IW-3	147,000.00	13,230.00	160,230.00
Total PPG Amount (\$)					300,000.00	27,000.00	327,000.00

Please provide Justification

Sources of Funds for Country Star Allocation

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Sources of Funds	Total(\$)
Total GEF Resources					0.00

Focal Area Elements

Programming Directions	Trust Fund	GEF Project Financing(\$)	Co-financing(\$)
IW-3	GET	13,461,468.00	174463442
Total Project Cost		13,461,468.00	174,463,442.00

Confirmed Co-financing for the project, by name and type

Please include evidence for each co-financing source for this project in the tab of the portal

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount(\$)
Recipient Country Government	Bolivia – Ministry of Environment and Water	Public Investment	Investment mobilized	1572456
Recipient Country Government	Bolivia – Mining Geological Service	Public Investment	Investment mobilized	481882
Recipient Country Government	Colombia - Corporation for the Sustainable Development of Southern Amazonia	Public Investment	Investment mobilized	4615385
Recipient Country Government	Colombia - Corporation for the Sustainable Development of the Northern and Eastern Amazon	Public Investment	Investment mobilized	574205
Recipient Country Government	Peru - National Water Authority	In-kind	Recurrent expenditures	951850
Recipient Country Government	Peru - National Water Authority	Public Investment	Investment mobilized	2304167
Recipient Country Government	Venezuela – Ministry of Popular Power for Ecosocialism	In-kind	Recurrent expenditures	572000
Recipient Country Government	Bolivia – Ministry of Environment and Water	In-kind	Recurrent expenditures	162400
Recipient Country Government	Brazil - National Agency for Water and Basic Sanitation	Public Investment	Investment mobilized	48480957
Recipient Country Government	Brazil - National Agency for Water and Basic Sanitation	In-kind	Recurrent expenditures	466135
Recipient Country Government	Colombia - Ministry of Environment and Sustainable Development	In-kind	Recurrent expenditures	209390
Recipient Country Government	Colombia - Amazon Institute for Scientific Research	In-kind	Recurrent expenditures	134572
Recipient Country Government	Ecuador - Ministry of Environment, Water and Ecological Transition	Public Investment	Investment mobilized	16196806
Recipient Country Government	Ecuador - Ministry of Environment, Water and Ecological Transition	In-kind	Recurrent expenditures	912471
Recipient Country Government	Guyana – Environmental Protection Agency	In-kind	Recurrent expenditures	327401
Recipient Country Government	Guyana – Hydrometeorological Service	In-kind	Recurrent expenditures	627050

Recipient Country Government	Guyana Water Inc	In-kind	Recurrent expenditures	840413
Recipient Country Government	Suriname Water Supply Company	In-kind	Recurrent expenditures	100000
Recipient Country Government	Suriname - Ministry of Spatial Planning & Environment	In-kind	Recurrent expenditures	384600
Recipient Country Government	Suriname - Ministry of Spatial Planning & Environment	Public Investment	Investment mobilized	19302
Others	Amazon Cooperation Treaty Organization	In-kind	Recurrent expenditures	630000
Recipient Country Government	Geological Service of Brazil (GSB)	Public Investment	Investment mobilized	16060000
GEF Agency	Inter-American Development Bank	Grant	Investment mobilized	2050000
GEF Agency	Inter-American Development Bank	Loans	Investment mobilized	63790000
GEF Agency	Inter-American Development Bank	Other	Investment mobilized	12000000
Total Co-financing				174,463,442.00

Please describe the investment mobilized portion of the co-financing

The eight ACTO member countries through their respective ministries responsible for the protection of water resources on the Amazon basin have provided the details and type of co-financing to be provided during the implementation of the project. The countries that will provide support through public investments are Bolivia, Brazil, Colombia, Ecuador, Suriname and Peru. These investments are aligned with all the 5 outcomes of the project, detailed below:

Public investments in Bolivia come from investments mobilized from projects within the Ministry of Environment and Water (MMAyA) and from the Mining Geological Service (SERGEOMIN). The MMAyA's public investments include water sowing projects and management of water recharge zones in five micro-basins in the municipalities of Filadelfia, Bolpebra, Bella Flor and Santa Rosa de Abuná in the department of Pando. In addition, natural resources restoration and conservation in the micro-basin of "Arroyo Bahía" and micro-basin "C" in the municipality of Cobija. Furthermore, SERGEOMIN documents and updates the database of the Hydrogeological Information System of Bolivia (SIHIBO) periodically and through its Thematic Maps Program is preparing, updating and publishing thematic maps (scale 1:250,000) of the pilot area with Brazil.. These investments will contribute to Outcome 1 and 3, specifically to Pilot implementation (Appendix 11-ii) in the department of Pando.

In the case of Brazil, public investments come from the Brazil Water Agency (ANA) and the Ministry of Energy and Mines through the Geological Service of Brazil. Among ANA's public investments is the PROGESTAO program. It is a financial incentive program for State systems in institutional strengthening and water resources management actions, through the achievement of goals defined based on the management complexity chosen by the federation unit. Other public investments come from the National Hydrometeorological Network in the Amazon Basin and the National Water Resources Information System – SNIRH. These public investments involve the equipment, operation and analysis of water quality and quantity data. In addition, ANA is investing in hydrogeological studies in the regions of Manaus and Sao Luis Island for the sustainable management of water resources.

In addition, the Geological Survey of Brazil co-financing includes the operation of the National Hydrometeorological Network in the Amazon Basin and the operation of the Groundwater Information System in the Amazon Basin (SIAGAS). It also includes the preparation and update of hydrogeological maps in the Amazon Basin, and the operation of the Integrated Groundwater Monitoring Network and the Global Network of isotopes in Precipitation. Brazil's public investments co-financing contribute to outcomes 1, 2, 3 and 4.

Colombia's public investment contribution is linked to two institutions: Corporación para el Desarrollo Sostenible del Sur de la Amazonia (CORPOAMAZONIA) and Corporación para el Desarrollo Sostenible del Norte y Oriente Amazónico (CDA). The co-financing is linked to the "Amazon for the World" action plans, for example the "Integrated management of water resources" program, which allows for the consolidation of territorial planning actions around water; promoting knowledge of water resources and establishing regulations for their use and management in a sustainable manner; and fostering an environmental monitoring culture. These public investments will contribute to outcomes 2 and 3 mainly.

The Ministry of Environment, Water, and Ecological Transition of Ecuador committed public investment through INAMHI and MAATE. The public investment includes projects for integrated management, preventive, protection, recovery, restoration, conservation and improvement of water resources and their associated ecosystems, in addition to the automation of the national hydrometeorological observation network (INAMHI) for decision-making and ecological transition. On the other hand, they are investing in the evaluation of environmental pollution of water bodies and in projects of the national plan for integrated management of water in the hydrographic basins of Ecuador. The co-financing contributes to outcomes 1, 2, 3 and 4.

The Peruvian government will provide support to the project in public investment through the National Plan for Environmental Evaluation and Supervision (PLANEFA) for 1,050 monitoring stations along the Amazonian region, which will contribute to outcomes 1, and 2.

Public investment from Suriname come from two projects related with geomorphological research in mangrove vegetation restoration and water analysis in the coastal plain. These investments will contribute to outcomes 1, and 2.

The Inter-American Development Bank (IDB) will also support ACTO member countries by providing cofinancing, which has been identified through a mapping of its portfolio in the Amazon region and its synergies with the GEF ID 11108 Project. The IDB's co-financing includes non-reimbursable resources executed through technical cooperation (grants), reimbursable resources (loans) under the scope of the Water and Sanitation Division. In addition, the IDB is currently developing a Program named 'Improving Climate Resilience by Increasing Water Security in the Amazon Basin,' which is under consideration for approval by the Green Climate Fund (GCF) Board in February 2025. IDB's projects complement GEF ID 11108 because it technically supports ACTO's efforts regarding its water security agenda. For instance, several technical cooperations aim to better understand climate change impacts in the Amazon basin and to strengthen the analytical capabilities of the Amazon Regional Observatory, which will also benefit the foreseen regional groundwater monitoring network "(under Output 2.3). All the loans associated as co-finance represent water and sanitation improvements in amazon territory, that have a direct or indirect relation with a component related to groundwater.

ANNEX B: ENDORSEMENTS

GEF Agency(ies) Certification

GEF Agency Type	Date	Project Contact Person	Phone	Email
GEF Agency Coordinator	8/19/2024	Ersin Esen	41229178196	ersin.esen@un.org
Project Coordinator	8/19/2024	Isabelle Vanderbeck	12027254201	isabelle.vanderbeck@un.org
GEF Agency Coordinator	8/19/2024	Gmelina Ramirez	12026231000	gmelinar@iadb.org
Project Coordinator	8/19/2024	Raul Munoz Castillo	12026231000	raulmu@iadb.org

Record of Endorsement of GEF Operational Focal Point (s) on Behalf of the Government(s):

Please attach the Operational Focal Point endorsement letter(s) with this template.

Name of GEF OFF	Position	Ministry	Date (MM/DD/YYYY)
Bolivia – Carlos David Guachalla Terrazas	Viceminister of Planning and Coordination	Ministry of Development Planning	5/8/2023
Brazil – Livia Farias Ferreira de Oliveira	General Coordinator for External Finance	Ministry of Finance	4/28/2023
Colombia - Maria Teresa Becerra Ramirez	Head of the International Affairs Office	Ministry of Environment and Sustainable Development	5/8/2023
Ecuador - José Luis Naula Naula	Coordinator - International Cooperation Directorate	Environment, Water, and Ecological Transition Ministry	5/10/2023
Guyana - Kemraj Parsram	Executive director	Environmental Protection Agency	5/2/2023
Peru - Inés Pando Ávila	Head of the General Office for Cooperation and International Affairs	Ministry of Environment	5/10/2023
Suriname - Ivette Pengel	Deputy Director Climate Change	Ministry of Spatial Planning and Environment	5/9/2023
Venezuela - Miguel Serrano	Director of Integration and International Affairs	Ministry of People's Power for Ecosocialism	4/21/2023

ANNEX C: PROJECT RESULTS FRAMEWORK

Please indicate the page number in the Project Document where the project results and M&E frameworks can be found. Please also paste below the Project Results Framework from the Agency document.

Project Objective	Objective level Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	UNEP MTS reference* Relevant Programme of Work (PoW) Outcomes	Relevant SDG target(s) and indicators
To get a common understanding of the Amazon Aquifer Systems (AAS) -the invisible giant-, to strengthen existing regional governance, and to develop and endorse an integrated groundwater management for its protection and sustainable use, thereby enhancing water security and	GEF Core Indicator 4. Area of landscapes under improved practices (hectare)	Insufficient knowledge at transboundary level. Lack of agreements for shared	GEF I4. 132,650 Ha (see Output 3.1) GEF I7. 1 shared freshwater system Contributions to Core indicators 7.1, 7.2, 7.3:	Country reports. Project reports.	Assumptions: All CM support the development of scientific, governance, communication and other activities.	Outcome 2A: An economically and socially sustainable pathway for halting and reversing the loss of biodiversity and	SDG 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

ecosystem resilience in the Amazon region.	<p>GEF Core indicator (7): Number of shared water ecosystems under new or improved cooperative management:</p> <p>GEF Core Indicator 11.</p> <p>People benefiting from GEF-financed investments disaggregated by sex (count).</p>	<p>groundwater governance.</p> <p>Lack of a common protection strategy for the AAS.</p> <p>Low public awareness related to AAS.</p> <p>Low regional technical capacities related to groundwater topics.</p> <p>No such data exchange rules exist in the region.</p> <p>No such groundwater regional monitoring protocols exist in the region.</p> <p>Aquifer monitoring activities not systematically carried out in all CM, and not harmonized across countries, therefore no such a regional monitoring network design exist in the region.</p>	<ul style="list-style-type: none"> – Agreed of TDA/SAP (<i>see Output 1.5</i>). – Recommendations for improving national legal, technical and institutional frameworks (<i>see Output 2.2</i>) – Endorsed AAS SAP at ministerial level, gender sensitive (<i>see Output 4.1</i>). – Contributions to Core indicator 4.4 (<i>see Output 5.4</i>). <p>GEF I11. 271,012 inhabitants (50% women)</p> <p>(<i>see Outputs 1.1, 1.2, 1.3, 1.4, 1.5, 2.2, 2.3, 2.4, 3.4, 4.1, 4.2, 5.1, 5.2, 5.3, 5.4</i>)</p>	<p>PSC reports.</p> <p>ACTO minutes.</p> <p>Training workshop reports.</p> <p>Capacity needs assessment report per CM (<i>see Output 5.1</i>)</p> <p>IW: LEARN website and publications.</p> <p>Symposium and international conference proceedings.</p>	<p>All CM endorse the SAP content and formally commit to its implementation.</p> <p>All CM support the development of regional protocols for groundwater monitoring and analysis.</p> <p>National institutions in CM actively support the implementation of pilot projects for groundwater knowledge and governance.</p> <p>Regional political will be maintained during AAS project.</p> <p>Risks:</p> <p>Global (climate and human-induced) changes impact on groundwater resources are larger than predicted.</p> <p>Poor inter and intra-governmental and intersectoral coordination effective during project execution.</p> <p>COVID or similar health restrictions limit the meetings, capacity development and dissemination of results.</p>	<p>ecosystem integrity is established.</p> <p>Outcome 2B:</p> <p>Sustainable management of nature is adopted and implemented in development frameworks.</p> <p>Outcome 2C:</p> <p>Nature conservation and restoration are enhanced.</p> <p>Outcome 3C:</p> <p>Releases of pollutants to air, water, soil and the ocean are reduced.</p>	<p>SDG 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.</p> <p>SDG 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.</p> <p>SDG 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water</p>
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							<p>scarcity and substantially reduce the number of people</p> <p>suffering from water scarcity.</p> <p>SDG 6.5:</p> <p>By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.</p> <p>SDG 6.6:</p> <p>By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.</p>
Component 1: Consolidation and expansion of the current understanding in the functioning of and threats to the Amazon Aquifer Systems (AAS)							
Project Outcome	Outcome Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Outcome(s) and indicator(s)	Relevant SDG target(s) and indicators
<p>Outcome 1</p> <p>Improved technical-scientific knowledge about the AAS and drivers of change to inform decision making for resource planning and sustainable groundwater management considering each country's context.</p>	<p>1. TDA approved by CM and informing management decisions at national and regional levels.</p> <p>2. Increased information about physical, human-induced hazards, aquifer vulnerability and priority zones for conservation.</p>	<p>The limits, the hydraulic behavior, the interconnections between the regional geological formations and the structural stratigraphic characteristics of the transboundary aquifers are poorly understood.</p> <p>At the same time, the present and future demands of the</p>	<p>1. TDA report validated by key stakeholders and CM (Yr 3, <i>see Output 1.5</i>)</p> <p>2.</p> <p>>15 submitted (by project's end) peer-reviewed publication in international journals (Q1 and Q2 quartiles).</p> <p>>=2 proceedings (symposium and international</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p> <p>ACTO minutes.</p>	<p>Assumptions:</p> <p>All CM support the development of scientific studies at the AAS scale.</p> <p>All CM support groundwater data sharing.</p> <p>Stakeholders actively participate in</p>	<p>Same as above.</p>	<p>Same as above.</p>

	<p>3. Number of groundwater-based Citizen Science initiatives.</p> <p>4. Number of technical-capacity building workshops.</p> <p>5. Number of certification programs in AAS.</p> <p>6. Centralized data.</p>	<p>resource by different stakeholders need to be estimated, under adverse effects of variability and climate change, thus to better assess water security in the region.</p> <p>Poor understanding and quantification the different hazards and vulnerability (e.g., degradation of quality due to pollution from various sources) in the AAS.</p> <p>Groundwater-based Citizen Science initiatives don't exist in the region.</p> <p>There is no certification program on knowledge and governance in AAS topics.</p> <p>CM currently have no central knowledge hub through which to access guidance or exchange data and information.</p>	<p>conference) (see <i>Output 1.5</i>).</p> <p>>30 international webinars on scientific topics related to groundwater and AAS.</p> <p>scientific data into ARO (see <i>Output 1.5</i>).</p> <p>3. Five (5) gender sensitive groundwater-based Citizen Science initiatives developed at priority zones and/or pilot sites (see <i>Output 1.5</i>).</p> <p>4. >25 science-based capacity building workshops to ACTO and CM.</p> <p>5. One (1) certification program in AAS, knowledge and governance (see <i>Output 1.5</i>).</p> <p>6. data uploaded into ARO's new AAS module.</p>	<p>Training workshop reports.</p> <p>Symposium and conference proceedings, Peer-reviewed scientific publications, SCOPUS, Web of Science (WoS).</p> <p>Data inventory and included into ARO.</p>	<p>TDA development.</p> <p>Risks:</p> <p>Development of TDA does not lead to active involvement of stakeholders.</p>		
Project Outputs	Output Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Direct Outcome(s)	Relevant SDG target(s) and indicators
<p>Output 1.1</p> <p>An assessment of current state of the groundwater resources building inter alia on geological, geophysics, hydraulics, hydrodynamic, hydro-chemical, isotopic hydrology, and hydrogeological studies.</p>	<p>1. Number of peer-reviewed scientific publications submitted before the end of the project.</p> <p>2. Number of technical capacity building workshops for ACTO and CM staff.</p> <p>3. Number of science-based</p>	<p>Insufficient knowledge at transboundary level.</p> <p>A systemic AAS baseline study does not exist, including physical, hazards, global changes and groundwater monitoring network.</p>	<p>1. >2 submitted (by project's end) peer-reviewed publication in international journals (Q1 and Q2 quartiles).</p> <p>2. >2 science-based capacity building workshops to ACTO and CM.</p> <p>3. >2 science-based communication notes.</p> <p>4. Report on the interaction between</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p> <p>ACTO minutes.</p> <p>Training workshop reports.</p>	<p>Assumptions:</p> <p>Stakeholders actively participate in the AAS baseline assessment.</p> <p>Consultants are capable of producing scientific peer-reviewed publications.</p> <p>Risks:</p> <p>Poor inter and intra-governmental and</p>	Same as above.	Same as above.

	communication notes. 4. Interaction between AAS and pilot scales		consultants at the AAS scale with CM pilots.	Peer-reviewed scientific publications, SCOPUS, Web of Science (WoS). Science-based communication notes in Project website and IW-LEARN.	intersectoral coordination effective during project execution. Key national partners delay in providing valuable information for the baseline assessment. Insufficient technical capacity of potential consultants.		
Output 1.2 A geo-referenced base map of the Amazon Aquifer Systems supported by a GIS infrastructure including specific vulnerability maps based on available or new information from each country.	1. A collection of baseline maps for physical characterization of AAS. 2. Visualization of baseline maps. 3. Number of peer-reviewed scientific publications submitted before the end of the project. 4. Number of technical capacity building workshops for ACTO and CM staff. 5. Number of science-based communication notes. 6. Interaction between AAS and pilot scales. 7. Definition of priority zones.	A centralized collection of georeferenced data and maps does not exist for the AAS. Insufficient knowledge of human-induced hazards and vulnerability into AAS resources. An AAS hierarchical-based analysis to define priority zones for monitoring and protection does not exist. A publicly available collection of georeferenced data for AAS does not exist.	1. 1 digital Atlas of the AAS. 2. Maps uploaded into project website and ARO's AAS module. 3. >3 submitted (by project's end) peer-reviewed publication in international journals (Q1 and Q2 quartiles). 4. >4 science-based capacity building workshops to ACTO and CM. 5. >3 science-based communication notes. 6. Report on the interaction between consultants at the AAS scale with CM pilots. 7. Report on the definition of priority zones in AAS to accommodate monitoring, protection and the development of Citizen Science initiatives.	Country reports. Project reports. PSC reports. ACTO minutes. Training workshop reports. Peer-reviewed scientific publications, SCOPUS, Web of Science (WoS). Project website. Amazon Regional Observatory (ARO)'s new AAS module. Science-based communication notes in Project website and IW-LEARN.	Assumptions: Consultants are capable of producing scientific peer-reviewed publications. ARO team is capable of creating a new AAS module. Risks: Insufficient technical capacity of potential consultants.	Same as above.	Same as above.

<p>Output 1.3</p> <p>A water security analysis and, hydrological and hydrogeological scenario modelling of aquifer behavior, with focus on frontier zones of the Amazon Aquifer Systems (AAS), under different climate change and socio-economic development scenarios.</p>	<p>1. Hydrological and hydrogeological modelling considering global changes and socio-economic development scenarios.</p> <p>2. Effects of El Niño and la Niña for the AAS.</p> <p>3. Development of global models (atmospheric, surface water and groundwater) at AAS scale.</p> <p>4. Development of water security analysis at AAS scale.</p> <p>5. Number of peer-reviewed scientific publications submitted before the end of the project.</p> <p>6. Number of technical capacity building workshops for ACTO and CM staff.</p> <p>7. Number of science-based communication notes.</p> <p>8. Interaction between AAS and pilot scales.</p>	<p>Insufficient knowledge on the impacts of considering global changes (climate and human-induced) and socio-economic development scenarios for the water security purposes, as well as for protection of groundwater resources.</p>	<p>1. A report on hydrological and hydrogeological modeling considering global changes and socio-economic development scenarios.</p> <p>2. A report on the effects of El Niño and la Niña for the AAS.</p> <p>3. A report on development of global models (atmospheric, surface water and groundwater) at AAS scale.</p> <p>4. A report on the development of water security analysis at AAS scale.</p> <p>5. >4 submitted (by project's end) peer-reviewed publication in international journals (Q1 and Q2 quartiles).</p> <p>6. >4 science-based capacity building workshops to ACTO and CM.</p> <p>7. >3 science-based communication notes.</p> <p>8. Report on the interaction between consultants at the AAS scale with CM pilots.</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p> <p>ACTO minutes.</p> <p>Training workshop reports.</p> <p>Peer-reviewed scientific publications, SCOPUS, Web of Science (WoS).</p> <p>Science-based communication notes in Project website and IW-LEARN.</p>	<p>Assumptions:</p> <p>CM agree on climate change and socio-economic development scenarios to be used.</p> <p>Risks:</p> <p>CM don't agree on climate change and socio-economic development scenarios to be used.</p> <p>Insufficient technical capacity of potential consultants.</p>	<p>Same as above.</p>	<p>Same as above.</p>
<p>Output 1.4</p> <p>Documented targeted research on:</p>	<p>1. Surface-groundwater interaction.</p>	<p>Limited knowledge on the interaction between surface and groundwater processes,</p>	<p>1. A report on the interaction of surface and groundwater.</p>	<p>Project reports.</p>	<p>Assumptions:</p> <p>Consultants are capable of producing scientific peer-</p>	<p>Same as above.</p>	<p>Same as above.</p>

<p>- Hydraulic interconnection with surface water with a focus on border areas, including a study of recharge mechanisms.</p> <p>- Understanding pollution threats to groundwater (i.e., As, Pb, Hg, and others to be determined by member countries).</p>	<p>2. River-aquifer interaction.</p>	<p>especially those related to different rates of recharge.</p>	<p>2. A report on river-aquifer interaction.</p>	<p>Training workshop reports.</p>	<p>reviewed publications.</p>		
	<p>3. Isotopic analysis near 15 ACTO gaging stations.</p> <p>4. Modelling of pollutant threats.</p> <p>5. Number of Citizen Science initiatives.</p> <p>6. Number of peer-reviewed scientific publications submitted before the end of the project.</p> <p>7. Number of technical capacity building workshops for ACTO and CM staff.</p> <p>8. Number of science-based communication notes.</p> <p>9. Visualization of field measurements.</p>	<p>Limited characterization of the interaction of rivers and aquifers in terms of exchange rates and contamination sources, including sediments.</p> <p>Limited application of isotopic analysis in AAS to determine sources, flow paths, water age, vulnerability to pollution and climate conditions.</p> <p>Limited modelling scenarios for pollution threats for AAS.</p> <p>Groundwater Citizen Science initiatives don't exist in the Amazon basin.</p> <p>A publicly available scientific data repository for AAS does not exist.</p>	<p>3. A report on isotopic analysis near 15 ACTO gaging stations.</p> <p>4. A report on modelling of pollutant threats.</p> <p>5. Five (5) gender sensitive groundwater-based Citizen Science initiatives developed at priority zones and/or pilot sites.</p> <p>6. >6 submitted (by project's end) peer-reviewed publication in international journals (Q1 and Q2 quartiles).</p> <p>7. >15 science-based capacity building workshops to ACTO and CM.</p> <p>8. >6 science-based communication notes.</p> <p>9. Scientific data uploaded into project website and ARO's AAS module.</p>	<p>Peer-reviewed scientific publications, SCOPUS, Web of Science (WoS).</p> <p>Project website.</p> <p>Amazon Regional Observatory (ARO)'s new AAS module.</p> <p>Science-based communication notes in Project website and IW-LEARN.</p>	<p>Local communities willing to engage in Citizen Science initiatives.</p> <p>Risks:</p> <p>Insufficient technical capacity of potential consultants.</p> <p>Local communities not willing to engage in Citizen Science initiatives.</p>		
<p>Output 1.5</p> <p>An agreed AAS Transboundary Diagnostic Analysis by the RADA (Network of Water Authorities).</p>	<p>1. An agreed TDA for AAS.</p> <p>2. Recognized role of science and education to decision making for different stakeholders in AAS.</p> <p>3. Centralized data.</p>	<p>Lack of jointly conducted science-based assessments of the current state of groundwater resources, and related modelling of regional behavior and evaluation of future scenarios.</p>	<p>1. TDA approved by PSC and accepted by ministerial level agencies (Yr 3).</p> <p>2. Certification program organized with two tracks (technical and governance) (see <i>Appendix 13</i>).</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p>	<p>Assumptions:</p> <p>Countries accept TDA conclusions and recommendations.</p> <p>Stakeholders actively participate in</p>	<p>Same as above.</p>	<p>Same as above.</p>

	4. Number of international scientific events for technical discussion and collaboration.	<p>Lack of certification program in AAS topics.</p> <p>Lack of science-based support to communication activities in AAS.</p> <p>Lack of centralized repository of AAS data.</p> <p>An international event that tackles AAS topics does not exist.</p>	<p>3. Development of the Amazon Regional Observatory (ARO)'s new AAS module.</p> <p>4. A mid-project international symposium and an end-project international conference on AAS topics.</p>	<p>ACTO minutes.</p> <p>National reports indicating acceptance of TDA.</p> <p>Training workshop reports.</p> <p>Symposium and conference proceedings.</p> <p>Data uploaded into ARO.</p>	<p>TDA development.</p> <p>Risks:</p> <p>Key national partners delay in providing valuable information for the TDA.</p>		
Component 2: Towards a multilevel management system for the AAS							
Project Outcome	Outcome Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Outcome(s) and indicator(s)	Relevant SDG target(s) and indicators
<p>Outcome 2</p> <p>Agreed elements for promoting transboundary cooperation and coordinated groundwater management at regional and national level.</p>	<p>1. Prepared White paper</p> <p>2. Increased recognition of ACTO's coordinating role in AAS</p> <p>3. Increased public participation in groundwater governance decisions (% women).</p> <p>4. # of policy briefs published and disseminated at ACTO, CM and international events.</p> <p>5. Sustainable groundwater management in Guyana and Suriname.</p>	<p>Limited knowledge of CM legal, technical, institutional frameworks on groundwater management and governance.</p> <p>Limited knowledge of CM groundwater information and monitoring methodologies.</p> <p>Lack of regional groundwater monitoring guidelines.</p> <p>Lack of bilateral or regional agreements for shared groundwater governance.</p> <p>Need for capacity strengths in Guyana and Suriname regarding groundwater management.</p>	<p>1. A White paper strengthening and articulating: a) legal and institutional frameworks of CM, as well as promoting the protection and sustainable conjunctive use of surface and groundwater resources; b) ACTO's role to support coordination for the regional management of groundwater resources, disseminated to stakeholders in 8 CM and ACTO.</p> <p>2. Dissemination of White paper at national, regional and international events.</p> <p>3. Eight (8) policy briefs related to White paper customized and shared publicly to each CM.</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p> <p>ACTO minutes.</p> <p>White paper (document).</p> <p>Policy briefs.</p>	<p>Assumptions:</p> <p>All CM continue to support ACTO's strengthening.</p> <p>Stakeholders actively participate in White paper development.</p> <p>Risks:</p> <p>Lack of Political willingness to implement and/or agreement on harmonized policies.</p> <p>CM do not agree to establish regional protocols for groundwater monitoring.</p>	Same as above.	Same as above.

			<p>4. Agreed regional protocols for groundwater monitoring and adopted by CM (during the RADA meeting).</p> <p>5. Roadmap to improve technical, regulatory and institutional frameworks on groundwater management in Guyana and Suriname.</p>				
Project Outputs	Output Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Direct Outcome(s)	Relevant SDG target(s) and indicators
<p>Output 2.1</p> <p>Assessment and gap analysis of legal, regulatory frameworks and institutional capacities for groundwater management in the region and countries including model policies and regulations toolkits for necessary reforms.</p>	<p>1. Synthesis reports on assessment of legal, regulatory frameworks, institutional capacities for groundwater management.</p>	<p>Limited knowledge of CM legal, technical, and institutional frameworks on groundwater management and governance.</p>	<p>1.</p> <p>A report on the institutional, legal and public policies framework of CM.</p> <p>A synthesis report on strengths, weaknesses and gaps regarding groundwater management.</p> <p>A report on socioeconomic analysis related to groundwater use, including gender inequalities and ethnic minorities.</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p> <p>ACTO minutes.</p>	<p>Assumptions:</p> <p>Countries support the assessment of legal, regulatory frameworks and institutional capacities for groundwater management.</p> <p>Risks:</p> <p>Key national partners delay in providing valuable information the assessment.</p>	<p>Same as above.</p>	<p>Same as above.</p>
<p>Output 2.2</p> <p>A gender responsive White Paper with recommendations for (i) improving national legal, technical, and institutional frameworks on groundwater management and regional coordination, and (ii) strengthening ACTO's cooperation role on groundwater resources management.</p>	<p>1. An agreed and disseminated White Paper.</p>	<p>Limited knowledge of CM legal, technical, and institutional frameworks on groundwater management and governance.</p> <p>Limited knowledge of CM groundwater information and monitoring methodologies</p> <p>Lack of groundwater</p>	<p>1.</p> <p>An agreed and disseminated White paper.</p> <p>Eight (8) CM workshops to discuss the White paper.</p> <p>Eight (8) digital policy briefs in relation to the White paper.</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p> <p>ACTO minutes.</p> <p>White paper document.</p>	<p>Assumptions:</p> <p>Countries support the White paper.</p> <p>Risks:</p> <p>Controversy results related with boundaries and groundwater governance.</p>	<p>Same as above.</p>	<p>Same as above.</p>

		monitoring guidelines	>3 presentations at international events for dissemination of White paper.	International events agenda.			
		Lack of bilateral or regional agreements for shared groundwater governance.					
Output 2.3 Design of a sustainable regional groundwater monitoring network interoperated with the Amazon Regional Observatory (ARO) and validated by each member country.	1. Data collection, harmonized sampling, and sharing protocols and agreements in place to facilitate knowledge exchange amongst all countries.	Currently, there is no standardized regional protocols for groundwater monitoring and data reporting. Limited knowledge of CM groundwater information and monitoring methodologies. Lack of groundwater monitoring guidelines.	1. Agreed regional protocols for groundwater monitoring and adopted by CM (during the RADA meeting). A regional workshop to train ACTO and CM in relation to the regional protocols for groundwater monitoring.	Country reports. Project reports. PSC reports. ACTO minutes. Minutes of the RADA meeting. Training workshop reports.	Assumptions: Countries support the regional monitoring systems and are willing to adopt and apply common monitoring methodologies, parameters, and protocols. Risks: Lack of Political willingness to adopt regional protocols for groundwater monitoring.	Same as above.	Same as above.
Output 2.4 A proposed road map for sustainable groundwater management and for strengthening policy and legal context in Suriname and Guyana.	1. Status of roadmap for sustainable groundwater management and for strengthening policy and legal context in Suriname and Guyana. 2. Type and number of binational capacity building workshops.	Assessment of current institutional and legal IWRM framework has been done on the ongoing GEF ID 9770 project in relation to the protection, conservation and management of groundwater systems in Guyana and Suriname. However, need for capacity strengths in Guyana and Suriname regarding groundwater management.	1. Road map for sustainable groundwater management between Guyana and Suriname. 2. >2 binational capacity building workshops on topics of sustainable groundwater management. >2 public workshops to share and exchange groundwater management themes.	Country reports. Project reports. PSC reports. ACTO minutes. Training workshop reports.	Assumptions: Guyana and Suriname are willing to adopt and apply common monitoring methodologies, parameters, and protocols. Risks: Key national partners delay in providing valuable information to assessment.	Same as above.	Same as above.
Component 3: Pilots for improved transboundary groundwater management and use							
Project Outcome	Outcome Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Outcome(s)	Relevant SDG target(s) and indicators

						and indicator(s)	
Outcome 3 Demonstrated strategies for improved groundwater management and water security in transboundary critical areas.	<p>1. Promoting natural recharge areas and aquifer protection through integrated water management and environmental management.</p> <p>2. Evaluating effects from alluvial mining activities into aquifers and ecosystem to implement protection measures.</p> <p>3. Testing multi-municipal cooperation mechanisms for groundwater management and aquifer protection.</p> <p>4. Testing innovative analysis to develop vulnerability mapping and to define aquifer protection zones.</p> <p>5. Comprehensive assessment of the transboundary coastal aquifer system</p> <p>6. Testing innovative approaches for groundwater well management in medium size cities.</p> <p>7. Identifying best practices for promoting drinking water</p>	<p>Limited and unbalanced technical capacity on CM to extensively develop groundwater monitoring efforts.</p> <p>Lack of inventory of groundwater wells in a shared aquifer. Levels of contamination in shallow wells from lack of sanitation. Promoting data and knowledge exchange, thus to develop transboundary management strategies.</p> <p>Lack of knowledge of impacts of alluvial mining activities into groundwater resources. Pilot will inform to areas with higher degree of alluvial mining operations and will develop conservation strategies and communication awareness.</p> <p>Lack of technical local capacity, lack of technical data and protocols.</p>	<p>1. Reports from pilot i.</p> <p>2. Reports from pilot ii.</p> <p>3. Reports from pilot iii.</p> <p>4. Reports from pilot iv.</p> <p>5. Reports from pilot v.</p> <p>6. Reports from pilot vi.</p> <p>7. Reports from pilot vii.</p> <p>8. Reports from pilot viii.</p> <p>9. Report on the interaction between national pilots and AAS' consultants.</p> <p>10. >7 technical capacity building workshops per pilot.</p> <p>11. >8 science-based communication notes.</p>	<p>Pilot project reports.</p> <p>National reports.</p> <p>PSC minutes.</p> <p>Workshop reports.</p> <p>Georeferenced data into ARO.</p> <p>Project website.</p> <p>IW: LEARN Web site posts.</p>	<p>Assumptions:</p> <p>National governments support transboundary cooperation involving local authorities.</p> <p>National and international agencies and universities willing to participate in pilot's activities.</p> <p>Risks:</p> <p>Insufficient capacity available at CM.</p> <p>Upscaling of pilots will not be applicable to AAS.</p> <p>Local communities oppose the development of field measurements at pilot sites.</p>	Same as above.	Same as above.

	<p>security in small indigenous communities.</p> <p>8. Promoting natural recharge areas and integrated water management and environmental management for enhanced water security.</p> <p>9. Upscaling to AAS.</p> <p>10. Number of technical capacity building workshops for ACTO and CM staff per pilot.</p> <p>11. Number of science-based communication notes.</p>						
Project Outputs	Output Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Direct Outcome(s)	Relevant SDG target(s) and indicators
<p>Output 3.1 A series of pilots testing good management practices to reduce stress on the aquifer systems and increase water security in the face of climate change variability, gender sensitive:</p>	<p>All pilots:</p> <p>1. Implementation status of the eight pilots and analysis informing upscaling to AAS.</p> <p>2. Monitoring data generated into ARO.</p> <p>3. Improved understanding of relevant stakeholders about their water supply, especially regarding source protection and</p>	<p>All pilots:</p> <p>Reduced awareness related to groundwater importance for potable water supply and other water uses, gap of proper water infrastructure for the sustainable use of groundwater.</p>	<p>All pilots:</p> <p>1. Reports from all pilots.</p> <p>2. Georeferenced data into ARO.</p> <p>3. >8 workshops (50% women).</p> <p>4. >6 presentations per pilot where lessons learn are presented in AAS Symposium and International Conference and other regional and international events.</p>	<p>All pilots:</p> <p>Pilot project reports.</p> <p>National reports.</p> <p>PSC minutes.</p> <p>Workshop reports.</p> <p>Groundwater monitoring plans.</p>	<p>Assumptions:</p> <p>All pilots:</p> <p>National governments support transboundary cooperation involving local authorities.</p> <p>National and international agencies and universities willing to participate in pilot's activities.</p> <p>Risks:</p> <p>All pilots:</p>	<p>Same as above.</p>	<p>Same as above.</p>

	sustainable consumption. (% women).			Georeferenced data into ARO.	Local communities oppose the development of field measurements at pilot sites.		
	4. Lessons learn from pilots are shared.			Project website.			
				Proceedings from AAS Symposium and International Conference.			
				Well inventory documented, and a groundwater monitoring network designed and established in the area of the pilots.			
				IW: LEARN Web site posts.			
Individual pilots							
(i) Innovative approaches for groundwater well management between Bolivia and Brazil (Cobija, Brasília/Epitaciolândia)	<p>Development of binational groundwater monitoring network.</p> <p>Development of binational hydrogeologic modelling and water security analysis.</p> <p>Development of binational groundwater management plan.</p> <p>National and local government agreements in Bolivia and Brazil.</p> <p>Transboundary collaboration</p>	<p>In Brasília and Epitaciolândia cities, around 18% and 11% (25% and 5%) of the population does not have access to potable water supply (sewer network), respectively. In Cobija, more than 60% of the population does not have access to sewer network and it is unknown the people using groundwater wells without proper designs and monitoring.</p> <p>Due to population growth in these cities, and due to the lack of urban planning, rudimentary and inappropriate groundwater wells are used, whereas nearby domestic sewage systems could</p>	<p>A binational plan for groundwater monitoring and management.</p> <p>> 4 binational workshops.</p> <p>> 5 national capacity building workshops in each country.</p> <p>> 5 awareness-based workshops to communities in each country.</p> <p>A report on isotopic analysis carried out at both countries.</p>	<p>Agreements between: SNIRH and SIASBO (Bolivia), ANA and ACRE state (Brazil).</p> <p>Transboundary baseline hydrogeologic data into ARO, transboundary plan for groundwater management, which will inform stakeholder's decision making.</p>	<p>Assumptions:</p> <p>Risks:</p>	Same as above.	Same as above.

	and capacity building between Bolivian and Brazilian institutions.	contaminate these wells. Furthermore, there is lack of inventory of groundwater wells.					
	Local workshops to foster awareness of the aquifer's importance (% women).	Reduced groundwater studies are available to develop appropriate water usage and management plans.					
		Isotopic analysis experience in Cobija but not in Brasília and Epitaciolândia.					
(ii) Strategy to evaluate the impacts of gold alluvial mining on aquifers and ecosystems of the Madre de Dios basin in Bolivia.	Development of characterization of potential impacts from alluvial mining into to the aquifer.	Lack of knowledge of impacts of alluvial mining activities into groundwater resources.	A hydrogeology-based report of the region including the development of surface alluvial mining activities.	Data in SIASBO and SINCA Bolivian platforms.	Assumptions: Risks:	Same as above.	Same as above.
	Number of capacity building workshops	Even though, Hg was found lower than maximum admissible values for water and sediments (Ministry of Environment and Water), methylmercury accumulation is unknown and maybe it is related to natural sources. However, Hg concentrations in fish such as the Pacú, Paiche and Tucunaré were found higher than EPA limits (1 mg/Kg).	A report on Hg and heavy metals in alluvial mining activities and potential landscape degradation, and how this is related to the aquifer.				
	Local workshops to foster awareness of potential impacts from alluvial mining activities to the aquifer.		A report describing the potential impacts due to alluvial mining activities (based on field measurements and modelling).				
	Number of mining operators that have reduced the use of Hg in at least 25% of their activities.	The pilot is located at earlier stages of alluvial mining, as opposed to upstream regions such as Madre de Dios in Peru, therefore, it will serve a pilot	> 5 national capacity building workshops.				
			> 5 awareness-based workshops to diverse stakeholders (e.g., mining, economic, local communities) on alluvial mining.				

		study without extensive impact.	Data uploaded into SIASBO and SINCA country platforms.				
			Two mining operators have reduced the use of Hg in at least 25% of their activities.				
(iii) Promoting of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in Puerto Asis, Valle del Guamuez and San Miguel, Putumayo region (Colombia)	Multi-municipal collaboration to develop hydrogeologic studies. Multi-municipal groundwater monitoring, including water quality. Multi-municipal plan for the protection and management of groundwater resources. Number of capacity building workshops Number of awareness-based workshops	The study area is located in the Caguán-Putumayo hydrogeological province, the third with the largest groundwater reserves, approximately 11.5% of the country's reserves. In the priority cross-border municipalities of the Department of Putumayo, a significant increase in the demand for groundwater has been observed in recent years. This increase is mainly due to the lack of coverage of local aqueducts, which has led most catchments to focus on superficial aquifers. However, these catchments, on many occasions, lack adequate sanitary conditions and contamination prevention measures, which has resulted in problems of microbiological contamination, especially. Although groundwater is considered an alternative resource in some areas, its quality has become a regional concern due to the	A multi-municipal report describing the technical studies. A multi-municipal report describing the groundwater monitoring network. A multi-municipal plan for the protection and management of groundwater resources. > 5 national capacity building workshops. > 5 awareness-based workshops to diverse stakeholders.		Assumptions: Risks:	Same as above.	Same as above.

		<p>impact of human activities.</p> <p>Therefore, it is essential to have updated information on the behaviour of groundwater to propose management and protection measures. This includes the identification and protection of aquifer recharge zones, which require special attention and administrative control by the Environmental Authority.</p>					
<p>(iv) Thematic mapping, vulnerability, identification, and protection of the Aquifer System, as well as recharge zones on Napo River Basin (Ecuador).</p>	<p>Baseline study of the pilot site.</p> <p>Physical characterization of the aquifers including the usage of isotopic analysis.</p> <p>Groundwater monitoring, including water quality.</p> <p>Groundwater vulnerability and impacts to recharge zones.</p> <p>Plan for the protection and management of groundwater resources.</p> <p>Number of capacity building workshops</p> <p>Number of awareness-based workshops</p>	<p>Currently, there is no information regarding the identification and behaviour of the recharge and circulation zones of the aquifers in the region.</p> <p>This pilot will increase the technical-scientific knowledge of the current properties and conditions of the aquifers, which will allow the development of plans and projects focused on the management and protection of waters, information that is essential to guarantee and preserve the conditions of the aquifers.</p> <p>A need for quality and quantity of both underground and surface water resources of transboundary water systems is required.</p>	<p>A report containing the baseline characteristics of the aquifer.</p> <p>A report containing the groundwater characterization by using field measurements.</p> <p>A plan for the protection and management of groundwater resources.</p> <p>> 5 national capacity building workshops.</p> <p>> 5 awareness-based workshops to diverse stakeholders.</p>		<p>Assumptions:</p> <p>Risks:</p>		6.3.2, 6.5

<p>(v) Testing innovative approaches for the sustainable management and protection of transboundary sedimentary aquifers (Guyana and Suriname).</p>	<p>Physical characterization of the coastal aquifers.</p> <p>Plan for the protection and management of coastal groundwater resources.</p> <p>Strengthening capacity building for the management of groundwater resources.</p> <p>Number of workshops and communication products to foster awareness on coastal aquifers.</p>	<p>In Guyana, the aquifers have been exploited since the early 1900s and have not had adequate monitoring or protection measures over the last 50 years. Usage has increased significantly as the coast is the major commercial and economic centre of the country. With 90% of the population using groundwater as a primary means of water supply, a review and improvement of monitoring is critical for the sustained use of this aquifer system.</p> <p>Ninety-five (95%) percent of Suriname's total supply of potable water comes from groundwater</p> <p>There is an abundance of good quality groundwater which is contained in the coastal basin. Groundwater in the young coastal plain is not renewable, groundwater in the old coastal plain and savannah belt area are renewable.</p>	<p>A binational report containing the physical characteristics of the coastal aquifer.</p> <p>A binational plan for the protection and management of coastal groundwater resources.</p> <p>A binational capacity building program for management of groundwater resources, including >5 binational workshops (in-person and virtual).</p> <p>> 5 binational workshops for public awareness, including the creation of educational material in English and Dutch.</p>		<p>Assumptions:</p> <p>Risks:</p>	<p>Same as above.</p>	<p>Same as above.</p>
<p>(vi) Hydrogeological analysis for the protection and sustainability of groundwater supply to Calleria and Manantay, Coronel Portillo Province, Ucayali Region (Peru).</p>	<p>Baseline characterization of shallow aquifer contamination for water supply.</p> <p>Strengthening capacity building for the management of groundwater resources.</p>	<p>Currently, there is a health public concern related to the ingestion of contaminated water with a high bacteriological load, with the presence of Escherichia Coli and thermo-tolerable Coliforms extracted from surface aquifer, through shallow open pit wells, that are affected by the lack of sanitation infrastructure.</p>	<p>A report containing the physical characteristics of the shallow aquifer.</p> <p>A capacity building program for management of groundwater resources with focus on water supply from shallow aquifers.</p>		<p>Assumptions:</p> <p>Risks:</p>	<p>Same as above.</p>	<p>Same as above.</p>

	<p>Number of capacity building workshops</p> <p>Number of workshops and communication products to foster awareness on shallow aquifers.</p> <p>Plan for the protection and management of shallow groundwater resources.</p>		<p>> 5 national capacity building workshops.</p> <p>> 5 workshops for public awareness, including decision makers from different Peruvian institutions.</p> <p>A plan for the protection and management of shallow groundwater resources.</p>				
(vii) Identifying best practices for promoting drinking water security through groundwater protection in small indigenous communities in Suriname	<p>Baseline characterization of aquifers and water supply for indigenous communities.</p> <p>Groundwater monitoring, including water quality.</p> <p>Number of capacity building workshops</p> <p>Number of workshops and communication products to foster awareness on shallow aquifers.</p> <p>Plan for the protection and management of shallow groundwater resources.</p>	<p>In the first indigenous village named Kwamalasamutu, there is the lack of potable water. Located almost as far as at the Surinamese and Brazilian border, it has been suffering for potable water ever since. Attempts to provide this village with potable water in a sustainable way have not been realized yet. Last year, the Suriname Water Provision Company (SWM) has installed pipe water in this village, using the surface water resources in this area. An in-depth scientific assessment for groundwater resources is needed.</p> <p>In the second indigenous village named Kawemhakan, the water supply is provided by surface water.</p> <p>Both projects are important because of their contribution</p>	<p>Baseline report approved by the Ministry of Spatial Planning and Environment, Ministry of Works & Ministry of Natural Resources.</p> <p>A report containing the groundwater characterization for water supply.</p> <p>> 5 national capacity building workshops.</p> <p>> 5 workshops for indigenous people.</p> <p>An agreed (with local communities) plan for the protection and management of groundwater resources.</p> <p>A note on lessons learned on use of groundwater resources by indigenous people.</p>	Approval of baseline report by ministers.	<p>Assumptions:</p> <p>Risks:</p>	Same as above.	Same as above.

		towards the conservation of the forests. These villagers are under pressure from the changing in the climate as rainfall variations are increasing with increasing change in the global climate, and secondly, by the human intervention in this area. The last mentioned regards the sector small goldmining activities, particularly for Kawemhakan village. Aiding these villagers in achieving potable water from the unpolluted ground water resources will also contribute to protecting the basin and hence the environment.					
(viii) Promoting natural recharge areas and aquifer protection through integrated water management and environmental management for enhanced water security in San Carlos de Río Negro-Casiquiare (Venezuela).	<p>National committee to promote groundwater analysis of the San Carlos de Río Negro aquifer.</p> <p>Baseline characterization of aquifer.</p> <p>Groundwater monitoring, including water quality.</p> <p>Geology map of the aquifer.</p> <p>Plan for the protection and management of groundwater resources.</p> <p>Number of capacity</p>	<p>Currently, there is no information regarding the identification and behaviour of the recharge and circulation zones of the aquifers in the region, including the existence of potential pollutants that could impact the San Carlos de Río Negro aquifer.</p> <p>No baseline studies are available.</p> <p>There is a need to form a technical committee to overseas the aquifer.</p>	<p>Formation and implementation of the national committee for the San Carlos de Río Negro Aquifer, including governmental institutions, universities, and professional societies.</p> <p>A report containing baseline groundwater characterization, including remote sensing and field measurement techniques.</p> <p>A 1:100000 geologic map of the aquifer.</p> <p>A validated (by the national committee) plan for the protection and management of groundwater resources.</p>	<p>Documentation describing the formation and description of activities of the National Committee for the San Carlos de Río Negro aquifer.</p>	<p>Assumptions:</p> <p>Risks:</p>	Same as above.	Same as above.

	building workshops		> 5 national capacity building workshops.				
	Number of awareness-based workshops		> 5 awareness-based workshops to diverse stakeholders.				
Component 4: Development of a Strategic Action Program for the AAS, including the country's gender action plan							
Project Outcome	Outcome Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Outcome(s) and indicator(s)	Relevant SDG target(s) and indicators
Outcome 4 Agreed and endorsed strategy for the protection and rational use of the shared aquifer systems.	1. Endorsement of Strategic Action Plan and its dissemination. 2. Financing plan for implementation of SAP elaborated. 3. Regional technical guidelines for the protection and sustainable use of AAS agreed.	Lack of a common protection strategy for the AAS and financial support to implementing AAS management and protection. Limited bilateral agreements for common groundwater governance and lack of regional ones. Limited national guidelines for groundwater protection and lack of regional ones.	1. SAP endorsed at ministerial level by CM. >8 National and regional workshop to prepared SAP and then socialize it. 2. Financial strategy for SAP implementation developed. 3. CM commitments with financial strategy.	PSC minutes. National reports. Strategic Action Plan (SAP) (document). Financial strategy for SAP implementation (document). Regional technical guidelines for the protection and sustainable use of AAS (document).	Assumptions: Sufficient broad stakeholder involvement to validate SAP. CM willing to endorse SAP. Risks: Lack of political will.	Same as above.	Same as above.
Project Outputs	Output Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Direct Outcome(s)	Relevant SDG target(s) and indicators
Output 4.1 AAS SAP developed and endorsed at ministerial level with a gender-responsive approach.	1. AAS SAP developed and endorsed. 2. Active participation by stakeholders in the SAP formulation (% women).	Limited governance at binational or regional level, related to groundwater management. Lack of agreements for common protection of AAS.	1. >8 National and regional workshops to prepared SAP. SAP validated and ratified by PSC. SAP endorsement letters signed at the ministerial level.	Country reports. Project reports. PSC reports. ACTO minutes.	Assumptions: Stakeholders engage in validation meetings. Risks: Development of AAS SAP does	Same as above.	Same as above.

		Lack of bilateral or regional agreements for shared groundwater governance.	>8 National events to SAP socialization 2. 50% women.	Strategic Action Plan (SAP) (document).	not lead to active involvement of stakeholders.		
Output 4.2 Agreed regional technical guidelines for the protection and sustainable use of the AAS.	1. Regional technical guidelines for the protection and sustainable use of AAS agreed. 2. Active participation by stakeholders in the regional technical guideline formulation (% women).	Limited national guidelines to protect groundwater. Lack of a common protection strategy for the AAS.	1. >8 National and regional workshops to prepared regional technical guidelines for the protection and sustainable use of the AAS. 2. 50% women.	Country reports. Project reports. PSC reports. ACTO minutes. Regional technical guidelines for the protection and sustainable use of AAS (document).	Assumptions: Stakeholders engage in the process to elaborate technical guidelines. Risks: Lack of commitment by CM political level.	Same as above.	Same as above.
Output 4.3 A financial strategy for implementing SAP strategic actions.	1. Financing plan for implementation of SAP elaborated.	Lack of financing strategy to support AAS management and protection.	1. Financial strategy for SAP implementation.	Country reports. Project reports. PSC reports. ACTO minutes. Financial strategy for SAP implementation (document).	Assumptions: Stakeholders actively engage in SAP financial strategy. Donors express interest in financial strategy. Acceptance of plans by national/local authorities in CM. Risks: Difficulty to identify and to integrate local investors into wide strategic investment plans. Limited availability of bankable projects to define specific investment plans per economic area.	Same as above.	Same as above.

					Difficulty to agree common interinstitutional mechanism to coordinate large scale infrastructure investments.		
Component 5: Reinforced institutional capacity, gender mainstreaming, communication and awareness raised on the AAS							
Project Outcome	Outcome Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Outcome(s) and indicator(s)	Relevant SDG target(s) and indicators
Outcome 5 Strengthened institutional capacity, gender mainstreaming, communication and awareness raised.	1. Number of professionals trained on institutional capacity, gender mainstreaming and awareness of AAS (% women). 2. Number of people from local communities trained on gender mainstreaming and awareness of AAS (% women).	Low public awareness related to AAS. Low technical capacity in the region in topics related to groundwater. Limited knowledge about women participation	1. > 38,000 ACTO and CM professionals trained (50% women). 2. > 3,900 people from local communities (50% women).	Country reports. Project reports. PSC reports. ACTO minutes. Training workshop reports.	Assumptions: Support from ACTO and CM for the implementation of the communication strategy and products. Risks:	Same as above.	Same as above.
Project Outputs	Output Indicators	Baseline	Targets	Means of Verification	Assumptions & Risks	Relevant PoW Direct Outcome(s)	Relevant SDG target(s) and indicators
Output 5.1 Training and capacity building activities for strengthening groundwater management at regional (including ACTO), national, municipal, and local levels (benefiting > 38,000 people).	1. Number and type of events (workshops, meetings, etc.) organized.	Currently there is no regional training programme to strengthen monitoring, governance and management of AAS. Capacity building (if done) is done agency by agency (country by country) and there is a substantial asymmetry by countries.	1. >8 National and regional workshops for technicians. >8 National and regional workshops for decision makers.	Country reports, project reports, PSC reports, ACTO minutes. Capacity building road map for training professional in governance and management of AAS. Progress reports on monitoring and the training programme.	Assumptions: ACTO and CM's national institutions support the regional training programme. Partnerships with national universities are established for training programs. Risks:	Same as above.	Same as above.

				Training workshop reports.			
Output 5.2 Groundwater and gender action plan adopted by countries and ACTO	1. Number and type of events (workshops, meetings, etc.) organized.	The participation of women in the sustainable management and use of groundwater is not adequately made visible.	1. >8 National and regional workshops.	Groundwater and gender Action Plan (document). Training workshop reports.	Assumptions: ACTO and CM's national institutions support the gender action plan. Risks:	Same as above.	Same as above.
Output 5.3 Communication strategy and knowledge management plan for enhanced awareness and understanding on the AAS.	1. Conduct a media campaign (e.g., websites, web pages on government sites, and a project portal) to increase public awareness through targeted social media activities. 2. Interaction with pilot studies. 3. Interaction with ACTO. 4. Website update.	There is currently no global communication plan focused on raising awareness on AAS. CM have no dedicated coordinated communication programme through which to engage their members or stakeholders. Currently there are no communication and marketing products related to AAS.	1. >12 communication videos related to AAS understanding and protection. >8 communication videos based on pilots. >50 science-based posts. >30 pilot-based posts. >20 posts based scientific product (articles, conferences). >50 posts based project activities. >20 posts based scientific product (articles, conferences). >10 posts on how AAS projects interacts with ACTO strategy.	Country reports. Project reports. PSC reports. ACTO minutes. Website traffic, survey results, participation lists. Communication strategy (document). Press releases. Social media posts.	Assumptions: Outputs from the project are delivered in a timely fashion and there are no delays in deploying the communication strategy. There is sufficient interest from regional stakeholders to engage with project outputs and activities. Risks: CM don't cooperate to develop communication products.	Same as above.	Same as above.

			<p>2. Report on how pilot studies were incorporated into the communication strategy.</p> <p>3. Report on how AAS project interacts with ACTO strategies.</p> <p>4. Website is updated constantly.</p>				
<p>Output 5.4</p> <p>Documented participation to IW LEARN activities, creation of a project website, and preparation of experience notes (1% of project budget).</p>	<p>1. Number of lessons learned and experience notes produced.</p> <p>2. A project website that incorporates all project products and information/data about AAS project.</p> <p>3. Project participation at IWC's and twinning events.</p>	N/A	<p>1.</p> <p>>10 key 'lessons' learned.</p> <p>>5 experience notes developed by project end. These will be summarized in a final project report.</p> <p>2. An IW:LEARN compliant project website developed.</p> <p>3.</p> <p>At least 2 twinning activities reported</p> <p>At least 9 participants attending IW:LEARN events by midterm and 20 by end of project.</p>	<p>Country reports.</p> <p>Project reports.</p> <p>PSC reports.</p> <p>ACTO minutes.</p> <p>IW:LEARN Web site posts.</p> <p>Analytics from the project website, downloads and pages visited.</p> <p>IW conference agenda and reports.</p>	<p>Assumptions:</p> <p>Willingness of national representatives to participate in IW:LEARN activities and IW Conferences.</p> <p>Risks:</p> <p>COVID or similar health restrictions limit the meetings, capacity development and dissemination of results.</p>	Same as above.	Same as above.

ANNEX D: STATUS OF UTILIZATION OF PROJECT PREPARATION GRANT (PPG)

Provide detailed funding amount of the PPG activities financing status in the table below:

Project Preparation Activities Implemented	GETF/LDCF/SCCF Amount (\$)		
	Budgeted Amount	Amount Spent To date	Amount Committed

PPG Project Coordinator	75,000.00	50,060.00	24,940.00
Technical coordinator	65,000.00	40,217.00	24,783.00
Project assistant	19,938.00	19,938.00	0.00
Financial Expert	10,648.00	10,648.00	0.00
Gender, KM and stakeholder's specialist	10,509.00	10,509.00	0.00
National Coordinators for 8 countries	56,000.00	24,230.00	31,770.00
Country dialogues, meetings/workshops, facilitation	44,736.00	44,736.00	0.00
Travel	18,169.00	18,169.00	0.00
Total	300,000.00	218,507.00	81,493.00

ANNEX E: PROJECT MAP AND COORDINATES

Please provide geo-referenced information and map where the project interventions will take place

Location Name	Latitude	Longitude	GeoName ID
Puerto Asis (Colombia)	0.5002	-76.5004	

Location Description:

Activity Description:

Pilot: Promotion of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in 3 municipalities, Puerto Asis, Valle del Guamuez and San Miguel, Putumayo region

Location Name	Latitude	Longitude	GeoName ID
Valle del Guamuez (Colombia)	0.4197	-76.9005	

Location Description:

Activity Description:

Pilot: Promotion of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in 3 municipalities, Puerto Asis, Valle del Guamuez and San Miguel, Putumayo region

Location Name	Latitude	Longitude	GeoName ID
San Miguel (Colombia)	0.3251	-76.8754	

Location Description:

Activity Description:

Pilot: Promotion of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in 3 municipalities, Puerto Asis, Valle del Guamuez and San Miguel, Putumayo region

Location Name	Latitude	Longitude	GeoName ID
Orellana (Ecuador)	-0.4711	-76.9875	

Location Description:

Activity Description:

Pilot: Thematic mapping, vulnerability, identification, and protection of the Aquifer System, as well as recharge zones in Napo River Basin (Ecuador)

Location Name	Latitude	Longitude	GeoName ID
Georgetown (Guyana-Suriname)	6.8013	-58.1551	

Location Description:

Activity Description:

Pilot: Testing innovative approaches for the sustainable management and protection of transboundary sedimentary aquifers (Guyana and Suriname)

Location Name	Latitude	Longitude	GeoName ID
Coronel Portillo (Peru)	-8.3929	-74.5826	

Location Description:

Activity Description:

Pilot: Hydrogeological evaluation to determine protection and sustainability measures in order to reduce vulnerability and risk in the water supply for population purposes in the districts of Callería and Manantay of the province of Coronel Portillo, Ucayali region (Peru)

Location Name	Latitude	Longitude	GeoName ID
Cobija (Bolivia)	-11.0274	-68.7674	

Location Description:

Activity Description:

Pilot: Innovative approaches for groundwater well management between Bolivia and Brazil

Location Name	Latitude	Longitude	GeoName ID
Brasília/Epitaciolândia (Brazil)	-11.0133	-68.7440	

Location Description:

Activity Description:

Pilot: Innovative approaches for groundwater well management between Bolivia and Brazil

Location Name	Latitude	Longitude	GeoName ID
Pando-Beni-LaPaz (Bolivia)	-12.5838	-67.6510	

Location Description:

Activity Description:

Pilot: Strategy to evaluate the impacts of gold alluvial mining on aquifers and ecosystems of the Madre de Dios basin in Bolivia

Location Name	Latitude	Longitude	GeoName ID
Kawemhaken (Suriname)	3.4215	-54.0278	

Location Description:

Activity Description:

Pilot: Identification of best practices for promoting drinking water security through groundwater protection in small indigenous communities in Suriname

Location Name	Latitude	Longitude	GeoName ID
San Carlos de Rio Negro (Venezuela)	1.9189	-67.0554	

Location Description:

Activity Description:

Pilot: Promotion of natural recharge areas and aquifer protection through integrated water management and environmental management for enhanced water security in San Carlos de Rio Negro-Casiquiare (Venezuela)

Location Name	Latitude	Longitude	GeoName ID
Kwamalasamutu (Suriname)	2.3562	-56.7945	

Location Description:

Activity Description:

Pilot: Identification of best practices for promoting drinking water security through groundwater protection in small indigenous communities in Suriname

Please provide any further geo-referenced information and map where project interventions are taking place as appropriate.



ANNEX F: ENVIRONMENTAL AND SOCIAL SAFEGUARDS SCREEN AND RATING

Attach agency safeguard datasheet/assessment report(s), including ratings of risk types and overall project/program risk classification as well as any management plans or measures to address identified risks and impacts (as applicable).

Title

11108 AAS - Annex F - IDB ESRR

11108 AAS - Annex F - UNEP SRIF

ANNEX G: BUDGET TABLE

Please upload the budget table here.

Annex G: Indicative Project Budget

Expenditure Category	Detailed Description	Component (USD)								Total (USD)	Responsible Entity (Executing Entity receiving funds from the GEF Agency)[1]
		Component 1	Component 2	Component 3	Component 4	Component 5	M&E	Sub-Total	PMC		
		Outcome 1.1	Outcome 2.1	Outcome 3.1	Outcome 4.1	Outcome 5.1					
PERSONNEL COMPONENT											
Project personnel											
Project Coordinator	Project Coordinator with responsibilities allocated as follows: Comp 1: 35%, Comp 2: 5%, Comp 3: 15%, Comp 4: 10%, Comp 5: 5%, Comp M&E: 5%, PMC: 25%.	151,200	21,600	64,800	43,200	21,600	43,200	345,600	86,400	432,000	ACTO
Financial Management Officer	Administrative and Financial Management (FMO) with responsibilities allocated 100% to the PMC.								269,960	269,960	ACTO
Water Resources Management Specialist	Water Resources Management Specialist with technical responsibilities allocated as	189,000		132,300			56,700	378,000		378,000	ACTO

	follows: Comp 1: 50%, Comp 3: 30%, M&E: 20%.										
Knowledge Management and Communications Specialist	KM and Comms Specialist will start 2nd year, with responsibilities allocated as follows: Comp 1: 20%, Comp 2: 20%, Comp 3: 15%, Comp 4: 15%, Comp 5: 15%, Comp M&E: 5%, PMC: 15%.	96,000	36,000	36,000	36,000	36,000		240,000		240,000	ACTO
Administrative Assistant	Admin assistant to be initiated in the 2nd year with responsibilities allocated 100% to the PMC.								184,000	184,000	ACTO
Consultants											
Technical National Focal Point (7 one per country)	Technical national assistants with responsibilities allocated in component 1 (50%) and component 3 (50%). They support field work, inter-ministerial coordination, NPEU coordination, national indicator and target reports (in years 3 and 4).	189,000		189,000				378,000		378,000	ACTO
Gender Specialist	Gender Specialist with responsibilities allocated in: Comp 1: 20%, Comp 2: 20%, Comp 3: 15%, Comp 4: 15%, Comp 5: 15%, Comp M&E: 5%, PMC: 15%.	72,000		72,000		24,000	72,000	240,000		240,000	ACTO
Evaluator (Midterm revision)	Midterm revision						40,000	40,000		40,000	ACTO
Evaluator (Final evaluation)	Final evaluation						60,000	60,000		60,000	ACTO

Travel on official business											
Staff Travel on Official Business	Travel expenses from PMU to monitor and supervise field work for component 1 and national meetings to strength policy and institutional capacities in comp. 2.	79,200	24,000					103,200		103,200	ACTO
Travel of Consultants & Experts	National and regional travel costs to discuss and approve the TDA.	80,000						80,000		80,000	ACTO
Travel of Meeting Participants	Travel costs for country participants (Comp. 1: seminars/trainings; Comp. 3: including national and regional pilot projects; Comp. 4: to support the negotiate the SAP endorsement; Comp. 5: for participation in regional and global events).	28,000		52,500	56,000	22,000		158,500		158,500	ACTO
SUB-CONTRACT COMPONENT											
Transfers & Grants to Implementing Partners											
Pilot Project Brazil	Budget allocation for: Pilots Brazil: (i) Innovative approaches for groundwater well management between Bolivia and Brazil (Cobija, Brasiléi a/Epitaciolândi a).			650,000				650,000		650,000	ACTO

Pilot Project Bolivia	Budget allocation for: Pilots Bolivia: (ii) Strategy to evaluate the impacts of gold alluvial mining on aquifers and ecosystems of the Madre de Dios basin in Bolivia.			300,000				300,000		300,000	ACTO
Pilot Project Colombia	Budget allocation for: Pilots Colombia:(iii) Promoting of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in Puerto Asis, Valle del Guamuez and San Miguel, Putumayo region (Colombia)			492,692				492,692		492,692	ACTO
Pilot Project Ecuador	Budget allocation for: Pilots Ecuador: (iv) Thematic mapping, vulnerability, identification, and protection of the Aquifer System, as well as recharge zones on Napo River Basin, applying innovative measures (Ecuador).			670,540				670,540		670,540	ACTO
Pilot Project Guyana	Budget allocation for: Pilots Guiana: (v) Testing innovative approaches for the sustainable management			430,000				430,000		430,000	ACTO

	and protection of transboundary sedimentary aquifers (Guyana and Suriname).										
Pilot Project Peru	Budget allocation for: Pilots Peru: (vi) Hydrogeologic al analysis for the protection and sustainability of groundwater supply to Calleria and Manantay, Coronel Portillo Province, Ucayali Region (Peru).			450,000				450,000		450,000	ACTO
Pilot Project Suriname	Budget allocation for: Pilots Surinam: (vii) Identifying best practices for promoting drinking water security through groundwater protection in small indigenous communities in Suriname			200,000				200,000		200,000	ACTO
Pilot Project Venezuela	Budget allocation for: Pilots Venezuela:(viii) Promoting natural recharge areas and aquifer protection through integrated water management and environmental management for enhanced water security in San Carlos de Rio Negro-Casiquiare (Venezuela).			450,000				450,000		450,000	ACTO

Sub-contracts (for commercial purposes)											
Data collection, processing and reporting services	Collection and analysis of data, indicators, and targets of pilots (comp 3), activities in the TDA (comp 1), and reporting (M&E).	45,000			42,200		49,200	136,400		136,400	ACTO
Technical Consulting Services	Technical services for Components 1, 2, 4, and 5*.	4,374,000	382,000		282,000	210,000	24,000	5,272,000		5,272,000	ACTO
MOOC, educational, and engagement services	Includes activities for the Development of Educational Content, Community Engagement, Outreach and Awareness, and Capacity Building (component 1).	240,000						240,000		240,000	ACTO
TRAINING COMPONENT											
Group training											
Trainings/seminars	Training activities under Component 4 and 5 (output 4.2.2 and output 5.4.1). Travel costs for guests or country delegations				50,000	60,000		110,000		110,000	ACTO
Meetings/Conferences											
Inception workshop	Inception workshop (travels cost, per diem, allowances, meals, accommodation)						34,000	34,000		34,000	ACTO
Steering Committee meetings	PSC (travels cost, per diem, allowances, meals, accommodation)						120,900	120,900		120,900	ACTO

Meeting costs	National (8 countries) and regional meeting costs under Component 4 (outputs 4.11, 4.1.3, 4.1.4, 4.15, 4.2.1 and 4.2.3) to ensure SAP agreements and its endorsement.				382,800			382,800		382,800	ACTO
EQUIPMENT AND PREMISES COMPONENT											
Expendable equipment											
Office Supplies and consumables	Office supplies including documentation, communication, and logistical support.		11,400		8,250			19,650		19,650	ACTO
Data Center for hosting data during project	Data and info. hosting during the project, as well as the internet and communication services required for its execution.	42,000						42,000		42,000	ACTO
Non-expendable equipment											
Communications Equipment											ACTO
Office Furniture & Equipment	Office furniture and equipment required for execution. It includes printers, gps, monitors, keyboard, mouse, desk, drawers, shelves.	67,500						67,500		67,500	ACTO
Computers and accessories	Computers and accessories for the PMU.	28,500						28,500		28,500	ACTO
MISCELLANEOUS COMPONENT											
Operation and maintenance of equipment											

Running Cost Office	Operational and institutional support for the project, including office space rental for project staff and consultants.	60,000						60,000		60,000	ACTO
Transport Costs											ACTO
Maintenance of Furniture & Equipment	Includes minor repairs or replacements of damaged office furniture and equipment to keep them functional and prolong their lifespan.	17,000						17,000		17,000	ACTO
EA Targeted Technical Assistance	ACTO technical support in areas such as indigenous peoples, natural resource management, climate change, and the exchange of local knowledge and information. It also includes efforts to strengthen institutional, financial, and legal aspects of the project. It is expected to provide the most support in Components 1, 3, and 4.	191,600		28,168	119,350			339,118		339,118	ACTO
Other operating cost	Costs necessary for project implementation and reporting.								50,662	50,662	ACTO
Reporting costs											

Communication, design and printing	Project's promotional materials related to the multilevel management system for the AAS (comp 2); sharing and disseminating pilots results (comp 3); SAP documentation and support documentation (comp 4); awareness raising products (comp 5).		27,446	50,000	50,000	26,400		153,846		153,846	ACTO
Translation services	For translation of the relevant materials in the three official languages and native languages when needed.	50,000	18,000	32,000	30,200			130,200		130,200	ACTO
Audit	Annual audits to the project.								50,000	50,000	ACTO
Grand Total		6,000,000	520,446	4,300,000	1,100,000	400,000	50,000	12,820,446	64,022	13,461,468	

[1] In exceptional cases where GEF Agency receives funds for execution, Terms of Reference for specific activities are reviewed by GEF Secretariat

*Technical consulting Services

Component 1:

- 1.1.1: Review of physical characterization of the AAS, gaps and opportunities.
- 1.1.2: Assessment of surface-groundwater interaction, including atmospheric and land surface processes under climate change conditions, gaps and opportunities.
- 1.1.3: Assessment of existing ground-based and remote sensing-based monitoring efforts with estimation of water storage, water table, withdrawal, surface deformation, among other parameters.
- 1.1.4: Assessment of groundwater processes at the scale covering the pilot sites (downscaling techniques in remote sensing).
- 1.2.1: Development of baseline maps for physical characterization of AAS, and aquifers.
- 1.2.2: Development of human-induced hazard maps (anthropogenic activities such as mining, infrastructure development, among others), StoG (surface to groundwater), GtoS (groundwater to surface).
- 1.2.3: Development of vulnerability maps for aquifers including downscaling to pilot sites.
- 1.2.4: Development of a hierarchical-based analysis to describe priority zones.
- 1.2.5: Development and implementation of maps into project website and into module AAS of Amazonian Regional Observatory (ARO).
- 1.3.1: Development of a hydrological/hydrogeological modeling considering global changes (climate and anthropogenic) and socio-economic development scenarios.
- 1.3.2: Downscaling the hydrological/hydrogeological modeling to priority zones and pilot sites.
- 1.3.3: Estimation of the effects of El Niño and La Niña into the AAS, prediction of future conditions.
- 1.3.4: Modeling atmospheric, surface and groundwater interaction under global changes: challenges and opportunities to develop global models.
- 1.3.5: Development of water security analysis, including downscaling to pilot sites and priority zones.

- 1.4.1: Surface-groundwater interaction monitoring (5 priority zones).
- 1.4.2: Geomorphic river floodplain characterization along main rivers linked to contaminated sediments affecting groundwater (5 priority zones).
- 1.4.3: Isotopic analysis (source and flow path, water age, vulnerability to pollution and climate conditions) near 15 of ACTO Amazon Regional Observatory (ARO) stations.
- 1.4.4: Assessment, measurements and modeling of main pollution threats StoG and GtoS (5 priority zones).
- 1.4.5: Implementation of Citizens Science initiatives (5 priority zones).
- 1.4.6: Implementation of data into project website and Amazonian Regional Observatory (ARO).
- 1.5.1: Certification in Amazon Aquifer Groundwater knowledge and governance.
- 1.5.2: Georeferenced AAS and pilot's data into ACTO Amazon Regional Observatory (ARO).
- 1.5.3: AAS symposium and AAS international conference, across scales, across components.
- 1.5.4: Transboundary Diagnostic Analysis (TDA).

Component 2:

- 2.1.1: Assessment of institutional, legal, regulatory, and public policies framework, regarding groundwater management, at national and regional level.
- 2.1.2: Institutional analysis to identify strengths, weaknesses and gaps regarding groundwater management, at national and regional level, with focus in decision making level, governance and information management of public institutions.
- 2.1.3: Socioeconomics analysis related with groundwater use, with focus in economic and gender inequalities, and specially analysis related with ethnic minorities.
- 2.2.1: Amazonian Groundwater White Paper prepared, based on the information collected in the activities of output 1.1 and 2.1, that proposes improvements to the technical, regulatory, and institutional frameworks of the countries on groundwater management, as well as to the ACTO's role.
- 2.2.2: Regional workshop to reflect on institutional, regulatory and social aspects in aquifer management and disseminate results of analysis and assessments related.
- 2.2.3: Dissemination of Amazonian Groundwater White Paper at national level in the 8 CM.
- 2.2.4: Dissemination of Amazonian Groundwater White Paper at international events.
- 2.3.1: Assessment of existing national information protocols and methodologies to monitoring groundwater.
- 2.3.2: Develop regional protocols for groundwater monitoring that includes methodologies, instrumentation, data transmission, collection and custodian protocols, as well as data exchange mechanism and procedures agreements.
- 2.3.3: Design data monitoring and reporting system into Amazonian Regional Observatory – ARO.
- 2.3.4: Strengthening national capacity for monitor and reporting into Amazonian Regional Observatory - ARO groundwater system through training programs/workshops.
- 2.4.1: Elaboration a Road Map to improve technical, regulatory, and institutional frameworks on groundwater management in Suriname and Guyana.
- 2.4.2: Improvement of national capacities for sustainable groundwater management.
- 2.4.3: Strengthening regulatory and institutional framework at national level on groundwater management.

Component 4:

- 4.1.2: Development of Amazon Aquifer Strategic Action Plan (AAS SAP) for groundwater protection, sustainable management and monitoring, using the Global Framework for Action guidelines and AAS White paper.
- 4.3.1: Assessment of financial opportunities regarding groundwater management, at global, regional and national level.
- 4.3.2: Development of financial strategy for implementing SAP strategic actions, with a portfolio of financing options and bankable investments.
- 4.3.3: CM commitment to financial support AAS SAP implementation process.
- 4.3.4: Cooperation and private sector agreements for AAS SAP implementation process.

Component 5:

- 5.1.1: Development of capacity building for institutional strengthening at national and subnational level technical personnel.
- 5.1.2: Development of capacity building for groundwater management governance to decision makers and other stakeholders.
- 5.1.3: Strengthen ACTO as a regional cooperation platform and coordination mechanism.
- 5.2.1: Training ACTO staff, National counterparts and directly involved partners to promote gender-sensitive approaches and gender mainstreaming in the AAS project, using AAS Gender Action Plan in accordance with Amazon SAP's Gender Action Plan
- 5.2.2: Incorporate groundwater and Gender Action Plan into the AAS project intervention, specially each pilot project.
- 5.3.1: Elaborate a Communication Action Plan of AAS, following the Communication Strategy guidelines.
- 5.3.2: Implementation of the Communication Action Plan, developing communication products.
- 5.3.3: Document and communicate lessons learned and best practices.
- 5.4.3: Develop project experience and best practices notes.
- 5.3.4: Design a project visual identity and development of project website.

Please explain any aspects of the budget as needed here

Annex G: Indicative Project Budget

Expenditure Category	Detailed Description	Component (USD)								Total (USD)	Responsible Entity <small>(receiving funds from the GEF Agency)</small>
		Component 1	Component 2	Component 3	Component 4	Component 5	M&E	Sub-Total	PMC		
		Outcome 1.1	Outcome 2.1	Outcome 3.1	Outcome 4.1	Outcome 5.1					
PERSONNEL COMPONENT											
Project personnel											
Project Coordinator	Project Coordinator with responsibilities allocated as follows: Comp 1: 35%, Comp 2: 5%, Comp 3: 15%, Comp 4: 10%, Comp 5: 5%, Comp M&E: 5%, PMC: 25%.	151,200	21,600	64,800	43,200	21,600	43,200	345,600	86,400	432,000	ACTO
Financial Management Officer	Administrative and Financial Management (FMO) with responsibilities allocated 100% to the PMC.								269,960	269,960	ACTO
Water Resources Management Specialist	Water Resources Management Specialist with technical responsibilities allocated as follows: Comp 1: 50%, Comp 3: 30%, M&E: 20%.	189,000		132,300			56,700	378,000		378,000	ACTO
Knowledge Management and Communications Specialist	KM and Comms Specialist will start 2nd year, with responsibilities allocated as follows: Comp 1: 20%, Comp 2: 20%, Comp 3: 15%, Comp 4: 15%, Comp 5: 15%, Comp M&E: 5%, PMC: 15%.	96,000	36,000	36,000	36,000	36,000		240,000		240,000	ACTO
Administrative Assistant	Admin assistant to be initiated in the 2nd year with responsibilities allocated 100% to the PMC.								184,000	184,000	ACTO
Consultants											
Technical National Focal Point (7 one per country)	Technical national assistants with responsibilities allocated in component 1 (50%) and component 3 (50%). They support field work, inter-ministerial coordination, NPEU coordination, national indicator and target reports (in years 3 and 4).	189,000		189,000				378,000		378,000	ACTO
Gender Specialist	Gender Specialist with responsibilities allocated in: Comp 1: 20%, Comp 2: 20%, Comp 3: 15%, Comp 4: 15%, Comp 5: 15%, Comp M&E: 5%, PMC: 15%.	72,000		72,000		24,000	72,000	240,000		240,000	ACTO
Evaluator (Midterm revision)	Midterm revision						40,000	40,000		40,000	ACTO
Evaluator (Final evaluation)	Final evaluation						60,000	60,000		60,000	ACTO
Travel on official business											
Staff Travel on Official Business	Travel expenses from PMU to monitor and supervise field work for component 1 and national meetings to strenght policy and institutional capacities in comp. 2.	79,200	24,000					103,200		103,200	ACTO
Travel of Consultants & Experts	National and regional travel costs to discuss and approve the TDA.	80,000						80,000		80,000	ACTO
Travel of Meeting Participants	Travel costs for country participants (Comp. 1: seminars/trainings; Comp. 3: including national and regional pilot projects; Comp. 4: to support the negotiate the SAP endorsement; Comp. 5: for participation in regional and global events).	28,000		52,500	56,000	22,000		158,500		158,500	ACTO
SUB-CONTRACT COMPONENT											
Transfers & Grants to Implementing Partners											
Pilot Project Brazil	Budget allocation for: Pilots Brazil: (i) Innovative approaches for groundwater well management between Bolivia and Brazil (Cobija,Brasília/Epitaciolândia).			650,000				650,000		650,000	ACTO
Pilot Project Bolivia	Budget allocation for: Pilots Bolivia: (ii) Strategy to evaluate the impacts of gold alluvial mining on aquifers and ecosystems of the Madre de Dios basin in Bolivia.			300,000				300,000		300,000	ACTO
Pilot Project Colombia	Budget allocation for: Pilots Colombia:(iii)Promoting of multi-municipal cooperation mechanisms for groundwater management and for aquifer protection (recharge zone and water quality) in Puerto Asis, Valle del Guarnuez and San Miguel, Putumayo region (Colombia)			492,692				492,692		492,692	ACTO
Pilot Project Ecuador	Budget allocation for: Pilots Ecuador: (iv) Thematic mapping, vulnerability, identification, and protection of the Aquifer System, as well as recharge zones on Napo River Basin, applying innovative measures (Ecuador).			670,540				670,540		670,540	ACTO
Pilot Project Guyana	Budget allocation for: Pilots Guiana: (v) Testing innovative approaches for the sustainable management and protection of transboundary sedimentary aquifers (Guyana and Suriname).			430,000				430,000		430,000	ACTO
Pilot Project Peru	Budget allocation for: Pilots Peru: (vi) Hydrogeological analysis for the protection and sustainability of groundwater supply to Calleria and Manantay, Coronel Portillo Province, Ucayali Region (Peru).			450,000				450,000		450,000	ACTO
Pilot Project Suriname	Budget allocation for: Pilots Surinam: (vii)Identifying best practices for promoting drinking water security through groundwater protection in small indigenous communities in Suriname			200,000				200,000		200,000	ACTO
Pilot Project Venezuela	Budget allocation for: Pilots Venezuela:(viii) Promoting natural recharge areas and aquifer protection through integrated water management and environmental management for enhanced water security in San Carlos de Rio Negro-Casiquiare (Venezuela).			450,000				450,000		450,000	ACTO
Sub-contracts (for commercial purposes)											
Data collection, processing and reporting services	Collection and analysis of data, indicators, and targets of pilots (comp 3), activities in the TDA (comp 1), and reporting (M&E).	45,000			42,200		49,200	136,400		136,400	ACTO
Technical Consulting Services	Technical services for Components 1, 2, 4, and 5*.	4,374,000	382,000		282,000	210,000	24,000	5,272,000		5,272,000	ACTO

12/6/2024

Page 118 of 128

*Technical consulting Services									
Component 1:									
1.1.1: Review of physical characterization of the AAS, gaps and opportunities.									
1.1.2: Assessment of surface-groundwater interaction, including atmospheric and land surface processes under climate change conditions, gaps and opportunities.									
1.1.3: Assessment of existing ground-based and remote sensing-based monitoring efforts with estimation of water storage, water table, withdrawal, surface deformation, among other parameters.									
1.1.4: Assessment of groundwater processes at the scale covering the pilot sites (downscaling techniques in remote sensing).									
1.2.1: Development of baseline maps for physical characterization of AAS, and aquifers.									
1.2.2: Development of human-induced hazard maps (anthropogenic activities such as mining, infrastructure development, among others), StG (surface to groundwater), GtoS (groundwater to surface).									
1.2.3: Development of vulnerability maps for aquifers including downscaling to pilot sites.									
1.2.4: Development of a hierarchical-based analysis to describe priority zones.									
1.2.5: Development and implementation of maps into project website and into module AAS of Amazonian Regional Observatory (ARO).									
1.3.1: Development of a hydrological/hydrogeological modeling considering global changes (climate and anthropogenic) and socio-economic development scenarios.									
1.3.2: Downscaling the hydrological/hydrogeological modeling to priority zones and pilot sites.									
1.3.3: Estimation of the effects of El Niño and La Niña into the AAS, prediction of future conditions.									
1.3.4: Modeling atmospheric, surface and groundwater interaction under global changes: challenges and opportunities to develop global models.									
1.3.5: Development of water security analysis, including downscaling to pilot sites and priority zones.									
1.4.1: Surface-groundwater interaction monitoring (5 priority zones).									
1.4.2: Geomorphic river floodplain characterization along main rivers linked to contaminated sediments affecting groundwater (5 priority zones).									
1.4.3: Isotopic analysis (source and flow path, water age, vulnerability to pollution and climate conditions) near 15 of ACTO Amazon Regional Observatory (ARO) stations.									
1.4.4: Assessment, measurements and modeling of main pollution threats StG and GtoS (5 priority zones).									
1.4.5: Implementation of Citizens Science initiatives (5 priority zones).									
1.4.6: Implementation of data into project website and Amazonian Regional Observatory (ARO).									
1.5.1: Certification in Amazon Aquifer Groundwater knowledge and governance.									
1.5.2: Georeferenced AAS and pilot's data into ACTO Amazon Regional Observatory (ARO).									
1.5.3: AAS symposium and AAS international conference, across scales, across components.									
1.5.4: Transboundary Diagnostic Analysis (TDA).									
Component 2:									
2.1.1: Assessment of institutional, legal, regulatory, and public policies framework, regarding groundwater management, at national and regional level.									
2.1.2: Institutional analysis to identify strengths, weaknesses and gaps regarding groundwater management, at national and regional level, with focus in decision making level, governance and information management of public institutions.									
2.1.3: Socioeconomics analysis related with groundwater use, with focus in economic and gender inequalities, and specially analysis related with ethnic minorities.									
2.2.1: Amazonian Groundwater White Paper prepared, based on the information collected in the activities of output 1.1 and 2.1, that proposes improvements to the technical, regulatory, and institutional frameworks of the countries on groundwater management, as well as to the ACTO's role.									
2.2.2: Regional workshop to reflect on institutional, regulatory and social aspects in aquifer management and disseminate results of analysis and assessments related.									
2.2.3: Dissemination of Amazonian Groundwater White Paper at national level in the 8 CM.									
2.2.4: Dissemination of Amazonian Groundwater White Paper at international events.									
2.3.1: Assessment of existing national information protocols and methodologies to monitoring groundwater.									
2.3.2: Develop regional protocols for groundwater monitoring that includes methodologies, instrumentation, data transmission, collection and custodian protocols, as well as data exchange mechanism and procedures agreements.									
2.3.3: Design data monitoring and reporting system into Amazonian Regional Observatory - ARO.									
2.3.4: Strengthening national capacity for monitor and reporting into Amazonian Regional Observatory - ARO groundwater system through training programs/workshops.									
2.4.1: Elaboration a Road Map to improve technical, regulatory, and institutional frameworks on groundwater management in Suriname and Guyana.									
2.4.2: Improvement of national capacities for sustainable groundwater management.									
2.4.3: Strengthening regulatory and institutional framework at national level on groundwater management.									
Component 4:									
4.1.2: Development of Amazon Aquifer Strategic Action Plan (AAS SAP) for groundwater protection, sustainable management and monitoring, using the Global Framework for Action guidelines and AAS White paper.									
4.3.1: Assessment of financial opportunities regarding groundwater management, at global, regional and national level.									
4.3.2: Development of financial strategy for implementing SAP strategic actions, with a portfolio of financing options and bankable investments.									
4.3.3: CM commitment to financial support AAS SAP implementation process.									
4.3.4: Cooperation and private sector agreements for AAS SAP implementation process.									
Component 5:									
5.1.1: Development of capacity building for institutional strengthening at national and subnational level technical personnel.									
5.1.2: Development of capacity building for groundwater management governance to decision makers and other stakeholders.									
5.1.3: Strengthen ACTO as a regional cooperation platform and coordination mechanism.									
5.2.1: Training ACTO staff, National counterparts and directly involved partners to promote gender-sensitive approaches and gender mainstreaming in the AAS project, using AAS Gender Action Plan in accordance with									
5.2.2: Incorporate groundwater and Gender Action Plan into the AAS project intervention, specially each pilot project.									
5.3.1: Elaborate a Communication Action Plan of AAS, following the Communication Strategy guidelines.									
5.3.2: Implementation of the Communication Action Plan, developing communication products.									
5.3.3: Document and communicate lessons learned and best practices.									
5.4.3: Develop project experience and best practices notes.									
5.3.4: Design a project visual identity and development of project website.									

ANNEX I: RESPONSES TO PROJECT REVIEWS

From GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF.

Appendix 8: Responses to GEF Council and STAP Comments.

GEF Council's Comments - Germany	Response
<p><u>Germany approves the following PIF in the work program but asks that the following comments are taken into account:</u></p> <p>Germany welcomes this proposal, which aims at stronger cooperation for improved management of the Amazon aquifer system. Understanding and monitoring groundwater is essential for its protection and sustainable use. At the same time, Germany has the following comments that it suggests being addressed in the next phase of finalizing the project proposal:</p> <p><u>Suggestions for improvements to be made during the drafting of the final project proposal:</u></p>	
<ul style="list-style-type: none"> Groundwater management is a long-term task. Germany suggests considering stronger capacity development activities, especially under component 5 and including with the Amazon Regional Observatory, to ensure the continuity and sustainability of the project results. Given the high costs of groundwater study and management in large aquifers, the project would benefit from clearer scoping of existing knowledge gaps and how and where these will be reduced through the project, and from more clarity about what is realistically achievable with the available budget and time. 	<p>Thank you for your comment. There are known knowledge and capacity gaps that the project will concretely address as part of its implementation. The Project will identify several gaps related to groundwater management in order to strengthen capacities where they are required. As described in Figure 3 in the project's flowchart that connects outputs and components, capacity building to ACTO and Country Members (CM) is included in the majority of technical activities for Component 1. Additionally, Output 5.1 includes training and capacity building for groundwater operators, municipalities, decision makers and other stakeholders, in addition to an online certification on the Amazon Aquifer Systems (AAS), groundwater knowledge and governance (Appendix 13) that will allow a greater scope in the dissemination of knowledge. The latter is also developed in collaboration with PRIC module from the Amazon Regional Observatory (ARO). Output 2.3 includes the development of regional monitoring protocols and Activity 2.3.4 also includes the development of national capacity for monitoring and reporting into the ARO. The latter includes capacity building related to the regional protocols (Activities 2.3.2 and 2.3.3) but also related to the platform (ARO) itself. The proposed goals are achievable in time and with the existing budget, but the project itself has a future outlook that hopes to be projected over time with the Transboundary Diagnostic Analysis (TDA), White paper on the Amazon aquifers and the Strategic Action</p>

	Program (SAP) for the AAS that will be looking to design.
<ul style="list-style-type: none"> The Amazon Aquifer Systems are located far from capitals and political centers. Germany therefore suggests working with municipal and local authorities in addition to national governments. These will make sure that governance mechanisms and project activities are implemented on the ground, that communities are involved and that regulations are enforced. The involvement of indigenous/community leaders and other groups of civil society should also be mentioned, as appropriate. 	<p>The project involves different linkages to municipal and local authorities, local communities and indigenous people, in addition to national governments. And this is evident from the pilots (Component 3) that will be implemented, for instance, in Colombia (Appendix 11.iii), which will promote a multi-municipal cooperation mechanism, Suriname will develop the pilots with indigenous communities (Appendix 11.vii), Venezuela's pilot will benefit indigenous people keeping domestic water supply and raising awareness about groundwater (Appendix 11.viii), as well as the other pilots (see Appendix 11) .</p> <p>Also, Component 1 (Output 1.4) includes the development of Citizens Science initiatives at 5 locations, where community participation is expected not only to monitor groundwater and contamination processes, but also to create awareness of the AAS project.</p> <p>Component 5 (Output 5.1) includes training and capacity building for groundwater operators, municipalities, decision makers and other stakeholders, in addition to an online certification (Appendix 13) on related topics that will allow a greater scope in the dissemination of knowledge.</p> <p>For projects to be viable and permanent over time, work on public policies is a key element, as long as they can be implemented by subnational authorities and therefore reach local communities.</p>
<ul style="list-style-type: none"> Germany suggests strong cooperation with other projects, including the substantial portfolio of German Cooperation with national and regional partners, such as OCTA. 	<p>The project will strongly cooperate with other projects, learning about the experiences and complementing their activities, in order to avoid duplicating efforts, and to ensure a comprehensive view, including those supported by German cooperation (see Figure 13 of the main document). During the inception and execution of the project, linkages to other GEF and non-GEF projects will be defined.</p>

GEF Council's Comments - Japan	Response
<p>We recognize that the 1:7.5 overall co-financing metric cited may have been inflated by a few private-sector/corporate-related projects. Of the regular projects, we observe the very large co-financing ratios in industry-related projects in sectors such as power generation and construction and suspect these may have contributed to this overall boost. We hope that these risks are taken into account in project designs and recommend careful review to back check these figures assessed, which may also affect the value of the grants proposed.</p> <ol style="list-style-type: none"> 1. Furthermore, since some of these industry projects relate to the sectors (hydrogen in particular) that could be easily financed by risk-tolerant private capital, we may want to consider additionality issues much more carefully (for example, by prioritizing/prompting re-allocation of capital in other themes/areas that can't have such easy access to markets for funding, even if it may have less co-financing ratios, or considering NGI path as an option). 2. We should be leaving these initiatives to the handling of the private sector, to avoid unnecessary politicization and other reputation-related risks for the GEF. We therefore recommend projects with these characteristics to be subject to a second review by Council with more information before CEO endorsement. 	<p>Thank you for your comment. The co-financing for this project primarily comes from public investments provided by the recipient country's governments. No direct corporate-related projects are included in this co-financing. Through a participatory consultation process, Amazon countries, ACTO, and Implementing Agencies reviewed their portfolios to identify existing or future projects that can support and enhance the objectives of this GEF project. A careful revision of the co-financing portfolio ensured compliance with GEF policies.</p> <p>For example, Bolivia's investments are mobilized from the Ministry of Environment and Water and include projects aimed at afforestation of watersheds and irrigation. Brazil's contributions come from the Brazil Water Agency (ANA) and the Ministry of Energy and Mines. Colombia's support is linked to CORPOAMAZONIA, while Ecuador commits through its National Plan for Integrated Management of Water Resources. Peru supports through the National Plan for Environmental Evaluation and Supervision (PLANEFA), and Suriname focuses on geomorphological research and water analysis in the coastal plain.</p> <p>Finally, the envisaged role of the private sector focuses on creating and enhancing strategic alliances to support project's sustainability. The private sector's involvement is recognized as crucial for innovation and technology deployment, especially given the existing finance gap for managing and protecting the Amazon Aquifer Systems.</p>

GEF STAP's Comments	Response
<p>Overall:</p> <p>The rationale is sound and well documented, demonstrating how the aquifer systems are hugely important despite remaining poorly understood. The proposed project targets enhancing the overall understanding of the aquifer systems and facilitating multi-state cooperation to directly reduce threats such as overexploitation and pollution. The three</p>	

<p>corresponding components can be summarized as 1) better and detailed information; 2) policy assessment and recommendations; 3) pilot projects; and 4) a strategic action plan (SAP) for the Amazon Aquifer System (AAS).</p>	
<p>The theory of change (ToC) provides a helpful and well-structured summary of change pathway, yet prompts several points for refinement:</p> <ol style="list-style-type: none"> 1. The assumption is that if people have greater knowledge, including through pilot projects, better capacity building, communication, etc. countries will agree to better coordinate management of the aquifer which will lead to improved water security. This logic is similar to the logic of many transboundary water projects, including GEF ID 9770 in the Amazon basin. Is there evidence that these components alone are sufficient to result in improved water quality and use in the basin? 2. It is questionable whether “an agreed SAP” is truly a suitable long-term outcome to target, as opposed to an output of component 4; a necessary but insufficient precondition for better, coordinated action. 3. Figure 1 – the AAS problem tree – is a helpful illustration but would be strengthened by specifying relationships among particular root causes, problems and effects, which may in turn help strengthen the description of causal pathways in the ToC. 	<ol style="list-style-type: none"> 1. The ToC was updated into the main document and what is not known or seen is not valued and this is the case of aquifers and their importance for water security. Its visibility is required in public policies, its consideration in the management of national and subnational governments and the knowledge of the population regarding its importance. <p>Just as it cannot be considered that separate actions in regulations, public management or citizen knowledge can generate change, nor can we treat groundwater as something independent of the cycle of its natural connections with the ecosystems of the basin in which the aquifer is located. The results must be achieved with a holistic and process perspective.</p> <p>Component 1 describes scientific-based activities that will map hazards from surface to groundwater, aquifer vulnerability to contaminants, scenarios for water security analysis under global (climate and anthropogenic) and socio-development conditions.</p> <p>Component 3 is related to pilot projects where countries have identified national and regional benefits (see Appendix 11), some of the related to technical and governance knowledge, some others (e.g. Peru) to define a local action plan for safe groundwater use for the population.</p> <p>Components 2, 4 and 5 seek to complement scientific technical knowledge with public policies, regulatory frameworks and institutional strengthening, in addition to strong training and communication work, all of this with a gender responsive approach.</p> <ol style="list-style-type: none"> 2. Having a multinational agreement that allows joint action beyond the life of a specific project is necessary to achieve the sustainability of a proposal such as the one referred to the AAS.

	<p>3. The PIF's ToC was modified in the present project by linking the assumptions, barriers, output, outcomes to the project objectives by describing an intermediate indicator (SAP), all of the above to achieve the following impact "sustainable, integrated management and use of the AAS to improve water security". The ToC has helped to develop the project's flowchart (Figure 3).</p>
<p>Component 2 seeks to 'diagnose' and address institutional inconsistencies and gaps among countries that would stand in the way of improved coordination on groundwater. It is not clear if this component will also examine issues of policy coherence within countries that may be driving decisions that inadvertently lead to poor groundwater usage and contamination</p>	<p>Cases of inconsistency between public policies and regulatory frameworks within the same country are not isolated, and there are even cases in which the same institution can make contradictory decisions simultaneously or within little time interval between them.</p> <p>The aim is for the diagnosis to develop an introspective analysis and then a comparative one, to ensure policy coherence, and then use the inputs to scale up to a regional perspective.</p>
<p>The fact that pilot projects have already been identified is promising; however, what is the ToC for scaling these innovations (if successful)? Or is their main purpose to inform the development of the SAP, with the implication that the SAP is the primary vehicle for scaling?</p>	<p>The pilots were identified in different countries under a certain criterion that is well described by Figure 6 (Design of pilots based on physical parameters, considering annual precipitation rates, recharge rates, water table, drought index, among other parameters). Their connection to other components and to AAS is described by Figure 8, while a conceptual upscaling of activities is also presented in Figure 9.</p> <p>Component 1 includes downscaling views of scientific results to the pilot's scale. Pilot interventions include the application of innovative techniques, such as isotopic analysis and standardization of methodologies (based on standardized protocols, see Output 2.3) throughout the country members. Based on the flowchart of the project (Figure 3), upscaling of technical findings from the scale of the pilot to the AAS scale is foreseen.</p> <p>Component 1 also includes the definition of priority zones that will be complementary to the pilot studies, thus, both pilots and priority zones will inform towards the development of the SAP</p>

	(Component 4), which is expected to be the primary vehicle for up-scaling in the context of this project.
<p>There is good information regarding the relationship between this proposed project and the GCF proposal aimed at increasing the resilience of people and nature in light of climate change impacts on water availability and quality. Conversely, there is a noticeable lack of detail regarding how this project relates to GEF ID 9770</p> <p>“Implementation of the Strategic Action Programme to ensure Integrated and Sustainable Management of the Transboundary Water Resources of the Amazon River Basin Considering Climate Variability and Change”. There are many overlapping activities (e.g., component 2.6 in GEF ID 9770 to develop groundwater source protection solutions, component 3.1 to develop Amazon basin monitoring systems, etc.). What have been the lessons learned so far and how are they informing this proposed project? This seems particularly important since ACTO is the Executing Agency for both projects.</p>	<p>The GEF ID 9770 project considered a few specific aspects related to groundwater, especially at a technical level. These topics were in-depth analyzed when developing the CEO Endorsement, aiming to include the learnings from the previous project and also trying to unify efforts when possible.</p> <p>To prepare the AAS project in detail, technical and institutional aspects of GEF ID 9770 have been analyzed so what is being proposed complements that project and does not repeat it, rather it complements it. This is now extensively described in the main document (e.g., Project Rational, Project Description). For instance, this project includes the development of Groundwater Citizen Science initiatives (see Output 1.4), and the GEF ID 9770’s intervention project in Leticia-Tabatinga (Colombia, Brazil) is proposed as one location of the initiatives.</p> <p>During the design phase and the consultation process, the team involved in the execution of GEF ID 9770 has been consulted, also taking advantage that UNEP is the Implementing Agency in both cases. As a result of this exercise, and particularly regarding knowledge management, communication and stakeholder engagement, some common areas were mapped and considered for the development of this proposal.</p> <p>A key aspect that we seek to learn from GEF ID 9770 is the way in which it has addressed gender responsive approach in relation to water management, which we will seek to replicate, where appropriate, in the case of the AAS project.</p> <p>ACTO and Implementing Agencies are approaching both projects in a holistic manner, which allows, in the case of the integrated management of water resources in the Amazon basin, to execute both projects in a complementary fashion.</p>

<p>Stakeholder engagement is mainly focused at the ‘highest political levels’ – presumably in order to gain agreement on the SAP. Information is lacking on the role of IPLCs, academia, the private sector, civil society, etc. – apart from indicating the intention to include all in identifying “consensus actions to manage the AAS.” This seems to ignore the inherent tensions and competing goals that are sure to emerge.</p>	<p>The AAS project has an important component related to generate commitments at the highest decision level, but to maintain the continuity of the awareness that it seeks to achieve, it must have multilevel decision makers, in addition to the commitment of local communities. and of course, from the academy.</p> <p>The identification of all actors has been complex, but it is clear that in components 1 and 3, public institutions, academia and local communities take precedence. In components 2 and 4, there is more participation from government authorities and technical teams. Component 5 seeks to count on the participation of a diversity of stakeholders.</p> <p>A fundamental aspect mentioned in the workshops for the development of the AAS project has been to consider the role of the communities and indigenous peoples located in those areas in which field work will be carried out and the way in which they must permanently participate to appropriate the proposals.</p>
<p>Risks are rated “low” across all categories besides climate, which is unconvincing given the threats to groundwater quality outlined in the project rationale, the low level of base knowledge, and the absence of suitable policy, regulatory and enforcement frameworks. While the project aims to mitigate these risks, they seem substantial in threatening achievement of successful outcomes.</p>	<p>Climate risks are rated “Moderate”, and others are rated as “Low”. As stated in the main document, during the execution of the project, the behavior of the assumptions that could increase the level of some of the indicated risk categories will be reviewed, especially, when scientific evidence will be available.</p>
<p>Specific point 1:</p> <p>Greater attention to the political economy of change is recommended in sharpening the project design. This includes querying the political, institutional and economic incentives envisioned to drive behavioural change, beyond the mere production of data and formal agreement on plans.</p>	<p>Not only in the design but mainly in the project implementation process, this aspect is fundamental. During the design of the project, the political, economic and institutional dynamics of the countries of the Amazon basin have been considered; and will be monitored in the implementation stage.</p>
<p>Specific point 2:</p> <p>As part of this, consider future narratives that take into account not only future climate scenarios but also, other important factors that can influence water usage such as population, development, political stability, etc. The latter is particularly important for the successful implementation of transboundary</p>	<p>As part of the Component 1, technical studies will consider not only future climate change scenarios but also socio-economic pathways, including different factors that can impact water supply and demand. In terms of communication and dissemination, these narratives will be also considered adjusting materials accordingly.</p>

<p>water agreements. See Using simple narratives to ensure durability of GEF investments.</p>	
<p>Specific point 3:</p> <p>Detail how diagnosis of institutional inconsistencies and gaps will address issues of policy coherence within countries.</p>	<p>The countries of the Amazon basin have designed their national interventions, in certain cases, in a sectorized and non-territorial manner. This means that in the same territory we can find interventions that become contradictory.</p> <p>The opportunity that a project like the AAS presents is to address the problem of aquifer management from a territorial (and not sectoral) perspective, bringing the various national institutional stakeholders to the table, with a view to seeking solutions. In the search for solutions, contradictions are identified, and proposals are made, considering that no one likes to be exposed for their wrong actions.</p> <p>The idea is to put the problem up for debate and design sectoral interventions around it, not the other way around.</p>
<p>Specific point 4:</p> <p>Within the theory of change, probe how the project will help to identify and scale successful innovations.</p>	<p>A conceptual design for scaling up lessons learned from pilots to AAS is shown in Figure 3. Pilot's connection to other components and to AAS is also described by Figure 8, while a conceptual upscaling of activities is also presented in Figure 9. As described, one of the key elements of the main document is the downscaling (from AAS to pilot) and the upscaling (from pilot to AAS).</p>
<p>Specific point 5:</p> <p>Detail lessons learned from prior and ongoing, related investments, including how this influence the design, with particular attention to links to GEF ID 9770.</p>	<p>Currently, ACTO has a series of projects and initiatives related to the management of surface and underground water resources, the challenge of providing safe water to communities and the management of information and monitoring to contribute to decision-making in relation to resource.</p> <p>The design of the AAS project has considered mainly, but not only, the GEF ID 9770 project. Figure 13 of the main document shows the extensive GEF and non-GEF projects that will be considered for collaboration during the execution of the project. As described before, one of the intervention projects from GEF ID 9770 is proposed as the location for developing a Groundwater Citizen Science initiative.</p>

	<p>The main challenges to be faced are related to governance around the management of water resources, the incorporation of this issue in public policies and legal framework, fragmented institutional leadership, as well as considering cultural and gender components in it.</p>
<p>Specific point 6:</p> <p>Review risk characterization and stakeholder engagement plans with an eye on more realistically assessing the potential for divergent goals, competition and conflict, and mechanisms to address these meaningfully.</p>	<p>In addition to the review of the risk categorization and the stakeholder plan, a permanent update of the context will be made to allow for periodic adjustments.</p>