THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

FOR OFFICIAL USE ONLY

Report No: PAD5277

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A
PROPOSED LOAN

IN THE AMOUNT OF US$150 MILLION

TO THE

PLURINATIONAL STATE OF BOLIVIA

FOR A

RESILIENT WATER MANAGEMENT FOR COMMUNITY AND HOUSEHOLD IRRIGATION PROJECT

JANUARY 29, 2024

Water Global Practice
Latin America And Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective Dec 30, 2023)

Currency Unit	=	Bolivianos (BOB)
BOB 6.96	=	US$1
US$0.14	=	BOB 1

FISCAL YEAR
January 1 - December 31

Regional Vice President:	Carlos Felipe Jaramillo
Regional Director:	Benoit Bosquet
Country Director:	Issam A. Abousleiman
Practice Manager:	David Michaud
Task Team Leader(s):	Luis Alfonso Alvestegui Justiniano, Griselle Felicita Vega, Martin Benedikt Albrecht,

ABBREVIATIONS AND ACRONYMS

ASA	Advisory Services and Analytics
AM	Accountability Mechanism
CAF	Development Bank for Latin America and the Caribbean
CPF	Country Partnership Framework
DA	Designated Account
DFIL	Disbursement and Financial Information Letter
DOU	Department Operating Unit
EDTP	Pre-investment Technical Design Studies
ENSO	El Niño –Southern Oscillation
EPHIC	Basin-level water planning strategy - *Estrategia de planificación hídrica en cuencas*
ESCP	Environmental and Social Commitment Plan
ESMF	Environmental and Social Management Framework
ESS	Environmental and Social Standard
ETA	Autonomous Territorial Entities – *Entidades Territoriales Autónomas*
FAO	Food and Agriculture Organization
FM	Financial Management
FORATP	Organizational Strengthening and Productive Technical Assistance – *Fortalecimiento Organizacional y Asistencia Técnica Productiva*
GBV	Gender-Based Violence
GCRF	Global Crisis Response Framework
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIZ	German Agency for International Cooperation
GoB	Government of Bolivia
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
GWSP	Global Water Security and Sanitation Partnership
Ha	Hectares
HLO	High Level Outcome
IBRD	International Bank for Reconstruction and Development
ICOLD	International Commission of Large Dams
IFR	Interim Unaudited Financial Report
IPCC	Intergovernmental Panel on Climate Change
IPF	Investment Project Financing
ITCP	Technical Reports on Preconditions – *Informe Técnico de Condiciones Previas*
IWRM	Integrated Water Resources Management
JICA	Japan Agency for International Cooperation
LAC	Latin America & the Caribbean
MDRyT	Ministry of Rural Development and Land – *Ministerio de Desarrollo Rural y Tierras*
MEFP	Ministry of Economy and Public Finance - *Ministerio de Economía y Finanzas Públicas*
MIC	Integrated Water Basin Management – *Manejo Integrado de Cuencas*
MMAYA	Ministry of Environment and Water - *Ministerio de Medio Ambiente y Agua*
MPD	Ministry of Development Planning - *Ministerio de Planificación del Desarrollo*
M&E	Monitoring and Evaluation
MTR	Mid-Term Review
NCU	National Coordination Unit

NDC	Nationally Determined Contribution
OGC	Basin Management Organization – *Organización de Gestión de Cuenca*
O&M	Operation and Maintenance
PA	Paris Agreement
PAR	Rural Alliances Project – *Proyecto de Alianzas Rurales*
PDES	Economic and Social Development Plan
PDO	Project Development Objective
PIC	Interinstitutional Basin Platform – *Plataforma Interinstitucional de Cuenca*
PIEB	Bolivia's Strategic Research Program - *Programa de Investigación Estratégica en Bolivia*
PIU	Project Implementation Unit. The PIUs are UCP-PPCR and UCEP-Mi Riego.
POA	Annual Operational Program – *Programa Operativo Anual*
POM	Project Operational Manual
PPCR	Pilot Program for Climate Resilience – Integrated River Basin Management Project
PPSD	Project Procurement Strategy for Development
RCO	Rural Community Organization
RPO	Rural Producer Organization
SA	Social Assessment
SCD	Systematic Country Diagnostic
SENAHMI	National Hydrological and Meteorological Service - *Servicio Nacional de Metereología e Hidrología*
SEDERI	Departmental Irrigation Services - *Servicios Departamentales de Riego*
SEI	Stockholm Environment Institute
SENARI	National Irrigation Service - *Servicio Nacional de Riego*
SEP	Stakeholder Engagement Plan
SGP	Projects Management System
SIGEP	Government's Integrated Financial Management System
SIGG	Georeferenced Management Information System
SORT	Systematic Operations Risk Rating Tool
TA	Technical Assistance
UCP PPCR	Coordination Unit of the Climate Resilience Program
UCEP Mi Riego	Coordination and Implementation Unit of Mi Riego Projects
UGC	Basin Management Unit – *Unidad de Gestión de Cuenca*
UNFCCC	United Nations Framework Convention on Climate Change
VAPSB	Vice Ministry of Water Supply and Sanitation – *Viceministerio de Agua Potable y Saneamiento Básico*
VIPFE	Vice Ministry of Public Investment and External Financing - *Viceministerio de Inversión Pública y Financiamiento Externo*
VRHR	Vice Ministry of Water Resources and Irrigation - *Viceministerio de Recursos Hidricos y Riego*
WB	World Bank
WBG	World Bank Group

TABLE OF CONTENTS

DATASHEET

BASIC INFORMATION

Project Beneficiary(ies)	Operation Name		
Bolivia	Bolivia Resilient Water Management for Community and Household Irrigation Project		
Operation ID	Financing Instrument	Environmental and Social Risk Classification	
P178861	Investment Project Financing (IPF)	Substantial	

Financing & Implementation Modalities

[ ] Multiphase Programmatic Approach (MPA)	[ ] Contingent Emergency Response Component (CERC)
[ ] Series of Projects (SOP)	[ ] Fragile State(s)
[ ] Performance-Based Conditions (PBCs)	[ ] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a non-fragile Country
[ ] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made Disaster
[ ] Alternative Procurement Arrangements (APA)	[ ] Hands-on Expanded Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
20-Feb-2024	30-Jan-2030
Bank/IFC Collaboration	
No	

Proposed Development Objective(s)

To improve integrated water resources management in selected basins and increase the resilience to climate variability of vulnerable rural families in selected micro basins.

Components

Component Name	Cost (US$)
Component 1. Water resources planning and pre-investment studies.	9,900,000.00
Component 2. Climate resilient infrastructure investments.	139,328,000.00
Component 3: Capacity building for water governance and enhanced productivity.	16,575,000.00
Component 4. Project management.	5,310,000.00
Front-end-fee (to be financed by the proceeds of the loan)	375,000.00

Organizations

Borrower:	Plurinational State of Bolivia
Implementing Agency:	Ministerio de Medio Ambiente y Agua (MMAyA), Viceministerio de Recursos Hidricos y Riego (VRHyR)

PROJECT FINANCING DATA (US$, Millions)

Maximizing Finance for Development

Is this an MFD-Enabling Project (MFD-EP)?	No
Is this project Private Capital Enabling (PCE)?	No

SUMMARY

Total Operation Cost	**171.49**
Total Financing	**171.49**
of which IBRD/IDA	**150.00**
Financing Gap	**0.00**

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	150.00

Non-World Bank Group Financing

Counterpart Funding	21.49

Borrower/Recipient	21.49

Expected Disbursements (US$, Millions)

WB Fiscal Year	2024	2025	2026	2027	2028	2029	2030
Annual	0.00	20.00	30.00	30.00	30.00	30.00	10.00
Cumulative	0.00	20.00	50.00	80.00	110.00	140.00	150.00

PRACTICE AREA(S)

Practice Area (Lead)

Water

Contributing Practice Areas

Agriculture and Food

CLIMATE

Climate Change and Disaster Screening

Yes, it has been screened and the results are discussed in the Operation Document

SYSTEMATIC OPERATIONS RISK- RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	Substantial
2. Macroeconomic	Substantial
3. Sector Strategies and Policies	Moderate
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Substantial
8. Stakeholders	Moderate
9. Other	

10. Overall	Substantial

POLICY COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

ENVIRONMENTAL AND SOCIAL

Environmental and Social Standards Relevance Given its Context at the Time of Appraisal

E & S Standards	Relevance
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts	Relevant
ESS 10: Stakeholder Engagement and Information Disclosure	Relevant
ESS 2: Labor and Working Conditions	Relevant
ESS 3: Resource Efficiency and Pollution Prevention and Management	Relevant
ESS 4: Community Health and Safety	Relevant
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant
ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Relevant
ESS 8: Cultural Heritage	Relevant
ESS 9: Financial Intermediaries	Not Currently Relevant

NOTE: For further information regarding the World Bank's due diligence assessment of the Project's potential environmental and social risks and impacts, please refer to the Project's Appraisal Environmental and Social Review Summary (ESRS).

LEGAL

Legal Covenants

Sections and Description
As per Section I.A.1 of Schedule 2 (Project Implementation Units) of the Loan Agreement, the Borrower, through MMAyA, shall at all times during the execution of the Project, maintain UCP-PPCR and UCEP-Mi Riego (the PIUs) with functions, responsibilities and resources, and staffed with personnel in number and with terms of reference, qualifications, experience and functions acceptable to the Bank, including, inter alia: (a) in the case of UCP-PPCR, a General Coordinator, a full-time procurement specialist, a full-time environmental specialist, a full-time social specialist, a biology specialist as and when required by the ESCP, and a full-time Financial Management Specialist; and (b) in the case of UCEP-Mi Riego, a General Coordinator, a full-time procurement specialist, a full-time environmental specialist, a full-time social specialist, a biology specialist as and when required by the ESCP, and a full-time Financial Management Specialist; all as further specified in the Operational Manual.
As per Section I.A.2 of Schedule 2 (Operational Manual) of the Loan Agreement, the Borrower, through the PIUs, shall carry out the Project in accordance with the Operational Manual, which shall include, inter alia, (i) the procedures for carrying out, monitoring and evaluation of the Project; (ii) the eligibility criteria for the selection of Subprojects under Part 2 of the Project; (iii) the procedures for approval, implementation, supervision, and monitoring of activities under Parts 1 and 2 of the Project, including the types of EPHICs, EDTPs, and Subprojects that require prior approval of the Bank for implementation (such as those in protected areas), the procedures for the transfer of completed Subprojects to ETAs, and the roles and responsibilities at the national, departmental, and municipal levels; (iv) the procedures for determining the cash and in-kind contributions that counterparts and beneficiaries of Subprojects under Part 2.2 of the Project may be required to provide; (v) the terms and conditions (including models) of Intergovernmental/ Interinstitutional Agreements; (vi) the organizational structure for implementation of the Project, including the composition, functions, and responsibilities of the PIUs; and (vii) the performance indicators for the monitoring and evaluation of the Project.
As per Section I.B (Intergovernmental/Interinstitutional Agreements) of Schedule 2 of the Loan Agreement, the Borrower shall, inter alia: (1) after having selected and approved a proposal for an EPHIC, EDTP, or Subproject in accordance with the Operational Manual, but before carrying out that activity, through the relevant PIU, enter into an Intergovernmental/Interinstitutional Agreement with the pertinent Eligible ETA and, in the case of an EPHIC, also with the relevant OGCs, UGCs, and PICs, in each case under terms and conditions described in and substantially in the respective form to be attached to the Operational Manual, which terms and conditions shall include, inter alia, the provisions described in Section I.B.1; (2) through each PIU party thereto, exercise its rights under each Intergovernmental/Interinstitutional Agreement in such a manner as to protect the interests of the Borrower and the Bank to accomplish the purposes of the Loan; and (3) except as the Bank shall otherwise agree, not assign, amend, abrogate, or waive any Intergovernmental/Interinstitutional Agreement in any way that could affect, materially and adversely, the implementation of the relevant EDTP, EPHIC, or Subproject.
As per Section I.C (Environmental and Social Standards) of Schedule 2 of the Loan Agreement, the Borrower, through the PIUs, shall, inter alia, ensure that the Project is carried out in accordance with the Environmental and Social Standards and the ESCP in a manner acceptable to the Bank.
As per Section II (Project Monitoring and Evaluation) of Schedule 2 of the Loan Agreement, the Borrower, through UCP-PPCR, shall furnish to the Bank each Project Report not later than 45 days after the end of each calendar semester, covering the calendar semester.
As per Section IV (Other Undertakings) of Schedule 2 of the Loan Agreement, not later than 4 months after the Effective Date, the Borrower shall implement a complementary financial information system (in addition to SIGEP) in a manner

satisfactory to the Bank, including, inter alia, the required functionality to allow preparation of financial reports and control and monitoring of Subprojects.

Conditions

Type	Citation	Description	Financing Source
Effectiveness	Section 5.01	The Operational Manual has been prepared by VRHR and approved by the Borrower through MMAyA in form and substance satisfactory to the Bank.	IBRD/IDA

I. STRATEGIC CONTEXT

A. Country Context

1. **Bolivia has made remarkable economic and social progress over the past twenty years.** Between 2006 and 2014, Bolivia's economy grew at an average rate of 5.1 percent per year in real terms due to a rapid increase in public investment and social spending.[1] Consequently, Bolivia experienced one of the region's largest reductions in poverty and inequality. Between 2002 and 2014, the national poverty rate declined from 63 percent to 39 percent, extreme poverty from 39 percent to 17 percent, and the Gini coefficient from 0.60 to 0.48, while the population increased from 8 to 11 million.[2] Economic and social progress continued from 2014 to 2018, albeit at a slower rate following the collapse of oil prices in late 2014 and the end of the global commodities boom.[3] To sustain economic growth in a less favorable external context, Bolivia has maintained high levels of public investment and social spending in line with the Government's state-led development model, alongside measures to grow domestic credit. This spending was financed, partially, by increased public debt and a drawdown on fiscal savings and international reserves. Nevertheless, despite the strong record of social progress, Bolivia remains one of the poorest countries in the region.

2. **The economy is gradually recovering from the 2020 COVID-induced recession**. The pandemic hit Bolivia hard; the economy contracted by 8.7 percent in 2020, and there was a temporary increase in poverty and inequality and a more protracted increase in informality. Growth recovered to 6.1 percent in 2021 and 3.5 percent in 2022, thanks to improving external conditions, easing mobility restrictions, and a recovery in public investment. Annual inflation remained at a low of 1.7 percent in December 2022, contained by a fixed exchange rate, subsidized fuel prices, and other price controls. The Government has refinanced the bulk of bonds due in 2022 and 2023, reducing rollover risks in the short term. Yet, possible limited access to funding in increasingly constrained international markets, declining gas exports, and weak private investment could limit growth in the medium term.

3. **Although poverty has declined after the pandemic-induced peak, some population segments have not made up for the lost ground, and important service delivery gaps remain to be closed**. In 2021, poverty fell below its pre-pandemic levels, the middle class rebounded, and income inequality declined. Measured under the international poverty line of $6.85 a day (2017 PPP), the poverty rate, in 2021 was 15.2 percent, down from 17.3 percent in 2020 and 15.5 percent in 2019.[4] Still, poverty remains particularly high in rural areas (32 percent), among indigenous people (22 percent), and children under 14 years of age (23 percent). Urban unemployment also declined from a peak of 11.6 percent in July 2020 to pre-pandemic levels of 4.5 percent in December 2022, but there has been a rise in informality amidst slower employment growth and lower labor force participation. Higher food inflation following the end of pandemic-related emergency cash transfers has impacted households' purchasing power; it is estimated that monetary poverty could have increased to 16.9 percent in 2022.[5]

4. **The 2021-25 Economic and Social Development Plan of Bolivia (PDES) reflects the Bolivian Government's development priorities.** The PDES (framed in the context of Bolivia's ten-year Patriot Agenda 2015–2025) seeks to restore

[1] Growth, unemployment, and inflation rates come from the National Statistics Institute.
[2] National poverty rates and Gini coefficients come from official figures from the National Statistics Institute, and population figures come from the World Development Indicators.
[3] World Bank. 2021. Rebalancing Inclusive and Sustainable Growth to Continue Reducing Poverty in Bolivia: Systematic Country Diagnostic Update.
[4] Poverty figures estimates based on the international poverty lines come from the Socio-Economic Database for Latin America and the Caribbean.
[5] World Bank estimates.

the economy through a Social Community Productive Economic model, which focuses on growth through internal demand facilitated by public investment. The PDES outlines policy objectives under ten strategic pillars (Figure 1).

Figure 1: Strategic Pillars of Bolivia's Economic and Social Development Plan, 2021–2025

5. **Bolivia is experiencing greater climate variability and more extreme climatic events.** The 2019 Global Climate Risk Index (CRI) ranks Bolivia 10th out of 178 countries in terms of the impacts of climate-related hazards. The most catastrophic disasters, including floods, droughts, and landslides, accounted for US$3.1 billion in damages over a 35-year period (1982–2016)—an average of US$91.1 million per year. These events, which are influenced by El Niño (the El Niño Southern Oscillation, ENSO), have been exacerbated by climate change, triggering increasingly intense rainfall, landslides, floods, and droughts over the last decade.[6] In the country's Amazonian lowlands, flooding has become more frequent and its effects increasingly widespread; from 2013 to 2014, floods caused estimated losses of US$450 million and affected 44,000 households in 113 municipalities (World Bank, 2017). In turn, Bolivia's Altiplano, inter-Andean Valleys and Chaco regions have experienced increasingly intense droughts. Projected increases in temperatures and rainfall during the rainy season will further expose the country to more prolonged dry periods and an increase in the frequency and magnitude of floods, landslides, and other weather-related events.[7]

B. Sectoral and Institutional Context

Sectoral Context

6. **In addition to the impact of climatic events, territorial and seasonal disparities have brought water security issues to the forefront.** Although Bolivia boasts 29,000 m^3 of water per inhabitant/year, significantly above the world average of 19,248 m^3/inhabitant/year,[8] the temporal and geographic distribution of water resources throughout the country is highly uneven. Most of Bolivia's major urban areas and economic centers are located upstream along the macro-basin systems of the Del Plata and Amazon or in the endoreic basin of the Altiplano, and face increasing desertification.[9] Water stress is further amplified by: (i) the low quality of water due to untreated human, industrial and mining wastewater; (ii) deforestation in Bolivia's lowlands, which has impacted water availability in the inter-Andean valleys; and (iii) land degradation in those valleys resulting from inadequate land-use and climate change. In addition, Bolivia faces extensive dry seasons between April and October, during which rainfall represents only about 0 to 15 percent of the annual total. Limited water management capacity has further aggravated water security issues across the country. Evapotranspiration accounts for the primary loss of precipitation inputs in key river basins, representing approximately 42 percent of losses in the Amazon, up to 75 percent in the Altiplano, and between 47 to 75 percent in the Del Plata. Consequently, annual runoff is estimated to be largest in the Amazon (679 mm), while it is much less in the Altiplano (70 mm) and variable in

[6] Cai et al., 2014
[7] World Bank 2013; WRI 2017
[8] FAO. 2016. AQUASTAT Database, Food and Agriculture Organization of the United Nations. Website accessed on: 02/12/2017. Note: Average estimate for Latin America includes all countries except the Caribbean.
[9] Around 77% of the Bolivia's population is living in degraded areas (IPCC, 2018).

the Del Plata (70–414 mm) basin. For the three macro-basins, seasonal differences in runoff are evident, with more than 60 percent of runoff occurring during the wet season.[10]

7. **Predicted impacts of climate change indicate more extreme temperatures and reductions in seasonal precipitation for Bolivia.** According to downscaled climate model data under the RCP8.5 scenario[11], increased warming and drying is expected in Bolivia by 2050 (Reichler, 2014). Projections show an annual mean temperature increase of 2-3 degrees centigrade averaged across the Bolivian territory, with warming becoming largest in spring (approximately 2.8 degrees centigrade). While projected patters of relative precipitation change indicate the drying is evident year-round and almost anywhere, the predicted reduction is most pronounced during fall and winter (20-40 percent less rainfall) than in summer (10-14 percent). The decrease in absolute precipitation is projected to be larger in summer (0.4-0.7 mm/day) than in winter (0.1-0.2 mm/day), and over the Andean foothills and the Amazon lowland. The trend to less precipitation will also be accompanied by noticeable reductions in soil moisture, relative humidity, and moisture transport.

8. **Water balances under future scenarios mostly reflect a reduction in water resources availability for Bolivia.** According to the assessment of climate change impacts under the RCP8.5 (concentration pathway scenarios) for 2018-2099, foreseen changes in hydrological regimes by one global circulation model (the MPI-ESM-MR) indicate a likely reduction in runoff between 17 and 32 percent for the 3 macro-basins. Estimates by other global circulation models (CESM-CAM5) however depict a reduction in runoff of 5 and 0.48 percent in the Amazon and Pilcomayo (del Plata) macro-basins, respectively, while runoff in the Altiplano and Bermejo (del Plata) could increase by 3 percent (MMAyA, 2016).

9. **Women are generally affected more adversely, both individually and as caretakers, by the impacts of climate change and natural disasters** as they tend to have less access to emergency shelters, less mobility as they often take care of children and the elderly when disaster hits, and are more vulnerable to gender-based violence, which often increases in disaster situations. Moreover, during droughts, women and girls tend to eat less and pay more for water and spend more time to collect water.[12]

10. **Agriculture is an important sector in Bolivia, accounting for 12.9 percent of the Gross Domestic Product.**[13] The agricultural sector, which includes forestry and fishing, had an annual growth of 5 percent between 2013 and 2018. The sector employs 31 percent of the active population, with nearly equal share of employed women and men working in agriculture.[14] Irrigation is a determining factor for land productivity and poverty reduction in rural areas, stabilizing agricultural production, contributing to food security and climate resilience, increasing agricultural income, and generating employment; however, only 32.9 percent of the agricultural production units in Bolivia use some type of irrigation for their crops.

11. **While women comprise a significant share of the agricultural workforce, play a critical role in how water is used and managed and play a key role in agricultural family businesses, they generally hold limited decision-making power.** In Bolivia, irrigation is mainly a male domain, and while rural women have prioritized an agenda to guarantee access to resources (land) and the promotion of productive development, their participation in decision making bodies is very limited,[15] and they have not been able to organize women's irrigators' organizations.[16] The reproduction of traditional

[10] WBG, Water and Climate Change in Bolivia - Background Paper to the Report on Economics of Climate Change Adaptation Bolivia. The World Bank, 2019.
[11] The RCP8.5 scenario corresponds to the pathway with the highest greenhouse gas concentration (not emissions) trajectory developed by van Vuuren et al. (2011) and adopted by the IPCC for its Fifth Assessment Report (ARS) in 2014.
[12] United Nations Framework Convention on Climate Change, 2022. Dimensions and examples of the gender-differentiated impacts of climate change, the role of women as agents of change and opportunities for women.
[13] https://datos.bancomundial.org/indicator/NV.AGR.TOTL.ZS?locations=BO
[14] https://datos.bancomundial.org/indicador/SL.AGR.EMPL.FE.ZS
[15] Elias, Bishelly (2015) “Derechos económicos de las mujeres rurales en el proceso de cambio de Bolivia: un análisis normativo” en Economía Social y Solidaria / Perspectivas
[16] Perales, Víctor Hugo (2015),” Género e interculturalidad en las políticas públicas de riego en Bolivia”.

roles and the undervaluing of women in organizations are some of the most subtle, invisible and accepted forms of reproduction of gender inequalities in Bolivia.[17] Female farmers oftentimes do not own the land that they farm, or if they do, do not hold the land titles under their names, which impacts their productivity and decision-making opportunities. They have less access to irrigation technology, finance, information about markets and innovative concepts such as climate resilient agriculture.

12. **Water availability is directly limiting agriculture.** Farmers in the highlands and in the inter-Andean valleys rely on rainfed agriculture and utilize the short rainy season to produce crops, such as potatoes, maize, wheat, oat, beans, peas and onions, primarily for personal use and secondly for local markets. The highlands are most affected by climate variability and change, given the increasingly frequent occurrence of droughts that have negatively impacted crop yields. Although irrigation, which ensures production in the rainy season and, if conditions allow, for a second production cycle during the dry season, is a key method for coping with temporal rainfall variability and periods of drought, only 10 percent of cultivated land in Bolivia is under irrigation.[18] It's important to note that changing the scheme from rainfed agriculture to irrigated agriculture also implies important changes in the need for technical assistance, not only for the operation and maintenance of the irrigation system, but also to reconsider the composition of irrigated agriculture based on improved yields. According to a 2010 dam inventory, Bolivia had 287 dams, 64 percent of which were categorized as small dams according to the International Commission of Large Dams (ICOLD) classification. The volume of total dammed water stands at roughly 596 million m^3. Most of these dams (74 percent) provide water for irrigation.

13. **Recognizing the importance of irrigation for agricultural production, the Government of Bolivia (GoB) developed an ambitious plan, "Decade for Irrigation 2015-2025, Towards One Million Hectares Under Irrigation" to promote irrigation.** From 2012 to 2017, the GoB invested roughly US$432 million (with its own funds and support from international partners) in irrigation, expanding coverage by an additional 83,236 hectares. However, most investments were targeted at traditional medium-sized irrigation systems. The average farm size in the highlands and inter-Andean regions, however, is less than three Ha, rendering traditional irrigation solutions impractical. Land fragmentation is most acute in the highlands, where 60 percent of farms span less than one Ha. Nevertheless, only 2 percent of investments made in the irrigation sector were directed towards household irrigation systems from 2012 to 2017. Despite limited investment, small-scale household irrigation solutions have been successfully implemented in several rural development projects.[19] These solutions capture discharge from small springs or harvest surface runoff and are primarily used for supplementary irrigation of rainfed agriculture. Such small-scale interventions have allowed rural households to diversify their agricultural production and provide additional water for livestock and human consumption.[20]

Institutional Context

14. **Bolivia's 2009 Political Constitution affirms the fundamental right to water (Article 373) and assigns the State a leading role in both the management of water resources (Article 374) and the provision of water and sanitation services (Articles 298, 300, 302 and 304).** The State must regulate, administer, and protect water resources to guarantee adequate and sustainable use of and access to water for all. The formulation of policies, planning and provision of basic services are established as exclusive responsibilities of the State at the different levels of government (national, departmental, and municipal). The Ministry of Environment and Water (MMAyA) is the lead governmental institution for environment and

[17] Salinas, Silvia (2017). "Mujeres, género y gestión del agua en los tiempos del "vivir bien" en Elemento de vida. El agua en el desarrollo, la cultura y la sociedad. Cooperación Suiza Bolivia

[18] According to the latest irrigation inventory (2012), Bolivia has 5,669 irrigation systems, covering approximately 303,192 ha which represents approximately 10 percent of the total cultivated area.

[19] According to the inventory of irrigation systems of 2012, there are 1,618 micro-irrigation systems with less than 10 ha. irrigated, representing 28% of the total irrigation systems supporting livelihoods of 26,159 families (9% of the total families benefitting from irrigation).

[20] Studies to assess the impact of household irrigation were carried out by the Ministry of Environment and Water and the German Cooperation Agency (GIZ), which included: *Riego familiar en regiones secas de Bolivia: guía para su implementación (2016); Estudio de efectos diferenciados de los Proyectos Integrales de Cosecha de Agua (PICA) en la familia (2013); Evaluación de atajados en la Macroregión Valles (2012); and "Tres estudios de caso de Manejo Exitoso de Atajados en el Norte de Potosí y Sur de Cochabamba" (2010).*

water in the country. The MMAyA's Vice Ministry of Water Resources and Irrigation (VRHR) is responsible for both policy formulation and providing guidelines for the regulation of irrigation and integrated basin management activities. The Ministry also encompasses decentralized entities, including the National Irrigation Service (*Servicio Nacional de Riego, SENARI*) and the Departmental Irrigation Services (*Servicios Departamentales de Riego, SEDERIs*), which are responsible for operating and updating the National Irrigation Information System, the National Register of Irrigation Systems, and the National Hydrological and Meteorological Service (*Servicio Nacional de Metereología e Hidrología, SENAHMI*)**.** According to the Political Constitution there is a concurrent responsibility regarding irrigation and watershed protection between the national government and the autonomous territorial entities (ETA), which are the autonomous departmental governments and the autonomous municipal governments.

15. **There is a widespread consensus on the need for an updated legal framework for water management and service delivery in Bolivia.**[21] Water legislation in Bolivia is based on numerous sectorial laws that assign different competencies to national and subnational institutions. Critical aspects for water security that are not adequately addressed under the current legal framework include: (i) unclear allocation of water resources among different users and lack of a competent authority to ensure equitable distribution, triggering urban-rural conflicts as metropolitan areas grow and agriculture increasingly depends on irrigation; and (ii) the absence of operational basin management units (UGCs). A main pillar of Bolivia's strategy for water resources management is the development of Basin Master Plans for prioritized river basins, which includes the creation of interinstitutional basin platforms (PICs) as well as UGCs[22] to coordinate the development and implementation of the river basin plans and mediate between different, and frequently competing, user groups. These organizations are mainly consultative in nature and require additional legal power to enforce any norms; (iii) the high fragmentation of water service delivery, be it for human consumption or irrigation, which prevents taking advantage of economies of scale. In the case of micro basins with areas of less than 200 km^2, the Basin Management Organizations (OGC)[23] are created to represent the interest of water users, however, despite being equally involved in agricultural production, women currently fill only 20 percent of decision-making positions, referring to board members in these governance bodies.[24]

16. **The funding and management procedures of minor irrigation systems are well established and follow the sector earlier experiences.** Municipal governments have exclusive jurisdiction in the implementation of minor irrigation schemes; they can legislate, regulate, and implement them. The national government has the capacity to contract loans to support the work of the municipal governments, develop investment policies and generate incentives for ETAs to implement these investments. To do so, each investment must have an agreement (*Convenio Intergubernativo de Financiamiento*) that sets forth the conditions of participation of each party. The operation and maintenance (O&M) of minor irrigation systems is the responsibility of community associations of users. Technical assistance is provided to users associations in two phases: (i) during the construction of the works to ensure that the beneficiaries carry out their counterpart activities and train the future users on the O&M of the schemes; and (ii) during the commissioning and

[21] The current Water Law in Bolivia dates back to 1906. The Water Law includes provisions such as water as a public good and establish Bolivian government as main authority responsible for water management. The definition of water rights is vague, "the water passing through the land belongs to the landowner as long as it does not affect others." No provision is included for neither groundwater property rights nor water tariffs. The Water Law was minimally modified in 1945, to specify that "no water right includes the right to deny access to water to downstream water users."

[22] Basin Management Unit (UGC) (*Unidad de Gestión de Cuenca*). This is a technical body responsible to facilitate, articulate and technically coordinate the organizational units of the Interinstitutional Basin Platforms *(Plataforma Interinstitucional de Cuenca)*. These platforms bring together public, private, and civil society stakeholders, to facilitate a participatory decision-making in the formulation, implementation, monitoring and evaluation of activities agreed within a basin water management plan. The Platforms are organized around three entities: political, social, and technical. The social entity is basically made up of the representatives of Basin Management Organizations (OGC), to ensure adequate and effective articulation between the strategic vision of the major basin and the visions of micro basins. The technical entity is the UGC, which is expected to provide technical advice to the stakeholders and receives financial support from Departmental Governments.

[23] Basin Management Organizations (OGC) (*Organizaciones de Gestión de Cuenca*). The OGCs are local, community bodies that identify and monitor the development of initiatives and local investments which are implemented within a basin water management plan. The OGCs are also active in following up the implementation of these initiatives as a means to developing management capacities at local level.

[24] MMAyA/VRHR 2023, in: Social Assessment for the 176681 Project. During Project preparation it was agreed that decision-making positions refer to all board members of the OGC, beyond president and vice-president, considering the importance of acknowledging the women´s role as delegates/representatives to these kinds of organizations.

operation stage, aiming at consolidating the users associations for the self-management and self-financing of the system, including the timing of water distribution, training for improving agricultural practices, alternative forms of association such as cooperatives, use of certified seeds, training on growing high-value products and ways to access markets, and the management of financial resources and their communal work for O&M. The users' associations have a legal status, and their water rights are registered at the departmental irrigation services (SEDERIs).

17. **In June 2022, the MMAyA launched its new Plurinational Water Resources Management Plan 2021-2025, which provides an integrated vision for the resilient and sustainable development of rural communities and includes: interventions in water management and related infrastructure; water governance at the national, macro, regional and micro-basins levels; irrigation; and risk management.**[25] Furthermore, Bolivia's updated Nationally Determined Contribution (NDC)[26] identified water as a priority adaptation sector and highlighted the adoption of integrated water resources management (IWRM) in a multi sectoral and multilevel manner as official policy, recognizing watersheds as life systems and water management units. The National Plan for River Basins (*Plan Nacional de Cuencas – PNC*) served as Bolivia's main policy instrument for IWRM until 2020.[27] While this policy represented important advances for IWRM, institutional and technical capacities as well as the legal framework for applying IWRM need to be further developed.

18. **Within the framework of this Plurinational Plan, the MMAyA has prepared the Bolivia Climate Smart and Resilient Program (*Programa Lucho por una Bolivia Climáticamente Inteligente y Resiliente*),**[28] a comprehensive rural development program encompassing actions ranging from water conservation, irrigation and risk management investments to information, knowledge management and water governance activities. This national Program will support Bolivia's 2021-2025 PDES, specifically Pillar 8, aimed at securing "a Sustainable and Balanced Environment in Harmony with Mother Earth," and Pillar 3, which focuses on "Food Security and Sovereignty, Value Added Export Promotion and Tourism Development." The GoB has requested World Bank support to implement the first phase of this Program through Investment Project Financing (IPF). The proposed US$171.5 million Project, which includes a counterpart contribution of US$21.5 million, will tackle water security challenges arising from climate change exacerbated flooding and droughts and build the resilience of families in vulnerable rural micro basins to the impacts of climate change.

C. Relevance to Higher Level Objectives

19. **The Project is aligned with and responds to the priorities established in the PDES 2021-25, its Plurinational Water Resources Management Plan 2021-2025, and its corresponding Bolivia Climate Smart and Resilient Program, as well as Bolivia's NDC, and the Decade for Irrigation 2015-2025 Plan**.

20. **The objectives and scope of the Project are in line with the World Bank Group's Country Partnership Framework (CPF) for Bolivia, FY2023-2026 (Report No. 181880-BO).** The first High Level Outcome (HLO) of the CPF aims to achieve "Increased climate and economic resilience" and develop institutional and management capacity to handle climate and external shocks. By supporting female farmers and gender equality, the project is in line with the WBG Gender Strategy as well as Bolivia's Constitution that in Article 8 mentions that the State shall be sustained in values of social and gender equity in all spheres of participation, including territorial and indigenous, native and peasant organizations.

21. **The Project is also aligned with the WBG Climate Change Action Plan 2021-2025.**[29] The Project is consistent with the WBG's climate-change commitments, and the Bank's Green, Resilient and Inclusive Development approach,

[25] MMAyA (2022): Plan Plurinacional para la Gestión Integral de Recursos Hídricos 2021-2025 (PPRH), issued on June 6, 2022.
[26] MMAyA (2022): Contribución Nacionalmente Determinada (CND) del Estado Plurinacional de Bolivia 2021-2030
[27] MMAyA (2017): Programa Plurianual de Gestión Integrada de Recursos Hídricos y Manejo Integral de Cuencas 2017-2020.
[28] MMAyA/VRHR (2022): Programa por una Bolivia Climáticamente Inteligente y Resiliente. Program document.
[29] WBG, Climate Change Action Plan, 2021-2025. Supporting Green, Resilient, and Inclusive Development. The World Bank, 2021.

particularly through its support of farmers to increase their adaptive capacity and resilience to the impacts of climate change.

22. **The project is consistent with the country's Nationally Determined Contribution (NDC).** In the latest NDC submitted to the United Nations Framework Convention on Climate Change (UNFCCC) on April 2022, the country commits to reduce greenhouse gas (GHG) emissions and enhance energy efficiency, on mitigation, and adopt a comprehensive approach to water resource management and improve water use efficiency in agricultural production, on adaptation. The project contributes to the NDC by improving the integrated water resources management in water stressed basins and increase the resilience to climate variability of vulnerable rural families in selected micro basins. Several project activities and expected outcomes, including improved water management, water harvesting, productive and efficient approaches to agriculture, increased food security, and afforestation/reforestation, are mentioned directly in the NDC as national goals. The country does not have a Long-Term Strategy yet, but the project is also consistent with other relevant climate commitments and strategies such as the National Adaptation Plan, which includes water resources as on its main five sectoral programs to reduce vulnerability and promote planned adaptation.

II. PROJECT DESCRIPTION

A. Project Development Objective

PDO Statement

23. **The Project Development Objective (PDO)** is to improve integrated water resources management in Selected Basins[30] and increase the resilience[31] to climate variability of vulnerable[32] rural families in selected micro basins.

PDO Level Indicators

Achievement of the PDO will be measured through the following proposed indicators:

PDO 1: Improved integrated water resources management in Selected Basins

(a) Number of selected basins with a basin-level water planning strategy (EPHIC) adopted.[33]
(b) Number of basin management organizations (OGCs) operating[34] (disaggregating male/ female participation).

PDO 2: Increased resilience to climate variability of vulnerable rural families in selected micro basins[35]

(c) Area (ha) provided with new or improved irrigation or drainage services -corporate results indicator- (number).
(d) Area (ha) with integrated water basin management (MIC) interventions implemented and area (ha) protected with flood risk management interventions (number).
(e) Vulnerable families[36] benefitting from climate resilience infrastructure interventions (number).

[30] Basins selected in accordance with the eligibility criteria to be set forth in the Project Operational Manual (POM).
[31] 'Resilience' is defined as the capacity to prepare, adapt to, and withstand disruptions or shocks. This definition has been adjusted from the definition provided in the report *Resilience Rating System: A Methodology for Building and Tracing Resilience to Climate Change* (https://openknowledge.worldbank.org/handle/10986/35039).
[32] Vulnerable rural families in the context of this Project are understood as those living in basins with high aridity index, high erosion, and high poverty levels, as further described in the Project Components section.
[33] An approved EPHIC requires that a PIC has been established and a UGC has been set up with a Board of Directors and a Social Council appointed. Under the Project, it is expected that 9 EPHICs will be approved by the UGC's Board of Directors, and at least 6 will be approved through a legal instrument (either a Departmental Law or Ministerial Resolution issued by MMAyA). This indicator can be regarded as a climate indicator for adaptation given that IWRM planning constitutes an important instrument for climate change adaptation.
[34] A basin management organization is defined as an OGC that is organized, it is working with the UGC of the main basin, and has developed and is implementing a Local Management Plan. Being a community organization the OGCs don't receive external financial support and relay on the support of their communities.
[35] These indicators are regarded as climate indicators for adaptation and mitigation given that by investing in irrigation and capacity building, farmers will avoid significant decreases in crop yields due to climate change.
[36] The majority of 'vulnerable rural families' in the PDO refers to subsistence farmers.

B. Project Components

24. **The Project will have a strong focus on adaptation strategies for tackling the impacts of climate change on water security as well as developing resilience to climate change exacerbated flood and drought risks for Bolivia's poorest communities.** The Project will adopt an integrated approach, from basin to micro-basin planning, and will include investments for water management at the micro-basin level, investments for hydrological risk management, as well as investments to secure adequate water for irrigation of rain-fed crops, increasing farmers' ability to improve food security and reducing their vulnerability to the increasing, climate change-induced rainfall variability.

25. **Project design will consider some basic principles:**

- **A comprehensive analysis of needs at the basin level.** Activities or subprojects to secure the availability and sustainable use of water resources for target areas will be identified through a comprehensive and participatory analysis of the needs of 15 targeted basins with areas up to 20,000 km^2 and the development of basin-level strategic integrated water plans (EPHIC) - formerly known as Basin Master Plans.
- **Micro-basins as the basic geographic unit.** Project interventions will target micro-basins spanning less than around 200 km^2 (operational hydrographic units), whose management units are OGCs. These micro-basins form part of larger basins managed by UGCs. Most of the micro-basins are located within the territory of one or a few autonomous municipal governments, thus facilitating coordination with the OGCs. In turn, larger basins that are managed by UGCs oftentimes extend beyond the boundaries of a single department and require the involvement of and closer coordination with the autonomous departmental governments and the MMAyA/VRHR. For activities under the VRHR's responsibilities and that are eligible for Project funding, pre-feasibility studies (Technical Reports on Preconditions, ITCPs) and detailed technical designs (Pre-investment Technical Design Studies, EDTPs) will be prepared in a participatory manner. In the case of activities that are not under the VRHR's responsibilities or are not eligible for financing under the Project, subproject profiles will be prepared to help stakeholders - municipal governments and community organizations such as OGCs - look for other funding sources.
- **A bottom-up approach.** The activities or subprojects will be identified and prioritized by the communities with the active participation of the municipal governments and the OGCs. A bottom-up approach will also be used for data collection in the field to build ownership and ensure that the communities are aware of the results of their work.

26. **The Project will target micro-basins located in the nine departments of Bolivia** (see **Annex 3**). The geographic area comprises 256 municipal governments, listed in **Annex 5**. Eligibility criteria for the selection of these basins included: (i) high aridity index, (ii) high levels of poverty, (iii) high population density, and (iv) potential areas of intervention under sub-components (2.1), (2.2) and (2.3) (see maps in **Annex 3**). The Project will sequence activities to focus initially on micro-basins that present high levels of need and high levels of readiness for implementation, tackling 'low-hanging fruit' quickly to demonstrate early successes in the first phase of the Bolivia Climate Smart and Resilient Program and inform the design of the following phases.

Project Components. The Project will comprise the following four components.

27. **Component 1. Water resources planning and pre-investment studies (US$9.900 million financed by the IBRD).** This component would fund studies that seek to address, respond to, and build capacity on present and anticipated impacts of climate change on water resources. The studies would have two objectives: (i) development of basin-level water planning strategies (EPHIC) that follow both IWRM and MIC approaches. This task will involve the identification and analysis of the main challenges the basins face from a territorial and sectoral perspective, taking into account the views,

local knowledge, and preference of communities and vulnerable groups, including women as well as minority indigenous and afro-Bolivian groups, and the development of a strategic vision based on the sustainable use of water resources; and (ii) preparation of pre-investment studies and detailed engineering designs that will address, inter alia, climate change impacts for subprojects to be implemented in micro-basins, which will be related to water conservation, irrigation, and risk management infrastructure.

28. **Component 2. Climate resilience infrastructure investments (US$139.328 million, of which US$117.840 million financed by the IBRD).** This component will fund works and the supervision of investments related to water conservation, soil and land management, irrigation, and risk management to adapt to the impacts of and to build resilience against climate change exacerbated floods and droughts. Supervision of MIC and risk management subprojects will include technical assistance for planning, execution, O&M. The component will be divided into three sub-components. The typology of infrastructure to be implemented is presented in **Annex 3**. The Project will take specific measures to support women and vulnerable groups in accessing the investments (see **Annex 7**).

- **Subcomponent 2.1. Investments in integrated water basin management.** Investments will include activities in micro-basins to protect water sources, including, inter alia, water planting and harvesting, soil improvement, protection of water recharge areas, forestation and recovery of forest areas, grazing control, terraces, educational watershed projects, infiltration and crowning ditches, in drought prone areas. The investments will also include technical assistance in O&M and consultancy contracts to supervise the works. These investments will aim to reduce the vulnerability of watersheds facing degradation and desertification from floods and droughts, and to increase water availability and local storage capacity. The investments will also enhance soil and crop carbon stock hence mitigating climate change.
- **Subcomponent 2.2: Minor (community and household) irrigation systems for improved sustainability and climate resilience.** Investments in household irrigation systems will include infrastructure for water capture (harvesting of surface runoff, capture of small spring water and other alternative water sources), installation of low energy family storage solutions, the conveyance of water to the field, and equipment necessary for water distribution and application on the plots (**see Annex 4**). Investments in community irrigation systems will focus on the rehabilitation and modernization of existing minor irrigation systems to reduce water losses and energy intensity. The investments will also include technical assistance for the supervision of the works.
- **Subcomponent 2.3: Risk management infrastructure to improve resilience.** This subcomponent will support infrastructure such as river defenses and deflectors, water erosion control, gully and flood control, to boost resilience to climate change impacts, protect land and communities against extreme hydrological events, including flooding, and to conserve, restore and manage soil degraded by erosion (see **Annex 3**). Supported infrastructure would be designed in line with the Resilient Design Brief[37] against floods, droughts, and high winds where applicable in an energy-efficient and resource-efficient manner. The investments will include technical assistance (TA) for the supervision of works and O&M.

29. While works implemented under Component 2 should ideally be generated from subprojects developed under Component 1, the VRHR already has a portfolio of pre-investment studies and detailed technical designs that reflect the social demands of communities or municipalities located in the Project's target areas. A comprehensive approach has been agreed upon with the VRHR to screen these studies and designs, validate the demand from communities and municipal governments, and confirm their eligibility for funding under the Project, including aspects highlighted in the Gender Gap Analysis and Action Plan to make sure the perspective of women and other vulnerable groups is being considered in the set-up for implementation. Irrigation investments could be accompanied by MIC investments to secure

[37] https://openknowledge.worldbank.org/handle/10986/34448

the water balance. Hence, initial investment lots that consider technical design, economic viability and environmental and social aspects are already ready for implementation.

30. **Component 3: Capacity building for water governance and enhanced productivity (US$16.575 million financed by the IBRD).** This component will fund TA and capacity building activities to enhance water governance at the regional and basin levels including climate change education and awareness. It will finance TA and training for UGCs, OGCs, ETA staff and farmers aimed at strengthening local capacity on planning, implementation, and O&M of the Project's infrastructure investments and improving and diversifying irrigated agricultural production. TA and training will be provided through consulting services, in local languages, and designed to suit schedules and needs of female farmers to promote their active participation. Training dedicated for female farmers to strengthen their status as agricultural producers, will also be planned. Women's needs will be identified to facilitate their access to training and to increase their participation in decision making bodies.

31. **Organizational Strengthening and Productive Technical Assistance (*Fortalecimiento Organizacional y Asistencia Técnica Productiva*, FORATP).** This is a TA and training program for minor (household and community) irrigation systems and includes training on agricultural production. It will be provided to farmers for around two years, spanning at least two complete production cycles, and will support farmers during the construction and operation of the irrigation infrastructure. The TA and training will include advice on agricultural production, efficient use of water, implementation of irrigation management plans, preparation of business plans for production and marketing, and strengthening the capacity of producer associations for the operation and maintenance of infrastructure investments.

32. **Information and knowledge on climate, water resources and hydrological risks is limited and one of the main deficiencies undermining effective water resources management and proactive risk management in Bolivia.**[38] [39] In parallel to the proposed Project, the Bank will provide TA through an Advisory Services and Analytics (ASA)[40] project funded by the Global Water Security and Sanitation Partnership (GWSP).

33. **Component 4. Project management (US$5.310 million financed by the IBRD).** This component will fund activities to support Project administration and management, including procurement, financial, environmental, social, and technical management as well and monitoring and evaluation (M&E) (including, inter alia, Operating Costs and Project external audits).

34. **Project Cost, Duration, and Financing.** The estimated total Project cost is US$171.49 million, of which US$150 million will be financed with an IBRD loan. The Project will be implemented over a period of six years. The Borrower will be the Plurinational State of Bolivia. The latter will be responsible for counterpart financing to cover the remaining US$21.49 million, which will be generated from cash and/or in-kind contributions from municipalities, and departmental governments. Rather than having the percentage of counterpart financing established in the financing agreement, the Project will establish counterpart financing criteria in the Project Operations Manual (POM) to limit the potential impact funds not materializing at the municipal or departmental level could have on impeding progress. The POM will also stipulate that the percentage of counterpart funding from municipal and departmental governments is variable and can drop as low as zero. In-kind contributions from communities will also be provided in every subproject but it is hard to

[38] The World Bank's analysis of the 2016 drought in Bolivia identified the lack of information on drought risks and a missing drought monitor and early warning systems as main reasons for the country's high drought vulnerability (World Bank, 2019).
[39] The MMAyA with SENAMHI, implemented several projects to strengthen the country's capacity in hydrological monitoring, including the development of a National Climate and Water Information System (*SNICA* for its acronyms in Spanish) which was supported by the World Bank within its Pilot Project on Climate Resilience (P129640).
[40] Mainstreaming climate resilience and promoting sustainable management of water resources and services in Bolivia, P179020

quantify and will amount to a limited sum overall.[41] The proposed lending instrument is an IPF. Project costs by component and financing arrangements are presented in **Table 1**.

Table 1. Project Costs and Source of Financing (amounts in US$)

Component	Project cost	IBRD Loan	Counterpart funding
Component 1. Water resources planning and pre-investment studies	9,900,000.00	9,900,000.00	0.00
Component 2. Climate resilient infrastructure investments	139,328,000.00	117,840,000.00	21,488,000.00
Component 3. Capacity building for water governance and enhanced productivity	16,575,000.00	16,575,000.00	0.00
Component 4. Project management	5,310,000.00	5,310,000.00	0.00
Front-end Fee[42]	375,000.00	375,000.00	0.00
Total	**171,488,000.00**	**150,000,000.00**	**21,488,000.00**

C. Project Beneficiaries

35. The Project will directly benefit 134 (84 strengthened and 50 created) OGCs and 15 UGCs. At least 15,120 families in 84 micro-basins will benefit from water management and conservation interventions through the recovery of degraded areas, soil improvement, protection of water recharge areas, and recovery of forest areas (these activities will reach a total area of approximately 16,000 km^2). An estimated 7,680 small-scale subsistence farmers will benefit from the development of household and community irrigation systems spanning a total area of approximately 6,720 ha. By adopting and improving sustainable irrigation schemes, subsistence farmers will be able to increase their productivity through irrigation systems that are more resilient to climate impacts. Furthermore, 7,200 families will benefit from the structural and non-structural works for the regulation and management of potential impacts caused by floods in 4,080 ha. In summary, the Project will benefit 30,000 families or 150,000 inhabitants. Staff from targeted municipal governments also stand to benefit from TA provided by the Project to strengthen their skills in monitoring subprojects throughout the full implementation cycle, including the post-construction phase.

D. Results Chain

36. **Figure 2 depicts the Theory of Change (ToC), which illustrates the inferred links between Project interventions, outputs, and outcomes, along with the underlying assumptions.** The Project will contribute to improving the water and food security of vulnerable rural communities in Bolivia. Particular attention was given to align the outcomes and PDO indicators with the monitoring indicators of the Plurinational Water Resources Management Plan 2021-2025.

E. Rationale for Bank Involvement and Role of Partners

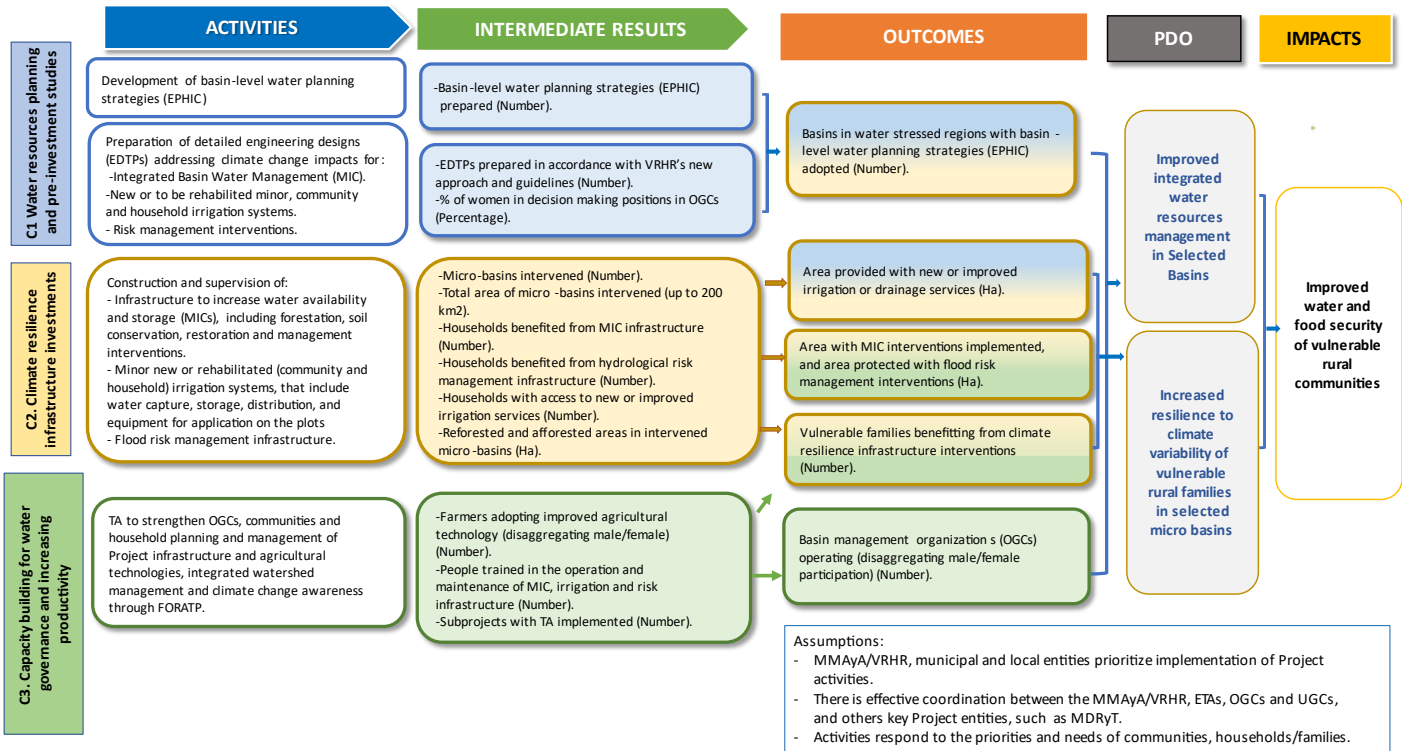
37. **The Bank's experience in the water sector in Bolivia as well as in agriculture has informed Project design and will provide added value during implementation**. Projects supported by the Bank in Bolivia, such as the Pilot Program for Climate Resilience Project (PPCR),[43] the Community Investment in Rural Areas Project (PICAR),[44] and the Rural Alliances

[41] The in-kind contribution from beneficiary communities will be detailed in a footnote in the Project's financial statements.
[42] The Front-end Fee is one quarter of one percent (0.25%) of the Loan amount. Following the Government's directive, the Front-end Fee will be financed by the proceeds of the loan.
[43] Bolivia Climate Resilience – Integrated River Basin Management Project (P129640)
[44] Bolivia – Community Investment in Rural Areas Project (P107137) and Bolivia – Community Investment in Rural Areas Project Additional Financing (P154854).

Project (PAR),[45] have provided services and infrastructure through a set of small subprojects. The Project will build on these experiences as well as the World Bank's global experience in strengthening resilience to climate change and governance for irrigation and drainage through the Sustaining Water Resources and Climate Resilient Irrigation Global Solutions Groups.

38. **Bolivia is one of the countries of focus of the Water Global Practice's Global Water Security and Sanitation Partnership (GWSP).** In 2016 the World Bank and the GoB agreed to renew lending and TA to the water sector. In 2017 Bolivia was selected as one of the GWSP's focus countries, termed as a 'Block C country,' rendering it eligible to receive yearly allocations to fund TA activities. A mid-term progress assessment undertaken in FY20 concluded that the Bank had effectively contributed to the development of strategic planning instruments.[46] A new multi-year programmatic ASA, 'Mainstreaming climate resilience and promoting sustainable management of water resources and services in Bolivia' (P179020), approved in August 2022, is funding activities that will inform the implementation of the proposed Project.

Figure 2. Project Theory of Change



39. **The Bank is well placed to leverage work of other development partners.** The World Bank maintains a collaborative dialogue to strengthen the water sector with several development partners, including the German Agency for International Cooperation (GIZ), the Embassy of Sweden/Stockholm Environment Institute (SEI), the Japan Agency for International Cooperation (JICA), the European Union, and the Development Bank of Latin America and the Caribbean (CAF).

[45] Additional Financing, Rural Alliances Project II (P 127743).
[46] The National Strategy of Wastewater Management and the National Strategy of Rural Water Supply and Sanitation

40. **The Project complements the Innovation for Resilient Food Systems Project – PAR III (P175672).** The Ministry of Rural Development and Lands (MDRyT), with the support of the World Bank, has been implementing during the last 16 years a strategy for the improvement of agricultural production and marketing through the Productive Alliances model, which involves organizations of producers, marketers, and the public sector. This model makes it possible to improve the capital and service needs of producers and proposes measures that allow updating their production capacities and skills to strengthen their link with the market through productive investments, technical assistance, and commercial development. In August 2022, the Bank approved a US$300 million loan to support the PAR III Project[47], whose objective is to contribute to increasing food security, access to markets and the adoption of climate-smart approaches by the beneficiaries. The VRHR and the executing unit of the PAR III Project, EMPODERAR, have established coordination and planning actions to generate synergies. This complementarity will focus in TA to increase agricultural production and productivity and/or the provision of working capital to strengthen their competitiveness.

F. Lessons Learned and Reflected in the Project Design

41. **The Project's design has been informed by the Bank's long-standing experience on the implementation of MIC projects in Bolivia.** The PPCR Project promoted stakeholder platforms to facilitate their participation in the planning, implementation, and monitoring of Basin Master Plans or EPHICs. The platforms that were set up by the Departmental Government of Cochabamba in the Rocha and Arque-Tapacarí basins proved pivotal to increase ownership of involved partners. The development of these Plans included basin assessments, the analysis of alternative scenarios, including a baseline and climate change scenarios, the identification of structural and non-structural measures, as well as guidelines for their implementation, M&E. The PPCR implemented infrastructure investments to increase the climate resilience of vulnerable communities that included the upgrading of irrigation canals and flood protection infrastructure; and MIC interventions, including both grey investments and green investments.

42. **Likewise, household irrigation systems have been implemented in government programs under the PNC and with the support of international development partners.** These experiences were compiled in a comprehensive book on the implementation of household irrigation systems in the semi-arid areas of Bolivia (MMAyA, 2016).[48] Technical guidelines for the elaboration of such household irrigation projects were also developed (MMAyA, 2015).[49] Key lessons that have been incorporated in the design of this Project are outlined below.

43. **Extensive TA is crucial for the successful introduction of agricultural production with irrigation.** Many beneficiaries of household irrigation projects have no prior experience with irrigated agriculture and lack knowledge and experience on what and how to produce with additional water for irrigation. The Project includes TA for the O&M of the new infrastructure and for agricultural production that will be provided during two complete production cycles following the construction phase. Depending on the region, the Project will allow farmers to shift from primarily subsistence agriculture towards market-oriented production.

44. **Ongoing support through trained municipal technical staff contributes to the sustainability of household irrigation projects.** Experience shows that farmers need long-term support and TA for the maintenance of their irrigation schemes, for agricultural production and for the management of the basin beyond project implementation. Municipalities can provide this support and meet this responsibility through trained technical staff. The Project will actively involve

[47] PAR III includes three types of sub-projects: subprojects on community partnerships, which include small-scale investments in infrastructure and basic services, activities to improve food security and nutrition, and actions to reduce vulnerability; subprojects on productive partnerships, implemented under financing agreements between organizations and the Project PIU (EMPODERAR); and complementary productive infrastructure subprojects, consisting of infrastructure at the municipal level to improve logistics and market access for organizations and communities.
[48] MMAyA, PROAGRO (2016): *Riego familiar en regiones secas de Bolivia: guía para su implementación*
[49] MMAyA (2015): *Guía para la elaboración de proyectos de riego familiares*

municipal governments from the early stages, demanding an in-kind contribution through municipal staff involvement. The Project will provide comprehensive capacity building for municipal staff.

45. **Standardized technical designs and specifications are critical for planning, supervision, and ensuring quality design and construction.** The MMAyA guidelines for household irrigation systems include standard designs for water capture, transport, and storage. The MMAyA will also provide technical specifications for on-field irrigation equipment.

46. **Small reservoirs or '*atajados*' require special attention to various factors to ensure their operation and sustainability.** The inclusion of this technology was widely discussed during Project preparation. Ex-post evaluations of this technology in Bolivia have shown that a significant percentage of *atajados* are not operational, owing mainly to: (i) inadequate design, location and construction of the reservoirs; (ii) over-emphasis/focus of investments on constructing the water catchment and storage infrastructure, without addressing socio-economic, environmental, and governance aspects; (iii) insufficient TA to farmers who largely lacked prior experience with irrigation; and (iv) abandonment of systems due to migration. Nevertheless, *atajados* may still represent a reliable source of irrigation water in semi-arid regions with irregular or increasingly varied rainfall. In Bolivia, factors such as mountainous landscapes, small-scale farming and weather conditions, accentuate the potential of rainwater harvesting and water intake from intermittent surface water sources. Consequently, for households with no access to a permanent water source, a carefully planned *atajado* could allow access to supplementary irrigation water.[50] The Bank is carrying out a study with ASA funding during the fiscal year 2024 that will provide guidelines to ensure successful design, implementation, and sustainable performance of these reservoirs. Those *atajados* that meet the guidelines' principles will be eligible for financing.

47. **Consideration should be given to multiple use of household irrigation systems.** Household irrigation systems are often used not only for irrigation, but also for animal watering, laundry or other uses as needed. These multiple uses will be considered in the TA's scope to ensure correct water management and increase post construction benefits. The POM will include standard designs and technical specifications of the solutions, and the scope of TA for these purposes.

48. **Project implementation arrangements should be straightforward and simple.** The PPCR Project aimed at promoting institutional capacity development by involving different levels of government, national, sub-national, and river basin, in project management. This resulted in very complex implementation arrangements with a Project Coordinating Unit (UCP) in the MMAyA, and three Project Implementation Units (PIUs), with the Social and Productive Investment Fund (FPS) at the national level, and two units in the Departmental Governments of Cochabamba and Santa Cruz. Co-financing arrangements were also complex, involving national and sub-national levels. As a result of this experience, the Project will work with only two existing PIUs, which report to the implementing agency, MMAyA, as described in the following section.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

49. **The MMAyA through its VRHR will serve as the implementing agency of the Project.** Two existing Project Implementation Units (PIUs) located within the MMAyA will be responsible for Project implementation; these PIUs were proposed by MMAyA due to their expertise in the different components of the Project, one PIU has substantial experience implementing "soft" activities, and the other PIU has substantial experience with "hard" investments. The fiduciary arrangements were discussed during appraisal, each PIU will have its own Designated Account to mitigate the risk of impeding implementation. The detailed responsibilities of each PIU are presented in **Annex 1**.

[50] Over the last two decades several studies on *atajados* were carried out providing lessons to improve the design and construction.

- **The Coordination Unit of the Climate Resilience Program (UCP-PPCR) will implement activities related to water resources planning, pre-investment studies and TA that correspond to Components 1, 3 and part of Component 4.** This PIU will maintain overall responsibility for all fiduciary aspects of the Project and the contracting of Project audits.
- **The Coordination and Implementation Unit of the Mi Riego Projects (UCEP-Mi Riego) will be responsible for the implementation of infrastructure investments and TA that correspond to Component 2 and part of Component 4** (see organizational chart in **Annex 3**).

50. **The ETAs where the target communities and household are located will be actively involved in all Components of the Project,** in the identification of communities, the implementation of EPHICs, EDTPs and subprojects and the provision of back-up support to the communities. The extent of the scope of the departmental and municipal governments' functions and responsibilities will be described in the POM and set out in intergovernmental/interinstitutional agreements between the ETAs and the relevant PIUs, and, as applicable, UGCs, PICs and OGCs.

B. Results Monitoring and Evaluation Arrangements

51. **An M&E system will be implemented as part of Project design. The UCP-PPCR will be responsible for the M&E of the Project towards achievement of its PDO objectives.** The UCP-PPCR will prepare semi-annual reports that will reflect progress under the Project using the performance indicators defined in the Results Framework and the POM. Municipal staff, the consultancy firms responsible for TA, the UCP-PPCR and the UCEP-Mi Riego staff will collect the necessary field data to inform Project reports. In addition, the UCP-PPCR will contract an external audit to confirm the findings through detailed analysis and field verification of a representative sample of communities and households.

52. **A mid-term review (MTR) will be carried out at the beginning of the third year of Project implementation to evaluate progress.** A final evaluation will be conducted in the last year of implementation to assess the Project's overall accomplishments. These evaluations will assess progress against the results framework indicators as well as the relevance, efficacy, efficiency, and sustainability of the Project. In the MTR, the effectiveness of the Project's technical solutions, the implementation arrangements, and the targets will be assessed to identify opportunities to improve or adjust them.

C. Sustainability

53. **Bolivia has relevant experiences with the implementation of MIC and minor irrigation projects.** To guarantee on-going support to communities and farmers after the Project ends, municipal staff and producer associations will be actively involved and trained during Project implementation; proven standard designs for the infrastructure following the existing technical guidelines of the MMAyA will be applied; and protection and conservation of micro basins, water sources and their recharge areas will secure springs and groundwater recharge, control landscape degradation, and reduce sedimentation and clogging of irrigation infrastructure.

54. **In-kind contributions from beneficiary households assure appropriation and, therefore, contribute to sustainability.** Since poor rural households usually lack the means for in-cash contributions, the Project design includes in-kind counterpart contributions through labor and local construction materials. FORATP will be provided in two phases: (i) accompaniment during the execution of the works to ensure the beneficiaries have the ability to carry out O&M tasks; and (ii) technical assistance after the execution of the works, which will aim to consolidate the users' organizations for the self-management and self-financing of the system as O&M is the responsibility of the community associations of users. As

mentioned earlier, the users' associations need to have legal status and water rights. If they do not have these, FORATP will support them in obtaining both their legal status and in consolidating their right to irrigation water.

55. **Activities under Component 3, specifically the TA related to FORATP, will link improvements in irrigation infrastructure with improvements in productivity. The TA will help farmers rethink the composition of irrigated agriculture – which crops yield the highest returns, the most jobs, and greatest food security.** This will enable producers to transition from low-productivity farming and production systems vulnerable to climate change and natural disasters to higher-productivity farming and climate-resilient production systems. The design of the interventions at the farm level will further consider the diversification of crops depending on the local market potential to generate positive net income in a sustained manner over time for family farmers. As a result of these interventions, farmers should be able to generate sufficient revenues to cover their crop costs, the replacement cost of their irrigation equipment at the end of its useful life, and the O&M costs.

56. **As a means to ensure environmental and social sustainability, the Project recognizes the potential risks of unintended negative consequences to downstream communities due to a net reduction in return flow caused by an increase in water use efficiency upstream.** This effect is a well-known challenge in the management of water resources around the globe. While this could become a problem in some of the Project's arid or water-stressed target areas, the first hydrological assessments concluded that total consumptive agriculture water demand, compared to the total water produced during the rainy period, is negligible (even for small micro-watershed areas). Nonetheless, a detailed identification and an analysis of the hydrological behavior of the micro-watersheds will be promoted by the Project to guarantee the environmental sustainability of the "*atajados*". In the case of community irrigation systems and rehabilitation and modernization of existing schemes classified as minor irrigation systems, there is a need to estimate how water use efficiency measures will free up water for other uses without affecting return flow to the environment as recharge or drainage. It is clear that the amount of water saved from efficiency measures at a local scale depends on the context and characteristics of each subproject. To properly account for the expected benefits from efficiency gains, and to avoid negative downstream consequences by reduced minimal return flow, interventions aimed at increasing irrigation efficiency must be accompanied by raising awareness and effective monitoring and regulatory instruments. The Project will promote actions to improve integrated water management at different watershed levels by articulating complementary irrigation investments, such as the preparation of MICs, TA to strengthen the capacity (of OGCs, Water User Organizations, and/or producer organizations) to monitor related system parameters, and the enforcement of regulations to assure sustainably managed water use.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic and Financial Analysis (if applicable)

Technical

57. **The technical solutions to be implemented through the Project will be robust, and maintenance of the works will be simple, comprising regular cleaning of the infrastructure, repairing of reservoir fencing, maintenance of irrigation equipment, as well as the management and protection of water sources and their recharge areas.** The minor irrigation systems consist of simple technologies that are already widespread in Bolivia. The Project will promote that minor irrigation systems be accompanied by MIC investments to secure the water balance. Initial investments with advanced feasibility studies, which include technical designs, economic viability, and environmental and social aspects, have already been comprehensively assessed and will be part of the Project's initial portfolio.

58. **The initial portfolio of subprojects consists of 95 EDTPs (30 MICs, 60 minor irrigation and 5 risk management interventions), in an amount of US$50 million**, equivalent to 33 percent of the loan, which will be ready for implementation at Board approval. The Task Team visited 20 of these subprojects, the location of this initial set of subprojects is presented in a map in **Annex 3**.

Economic Analysis

59. The Project aims to improve integrated water resources management at the basin level and increase the resilience of poor rural families in selected micro basins. The Project will finance three types of infrastructure subprojects, that include the construction of minor (community and household) irrigation systems; investments in watershed management; and investment in risk management infrastructure. In the case of irrigation subprojects, where the benefits and costs are mostly accruing to individual farmers in targeted communities, a financial analysis has also been conducted. In the other two types of subprojects, basins management and flood risk management, the externalities are large and only an economic analysis has been conducted. In these latter two types of subprojects the benefits are diffuse and do not only accrue to the communities directly involved in the project. The economic analysis employs the "with and without project" approach to assess the economic viability of the various subprojects. Details of the analysis are included in **Annex 2**.

60. **Results of the cost-benefit analysis.** The cost-benefit analysis considers all infrastructure and project management costs equivalent to about 80 percent of the total project costs. It also captures the O&M costs to ensure the operation and maintenance of the investments once they are built. The cost benefit analysis quantifies benefits from three types of subprojects. The benefits of these subprojects include (i) an increase in agricultural production, including animal husbandry, as the availability and/or quality of agricultural lands will improve under the "with project" situation; (ii) afforestation and reforestation including the planting of fruit trees; (iii) improvements in land use management because of a reduction of erosion; (iv) a reduction of GHG emissions; and (v) avoided losses associated with floods and mudslides. There are more benefits associated with these projects that may include the use of timber and other forest products, improvements in drought resilience, employment generation (both short-term due to the subproject interventions, and in the longer-term) and subsequentially a reduction in emigration. Finally, improvements in land and water resource management are likely to benefit downstream populations. Yet, these additional benefits are harder to quantify and have not been included in the analysis. The exclusion of these latter types of benefits therefore underestimates the actual project benefits.

61. *Irrigation subprojects.* The Project consists of many different small subprojects that are not all known at the time of project appraisal. The results of the analysis include a sample of three irrigation models representing different irrigation systems located in two distinct regions of the country. These six sample irrigation subprojects generated a financial rate of return of 23 percent and an economic rate of return of 38 percent. Five of the six models generate very positive returns (as can be seen in **Annex 2**). However, the "*atajados*" model in the Altiplano (highlands) of the country does not generate positive returns with the expected cropping patterns. In the current portfolio of prepared irrigation subprojects only one subproject was prepared with "*atajados*" and as such there was no representative irrigation model available at the time of appraisal. Hence, as part of the government's preparation guidelines, an economic analysis will be undertaken for each proposed "*atajados*" subproject.

62. *Basin management subprojects.* A sample of six basin management subprojects located in six different departments of the country found an average economic rate of return of about 28 percent. These basin subprojects have large spillover effects, as the number of people benefiting from these interventions are not only the communities directly involved but also communities downstream. In the six subprojects reviewed the number of households directly benefiting was 1,689 but the number of people indirectly impacted by these subprojects was close to 2,500. As such, the operation

and maintenance of these investments cannot only be paid for by the communities directly involved, and hence the role of municipalities in the operation and maintenance of these types of subprojects is critical.

63. *Flood risk management subprojects.* The sample of flood risk management subprojects contained 8 subprojects. Most of these subprojects did not generate positive returns and will not be considered for implementation. The two subprojects that generate positive returns generated a weighted economic rate of return of about 17 percent.

64. **An ex-ante estimation of a possible distribution of the different types of subprojects, carried out by the Bank, suggests a weighted economic rate of return of almost 30 percent.** The demand-driven character of the Project in combination with the fact that not all subprojects were known at the time of appraisal allows the team to only estimate what could be a possible final distribution of investments over the various types of subprojects.

65. **GHG mitigation benefits.** The World Bank uses the EX-ACT tool to quantify the GHG mitigation potential of projects it funds, as an important step in managing and ultimately reducing emissions. For the proposed Project, the net carbon balance quantifies carbon emissions emitted or sequestered when the project is implemented. The estimated net carbon balance resulting from GHGs emitted or sequestered/reduced during the project implementation and capitalization period (25 years) will bring a mitigation benefit of 341,991 tCO2e/year compared to a business-as-usual baseline scenario. This is equivalent to annually reduced GHG emissions of 10 tCO2e/year per hectare of land impacted by the project. After 25 years, GHG mitigation benefits would have generated a reduction of -8.6 million tCO2e. The sequestration benefits originate predominantly from land use changes linked to afforestation and/or reforestation and grassland management, while implementation of agricultural practices in annual crop production are overall also resulting in a reduction of carbon emissions. More details can be found in **Annex 6**.

66. **The operation is aligned with the goals of the Paris Agreement (PA) on both mitigation and adaptation.** *Assessment and reduction of mitigation risks***.** The Project aims for net emissions reductions due to greater carbon sequestration in soil and biomass. Irrigation and drainage systems will use low-energy sources, with crops predominantly rainfed. While the Project is expected may increase in fertilizer use, Bolivia current usage is among the lowest globally. Even with this increase, significant emissions reductions of -8,549,784 tCO_2eq are expected over its economic lifetime. Hence, the project supports Bolivia's low GHG-emissions development path and aligns with mitigation efforts.

67. *Assessment and reduction of adaptation risks***:** The Project's main climate and disaster risks are floods, droughts, and landslides due to soil erosion and other climate-related factors. These could temporarily disrupt service and delay project activities, including technical assistance and capacity building. Despite potential short-term delays, the Project's integrated approach ensures these won't compromise the project's overall objectives. Additionally, the Project will take climate-related factors into account, both Components 1 and 2 include a major focus on increasing understanding of the hydrology of the local micro-basins, enhancing adaptability to flood and drought risks. Resilience planning principles will be included in engineering designs. For further details on PA, refer to **Annex** 8.

B. Fiduciary

(i) Financial Management (FM)

68. **The Project will be implemented by two PIUs within MMAyA: UCP-PPCR and UCEP Mi-Riego. All activities related to financial responsibilities such as planning and budgeting, control systems, accounting and reporting, treasury and flow of funds and auditing will be carried out through these units.** Additionally, UCP-PPCR will consolidate the project financial information, prepare the IFRs and contract the annual financial audit.

69. The main FM risks identified for the Project relates to: (a) counterpart funding required from ETAs, which was a challenge in earlier projects (PPCR Project, P129640) and caused delays in payments; (b) timely availability of funds for

Component 2 may be affected if adequate arrangements between the two PIUs are not in place; (c) need of adequate policies and procedures for the collection, control, recording and reporting of municipal contributions; (d) high turn-over of qualified staff; (e) the processes and internal controls for the recording, reporting and monitoring of subprojects funding is in process of implementation.

70. These risks will be mitigated through the following actions agreed with MMAyA and both PIUs: (a) the PIUs will sign Intergovernmental/interinstitutional Agreement with the ETAs defining the procedure and treatment for the counterpart contributions, and providing the activation of the "*Debito automatico*" procedure executed directly by the Ministry of Economy and Public Finance (MEFP) in case of default; (b) for a timely provision of funds, each PIU will administer a separate Designated Account (DA) in dollars and an operational account in Bolivianos, respectively; (c) UCP-Mi Riego has concluded the design of a Projects Management System (SGP) that will help to register, monitor, and report the collection and administration of counterpart funding at subprojects level; (d) based on experiences from other projects in Bolivia, the Project's fiduciary staff rotation risk will be reduced using multi-year contracts based on periodic performance evaluations; furthermore, to support Project implementation, two Financial Specialists will be recruited, one for each Unit at central level; (e) building on prior experiences, the MMAyA through UCP-Mi Riego will include in the POM policies, rules and detailed procedures to record and control the financing of subprojects (loan and counterpart funds), also defining clear roles and responsibilities and reporting. Additional FM information is presented in **Annex** 1.

(ii) **Procurement**

71. **Procurement activities will be undertaken by the Procurement staff in the UCEP-Mi Riego for Component 2 and part of Component 4 and by the UCP-PPCR for Components 1, 3 and part of Component 4**. A capacity assessment of UCEP-Mi Riego and UCP-PPCR included a review of the organizational structures and the relationship between the procurement, technical, administrative, and financial units. The UCEP-Mi Riego and UCP-PPCR developed a Project Procurement Strategy for Development (PPSD) and Procurement Plans for the first eighteen months of Project implementation, which provides the basis for the procurement methods and market approaches. The 18-month Procurement Plans that were agreed upon between the Borrower and the Bank, will be uploaded and updated in the publicly accessible Systematic Tracking of Exchanges in Procurement (STEP), in agreement with the Bank or as required, to reflect Project implementation needs and improvements in institutional capacity.

72. **Procurement will be conducted according to the World Bank's Procurement Regulations for IPF Borrowers, dated September 2023, for the supply of Goods, Works, Non-Consulting Services and Consulting Services.** The application of the 'Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants', dated October 15, 2006, and revised in January 2011 and July 1, 2016 (World Bank's ACG), and sanctions procedures will continue to be ensured through the Bank's model legal agreements for IPF operations, which require that provisions apply to the ultimate recipients of World Bank funds. The Bank's Standard Procurement Documents will govern the procurement of contracts under the International Market Approach. For procurement involving the National Market Approach, the Borrower may use their own procurement documents, acceptable to the World Bank. All Standard Procurement Documents as well as model contracts will be attached to the POM.

C. Legal Operational Policies

73. OP 7.50 is applicable to this Project given that it will finance activities that may use or risk polluting waters of the La Plata and the Amazon River systems, and Lake Titicaca, and/or their tributaries, which are considered international waterways. The exceptions to the riparian notification requirement according to paragraphs 7(a) and (b) of the Policy apply. Activities are limited to upgrading and modernization of existing, small-scale irrigation schemes which will not cause change in existing use of water or in water quality. The terms of reference for basin planning studies will require the

assessment of any riparian issues. **The exception to the notification requirement was approved by the Regional Vice Presidency on March 15, 2023**.

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	Yes
Projects in Disputed Area OP 7.60	No

D. Environmental and Social

74. **The Project's environmental risk is considered Moderate.** The VRHR prepared the draft Environmental and Social Management Framework (ESMF), carried out the analysis of subprojects of the first portfolio that have technical designs, and the eligibility criteria and exclusion list for the second portfolio. The geographic area, the ecoregions of intervention, and the potential environmental and social risks and impacts were identified in general terms. Component 2 includes investments in MIC, minor irrigation systems, and risk management infrastructure. These activities will contribute to the conservation and improvement of ecosystems and productive systems. Due to the small to medium scale and location of civil works anticipated for each subproject, most risks and impacts are expected to be predictable, temporary, reversible, of low magnitude, site-specific, and with a low probability of major adverse human, health, or environmental effects.

75. The risks related to the construction of the infrastructure include: (i) risks related to water consumption and management during construction; (ii) improper handling of waste and hazardous waste during construction; (iii) contamination, atmospheric emissions, and noise during construction; (iv) damage to archaeological remains due to excavations; (v) occupational health and safety risks; (vi) temporary or permanent river channel alteration and erosion processes. For these risks, Environmental and Social Management Plans (ESMPs) will be included in the ESMF, serve as guidelines for contractors to prepare required site-specific environmental and social management plans (ESMP-cs), and implemented in both the first and second subproject portfolios. For environmental risks related to the O&M of subprojects that could have impacts on natural habitats or modified habitats or population such as: (i) use of invasive species that are related to the impact on the ecosystem or natural habitat in reforestation activities; (ii) use of pesticides with high toxicity to the environment or population; and (iii) introduction of exotic crops to the detriment of native crops; (iv) reduced water availability in downstream communities; (v) reduced ecological flow; and (vi) risks related to the construction of small reservoirs (*atajados*), which may include changes in surface hydrology and reservoir safety considerations, the draft ESMF has defined criteria for environmental and social eligibility as well as a list of subproject exclusions to avoid any risk with significant impact. Although the draft ESMF does not have a cumulative impact assessment, the VRHR has indicated that only a few subprojects will be financed per municipality, thus reducing the risk of cumulative impacts in the micro-basins. For water resources planning and pre-investment studies under Component 1, the ESMF considered the ToR and reviewed studies for both: (i) EPHIC plans; and (ii) pre-investment studies and detailed engineering designs for subprojects related to MICs, irrigation, and risk management infrastructure, to comply with the ESS of the Environmental and Social Framework (ESF). The final ESMF will be adopted and disclosed no later than 90 days after the Project effectiveness date.

76. **The Project's social risk is considered Substantial. Based on the Social Assessment (SA), the Project's potential social risks include**: (i) potential exclusion of vulnerable populations and groups, such as indigenous women, elders, youth, persons with disabilities, and sexual and gender minorities, whose interests could be under-represented from Project benefits if targeted strategies to ensure their engagement are not incorporated in the preparation and implementation of the Project. This is particularly important in an institutional context with limited level of coordination between the multiple

entities expected to be involved, including the implementing agency through UCEP-Mi Riego and UCP-PPCR and their decentralized offices, the water users organizations, subnational governments, and local intersectoral agencies; (ii) the negative impacts of the subprojects will fall disproportionately on individuals or groups that, given their particular circumstances, may be vulnerable or disadvantaged; (iii) potential loss of the indigenous agricultural and biodiversity management knowledge in the Project area, mainly as a result of agricultural TA and increased involvement in the market economy if cultural pertinence measures are not properly taken into account; (iv) minor labor influx risks associated with the civil works, especially if codes of conduct are not followed, even though Project efforts will focus on promoting local hiring of community workers; (v) potential increase or intensification of underlying local tensions (intra-or-inter-community) and even of conflicts if stakeholder engagement processes are not properly carried out in rural agricultural areas with water scarcity; (vi) social conflicts due to the potential reduced availability of water in downstream communities related to small reservoirs construction; (vii) use of areas with potential economic or social alternative uses, particularly agriculture, to build the community irrigation infrastructure works, creating an opportunity cost for the local population; (viii) increased expectations and demands of the local population for employment and income; (ix) risk of reproducing structural gaps of gender inequity; and (x) impact on women's traditional productive, reproductive and community roles. These risks could be more pronounced due to the sensitive context associated with the high level of migration in the Project area of young people over 19 years of age, which leaves part of the productive agricultural work in the hands of vulnerable groups such as women, children, and the elderly.

77. **The Final ESMF will provide information about:** (i) the potential direct, indirect and cumulative E&S risks and impacts from the proposed investments based on the typology of activities and location; (ii) characterization of potential contextual E&S risks and issues which may be present in different beneficiary locations, including potential Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) risks, risk of child labor, and potential intensification of social conflicts over the proposed water usage measures; (iii) identification of applicable national legislation, relevant WB Environmental and Social Standards, and any other applicable international requirements, and gaps to achieve consistency with the ESF; (iv) management and mitigation measures for potential E&S risks and impacts identified, both during construction and O&M; (v) identification of vulnerable groups and specific measures to prevent adverse impacts on them and improve their opportunities for inclusion; (vi) cultural pertinence measures and protocols to implement Project activities with indigenous peoples (IP) and Afro Descendants (AD) populations; (vii) a protocol to ensure that Project beneficiaries receive adequate information about the voluntary nature of any donation of land for irrigation works and prevent forms of coercion; (viii) a Social Assessment (SA); (ix) details of the requirements for site-specific Environmental and Social Management Plans (ESMP-cs) and checklists; and (x) implementation arrangements, capacity building measures, and budget for E&S management.

78. **Disaster risk screening and climate change.** The proposed Project is, at its core, a climate change adaptation program for rural areas. A preliminary screening for climate change and disaster risks was carried out for the Project. The Project's overall risk rating was found to be moderate. The identified risks included extreme precipitation and flooding, droughts, strong winds and geophysical hazards. These events which are influenced by the El Niño –Southern Oscillation (ENSO) are exacerbated by climate change, which has triggered increasingly intense rainfall, landslides, floods, and droughts over the last decade. Climate change has also reduced water stored and released by glacier melts. Furthermore, a significant proportion of Bolivia's rural population lives in the highlands and inter-Andean valleys. These areas have fragile ecosystems and expanding arid zones. The proposed Project will tackle water security challenges and build residents' resilience to the impacts of climate change through activities such as water resources planning and proactive water governance, the construction of minor irrigation and risk management infrastructure, and capacity building to strengthen management capacity. The preliminary assessment of Climate Co-Benefits carried out by the Climate Change Group has determined that the total Climate Co-Benefits of the Project amount to US$107.16 million (71.44 percent).

79. **Inclusiveness and gender.** On average women in rural areas of Bolivia have fewer opportunities to participate in the public sphere and labor market, and have lower levels of education, income, information, and employment. The SA has identified the risk of reproducing **gender gaps** in Project activities due to differentiated productive, reproductive and community roles between men and women, which could hinder the adequate participation of women in Project activities. The SA has identified the following interconnected gender gaps: (i) lack of women's organizations; (ii) political participation and decision making; (iii) access to employment for women; (iv) productive and reproductive roles, double work burden; (v) access to land; (vi) access to productive resources and technology; (vii) differentiation in gender-specific productive activities; (viii) access to education and training; (ix) remuneration for women; and (x) gender-based violence (GBV). The Project has included the following **actions** to address these gender gaps: (i) register the allocation of Project resources to the creation and/or strengthening of women's organizations in water governance; (ii) encourage (through targeted communication, scheduling and training) and monitor women's participation in meetings and/or assemblies, and their participation in decision making bodies; (iii) organize workshops with specific gender themes; (iv) enable dual ownership of households among those benefiting from subprojects; (vi) include women in training and knowledge transfer on irrigation; (vii) include women in access to and transfer of technology and equipment in the Project and contribute to enabling conditions to their participation in the Project benefits (including, inter alia, agreements with authorities that issue identity cards to facilitate access for women and other vulnerable groups to required legal documentation); (viii) offer equal payment to men and women for the same work; (ix) introduce and/or support suitable codes of conduct and complaint mechanisms for reporting GBV.

80. The Project will aim to increase the share of decision-making positions held by women in OGCs to 30 percent, from current baseline of 20 percent referring to all women board members of these organizations. It will also measure the number of farmers adopting improved agricultural technology (target for men: 10,752; for women: 4,608) and will report on people trained in the O&M of MIC, irrigation and risk infrastructure in sex-disaggregated way (no specific targets for men/ women set at this point). The Project agreed upon specific objectives and concrete action to narrow the identified gender gaps, including (i) mapping of women's organizations at the ETA level, (ii) setting up working groups at subproject and ETA levels that directly feedback to decision-making about the Project and into the water governance bodies, (iii) register the percentage of subproject financing for subprojects under women's leadership, (iv) tailored TA to facilitate women's participation, (v) promote women access to training and technology to address the motivation of the creation of women's organizations that strengthen the instances of water governance in the communities. Other vulnerable groups identified and described in the SA include minority indigenous and afro-Bolivian communities, who have fewer opportunities to participate in the public sphere and labor market, and have lower levels of education, income, information, and employment. For these groups, the SA also identified the risk of reproducing these inequalities and included specific planning and management procedures and mechanisms to address these through the Stakeholder Engagement Plan (SEP).

81. **Citizen engagement.** One of the key principles the Project adopted is a participatory, bottom-up approach, meaning that the activities or subprojects will be identified and prioritized by the communities with the active participation of ETAs and the OGCs. A bottom-up approach will also be used for data collection in the field to build ownership and ensure that the communities are aware of the results of their work. The Project has developed a SEP for its design and implementation phases. The borrower identified project stakeholders and vulnerable groups to propose procedures and mechanisms for effective participation and meaningful consultation with a perspective of inclusiveness. Due to the national scale of the Project, the borrower elaborated a SEP with a detailed stakeholder mapping at the national, departmental, municipal, and local levels. This SEP includes the following**:** (i) a description of Project components; (ii) stakeholder mapping –including for indigenous peoples, per the criteria for the identification of IPs under Environmental Social Standard 7 of the ESF, as well as non-indigenous rural producers; (iii) the characterization of main stakeholders and

vulnerable groups; (iv) a program for stakeholder engagement including guidelines to socialize Project activities and promote participation of indigenous and non-indigenous actors; (v) information on the consultation processes carried out during Project preparation; (vi) proposed consultation and feedback mechanisms during the implementation phase according to the type and magnitude of the activities; (vii) operational arrangements, including institutional responsibilities, staffing, indicators, and budget resources; and (viii) a description of the Project-level Grievance Redress Mechanism (GRM). The GRM will comply with the ESS 10, be culturally appropriate and gender-sensitive, ensure that the confidentiality of the users is protected, allow for the reception and processing of anonymous complaints, and include specific measures to capture feedback and disseminate the existence of the GRM and the channels to receive complaints. The SEP also specifies the GRM budget requirements, indicators, and the assignment of staff and resources to operate and disseminate the GRM. Two citizen engagement indicators are included in the results framework: (i) Number of basins in water stressed regions with EPHICs adopted, and (ii) OGCs operating (disaggregating male/female participation.[51] Also, an intermediate indicator has been included to measure the percentage of complaints addressed according to stipulated timeframe, to allow for early-on identification of relevant issues. These will be reflected with analysis of contents of complaints in biannual reports.

82. **Key stakeholders include indigenous organizations, farmers' organizations, indigenous women's organizations, farmers, and agri-food entrepreneurs**. IPs will be directly and indirectly impacted by Project activities through the generation of job opportunities, irrigation works, and TA for improving agriculture production and related business plans. IPs are expected to be the main group towards which the stakeholder outreach efforts will be directed, along with other vulnerable groups, including migrants. However, other social actors, including Afro-Bolivians, government agencies related to the Project, and civil society organizations (universities, professional associations, non-governmental organizations, etc.), will also be involved.

83. **Documentary evidence of the consultations carried out during Project preparation is included in the SEP**. The preliminary version of the SEP disclosed before appraisal includes a summary of the concerns of a sample of stakeholders and the responses of the VRHR to each concern. The main concerns were as follows: (i) lack of socialization of the subprojects; (ii) lack of knowledge of the activities to be developed; (iii) lack of an organization for Project execution; (iv) the need for urgent action given the scarcity of water and the immediate execution of the Project; (v) concern about the age of the Project and its scope (they want to update the beneficiaries); (vi) lack of knowledge of the producers about the importance of the irrigation system and the O&M; and (vii) absence of young people in the beneficiary communities. The communication strategy has gathered these inputs to secure stakeholders the access to information.

V. GRIEVANCE REDRESS SERVICES

84. ***Grievance Redress.*** Communities and individuals who believe that they are adversely affected by a project supported by the World Bank may submit complaints to existing project-level grievance mechanisms or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the Bank's independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, as a result of Bank non-compliance with its policies and procedures, and the Dispute Resolution Service, which provides communities and borrowers with the opportunity to address complaints through dispute resolution. Complaints may be submitted to the AM at any time after concerns have been brought directly to the attention of Bank Management and after Management has been given an opportunity to respond. For information on how to submit complaints to the Bank's Grievance Redress Service (GRS), visit http://www.worldbank.org/GRS. For

[51] Basin Management Organizations (OGC) are created to represent the interest of water users.

information on how to submit complaints to the Bank's Accountability Mechanism, visit https://accountability.worldbank.org.

VI. KEY RISKS

85. **The overall risk of the Project is assessed as Substantial.** There are substantial risks to the implementation of the Project. A key element of the mitigation measures is the cadre of local fiduciary and social and environmental specialists based in the country office, who will monitor the Project closely and will provide implementation support when required. Prevailing institutional, political and governance issues are expected to persist making it necessary to ensure that the Project design is simple and straightforward. The key risks rated as **Substantial** are described below, all other risks are rated **Moderate**.

86. **Political and Governance Risk is rated as Substantial.** This risk is associated with the challenges in the coordination between national, departmental, and municipal government levels, the national elections that are scheduled in late 2025, and municipal and departmental elections in early 2026. This risk will be mitigated by promoting effective Project management and working with the MMAyA, VRHR and executing agencies in Project implementation and providing close implementation support and training on the Bank's Anticorruption Guidelines.

87. **The Macroeconomic Risk is rated as Substantial.** Although the Project envisages limited counterpart funding and has a small proportion of imported supplies, the challenging macroeconomic situation, including the decline in international reserves coupled with growing public debt, could hamper the capacity of some subnational governments to provide counterpart financing. Additionally, the national government's debt capacity and resources for O&M of infrastructure is a risk. As a mitigation measure the requisite for counterpart financing will remain flexible and it will be possible to revise it at the POM.

88. **The Technical Design of the Project is rated Substantial.** Due to the large number of infrastructure investments in small communities located in remote areas across the country with difficult access. This risk will be mitigated with the grouping of subprojects per region which should generate economies of scale and facilitate planning, and the significant participation of beneficiaries throughout the Project cycle. The Procurement Strategy has included this approach.

89. **The Institutional Capacity for Implementation and Sustainability is rated Substantial.** The PIUs have limited experience in managing WB projects and present a high staff turnover that may affect Project implementation. This risk will be mitigated by working closely with the agencies and providing close implementation support and training on the Bank's Anticorruption Guidelines. The Bank has developed an implementation support plan to enhance the quality of implementation and minimize risks.

90. **The Fiduciary risk is rated as Substantial.** The challenges faced by the Project include: the nature and high volume of transactions (high volume of work and consultant contracts with centralized control), and the responsibilities of the administrative and technical units to register, control, and produce reliable and timely financial information in a complex operational scenario. The mitigation measures include the recruitment of fiduciary staff with relevant knowledge and experience, implementation of financial systems to register the Project transactions and the adherence to the POM.

91. **The environmental and social risk is rated as Substantial.** The social risk rating is Substantial due to the national coverage of the Project's zone of influence; the complexity of stakeholders from national to municipal and local levels; limited information on the location of subprojects; the weakness in VRHR's social management capacity; this is the first experience of MMAyA/VRHR with WB environmental and social standards; and vulnerability of the beneficiary indigenous populations. The proposed mitigation measures are presented in the ESMF, including the requirements for site-specific ESMP-cs.

VII. RESULTS FRAMEWORK AND MONITORING

PDO Indicators by PDO Outcomes

Baseline	Closing Period
Improved integrated water resources management in selected basins	
Basins with a basin-level water planning strategy (EPHIC) adopted. (Number)	
Jan/2024	Jan/2030
0.00	15.00
Basin management organizations (OGCs) operating (disaggregating male/female participation). (Number)	
Jan/2024	Jan/2030
19.00	134.00
Increased resilience to climate variability of vulnerable rural families in selected micro basins	
Area provided with new/improved irrigation or drainage services (Hectare(Ha)) CRI	
Jan/2024	Jan/2030
0.00	6720
➢Area provided with new irrigation or drainage services (Hectare(Ha)) CRI	
Jan/2024	Jan/2030
0.00	3696
➢Area provided with improved irrigation or drainage services (Hectare(Ha)) CRI	
Jan/2024	Jan/2030
0.00	3024
Area with MIC interventions implemented and area protected with flood risk management interventions (Hectare(Ha))	
Jan/2024	Jan/2030
0.00	40,452.00
Vulnerable families benefitting from climate resilience infrastructure interventions (Number)	
Jan/2024	Jan/2030
0.00	30,000.00

Intermediate Indicators by Components

Baseline	Closing Period
Component 1. Water resources planning and pre-investment studies.	
Basin-level water planning strategies (EPHIC) prepared (Number)	
Jan/2024	Jan/2030
0.00	15.00
EDTPs prepared in accordance with VRHR's new approach and guidelines (Number)	
Jan/2024	Jan/2030
0.00	160.00
Share of decision-making positions in OGCs held by women (Percentage)	
Jan/2024	Jan/2030
20.00	30.00
Component 2. Climate resilient infrastructure investments.	
Micro-basins intervened (Number)	
Jan/2024	Jan/2030
0.00	84.00
Total area of micro-basins intervened (up to 200 km2) (Square kilometer(km2))	
Jan/2024	Jan/2030
0.00	16,000.00
Households benefited by MIC infrastructure (Number)	
Jan/2024	Jan/2030
0.00	15,120.00
Households benefited by hydrological risk management infrastructure (Number)	
Jan/2024	Jan/2030
0.00	7,200.00
Households with access to new or improved irrigation services (Number)	
Jan/2024	Jan/2030
0.00	7,680.00
Reforested and afforested areas in intervened micro-basis (Hectare(Ha))	
Jan/2024	Jan/2030
0.00	34,356.00
Component 3: Capacity building for water governance and enhanced productivity.	
People trained in the operation and maintenance of MIC, irrigation and risk infrastructure (disaggregating male/female participation). (Number)	
Jan/2024	Jan/2030
0.00	60,000.00

Subprojects with TA implemented (Number)	
Jan/2024	Jan/2030
0.00	316.00
Farmers adopting improved agricultural technology (Number) [CRI]	
Jan/2024	Jan/2030
0.00	15360
➢Farmers adopting improved agricultural technology - Female (Number) [CRI]	
0.00	4608
➢Farmers adopting improved agricultural technology - male (Number) [CRI]	
0.00	10752
Percentage of complaints from farmers regarding the processes and services implemented by the Project addressed according to stipulated timeframe (Percentage)	
Jan/2024	Jan/2030
0.00	80.00
Component 4. Project management.	
Front-end-fee (to be financed by the proceeds of the loan)	

Monitoring & Evaluation Plan: PDO Indicators by PDO Outcomes

Improved integrated water resources management in selected basins	
Basins with a basin-level water planning strategy (EPHIC) adopted. (Number)	
Description	This indicator measures the number of basins that have: i) an EPHIC prepared, ii) an Interinstitutional Basin Platform established, iii) a UGC has been set up with a Board of Directors and a Social Council appointed. Under the Project it is expected that 9 EPHICs will be approved by the UGC's Board of Directors, and at least 6 will be approved through a legal instrument (either a Departmental Law or Ministerial Resolution issued by MMAyA).
Frequency	Annually
Data source	Annual progress reports
Methodology for Data Collection	Annual evaluation
Responsibility for Data Collection	UCP-PPCR
Basin management organizations (OGCs) operating (disaggregating male/female participation). (Number)	
Description	A basin management organization is defined as an OGC that is organized, it is working with the UGC of the main basin, and has developed and is implementing a Local Management Plan. Being a community organization the OGCs don't receive external financial support and relay on the support of their communities.
Frequency	Annually
Data source	Annual progress reports
Methodology for Data Collection	Annual evaluation
Responsibility for Data Collection	UCP-PPCR
Increased resilience to climate variability of vulnerable rural families in selected micro basins	
Area provided with new/improved irrigation or drainage services (Hectare(Ha)) [CRI]	
Description	This indicator measures the total area of land provided with irrigation and drainage services under the project, including in (i) the area provided with new irrigation and drainage services, and (ii) the area provided with improved irrigation and drainage services, expressed in hectare (ha).
Frequency	Annually
Data source	Annual progress reports
Methodology for Data Collection	Annual assessments
Responsibility for Data Collection	UCEP-Mi Riego
Area provided with new irrigation or drainage services (Hectare(Ha)) [CRI]	
Description	Measures in hectares the total area of land provided with new or improved irrigation or drainage services in operations supported by the World Bank.
Frequency	Annually
Data source	Progress reports
Methodology for Data Collection	Annual assessments
Responsibility for Data Collection	UCEP-Mi Riego
Area provided with improved irrigation or drainage services (Hectare(Ha)) [CRI]	
Description	Measures in hectares the total area of land provided with new or improved irrigation or drainage services in operations supported by the World Bank.
Frequency	Annually
Data source	Progress reports

Methodology for Data Collection	Annual assessments
Responsibility for Data Collection	UCEP-Mi Riego
Area with MIC interventions implemented and area protected with flood risk management interventions (Hectare(Ha))	
Description	This indicator measures the total area benefited with MIC interventions, and the area protected with flood risk management interventions
Frequency	Annually
Data source	Progress reports
Methodology for Data Collection	Annual assessments
Responsibility for Data Collection	UCEP-Mi Riego
Vulnerable families benefitting from climate resilience infrastructure interventions (Number)	
Description	This indicator measures the total number of families benefited by at least one activity of a MIC intervention, protected by hydrological risk management infrastructure, or benefited with new household irrigation systems or rehabilitated minor irrigation systems. The number of families benefited by the Project may be greater than the number of households as there may be one or more families living in a household.
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCEP-Mi Riego

Monitoring & Evaluation Plan: Intermediate Results Indicators by Components

Component 1. Water resources planning and pre-investment studies.	
Basin-level water planning strategies (EPHIC) prepared (Number)	
Description	This indicator measures the number of basins with an EPHIC prepared, presented and agreed with stakeholders.
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCP-PPCR
EDTPs prepared in accordance with VRHR's new approach and guidelines (Number)	
Description	This indicator measures the number of EDTPs complying with all the requirements established in VRHR's guidelines, that have been presented to VRHR for their assessment
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCP-PPCR
Share of decision-making positions in OGCs held by women (Percentage)	
Description	This indicator measures the percentage of women appointed in decision-making positions in the Board of OGCs
Frequency	Annually
Data source	Progress reports

Methodology for Data Collection	Annual assessments
Responsibility for Data Collection	UCP-PPCR
Component 2. Climate resilient infrastructure investments.	
Micro-basins intervened (Number)	
Description	This indicator measures the number of micro-basis with implementd MIC interventions
Frequency	Annually
Data source	Progress reports
Methodology for Data Collection	Annual assessments
Responsibility for Data Collection	UCEP-Mi Riego
Total area of micro-basins intervened (up to 200 km2) (Square kilometer(km2))	
Description	This indicator measures the total net area of Project interventions at micro-basin level
Frequency	Annually
Data source	Progress reports
Methodology for Data Collection	Annual assessments
Responsibility for Data Collection	UCEP-Mi Riego
Households benefited by MIC infrastructure (Number)	
Description	This indicator measures the number of households benefited by at least one activity of a MIC intervention
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCEP-Mi Riego
Households benefited by hydrological risk management infrastructure (Number)	
Description	These indicator measures the number of households protected against the effects of floods, landslides or another hydrological risk by means of hydrological risk management infrastructures
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCEP-Mi Riego
Households with access to new or improved irrigation services (Number)	
Description	This indicator measures the number of households benefitting from new household irrigation systems and rehabilitated minor irrigation systems
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCEP-Mi Riego
Reforested and afforested areas in intervened micro-basis (Hectare(Ha))	
Description	This indicator measures the reforested and afforested areas with suitable species according to the MIC
Frequency	Annually

Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCEP-Mi Riego
Component 3: Capacity building for water governance and enhanced productivity.	
People trained in the operation and maintenance of MIC, irrigation and risk infrastructure (disaggregating male/female participation). (Number)	
Description	This indicator measures the number of people trained in the operation and maintenance of MIC, minor irrigation and risk infrastructure through FORATP and/or other training activities during and after the implementation of subprojects
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCP-PPCR and UCEP-Mi Riego
Subprojects with TA implemented (Number)	
Description	These indicator measures the number of subprojects which have implemented satisfactorily the planned AT, either through FORATP in minor irrigation, or as part of the supervision contracts in MIC and risk management interventions
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Assessments
Responsibility for Data Collection	UCP-PPCR and UCEP-Mi Riego
Farmers adopting improved agricultural technology (Number) [CRI]	
Description	This indicator measures the number of farmers (of agricultural products) who have adopted an improved agricultural technology promoted by the Project.
Frequency	Annually
Data source	Annual progress reports
Methodology for Data Collection	Assessment
Responsibility for Data Collection	UCP-PPCR
Farmers adopting improved agricultural technology - Female (Number) [CRI]	
Description	
Frequency	Annually
Data source	Annual progress reports
Methodology for Data Collection	Assessment
Responsibility for Data Collection	UCP-PPCR
Farmers adopting improved agricultural technology - male (Number) [CRI]	
Description	
Frequency	Annually
Data source	Annual progress reports
Methodology for Data Collection	Assessment
Responsibility for Data Collection	UCP-PPCR
Percentage of complaints from farmers regarding the processes and services implemented by the Project addressed according to stipulated	

timeframe (Percentage)	
Description	This intermediate indicator will measure the percentage of complaints from beneficiaries, regarding the processes and services implemented by the project, addressed according to stipulated timeframe, to allow for early-on identification of relevant issues. This information will be reflected with analysis of contents of complaints in biannual reports as annex to the biannual Project reports.
Frequency	Biannual
Data source	Progress reports
Methodology for Data Collection	Collection of complaints, registered at sites of Project's activities or subprojects
Responsibility for Data Collection	UCP-PPCR and UCEP-Mi Riego
Component 4. Project management.	

ANNEX 1: Implementation Arrangements and Support Plan

COUNTRY: Plurinational State of Bolivia
Bolivia Resilient Water Management for Community and Household Irrigation Project

Implementation Arrangements

1. **MMAyA will be the agency responsible for overall project implementation through the VRHR. The MMAyA/VRHR will work with two existing PIUs within the MMAyA:**

- **The Coordination Unit of the Climate Resilience Program (UCP-PPCR) will implement activities related to water resources planning, pre-investment studies and TA, Components 1, 3 and part of Component 4.** The UCP-PPCR will maintain overall responsibility for all fiduciary aspects of the Project and the contracting of Project audits. The UCP-PPCR will also coordinate activities with the departmental and municipal governments, UGCs and OGCs, disseminate information on the Project, and contract consulting services for water resources planning and pre-investment studies, as well as consulting services for TA during and after construction.
- **The Coordination and Implementation Unit of the Mi-Riego Projects (UCEP-Mi Riego) will be responsible for the implementation of infrastructure investments: Integrated management of basins, minor (community and household) irrigation systems and risks management interventions, Component 2 and part of Component 4 (see organizational chart in Annex 3).** The UCEP-Mi Riego will be responsible for contracting out works and their supervision services. The UCEP-Mi Riego has regional offices in seven departments, La Paz, Oruro, Potosi, Chuquisaca, Tarija and Cochabamba/Santa Cruz, which will be a critical element for Project implementation given its geographic scope and scale.

2. **Municipal and departmental governments (Autonomous Territorial Entities-ETAs) and participating UGCs,OGCs, and PICs will be the beneficiaries of planned climate-resilience activities and water infrastructure investments, and as such, will play a key role with both PIUs for the execution of activities and subprojects.** In Component 1, they will be responsible for presenting the funding requests to VRHR, taking the leadership in the preparation of EPHICs, and preparing detailed pre-investment studies designs and submitting them to VRHR. In Component 2 they will oversee the construction of works, and alongside with the PIUs, receive and give their approval of the works. The technical assistance activities proposed in Component 3 will be discussed with the ETAs, UGCs,OGCs and PICs, as applicable, including the terms of reference. The progress and end-results will be assessed jointly by the ETAs, UGCs, OGCs and PICs, as applicable. MMAyA/VRHR will receive and pre-evaluate subprojects submitted to VRHR by ETAs, UGCs and/or OGCs. Subprojects, EDTPs and EPHICs within protected areas must have the No Objection from the WBG and the integration of the environmental and social criteria established in the ESMF.

3. **A Project Operation Manual (POM) describing all processes, procedures, roles, and responsibilities related to project management and implementation will be prepared by the borrower, satisfactory to the Bank, and duly adopted by the PIUs as a condition of Loan Effectiveness.** The POM will include: i) the budgeting, accounting, auditing, reporting, financial, disbursement, procurement, environmental, and social procedures, including specific gender actions of the Project in terms of parity in contracting Project personnel, and implementing specific actions that supports the participation of women in decision-making mechanisms, and in access to subprojects and relevant training and services, as well as the application of codes of conduct in all contracts, and the set-up of mechanisms to channel gender-based violence incidents at the subproject level to the previously mapped official entities and

additional services who provide support to survivors, as established in the Gender Analysis and Action Plan (**see summary in Annex 7**); ii) the eligibility criteria for the selection of the eligible subprojects in Component 2; iii) the procedures for approval, implementation, supervision and monitoring of activities under Components 1 and 2 (including the types of subprojects and other activities that require prior approval of the Bank for implementation, if required); iv) the requirements for cash and in-kind contributions that counterparts of subprojects under Subcomponent 2.2 will be required to provide,; v) the terms and conditions (including models) of Intergovernmental Agreements; vi) the organizational structure for implementation of the Project, including the composition, functions and responsibilities of the PIUs; and vii) the Project indicators for the monitoring and evaluation of the Project; and such other arrangements and procedures as shall be required for the effective implementation of the Project.

The Subproject Cycle

4. **Infrastructure investments and TA.**

- The request from a community organization, an OGC or an UGC, will be submitted to the VRHR through their ETA which can be a municipal or a departmental government. The request may include an ITCP/EDTP of a MIC/Risk management/Minor (community and household) irrigation systems subproject. At the VRHR the documents will be forwarded to the General Directorate of Basins and Water Resources (DGCRH) for MIC and Risk Management requests or to the General Directorate of Irrigation (DGR) for irrigation subprojects.
- Their eligibility will be evaluated according to the Guidelines currently available in VRHR for each type of intervention; in this step the social and environmental criteria related to compliance with national regulations and the WB Environmental and Social Standards (EAS) will be applied.
- The request will be registered in the 'Sistema Único de Seguimiento de Infraestructura de Recursos Hídricos' (both Directorates in this same filter); both, the request and EDTP will be georeferenced in the system and the information will be registered in the national water balance. Then, a prioritization note and report will be prepared and submitted to the Technical Investment Unit of the UCP-PPCR.
- The UCP PPCR will carry out a joint field evaluation alongside the UCEP Mi Riego, to verify the demand and feasibility of the subproject, evaluate the proposed technical solution as well as the social, environmental and economic aspects. From the social point of view, the assessment will include consultations with the potential beneficiaries, and the free and informed prior consultation (FPIC) in the case of subprojects proposed in Indigenous Communities, Territories and the 'Territorios Indigenas Originarios Campesinos-TIOC'.
- Then, the Budget Unit of the UCP PPCR, will prepare the TOR for FORATP, while the UCEP Mi Riego will prepare the TOR for the works construction and works supervision, the later including TA for operation and maintenance training in the case of MIC and Risk Management subprojects.
- Subsequently, the request will be submitted to the Legal Unit of VRHR for the Agreement (*Convenio Intergubernativo de Financiamiento*) signature between the ETA and the relevant PIU and the certification of resources in the annual budget (Programa Anual Operativo, POA) of the ETA. Finally, the TORs will be submitted to the procurement area.
- The beneficiaries of MIC and Risk subprojects (Subcomponents 2.1 and 2.3, respectively) are the OGCs/Communities and Associations, while in the case of FORATP the beneficiaries are the farmers and Irrigation Committees.

Financial Management

5. **A Financial Management (FM) Assessment was carried out in accordance with OB/BP 10.00, the FM Manual for WB's IPF, and Bank Directive Investment Project Financing IPF, and FM Manual for IPF Operations** to evaluate the

adequacy of the MMAyA and its two PIUs (UCP-PPCR and UCEP-Mi Riego) FM arrangements for the implementation of the proposed Project. The estimated total Project cost is US$171.49 million, of which US$150 million will be financed with an IBRD loan. The GoB will be responsible for counterpart financing to cover the remaining US$21.49 million, which will be provided by municipal and/or departmental governments.

6. **Based on the information available at this stage, the FM residual risk is substantial.** The main FM risks identified for the Project relates to: (a) subproject design requires counterpart funding from municipal and/or departmental governments, which in the last project implemented by MMAyA[52] was not provided in a timely manner, causing delays in payments; (b) timely availability of funds for Component 2 may be affected if adequate arrangements between the two units are not put in place; (c) lack of adequate policies and procedures for the collection, control, recording and reporting of municipal contributions; (d) weaknesses in the public sector to attract and maintain qualified staff with subsequent high staff rotation, which could adversely affect Project implementation; (e) the processes and internal controls for the recording, reporting and monitoring of financing the subprojects (i.e. civil works) are in process to be implemented for all sources of financing.

7. **Identified risks will be mitigated through the following actions agreed with MMAyA and both PIUs:** (a) MMAyA, through each PIU, will sign a Subproject Agreement with each ETA defining, among other topics, the procedure and treatment for the counterpart contributions, and providing the activation of the "*Debito automatico*" procedure executed directly by the MEFP in case of default; (b) at Appraisal, MMAyA has assessed options for timely provision of funds to both units, including administration of the DA(s); (c) UCP-Mi Riego has defined the policies and procedures for the collection and administration of ETA counterpart funding; (d) based on the experiences from other projects in Bolivia, the fiduciary staff rotation risk will be reduced by looking for at least annual contracts for project financial staff based on periodic performance evaluation. To support project implementation, it has been considered the addition of two Financial Specialists, one for each Unit -at central level- to strengthen each financial team; (e) at subproject level, and building on prior experiences, MMAyA though UCP-Mi Riego has designed (and will be included in the POM) appropriate policies and rules including detailed procedures to record and control the financing of subprojects including loan and counterpart funds; (f) defined and clear roles and responsibilities for reporting agreed with each PIU.

8. The FM team has completed and agreed on the mitigating measures to conclude on the adequacy of the proposed arrangements. The following sections details the main features of financial management arrangements, mainly based on MMAyA's existing capacity and performance.

9. **Use of Country Public Financial Management (PFM) Systems.** Like other projects in the Bank's Bolivia portfolio, the proposed Project will be fully integrated and executed into the national planning and budget arrangements, and it will benefit from the use of well-functioning PFM elements including country's integrated financial management system (*Sistema de Gestión Pública - SIGEP*) and the Treasury Single Account (TSA), supplementing them where needed to ensure what the Project needs and risks are adequately addressed, mainly as they relate to internal controls, financial reporting, and auditing. Within this framework, the following sections describe some specific arrangements.

10. **Organizational arrangements and staffing.** Two existing PIUs located within MMAyA will be responsible for Project implementation as described in paragraph 1 of this annex. Each Unit will have financial management responsibilities for its respective components, and UCP-PPCR will consolidate the Project financial information, prepare the IFRs and contract out the financial audit. The UCP-PPCR and the UCEP-Mi Riego will coordinate activities with the ETAs to

[52] PPCR Project, P129640

disseminate information on the Project and appraise subprojects; the contracting of consulting services and studies and their respective payments will remain with UCP-PPCR. UCEP-Mi Riego will be responsible for contracting out works and supervision services, and processing payments for the implementation of infrastructure investments.

11. Both PIUs currently have a finance team that carries out FM tasks related to budgeting, accounting, disbursements, financial reporting, and subprojects monitoring. At the UCP-PPCR there is a Finance Officer, an accountant, and a budget analyst. At UCEP-Mi Riego, there is a Finance Officer, two accountants and a budget analyst. To support Project implementation, it has been agreed the addition of two Financial Management Specialists, one for each Unit at central level. This staff can be financed out of loan proceeds, the FM specialists will be hired under terms of reference agreed with the Bank procedures.

12. At the departmental level, only UCEP-MI Riego has an administrative analyst in each departmental office whose main function is to complete all the support documentation for the payments and send the expenditure documentation to the Central office for the contractors 'payments. Even though the roles and responsibilities between central and departmental offices are in general well defined – including both technical and fiduciary teams, they will need to be described in the POM.

13. **Programming and Budget.** The preparation of the annual program and budget will follow local regulations established by the MEFP, as well as instructions issued by VIPFE, as applicable. The Project's budget will be part of the national budget, and its execution will be centrally and fully integrated into the country's integrated financial management system (SIGEP). Disbursements will be processed through the TSA providing direct bank transfers from the account managed by the Central Office from UCP-PPCR and UCEP-Mi Riego to contractors or suppliers' bank accounts in the financial system. This will allow an agile and simple flow of funds without additional and unnecessary layers.

14. **Accounting – Information systems.** MMAyA must comply with the Governmental Accounting Standards. Therefore, the proposed Project would use the Chart of Accounts established by Bolivia's Accountant General's Office (*Dirección General de Contabilidad Fiscal*). The Project will benefit from the use of SIGEP and the STA (in US dollars and local currency) to process payments, including payments to contractors and suppliers under the subprojects. From thereon, Project execution will be fully integrated into the central government accounting.

15. The use of SIGEP will be complemented with the SGP system. This is a system that is already implemented in UCEP Mi Riego to allow recording, control, reporting and monitoring of subproject implementation. SGP system will allow recording of project transactions incurred with both sources of financing (WB loan and municipal counterparts) and following a more functional classification (component/subcomponent) for further issuance of financial reports and statements of expenditures. The proposed project's transactions and preparation of financial statements will follow the cash basis of accounting.

16. **Processes and procedures.** Overall, MMAyA should comply with local requirements related to administrative and control systems (SAFCO Law), which are partially integrated into the operation of SIGEP, as they relate to budget preparation and execution. Considering the Project needs and identified risks, MMAyA will also describe the processes and procedures for subprojects execution and monitoring. Those procedures need to provide for clear and concrete arrangements in the roles and responsibilities at national, departmental and municipal level; adequate segregation of duties in terms of authorization; and recording and approval of payments and disbursements. While the Project contracting and payments will be centrally executed, the Departmental Offices of UCEP-Mi Riego will need to provide the supporting documentation of payment requests and follow up all the process until the final payments to the

contractors. All the supporting documentation will be archived at central level, and this will be closely monitored so that required corrective actions are taken on a timely basis. All these tasks will be described in the POM.

17. **Internal Audit.** MMAyA has an Internal Audit Unit that is part of the internal control framework of all the Ministry. This Unit would include the project activities in its annual work plan. The team has a Director and two auditors and it is expected that they will help the project in monitor the compliance of the internal control system and follow up of the findings of the external audit to strengthen the processes effectiveness.

    Financial reporting. it is expected that the interim financial reports (IFRs) will use the SIGEP and SGP database to prepare the financial reports in excel spreadsheet with the reconciliation report from both systems. IFRs will include: (a) sources and uses of funds, reconciling items, and cash balances, with expenditures classified by project component; (b) a statement of investments, classified by Project component/subcomponent and Loan category, reporting the current semester and the accumulated operations against ongoing plans, as well as footnotes explaining the important variances; and (c) a Subproject Statement which shows amount approved, executed, and outstanding balances, both for loan proceeds and counterpart funding. The IFRs will include Loan proceeds and counterpart funding. The IFRs will be prepared and submitted to the Bank on a semi-annual basis no later than 45 days after the end of each calendar semester. The IFRs will be prepared in local currency and US dollars. On an annual basis, UCP-PPCR will also prepare project financial statements including cumulative figures for the year and as of the end of the fiscal year (December 31).

18. **Audit.** Annual audit reports on Project financial statements, including the management letter should be submitted to the Bank, within six months of the end of the Borrower's fiscal year (December 31). The audit should be conducted by an independent private audit firm acceptable to the Bank and under terms of reference approved by the Bank. Audit costs will be financed out of the Loan proceeds and selection will follow standard Bank procedures. The scope of the audit will be defined by both PIUS within MMAyA in agreement with the Bank, based on Project specific requirements and responding as appropriate to identified risks, including review of compliance with agreed processes and procedures, as well as on-site revision of a sample of subprojects. Audit TOR will specifically require that the internal control report clearly identifies the issues related to MMAyA's Executing Units (UCP-PPCR and UCEP-Mi Riego) issues related to municipal governments. Audit requirements will include the following:

Table A.1 Submission dates of audit reports

Audit Report	Due date
Project financial statements	June 30
Management Letter	June 30

    In accordance with WBG's Access to Information Policy, the audited annual financial statements will be made publicly available through MMAYA website.

19. **Flow of Funds and Disbursement Arrangements.** Following the general practice of the current portfolio, the following disbursement methods may be used to withdraw funds from the proposed Loan: (a) reimbursement, (b) advance, and (c) direct payment. Under the advance method, and to facilitate project implementation, two Designated Accounts (DA) (one for each PIU) will be opened in US dollars. Funds deposited into the DAs as advances will follow Bank disbursement policies and procedures, as described in the Financing Agreement and in the Disbursement and Financial Information Letter (DFIL).

20. In keeping with current arrangements established by the Viceministry of Treasury and Public Credit for the operation and use of a Treasury Single Account in US dollars, the DAs would be opened and maintained as a separate *Libreta* within the TSA in US dollar. Following the existing treasury arrangements, funds from TSA in US dollars will be periodically transferred to both TSA in *Bolivianos* into a separate *Libreta(s)* under the project name, from which all payments and disbursements to beneficiaries' bank accounts will be processed.

    For the counterparts financing, UCEP-Mi Riego will open a separate account to register, collect, administer and carry out the individual control of each subproject execution.

21. **Supervision Plan:** The WBG plans to perform at least two supervision missions per year to the extent possible while also reviewing the annual audit reports and the IFRs. As there are still some definitions to be agreed, an action plan with the pending actions to complete the assessment is presented below.

Table A.2. Action Plan

Action	Responsible
1. Definition of the appropriate Project Flow of funds including the definition of the Responsible to administer the DA.	MMAyA
2. Definition of subprojects policies, procedures, and rules for the Project to be included in the POM	MMAyA and the WB
3. Description of the counterpart funding, how it will operate, process and control procedures for its administration. These rules and procedures willl need to be reflected in the POM.	MMAyA, MEFP and WB.
4. Meeting with MMAyA Internal audit to understand the function, capacity, responsibilities and tasks assigned and how this could contribute to strengthen the Project internal control procedures.	Completed.

Procurement

22. **All Project procurement will be carried out in accordance with the "World Bank Procurement Regulations for IPF Borrowers" dated September 2023, herein referred as "Procurement Regulations".** Bank's Standard Procurement Documents shall be used for all contracts under international market approach and the STEP system is to be used for Procurement Plans, clearances, and monitoring. Procurement Plans will be updated at least semi-annually or as required to reflect the actual Project implementation needs and improvements in institutional capacity.

23. **The assessment concluded that the UCEP-Mi Riego does not have experience in the implementation of World Bank financed Projects while the UCP-PPCR has experience executing Bank's financed projects.** Staff of both entities do not have experience on Bank's Procurement Regulations. However, both UCEP-Mi Riego and UCP-PPCR have extensive experience contracting and supervising similar contracts to those planned in this Project. The activities financed by the Project are foreseen to consist of small and medium value contracts. The overall Project risk for procurement is Substantial. The World Bank will provide necessary capacity building to UCEP-Mi Riego and UCP-PPCR to conduct procurement activities.

24. **Procurement of Goods, Works, and Non-Consulting Services.** The open international competitive bidding approach should be applied when the Procurement Plan establishes it, while for small contracts the open national competitive bidding approach is supported by the availability of bidders in the local market. Procurement for works will be under contracts including complete technical specifications and final designs. The Borrower can specify detailed

requirements to which bidders respond by offering bids; the Request for Bids or the Request for Quotations would be the selection methods for these contracts.

25. **Procurement of Consulting Services, Technical Assistance, designs, supervision services, and other studies.** Considering that these will be small and medium value contracts, the suitable market approach would be an open competition in the national or international market approach, while the Quality-Cost- Based Selection or the Consultant's Qualification Based Selection (considering the nature of the services and the need to take into account the quality of the proposals based on the evaluation of the different solutions and the cost of the services), or Direct Selection (when a sole firm consultant with needed capabilities is identified and justified) would be the selection methods.

26. **Project implementation support personnel.** Individuals contracted to support Project implementation (Project staff), other than individual consulting positions identified in the Legal Agreement, may be selected by the Borrower according to their personnel hiring procedures for such activities, as reviewed, and found acceptable by the Bank and described in the Project Operations Manual.

27. **Individual consultants.** Individual consultants will be selected for an assignment for which: (i) a team of experts is not required; (ii) no additional office support is required; and (iii) the experience and qualifications of the individual are of paramount requirement. The evaluation shall be based on the relevant qualifications and experience of the individual consultant in accordance with provision of paragraphs 7.34 to 7.39 of Section VII of the Procurement Regulations.

28. **Frequency of procurement implementation support.** Contracts subject to post review will be reviewed by the World Bank once a year. Additionally, semi-annual supervision visits will take place to carry out reviews of procurement actions. Procurement staff of the UCEP-Mi Riego, UCP-PPCR, and the World Bank will meet annually to review the implementation of the Procurement Plan and to carry out Post Reviews. Based on the findings of these reviews and the proposed ratings, the World Bank may determine the revision of the prior review requirements.

Implementation Support Plan

Strategy and Approach for Implementation Support

29. **The Implementation Support Plan (ISP) describes how the Bank and other development partners will support the implementation of the risk mitigation measures and provide the technical advice necessary to facilitate achieving the PDO (linked to results and outcomes identified in the result framework).** The ISP also identifies the minimum requirements to meet the Bank's fiduciary obligations. With its substantial risk profile, implementation support will need to be well structured. Requirements may change during implementation of the project and the ISP will be reviewed periodically to ensure that it continues to meet the implementation support needs of the Project.

30. The Project implementation will require substantial support from the Bank's task team, in view of numerous weaknesses identified, including institutional implementation capacity; the limited or experience of the executing agencies in implementing World Bank projects; and the overall implementation risk rating.

31. **The ISP was developed to assist Project counterparts in achieving the PDO and to mitigate anticipated implementation risks.** The ISP has the following objectives: (i) provide necessary technical advice to the executing agencies and bring international experiences and good practices to ensure that the Project meets the Bank's technical standards; (ii) ensure that the required fiduciary, social, and environmental safeguards are put in place and implemented as required by the Loan Agreement and other project documents; (iii) ensure that the climate-resilience

activities foreseen under the project benefit the main project beneficiaries; (iv) provide training and support for overall monitoring and evaluation.

32. **This implementation support will be focused on:** (i) ensuring coordination among the various stakeholders involved in the execution of Project investments at the local, municipal, departmental, and national levels; (ii) monitoring compliance with environmental and social safeguards; (iii) strengthening the capacity of the executing agency to follow Bank fiduciary policies and requirements; and (iv) extensive monitoring of project activities to allow for implementation.

33. **A Project Operation Manual (POM) will be prepared by the borrower and adopted by executing agencies before the project becomes effective.**

34. **The Bank task team will work closely with Project counterparts by undertaking regular implementation support and supervision missions and site visits, as well as by involving a group of professional experts who have the various required skills and profiles to support the executing agencies in implementing the various project investments and activities.** It is planned that a significant part of this expertise can be mobilized locally in the country office. Currently, a significant part of the task team is decentralized, which will enhance implementation support. Fiduciary support is also provided at the country office. Project design places a strong emphasis on monitoring and evaluation. The emphasis on information gathering and management will complement implementation support by the World Bank task team.

Implementation support by the World Bank task team.

35. **Table A.3** below summarizes the ISP and provides estimates of skills, timing, and resource requirements for the Project lifetime. All these estimates are subject to modifications during Project implementation.

Table A.3 Implementation Support Plan and Resource Requirements

Time	Focus	Skills Needed
First twelve months	• Staff of UCP-PPCR, and UCEP-Mi Riego • Undertake procurement of works of the initial portfolio of infrastructure sub-projects • Undertake the procurement of first batch of TA activities • Initiate the preparation of the first batch of EPHIC studies in target basins • Carry out the preparation of ETDPs of the second portfolio of subprojects (including social and environmental standards) • Establish M&E and reporting systems • FM, procurement, and safeguards	Technical skills specifically on: project management; water resources, environmental and irrigation engineering; social sciences; environment; procurement; fiduciary; and M&E specialists

12-60 months	• Construction works and supervision • TA activities (FORATP) • Procurement of works of the second portfolio of infrastructure subprojects • Procurement of second batch of TA activities • Systematic training programs • FM, procurement, and safeguards • Monitoring and evaluation	Technical skills specifically on: project management; water resources, environmental and irrigation engineering; social sciences; environment; procurement; fiduciary; and M&E specialists
60-72 months	Warranty period of infrastructure works	Technical skills on engineering, project management, fiduciary, and M&E

Skills Needed	Number of Staff Weeks per Year	Number of Trips per Year	Comments
Team Leaders	20	2/3	Overall implementation support, includes one country office based TL
Irrigation/Agronomy Specialist	8	3	Support to irrigation activities and agricultural production/productivity
Climate Change Specialist	2	1	Climate change commitments follow up Country based consultant
Gender Specialist	2	1	Country based consultant
TA Specialists	4	3	Country based consultants
M&E Specialist	2	2	M&E indicator tracking, refinement, and use
Environmental Specialist	4	3	Country Office based - environmental aspects and safeguards
Social Development Specialist	4	3	Country Office based - social aspects and safeguards
Procurement Specialist	6	As needed	Country Office based - procurement aspects, procurement plan revision and implementation monitoring, and procurement audits
Financial Management Specialist	5	As needed	Country Office based - FM aspects, fund flow, and FM audits
Team Assistance	10	As needed	Country Office based - team support

Implementation Support Plan and Resource Requirements

36. **Technical Implementation Support.** During the implementation phase, the Task Team will engage experienced environmental, civil and irrigation engineers to ensure the technical quality of the infrastructure investments, as well as institutional and climate change experts, to support the design and implementation of capacity building of participating stakeholders. During the construction phase, the engineers will provide supervision support to ensure the quality of works and safety as well as to advance discussions on the O&M strategies. Technical implementation missions will be implemented three times a year during the first 24 months of project implementation, after which

supervision missions will occur twice a year. Engineers will carry out site visits where works are ongoing or where service has recently commenced.

37. **Procurement Support.** The Bank's procurement team is already providing, and will continue to provide, training on the World Bank's "Procurement Regulations for IPF Borrowers" covering the supply of goods, works, non-consulting services, and consulting Services. Training will also be provided on additional topics, including on handling requests for bids or proposals documents, and on evaluating bids and proposals. The Bank's team, in coordination with PIU's teams, will periodically review the Project Procurement Strategy for Development (PPSD) and the Operation Manual to update and improve them. It will be important for the Bank team to participate in the induction of the PIU's procurement staff. Each year, the Bank will develop a procurement post-review mission to help the PIU's develop an improvement action plan to implement all recommendations of the respective report.

38. **Financial Management Implementation Support**. The Bank will provide support in drafting the FM chapter of the Project's Operation Manual. Bank staff will also regularly review interim financial reports and audit reports and will make two FM onsite visits per year. The UCP-PPCR, has limited prior experience in Bank´s operations, and hence training in financial management will be conducted for the implementing entities before the start-up of the project and as needed, during implementation. Close follow-up with the Ministry of Economy and Public Finances (MEFP) and Vice-Ministry of Public Investment (VIPFE) is necessary to monitor timely recording of the budget.

39. **Environmental and Social Standards Implementation Support**. During the implementation phase, the safeguards team will follow up the Project activities to ensure that it is implemented according to the Bank's environmental policies. The team will determine the relevance, efficiency, and effectiveness of environmental management, while also identifying any remaining impacts and unresolved problems. The PIUs are responsible for compliance with the World Bank standards and with the overall environmental supervision of the project and its compliance with the Environmental Law (Law 1333) and other legislation applicable to the sector. Environmental and social supervision missions will take place twice a year.

40. Specific measures have been included in the social instruments to fully respond to the social context in the Project area. These arrangements have been agreed upon and finalized and will be reflected in the Operational Manual. To address key capacity weaknesses in the PIUs regarding social safeguards implementation, particularly capacities for social risk management, the Bank through its social safeguard's specialists will provide technical advice and supervision at least twice a year.

ANNEX 2: Economic Analysis

1. The Project aims to improve integrated water resources management at the basin level and increase the resilience of poor rural families in selected micro watersheds. The Project focuses on the poorest communities in the country. In the case of irrigation subprojects, where the benefits and costs are mostly accruing to individual farmers in targeted communities, an economic and financial analysis has been conducted. For the other two types of subprojects, watershed management and flood risk managements, the externalities are large and only an economic analysis has been conducted. In these latter two types of subprojects the benefits are diffuse and do not only accrue to the communities directly involved in the Project.

Rationale for Public Sector Investment

2. Land degradation and soil erosion are externalities caused by market failure. The impacts of natural processes like wind and water erosion have in many places been exarcebated by unsustainable agricultural practices and excessive deforestation. Without interventions, these market failures will continue to pose major costs to the local population, and the environment. The benefits of this project therefore accrue not only to individuals but also to society in terms of improvements in food security and significant environmental benefits (through micro watershed management, soil conservation practices and flood risk management) that will also benefit the population downstream in these watersheds. In the long run, the project will improve income security, generate additional income through commercialization of agricultural surpluses, while reducing periodic labor migration. It will also increase communities' resilience to climate change by reducing drought and flood risks. Although the benefits of the proposed interventions will accrue to society as a whole, the benefits of such investments are usually insufficient to induce private sector investments, especially in communities that are among the poorest in the country, and which are mostly located in rural dispersed areas. Hence, public financing is still needed to guarantee that such investments will take place.

Rationale for Bank Involvement

3. The Bank, with its global experience in land and water resource management and rural development, will focus on funding the most cost-effective investments. The Bank has funded many operations that include projects that involve the financing and implementation of a large number of small-sized subprojects in different municipalities. This project will build on this experience in Bolivia, and will include a component of technical assistance to raise awareness and capacity to improve the management of land and water resources locally. The Bank will combine this investment financing with a program of measures that is essential to enhance local capacities to optimize water and land resources locally to counteract the effects of climate change so as to ensure the longer-term sustainability of such investments.

Cost Benefit Analysis

4. Because the Project focuses on addressing externalities, it is necessary to construct a cost-benefit analysis. A financial analysis can be prepared for the irrigation subprojects, that also generates private benefits (mostly measured in improvements in agricultural production). However, as the population benefiting from these investments are mostly (very) poor, it is unlikely that they can pay for all the private costs of these investments. To ensure the sustainability of these investments in the long run, sufficient funding for the operation and maintenance costs is needed. The project's financial sustainability of the irrigation subprojects will hence be assessed using an aggregated financial analysis that investigates the ability and resources required to operate and maintain the newly developed infrastructure.

5. The cost-benefit analysis (CBA) compares net benefits expected in a scenario with the Project being implemented to a "without project" scenario. The flow of costs and benefits was estimated for the lifetime of the project investments, estimated at 25 years (including the years of project implementation). Costs and benefits were expressed in constant prices as of 2022. Financial costs were transformed into economic costs using conversion factors (SCF), which eliminate market distortions created by taxes, tariffs, and subsidies. The Project uses the Government of Bolivia's standard conversion factors[53]. As per World Bank guidelines a discount rate of 6 percent has been used to determine the project's viability[54].

6. The expected benefits of the Project will include (i) improvements in the supply of water and the impact on agricultural production, with the possibility to intensify production, diversify cropping patterns and reduce vulnerabilities, and (ii) environmental benefits through micro watershed management and soil conservation practices, while also reducing flood and mudslide risks. In the long term the project will improve food security, generate additional income through commercialization of surplus production, while reducing periodic labor migration and the increase in local employment. The Project will also reduce carbon emissions. Overall, the Project will increase the resilience to climate change of beneficiary households.

7. **Data Collection.** The Project consists of three types of interventions. Depending on data availability, the cost-benefit analysis used several methods to calculate the Project benefits of these different types of subprojects.

8. *Irrigation Subprojects*: Under the Project, the "with project" scenario is the scenario in which the farmer has access to irrigation water, and the benefits will come in the form of productivity and quality increases that will increase production volumes through additional land that can be brought into production, higher crop yields and/or crop diversification and improvements in the quality of crops. Irrigation water can also be used as a secure source for watering animals. The "without project" scenario considers that farmers depend on rainfall, as is currently the case. The net benefit is the difference between the incremental benefits and the incremental costs of the "with project" and "without project" scenarios. The "with project" costs will include investment costs and incremental operation and maintenance costs. Due to the large diversity of landscapes and microclimates in Bolivia across the areas where the project will be active, and the inability to capture all this diversity, six types of cropping models were defined. For the two major regions (*Altiplano* and *Valles*), three different types of irrigation investments were considered for the analysis: (i) "*atajados*" (ii) new micro irrigation systems at the household level ("*riego familiar*"); (iii) rehabilitation of minor irrigation systems. Data on production levels, yields, distribution of land under cultivation, prices, production costs and general characteristics of irrigation systems used in crop production were collected from similar projects in the country and supplemented with experts' opinions where data was insufficient.

9. *Basin Management Subprojects*. Under this set of subprojects, the "with project" scenario is the scenario in which measures are taken to reduce soil erosion and improve degraded lands. These measures may be structural or non-structural in nature. In the "without project" situation, soil erosion and land degradation will continue. As a result of the subproject intervention, soil erosion will reduce. The benefits of these subprojects will be manifold. The main benefits included in the cost-benefit analysis are (i) an increase in agricultural production, including animal husbandry, as the availability and/or quality of agricultural lands will improve under the "with project" situation; (ii) improvements in land use and land use management (including afforestation, reforestation, grassland management and fruit tree orchards) will not only help to improve soil management but also result in a reduction of GHG emissions in these

[53] The project uses a SCF of 1.24; the conversion factors for unskilled and skilled labor in rural areas are 0.47 and 1.0 respectively. The conversion factors of tradeable goods of domestic origin were estimated at 0.86 and for imported at 0.76.
[54] The Government of Bolivia is revisiting the level of discount rates to be used. It still uses a discount rate of 12.67 percent that was calculated several years ago.

localities. There are more benefits associated with these projects that may include employment generation (both short-term due to the subproject interventions, and in the longer-term), the use of timber and other forest products, and improvements in drought resilience. Finally, improvements in the management of watersheds are likely to benefit downstream populations. Yet, these additional benefits are harder to quantify and have not been included in the analysis. In the case of the basin management subprojects, a sample of 6 subprojects was taken. These subprojects represent the different departments in which the project will be operating, with a feasibility study being prepared. The sample of subprojects also includes in some cases additional measures (such as beekeeping and composting) to improve soil management. Data from the feasibility studies (if available) was triangulated with other data sources available in the country and supplemented with experts' opinions.

10. *Flood risk management subprojects*. During project preparation, the team also reviewed a small set of flood risk management projects. These subprojects which tend to much larger in size than the irrigation and watershed management subprojects will generate benefits in the form of avoided losses of floods and mudslides which pertain to people, crops, and infrastructure because of reduction in the risk of floods and/or mudslides. These subprojects will also help to stem soil erosion. Ultimately, the additional security that a reduction of these avoided losses bring will translate itself in an improvement of land prices in the areas.

Irrigation Subprojects

11. The cost-benefit analysis of the irrigation subprojects computes the benefits of small-scale interventions in the departments of Cochabamba, Chuquisaca, La Paz, Oruro, Potosi, and Santa Cruz. The current project portfolio was used. This portfolio includes 63 subprojects in six departments. We calculated the costs and benefits of the three different types of irrigation projects in two distinct areas: Altiplano and Valles – which have different cropping patterns, and productivity levels. For each type of irrigation system, a specific cropping pattern was identified for each of the two regions. The irrigation alternatives considered for the analysis were: (i) "*atajados*", (ii) new micro irrigation systems at the household level ("*riego familiar*"); (iii) rehabilitation of small irrigation systems. The "with project" scenario considers the proposed project and its associated targets.

Table A.4 Reference cropping patterns by geographical zones

Type of Irrigation Systems	Cropping patterns
Highlands (Altiplano)	
Atajado	Potato, tarwi, fava beans, and onion
New micro irrigation systems at the household level ("*riego familiar*");	Potato, carrot, onion, and strawberry
Rehabilitation of small irrigation systems.	Potato, carrot, fava bean, onion, garlic, quinoa, and alfa alfa
Valleys (Valles)	
Atajado	Potato, corn, beans and onion
New micro irrigation systems at the household level ("*riego familiar*");	Potato, sweet corn, fava beans and onion
Rehabilitation of small irrigation systems.	Potato, sweet corn, onion, tomato, apricot, grapes and apple

12. The irrigation subprojects' investments are focused on household farming systems where the farmer uses a a group of crops in each area. Irrigation alternatives implemented by the project improve crop yields and land use intensity. Irrigation investments with micro reservoirs will allow an increase of the number of crop seasons as the producer has access to a permanent irrigation system. Basic farm models were used to calculate the change in productivity and crop diversification[55] by different geographical zones as can be seen in **Table A.5.** It is assumed that irrigation systems will increase the irrigated area to respectively 0.08 ha for "*atajados*"[56] (referring to only one project in the current irrigation subproject portfolio prepared) and 0.60 ha for "riego familiar" and 0.44 ha for rehabilitated small irrigation systems. All data for the analysis used existing data sources updated to reflect current costs and prices, and verified by irrigation experts.

13. The irrigation subproject costs will include investment costs and incremental operation and maintenance costs. The investments costs will include the project's overall project management costs (estimated at 10 percent of total investment costs). The investment costs are the average investment costs found in the portfolio already prepared for the different types of irrigation systems. The operation and maintenance costs are estimated at 10 percent of the total investment costs.

Table A.5 Cost Benefit Analysis – Irrigation Subprojects

Type of irrigation system	NPV (Bs. mln)		Internal Rate of Return		Sensitivity Analysis		
	Financial	Economic	Financial	Economic	Decrease in benefits of 25%	Increase in costs of 25%	Decrease in benefits of 25% and Increase in Costs of 25%
Altiplano							
Atajado	-1.4	-0.8	negative	negative	Negative	Negative	negative

[55] We have assumed the same crops with and without irrigation systems but the shares of the different crops is different for the "without" and "with project" scenarios.

[56] In the revised portfolio, only one project using "*atajados*" is included. The costs and benefits of this one project may hence not be very representative of the costs and benefits of *"atajados"* in general.

New micro irrigation systems at the household level (“*riego familiar*”)	3.7	5.8	31%	49%	36%	39%	28%
Rehabilitation of small irrigation systems	2.7	5.0	18%	28%	20%	22%	15%
Valles							
Atajado	2.7	4.6	21%	34%	26%	27%	20%
New micro irrigation systems at the household level (“*riego familiar*”);	4.0	6.4	31%	49%	37%	40%	30%
Rehabilitation of small irrigation systems.	2.5	5.1	13%	21%	16%	17%	13%

14. **Table A.5** shows that the cost-benefit analysis for the different types of subprojects analyzed revealed that they generated healthy rates of returns in the base case scenario except for the *“atajados”* subprojects in the Altiplano region. The latter is the result of a lack of *“atajados”* subprojects included in the current irrigation subproject portfolio. It is hence important that a proper screening of *“atajados”* projects will take place before they enter the investment portfolio – according to Government regulation –. Assuming an ex-ante distribution of irrigation systems similar to the initial portfolio of 63 irrigation subprojects, would result in a weighted financial return of 23 percent and a weighted economic rate of return just over 38 percent.

15. The financial rates of return in five of the six irrigation models are positive, suggesting that operation and maintenance of the projects can be covered by the beneficiaries. In general, the operation and maintenance costs are only a small share of the total additional income that is generated because of the construction (or rehabilitation) of the irrigation systems. Yet, as mentioned earlier extensive TA is crucial for the successful introduction of agricultural production with irrigation enabling farmers to generate all the potential benefits with the new technologies and allowing farmers where possible to shift from primarily subsistence agriculture towards market-oriented production.

16. The results obtained so far assume that the values of all variables are certain. The sensitivity analyses measure the impact on the results when some of the assumed values for critical variables change. Yet, even under scenarios of increases in costs and/or decreases in benefits by respectively 25 percent and a scenario where both costs will increase by 25 percent and benefits will decrease by a similar percentage, the viability of the irrigation subprojects will not be impacted in such a way as to render these subprojects non-viable except for *“atajados”* subprojects in the Altiplano.

Basin Management Subprojects

17. The cost-benefit analyses of the basin management compute the benefits of small-scale interventions in micro watersheds in the departments of Cochabamba, Chuquisaca, La Paz, Oruro, Potosi, and Santa Cruz. The current portfolio of prepared subprojects was used to determine the costs and benefits of the basin management projects during project preparation. This portfolio consists of 61 subprojects located in six departments. These subprojects had a total investment value of about BOB 322 million. The average size of these subprojects is small and varies from BOB 1.9 to 8.6 million with an average size of BOB 5.2 million (about USD758,572 equivalent).

18. The small-scale interventions to be funded under this subcomponent are a combination of structural and non-structural measures. These investments will include activities to protect water sources, water harvesting, soil improvement, protection of water recharge areas and the recovery of forest areas and grasslands. The proposed investments aim to reduce the vulnerability of watersheds facing degradation and desertification, and to increase water availability and local storage capacity. The investments will enhance soil and crop carbon stock.

19. We examined six of these subprojects – we selected one in each of the departments to allow for ecological variation of the different watersheds. These six subprojects will directly benefit 1,698 households located in 54 communities. The six subprojects cover 660 km^2 of basins that are directly impacted, while the total area affected by the measures is more than 3,700 $km^{2.}$ The six projects will amongst others provide 627 ha of improved forest and grassland management, 104 ha of new orchards, soil management measures (including terracing and riverbank protection) and water management measures (including micro irrigation, water harvesting, and water storage).

20. *Benefits*. The economic benefits are measured in terms of increases in agricultural production and animal husbandry, the plantation of fruit trees, and a reduction in GHG emissions (because of improved land use management through afforestation, reforestation, and grassland management). The benefits of crop production are related to an increase in production because of improvements in land use management. In certain areas, the subproject interventions will increase the area that can be used for agricultural production. The analysis does not assume an increase in agricultural prices linked to improvements in the quality of the crops. The analysis also includes a reduction in drought risks. The financial benefits of the subprojects are limited to increases in agricultural production, animal husbandry and fruit production that can be sold in the market. The economic benefits of the project also include changes in carbon emissions following World Bank guidelines.

21. *Costs*. The costs of the subprojects include the investment costs, and the overall project management costs. We have included the operation and management costs of these subprojects that are estimated to make up 10 percent of investment costs.

22. *Results.* **Table A.6** shows that the cost-benefit analysis for all subprojects analyzed revealed that they generated healthy economic internal rates of returns. It is estimated that the population weighted economic IRR of these 6 subprojects would be 27 percent. The sample shows that there is a large variation in economic outcomes between locations.

Table A.6 Cost Benefit Analysis – Basin Management Subprojects

Departmento	Municipality	Watershed	Economic NPV (Bs. Mln)	Economic IRR (%)	Population directly benefiting	Financial cost per household directly benefiting (Bs)
Chuquisaca	Villa Vaca Guzman	Cuenca del Rio Tapera	42.9	43%	990	18,336
Cochabamba	Alalay	Cuenca Kuturi	3.6	13%	389	26,480
La Paz	Pucarani	Microcuenca del Rio Sehuenca	10.8	23%	1,985	16,025
Oruro	Poo po	Microcuenca del Rio Challviri	0.4	7%	461	19,607
Potosi	Arampapa	Microcuenca del Kicha Kicha Caine	10.2	21%	1,977	10,778
Santa Cruz	Moro Moro	Micrcuenca La Tranca Chinco Blanco	49.3	47%	1,141	16,156
Total of 6 subprojects			**117.2**	**28%**	**6,943**	**16,028**

Note: the financial and economic IRR are weighted with investment costs.

23. *Sensitivity Analysis.* The IRRs are sensitive to changes in benefits (crop prices and crop productivity), costs and the impact of GHG emissions. A scenario in which costs increase by 25 percent while at the same time benefits drop by 25 percent would result in an economic rate of return of 17 percent. Yet, the watershed managements are in general rather robust.

24. It should be noted that some of the subprojects carry some risks that were more difficult to model. Improvements in grasslands will reduce the impact that overgrazing has had in many of these areas. Yet, improvements in grasslands will provide farmers with an incentive to increase animal herds. Yet, an increase in animal herds will negatively impact the reduction in GHG emissions and the overall result could be a subproject that can become non-viable under such conditions. Technical assistance provided to the beneficiaries of watershed management interventions is a key factor for compliance with the assumptions considered in the analysis. At the same time, one major benefit of the project is the possible reduction in migration. Assuming the opportunity cost of migration is like that of involuntary settlement, the cost savings could be significant. In 4 of the 6 subprojects, population growth is negative these days. If these benefits were included, the economic rate of return can increase to more than 35 percent.

Flood Risk Management Subprojects

25. The cost-benefit analyses of the flood risk management subprojects quantify the benefits of controlling the risks of floods and mudslides. The current portfolio counts with 8 subprojects, that unlike the other types of subprojects are relatively large compared to the earlier discussed irrigation and watershed management subprojects.

26. *Benefits*. The economic benefits are measured in terms of avoided losses from floods and/or mudslides. These benefits include both direct and indirect losses on people, infrastructure, and crops. In addition, the subprojects will also reduce the loss of land due to erosion. These benefits will over time increase the value of the land. The data provided uses land prices that amount to BOB 4.5 million (equivalent to USD 646,550) per hectare. This may be a rather optimistic estimate when rural land is concerned.

27. *Costs*. The costs of the subprojects include the investment costs (including its share of the project management costs of 10 percent). The calculations also include the operation and management costs of these subprojects that are estimated to make up 1 percent of investment costs.

28. *Results.* The cost-benefit analysis for all subprojects analyzed revealed that only two subprojects generate positive net present values and economic rates of returns above 6 percent. Most subprojects generate rates of returns below the discount rate of 6 percent. The only two subprojects with positive net present value are those of El Torno and Taquiña. The other subprojects generate too few benefits to be considered for implementation.

29. *Sensitivity Analysis.* The IRRs are sensitive to changes in investment costs. For instance, an increase of 25 percent in the investment costs would result in a decrease in the economic rate of return of about 3 percent points for each viable subproject but would still render them viable. A benefit reduction of 25 percent will result in a lower economic rate of return but both subprojects would remain viable. The IRRs are sensitive to changes in benefits and costs. A scenario in which costs increase by 25 percent while at the same time benefits drop by 25 percent would turn the subproject in El Torno unviable, while the subproject in Taquiña remains viable.

Table A.7 Cost Benefit Analysis – Flood Risk Management Subprojects

Department	Municipality	NPV (million BOB)	IRR	Area of Intervention (hectare)	Financial Cost per hectare (BOB)
Chuquisaca	Monteguda	-4.4	1.%	15.4	832,244
Chuquisaca	Zudanez	-81.2	0%	157.5	1,151,307
Cochabamba	Arque	-0.03	6%	95.0	377,895
Cochabamba	Taquiña	29.4	18%	36.0	726,664
Cochabamba	Villa Tunari	-5.6	1%	10.5	1,430,032
La Paz	Mecapaca	-6.0	4%	15.1	2,292,106
La Paz	Palca	-16.0	-15%	4.4	3,195,170
Santa Cruz	El Torno	2.9	14%	1.7	2,424,387

ANNEX 3: Maps and PIUs Organigram

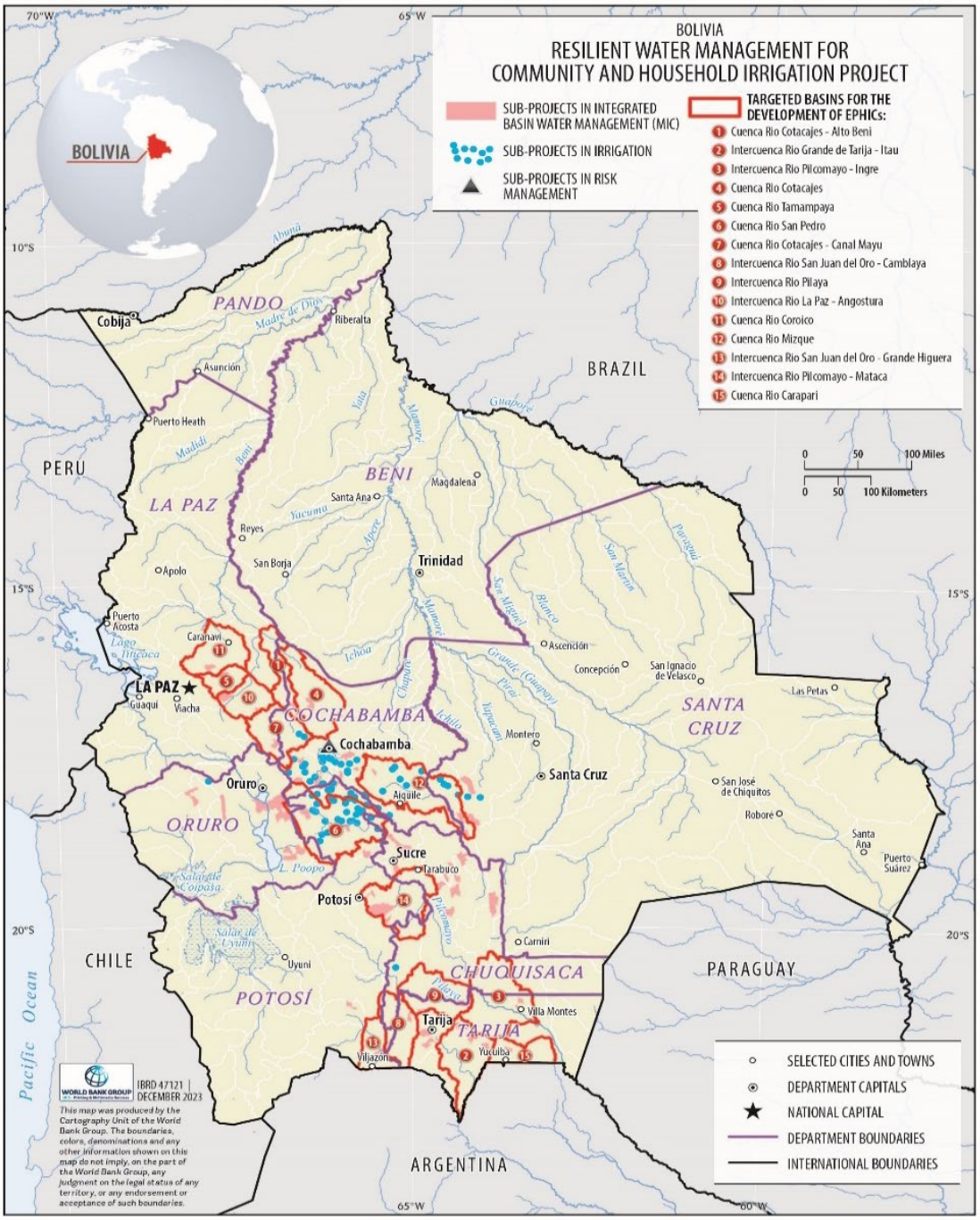
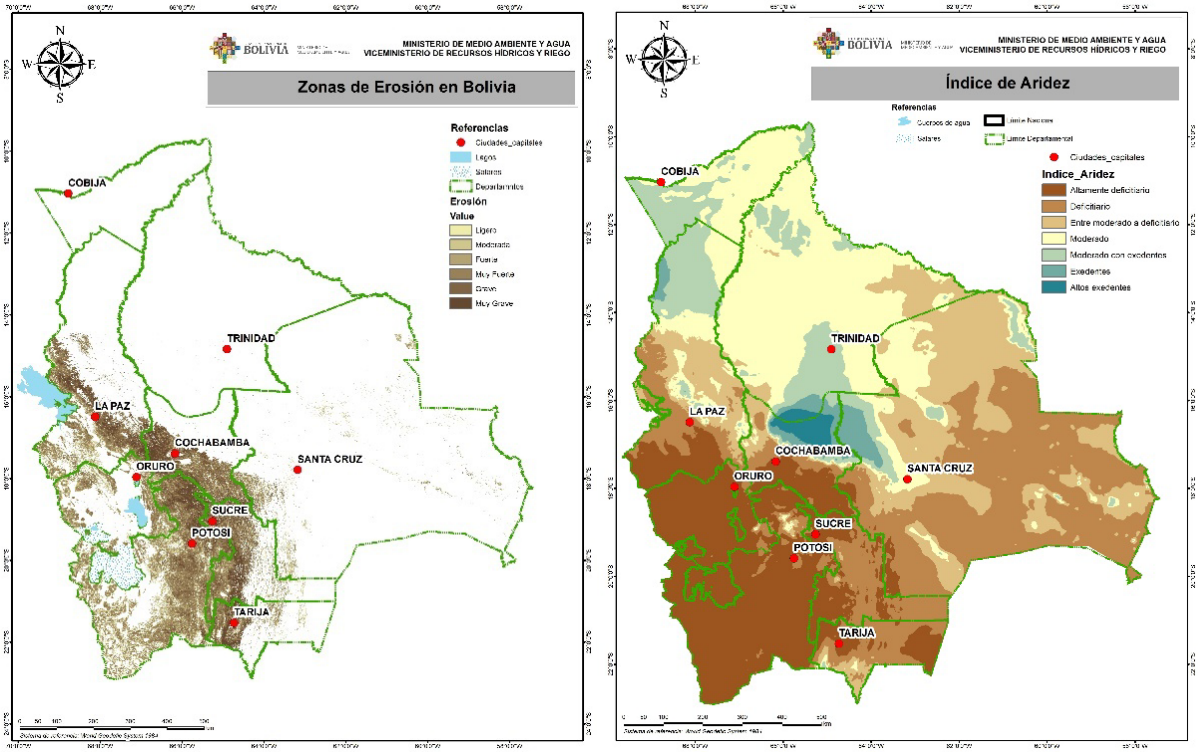


Figure A.1: Project Map



Figures A.2 and A.3: Maps of Erosion and Aridity Index in Bolivia

Sub component	Proposed activities
Subcomponent 2.1. Investments in integrated basin management (MHIC)	– Forestation – Water seeding – Terraces – Infiltration and crowning ditches – Educational watershed projects – Protection of water recharge areas – Grazing control – Construction of small water reservoirs (*atajados*)
Subcomponent 2.2. Community and household irrigation systems	– Household irrigation – Community irrigation systems – Rehabilitation of irrigation systems (less than 60 Has.)
Subcomponent 2.3. Risk management infrastructure	– River defenses and deflectors – Water erosion control – Gully and flood control

Figure A.4 Component 2: Typology of Works per Subcomponent (MMAyA, 2022)

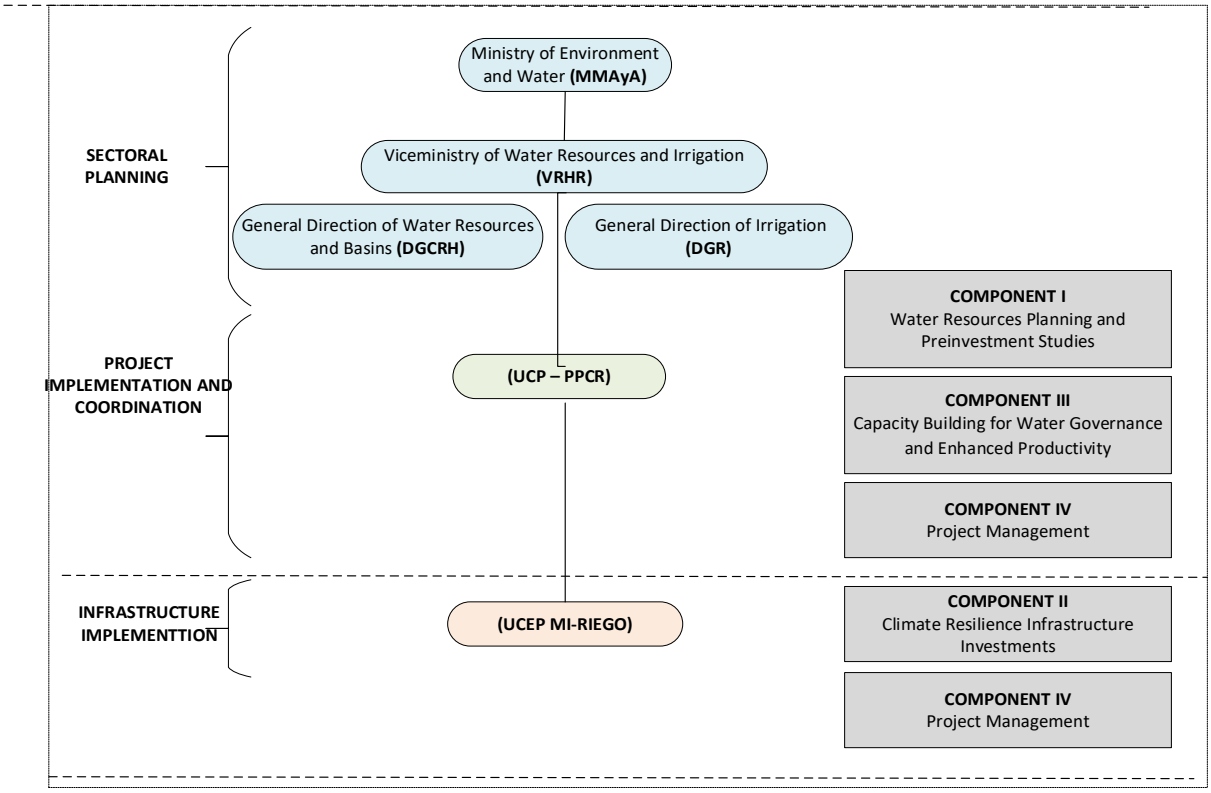


Figure A.5 Project Organization Chart

ANNEX 4: Technical Analysis on Irrigation Subprojects

1. This annex presents: (i) an analysis of the hydrological implications of the proposed irrigation investments in the Project and, (ii) actions identified to avoid possible negative impacts on other uses.

2. **The Law of the Decade of Irrigation 2015 - 2025** (Law N° 745 - 2015), approved by the Plurinational Legislative Assembly on October 5, 2015, declares the period 2015 to 2025 as the Decade of Irrigation "Towards the Million Hectares", and promotes agricultural production through investments from the national government and the autonomous territorial entities, oriented towards the development of irrigation in the country.

3. The Law identifies the following lines of action to promote inter-sectorial, inter-governmental, and inter-institutional agreements and/or covenants, implementation mechanisms, and access to investment programs and projects:

   i. Expansion of irrigated land, with the following strategic lines:
      - *Improvements in irrigation systems*
      - *Implementation of water storage systems with small dams*
      - *Implementation of family systems for multiple use and water harvesting*
      - *Promotion of technified irrigation*
      - *Implementation of the Flood Irrigated Rice Program*
      - *Implementation of strategic multi-purpose projects*

   ii. Organizational and institutional strengthening, with the following strategic lines of action:
      - *Strengthening irrigation organizations and training in on-plot irrigation*
      - *Institutional strengthening of irrigation and information management*
      - *Training of irrigation specialists and research in irrigation*

   iii. Sustainable increase of agricultural productivity under irrigation through the following strategic line:
      - *Increase agricultural productivity in new and existing irrigation systems.*

4. **Infrastructure and hydrological characteristics of household and minor irrigation systems***.* Investments in household and community irrigation systems, classified as minor irrigation systems by the VRHR, include infrastructure for water capture: harvesting of surface runoff, groundwater extraction, use of spring water and other alternative water sources, the installation of water storage solutions, the conveyance of water to the field, and the equipment necessary for water distribution on the plots. The main characteristics of each proposed typology are described below:

4.1 **Household systems with existing small water sources.** Experiences in the implementation of household systems show that these investments contribute to sustainable water management, the adaptation of agricultural production to climate change, and improved food security. Small springs or springs with perennial discharge below 3 liters per second (l/s) are common in mountainous areas. However, these water sources are used inefficiently due to the lack of irrigation equipment, high slopes that make it difficult to develop the plots, and the lack of knowledge of producers on irrigation management and productive aspects. A household irrigation system takes advantage of a small permanent surface water source, with a primary flow rate of less than 3 l/s. Generally, it has a simple intake work, conduction pipes, a small reservoir (with a capacity between 10 and 120 m3), and a distribution network with piping, tap chambers, pressure break chambers, and aqueduct bridges. The infrastructure components of a family irrigation system vary from larger systems only in size.

Table A.8 Main features of a household irrigation system

Users	1 – 3 families
Flows	0.03 – 3.0 l/s
Irrigated área	0.25 – 2 ha/family

Figure A.6 Household systems with existing small water sources (*microriego familiar*)

Investments in households with existing small water sources aim to improve the water use efficiency of the cultivated area and ensure drinking water for livestock and domestic use. Therefore, the investments will seek to reduce the water abstraction from the existing water sources.

4.2 **Household-water harvesting solutions (atajados).** Among the different climate-smart agriculture (CSA) approaches, rainwater harvesting can ensure water resources in regions with irregular or increasingly varied rainfall due to climate change. Farmers who practice rainwater harvesting can store rainwater in reservoirs or tanks during the rainy season for use as complement to ensure productivity and even use the remaining, if any, in the dry season. These practices allow farmers to meet their crops' water needs and avoid significant losses in production. In Bolivia, factors such as mountainous landscapes, small-scale farming, weather conditions such as limited rainfall during prolonged dry seasons or concentrated rains in short seasons, and the vulnerability of producers to the effects of climate change all underscore the potential of rainwater harvesting and water intake from rivers. These CSA practices can provide the necessary water resources for small-scale irrigation systems and help achieve sustainable agricultural production. For households without access to a permanent water source, harvesting surface runoff from rainfall events may the only viable alternative to improve access to irrigation water. Due to steep slopes and poor soils with low infiltration capacity, regular high-intensity rainfall events generate significant surface runoff. The so-called *atajados* collect surface runoff through simple earthen channels in areas with moderate slopes. The water passes through a sedimentation unit before entering the reservoir to minimize

sediment inflow. These are small water harvesting systems for irrigation, livestock watering, and in some cases, domestic use. These systems benefit one family or a small group of families with small, irrigated areas (up to 2 ha/family) whose management does not depend on collective decisions (community or an irrigation organization). Small, fenced reservoirs of 1,200 to 5,000 m3 are generally built with local material, such as clay, with irrigation equipment (sprinkler and drip irrigation). The stored water is mainly used for supplementary irrigation of rainfed crops and water for animals.

Figure A.7 Micro irrigation system with rainwater harvesting (*atajados*)

5. A good example of this approach is found in the municipality of Anzaldo, located in the Department of Cochabamba, which has a significant number of *atajados*[57], see **Table A.9**.

Table A.9 *Atajados* built in the municipality of Anzaldo

Volume (in m3)	No. of atajados
800	13
1000	125
1500	38
2000	87
2500 – 3000	109
Total	372

6. A detailed assessment on the operational conditions of *atajados* in Anzaldo was carried out by the Strategic Research Program in Bolivia (PIEB) in 2012. A significant number of *atajados* were not operational, 234 units (63%), while 138 units (37%) were performing adequately. The following factors were identified for their lack of sustainability:

[57] 'Aportes y Dificultades en la utilización de atajados frente al cambio climático en el municipio de Anzaldo'. Programa de Investigación Estratégica en Bolivia (PIEB), 2012

- inadequate design, location, and construction
- investments focused on building the infrastructure, water conveyance from the catchment and storage, without addressing socio-economic, environmental, and governance aspects
- family migration; and
- insufficient TA to farmers with no prior experience with irrigation

7. However, despite these risks and the relatively high costs, *atajados* may still be a reliable source of irrigation water in semi-arid regions with irregular or increasingly varied rainfall. In Bolivia, factors such as mountainous landscapes, small-scale farming, weather conditions such as limited rainfall during prolonged dry seasons or concentrated rains in short seasons, and the vulnerability of producers to the effects of climate change accentuate the potential of rainwater harvesting and water intake from intermittent surface water sources. Some of the most relevant challenges for implementing successful water harvesting subprojects are:

- the cost-effective identification of investment proposals (location of the reservoir/water catchment, size/volume of the water catchment)
- an adequate identification of water sources, the ideal sites to establish the water catchment, and the characteristics of the micro-basin
- lack of information for the designs (water intake, conduction lines (open canals/pipes), control elements, sand trap, sedimentation tank, spillway)
- technical capacity of engineers
- lack of knowledge of producers for the efficient and productive use of water
- inadequate or weak management of the water catchment area.

8. **Assessment of hydrological features of *atajados.*** The Project team undertook a rapid assessment on the hydrological features needed for a well-functioning *atajado* in the municipality of Anzaldo. To this purpose, the following geomorphological and climatic conditions of Anzaldo were considered:

- Precipitation series: CHIRPS, monthly database from 1981 to 2022;
- Potential evapotranspiration: Monthly database from 2001-2022

Total Area	1.00 ha

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Evapotranspiración Potencial (mm/d) ET0	4.4	4.5	4.6	3.9	4.3	4.4	4.5	5.1	5.9	4.7	5.6	4.4	
Potential Evapotranspiration mm/month (2001-2020)	136.0	125.1	143.4	118.1	132.8	131.2	140.9	158.8	176.6	145.4	167.7	137.0	**1713**
AverPrecipi (2001-2020) (mm/month)	188.3	180.3	102.8	45.2	20.1	14.0	11.7	15.7	28.0	75.1	99.2	141.5	**922**
Effective Precip. (mm/month)	131.6	128.3	85.9	41.9	19.4	13.7	11.5	15.3	26.7	66.1	83.5	109.5	**733**
Efficiency	**0.80**												

- Digital Elevation Model (SRTM)

- Land Use, Global Cover 2009 and CCI
- Hydrologic Soil Group (Hydrologic Soul Group derived from ISRIC SoilGrids)

Slopes Class group	%
Little or no slope: 0 - 3 % gradient	0.01
Gentle slopes: 3 - 9 % gradient	0.09
Moderate slopes: 9 - 15 % gradient	0.11
Steep slopes: 15 - 30 % gradient	0.30
Extremely steep slopes: > 30% gradient	0.49
	%
No vegetation / Urban Areas	0.1%
Croplands	7.3%
Herbaceous cover / Grassland	67.4%
Shrubland	21.3%
Tree Cover	3.9%

9. Based on calculations using these data, the Project team calculated the following:

- Curve Number, GCN250 Average, Dry and Wet antecedent):

Antecedent conditions	CN
Average	81.54
Dry	65.29
Wet	91.93

10. Estimated run-off under different probabilistic scenarios/hectare. Considering Wet: 20% Probability of occurrence (PoO), average year: 50% PoO, and dry year: 80% PoO:

Probability	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (mm)
20% - Humid	101.8	110.5	90.5	55.6	0.0	0.0	0.0	0.0	0.6	17.6	31.0	58.7	**466**
50% - Mean	66.4	58.9	40.4	10.8	1.3	0.3	1.1	2.6	2.2	8.0	14.4	38.3	**245**
80% - Dry	42.7	39.7	13.5	0.0	0.0	0.0	0.0	0.0	0.0	1.8	3.4	11.7	**113**

11. Agriculture water demand per hectare. Considering a permanent fixed KC = 0.7, simulating permanent horticulture rotation:

12. The required size of the runoff catchment area to satisfy the water requirement of 1 ha. under different scenarios (wet, average, and dry) is:

Table A.10 Required size of the runoff catchment to benefit 1 ha.

Probability	Total (mm)	Required Catchment Area (ha)
20% - Humid	466	1.49
50% - Average	245	2.84
80% - Dry	113	6.16

13. The storage volume to meet the water requirement of different irrigated areas, considering the average precipitation in the catchment area of 2.9 ha. is summarized below:

Table A.11 Volume of *atajado* needed to benefit different irrigated areas

Irrigated area (ha)	Volume of *atajado* (m3)
1.0	6200
0.9	5500
0.8	5000
0.6	3600
0.5	3000
0.4	2400
0.3	1900

14. This data was compared with information shared by VRHR on 60 existent *atajados*, which have a total catchment/storage capacity of 110.600 m^3 and irrigates 31.05 hectares.

Table A.12 Information on 60 existent *atajados* (source : VRHR)

60 atajados' existing data			Average/atajado		
No.	Volume (m^3)	Irrigated area (Ha)	Volume/ha	Volume/atajado	Area (ha.)/atajado
60	110,606	31.05	3,562	1,843	0.52

15. The above results show that the average volume stored per hectare is lower than the estimated water requirements. This may be one of the causes of the significant failures of the constructed *atajados*; a detailed analysis of the complete system (runoff catchment area + reservoir) would be needed to ensure the sustainability of the agricultural system. Extrapolating these average figures to the total 372 *atajados* built in Anzaldo, the total potential water requirement for irrigation would be:

Table A.13 Potential water requirement for irrigation in Anzaldo

No	Irrigated Area (ha)	Water dem volume (m^3)
372	192.51	1,193,562

16. The relation between the potential water demand and the total estimated runoff under different scenarios would the following:

Table A.14 Potential water demand and the total estimated runoff in Anzaldo

Type year	PoO	Runoff (m^3/ha)	Total Anzaldo (m3)	Rel water stored/consumption / runoff
Wet	20%	4,988	242,181,839	0.49%
Average	50%	2,446	118,744,850	1.01%
Dry	80%	1,335	64,828,051	1.84%

The following conclusions from this rapid assessment for investments in household water harvesting solutions can be drawn:

The total consumptive agriculture water demand, compared to the total water produced during the rainy period, is negligible (even for small micro-basin areas).

Nonetheless, a detailed identification and an analysis of the hydrological behavior of the micro basin/runoff catchment area is needed to ensure the environmental/sustainability of the overall water harvesting system.

The size of the reservoirs/water catchments and the area that can be adequately irrigated should be carefully evaluated to ensure the sustainability of the plot/farm system without generating expectations with the farmers that will not be meet.

17. **Improvement of existing minor irrigation systems.** Minor irrigation systems are collective communal irrigation systems based on water sources (rivers, springs, streams, wells with photovoltaic pumping, etc.), with variable flow rates to irrigate a maximum of 60 ha. under irrigation per system. The production generated is enough for self-consumption, ensuring family and community food security, and selling the surplus for the market. Minor irrigation systems of less than 60 ha. can have different water sources, such as surface, subsurface, and groundwater. The proposed investments typically comprise a catchment, conduction, distribution lines, and on-farm irrigation systems.

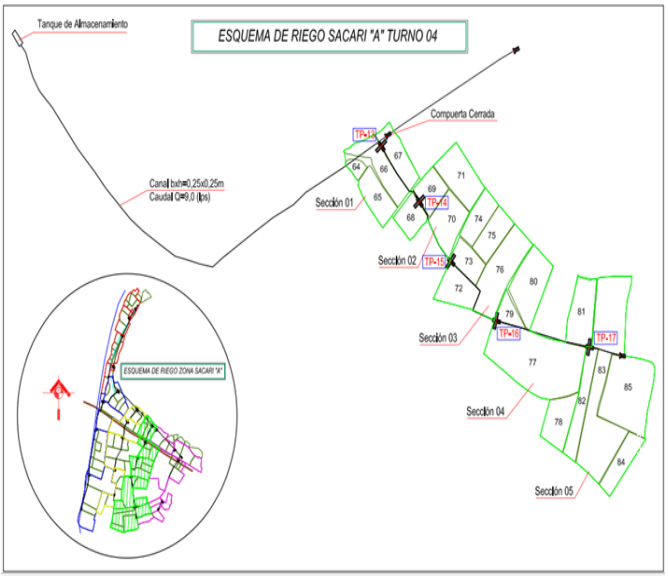


Figure A.8 A typical minor irrigation scheme

18. Existing system improvements consist of the rehabilitation, modernization, and reconditioning of minor irrigation systems to optimize the efficiency of the irrigation system to increase productivity and agricultural production. Existing minor irrigation systems present different deficiencies, either in their catchment, storage, conduction, distribution, etc. Low irrigation efficiencies, poor water use, and low productivity are among the primary causes for the migration of men, leaving behind women, children, and the elderly.

Elements to be considered from a hydrological point of view for improvements and rehabilitation of minor irrigation systems.

Adopting precision irrigation, as promoted by the Project, would boost the agricultural productivity of the subprojects. Still, there is a need to estimate how water uses efficiency measures will free up water for other uses without affecting return flow to the environment as recharge or drainage. To ensure environmental and social sustainability, the Project should identify and assess the potential risk of unintended negative consequences for downstream communities due to a net reduction in return flow caused by an increase in water use efficiency upstream.

The volume of water saved from efficiency measures at a local scale depends on the context and characteristics of each subproject. Increasing irrigation efficiency delivers the presumed expected benefits of increased water availability overall.

To properly account for the expected benefits from efficiency gains and to avoid negative downstream consequences by reduced minimal return flow, interventions aimed at increasing irrigation efficiency must be accompanied by effective monitoring and regulatory measures.

19. **Aspects that will be considered in the Project**

19.1 For household water harvesting solutions

- Due to the need for different and diverse measures, family irrigation projects must have a comprehensive approach; apart from implementing irrigation infrastructure, the proposals will consider measures for the conservation of water sources and catchment areas, protection of cultivation areas, irrigation technology, and technical assistance to users.
- The management of the catchment areas should aim at: (i) in the case of atajados, controlling runoff to reduce the dragging of sediments toward the reservoirs, (ii) in the case of family micro-irrigation, increasing water infiltration to the aquifer layers that feed the springs and streams, and (iii) for both cases, protecting the irrigation infrastructure.
- The catchments for atajados need a minimum size according to the area to be irrigated to ensure cost-effectiveness, project life cycle due to sedimentation, etc., particularly from a climate change perspective, increasing climate variability. While this could become a problem in some of the Project's arid or water-stressed target areas, initial hydrological assessments concluded that the total consumptive agriculture water, compared to the total water produced during the rainy period, is negligible (even for small micro-basin areas).
- The appropriate design of the minimum size of the reservoir is also crucial for ensuring cost-effectiveness, project life cycle due to sedimentation, etc.
- Considering earlier ex-post assessments, which concluded that a significant percentage of the existing atajados is not operational, the Project will carry out a comprehensive study that will include a review of the technical design, sedimentation assessment, and other issues related to its sustainability.

19.2 For Improvements of existing minor irrigation systems

- In the case of rehabilitation of existing schemes classified as minor irrigation systems, there is a need to estimate how water use efficiency measures will free up water for other uses without affecting return flow to the environment as recharge or drainage. The volume of water saved from efficiency measures at a local scale depends on the context and characteristics of each subproject.

- To properly account for the expected benefits from efficiency gains and to avoid negative downstream consequences by reduced minimal return flow, interventions aimed at increasing irrigation efficiency will be accompanied by raising awareness and effective monitoring and regulatory instruments.
- The Project will promote actions to improve integrated water management at different basin levels by articulating the complementary irrigation investments with the preparation of MHICs, technical assistance to strengthen the capacity (OGCs, Water User Organizations, and/or producer organizations) to monitor related system parameters, and the enforcement of regulations to assure sustainably manage water use.

ANNEX 5: Municipalities that may participate in the Project

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
1	Beni	Mamoré	San Ramón	Risks
2	Beni	Mamoré	San Joaquín	Risks
3	Beni	Cercado	San Javier	Risks
4	Beni	Marbán	Loreto	Risks
5	Beni	Marbán	San Andrés	Risks
6	Beni	Iténez	Baures	Risks
7	Beni	Iténez	Magdalena	Risks
8	Beni	Iténez	Huacaraje	Risks
9	Beni	General José Ballivián	Reyes	Risks
10	Beni	General José Ballivián	Santa Rosa	Risks
11	Beni	Mamoré	Puerto Siles	Risks
12	Beni	Yacuma	Exaltación	Risks
13	Chuquisaca	Nor Cinti	Incahuasi	MIC
14	Chuquisaca	Belisario Boeto	Villa Serrano	MIC
15	Chuquisaca	Tomina	Padilla	MIC
16	Chuquisaca	Zudáñez	Zudañez	MIC
17	Chuquisaca	Sur Cinti	Villa Abecia	MIC
18	Chuquisaca	Sur Cinti	Las Carreras	MIC
19	Chuquisaca	Sur Cinti	Culpina	MIC
20	Chuquisaca	Hernando Siles	Monteagudo	MIC
21	Chuquisaca	Tomina	Tomina	MIC
22	Chuquisaca	Tomina	Sopachuy	MIC
23	Chuquisaca	Tomina	Alcalá	MIC
24	Chuquisaca	Azurduy	Tarvita	MIC
25	Chuquisaca	Azurduy	Azurduy	MIC
26	Chuquisaca	Tomina	El Villar	MIC
27	Chuquisaca	Nor Cinti	Villa Charcas	Irrigation
28	Chuquisaca	Zudáñez	Presto	Irrigation
29	Chuquisaca	Zudáñez	Mojocoya	Irrigation
30	Chuquisaca	Yamparáez	Yamparáez	Irrigation
31	Chuquisaca	Zudáñez	Villa Ricardo Mugia - Icla	Irrigation
32	Chuquisaca	Luis Calvo	Huacaya	Irrigation
33	Chuquisaca	Hernando Siles	Huacareta	Irrigation

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
34	Chuquisaca	Luis Calvo	Villa Vaca Guzmán	Irrigation
35	Chuquisaca	Nor Cinti	Camargo	Irrigation
36	Chuquisaca	Nor Cinti	San Lucas	Irrigation
37	Chuquisaca	Yamparáez	Tarabuco	Irrigation
38	Chuquisaca	Oropeza	Poroma	Irrigation
39	Chuquisaca	Oropeza	Yotala	Irrigation
40	Chuquisaca	Oropeza	Sucre	Irrigation
41	Chuquisaca	Luis Calvo	Macharetí	Irrigation
42	Cochabamba	Mizque	Vila Vila	MIC
43	Cochabamba	Mizque	Alalay	MIC
44	Cochabamba	Carrasco	Pojo	MIC
45	Cochabamba	Carrasco	Pocona	MIC
46	Cochabamba	Arani	Vacas	MIC
47	Cochabamba	Quillacollo	Tiquipaya	MIC
48	Cochabamba	Quillacollo	Colcapirhua	MIC
49	Cochabamba	Quillacollo	Vinto	MIC
50	Cochabamba	Chapare	Villa Tunari	MIC
51	Cochabamba	Chapare	Colomi	MIC
52	Cochabamba	Ayopaya	Ayopaya	MIC
53	Cochabamba	Tiraque	Tiraque	MIC
54	Cochabamba	Ayopaya	Cocapata	MIC
55	Cochabamba	Punata	Punata	MIC
56	Cochabamba	Esteban Arze	Arbieto	MIC
57	Cochabamba	Capinota	Capinota	MIC
58	Cochabamba	Germán Jordán	Cliza	MIC
59	Cochabamba	Esteban Arze	Tarata	MIC
60	Cochabamba	Ayopaya	Morochata	MIC
61	Cochabamba	Esteban Arze	Sacabamba	MIC
62	Cochabamba	Esteban Arze	Anzaldo	MIC
63	Cochabamba	Punata	Villa Gualberto Villarroel	MIC
64	Cochabamba	Capinota	Santivañez	MIC
65	Cochabamba	Germán Jordán	Tolata	MIC
66	Cochabamba	Arani	Arani	MIC
67	Cochabamba	Punata	San Benito	MIC

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
68	Cochabamba	Quillacollo	Quillacollo	MIC
69	Cochabamba	Chapare	Sacaba	MIC
70	Cochabamba	Cercado	Cochabamba	MIC
71	Cochabamba	Campero	Pasorapa	Irrigation
72	Cochabamba	Campero	Omereque	Irrigation
73	Cochabamba	Carrasco	Totora	Irrigation
74	Cochabamba	Bolivar	Bolivar	Irrigation
75	Cochabamba	Mizque	Mizque	Irrigation
76	Cochabamba	Tapacarí	Tapacarí	Irrigation
77	Cochabamba	Campero	Aiquile	Irrigation
78	Cochabamba	Quillacollo	Sipe Sipe	Irrigation
79	Cochabamba	Arque	Tacopaya	Irrigation
80	Cochabamba	Capinota	Sicaya	Irrigation
81	Cochabamba	Arque	Arque	Irrigation
82	La Paz	Ingavi	La (Marka) San Andrés de Machaca	Risks
83	La Paz	Muñecas	Ayata	Risks
84	La Paz	Abel Iturralde	Ixiamas	Risks
85	La Paz	Pacajes	Santiago de Callapa	Risks
86	La Paz	General José Manuel Pand	Catacora	Risks
87	La Paz	Pacajes	Calacoto	Risks
88	La Paz	Pacajes	Corocoro	Risks
89	La Paz	General José Manuel Pand	Santiago de Machaca	Risks
90	La Paz	Pacajes	Caquiaviri	Risks
91	La Paz	Pacajes	Comanche	Risks
92	La Paz	Aroma	Umala	Risks
93	La Paz	Muñecas	Aucapata	Risks
94	La Paz	Larecaja	Tipuani	Risks
95	La Paz	Larecaja	Teoponte	Risks
96	La Paz	Larecaja	Mapiri	Risks
97	La Paz	Abel Iturralde	San Buenaventura	Risks
98	La Paz	Caranavi	Alto Beni	Risks
99	La Paz	Larecaja	Tacacoma	Risks
100	La Paz	Bautista Saavedra	Charazani	MIC
101	La Paz	Loayza	Malla	MIC

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
102	La Paz	Loayza	Sapahaqui	MIC
103	La Paz	Loayza	Cairoma	MIC
104	La Paz	Inquisivi	Quime	MIC
105	La Paz	Bautista Saavedra	Curva	MIC
106	La Paz	Franz Tamayo	Pelechuco	MIC
107	La Paz	Omasuyos	Villa Ancoraimes	MIC
108	La Paz	Murillo	Mecapaca	MIC
109	La Paz	Sud Yungas	Chulumani	MIC
110	La Paz	Sud Yungas	Irupana	MIC
111	La Paz	Nor Yungas	Coripata	MIC
112	La Paz	Nor Yungas	Coroico	MIC
113	La Paz	Los Andes	Pucarani	MIC
114	La Paz	Murillo	Achocalla	MIC
115	La Paz	Murillo	Palca	MIC
116	La Paz	Manco Kapac	San Pedro de Tiquina	MIC
117	La Paz	Sud Yungas	Yanacachi	MIC
118	La Paz	Murillo	El Alto	MIC
119	La Paz	Murillo	Nuestra Señora de La Paz	MIC
120	La Paz	Inquisivi	Inquisivi	Irrigation
121	La Paz	Loayza	Yaco	Irrigation
122	La Paz	Aroma	Calamarca	Irrigation
123	La Paz	Inquisivi	Ichoca	Irrigation
124	La Paz	Inquisivi	Villa Libertad Licoma	Irrigation
125	La Paz	Muñecas	Chuma	Irrigation
126	La Paz	Camacho	Mocomoco	Irrigation
127	La Paz	Gualberto Villarroel	Chacarilla	Irrigation
128	La Paz	Gualberto Villarroel	Papel Pampa	Irrigation
129	La Paz	Aroma	Collana	Irrigation
130	La Paz	Aroma	Colquencha	Irrigation
131	La Paz	Pacajes	Nazacara de Pacajes	Irrigation
132	La Paz	Loayza	Luribay	Irrigation
133	La Paz	Aroma	Ayo Ayo	Irrigation
134	La Paz	Ingavi	Jesús de Machaca	Irrigation
135	La Paz	Larecaja	Combaya	Irrigation

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
136	La Paz	Larecaja	Quiabaya	Irrigation
137	La Paz	Larecaja	Guanay	Irrigation
138	La Paz	Omasuyos	Achacachi	Irrigation
139	La Paz	Los Andes	Batallas	Irrigation
140	La Paz	Camacho	Escoma	Irrigation
141	La Paz	Camacho	Puerto Acosta	Irrigation
142	La Paz	Inquisivi	Cajuata	Irrigation
143	La Paz	Camacho	Humanata	Irrigation
144	La Paz	Omasuyos	Santiago de Huata	Irrigation
145	La Paz	Los Andes	Puerto Pérez	Irrigation
146	La Paz	Omasuyos	Huarina	Irrigation
147	La Paz	Omasuyos	Huatajata	Irrigation
148	La Paz	Omasuyos	Chua Cocani	Irrigation
149	La Paz	Camacho	Puerto Mayor de Carabuco	Irrigation
150	La Paz	Aroma	Sica Sica	Irrigation
151	La Paz	Aroma	Patacamaya	Irrigation
152	La Paz	Inquisivi	Colquiri	Irrigation
153	La Paz	Pacajes	Waldo Ballivian	Irrigation
154	La Paz	Gualberto Villarroel	San Pedro de Curahuara	Irrigation
155	La Paz	Ingavi	Desaguadero	Irrigation
156	La Paz	Ingavi	Puerto Mayor de Guaqui	Irrigation
157	La Paz	Ingavi	Viacha	Irrigation
158	Oruro	Poopó	Poopó	Risks
159	Oruro	Poopó	Antequera	Risks
160	Oruro	Pantaleón Dalence	Machacamarca	Risks
161	Oruro	Cercado	Paria	MIC
162	Oruro	Sebastián Pagador	Santiago de Huari	Irrigation
163	Oruro	Cercado	El Choro	Irrigation
164	Oruro	Tomás Barrón	Eucaliptus	Irrigation
165	Oruro	Abaroa	Challapata	Irrigation
166	Oruro	Cercado	Caracollo	Irrigation
167	Oruro	Ladislao Cabrera	Salinas de Garcí Mendoza	Irrigation
168	Oruro	Sajama	Turco	Irrigation
169	Oruro	Carangas	Choquecota	Irrigation

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
170	Oruro	Sajama	Curahuara de Carangas	Irrigation
171	Oruro	Mejillones	La Rivera	Irrigation
172	Oruro	Mejillones	Carangas	Irrigation
173	Oruro	Abaroa	Santuario de Quillacas	Irrigation
174	Oruro	Sur Carangas	Santiago de Andamarca	Irrigation
175	Oruro	Sur Carangas	Belen de Andamarca	Irrigation
176	Oruro	Carangas	Corque	Irrigation
177	Oruro	Nor Carangas	Huayllamarca	Irrigation
178	Oruro	Sabaya	Sabaya	Irrigation
179	Pando	Nicolás Suárez	Bolpebra	Risks
180	Pando	Manuripi	Filadelfia	Risks
181	Pando	Nicolás Suárez	Porvenir	Risks
182	Pando	Madre de Dios	Sena	Risks
183	Pando	Madre de Dios	San Lorenzo	Risks
184	Pando	Madre de Dios	Puerto Gonzalo Moreno	Risks
185	Pando	Nicolás Suárez	Bella Flor	Risks
186	Pando	Manuripi	San Pedro	Risks
187	Pando	Federico Román	Villa Nueva	Risks
188	Potosí	Alonso de Ibáñez	Caripuyo	Risks
189	Potosí	Daniel Campos	Llica	Risks
190	Potosí	Sur Lipez	Mojinete	Risks
191	Potosí	Antonio Quijarro	Tomave	Risks
192	Potosí	Nor Chichas	Vitichi	MIC
193	Potosí	Modesto Omiste	Villazón	MIC
194	Potosí	Tomás Frías	Tinguipaya	MIC
195	Potosí	Sur Chichas	Tupiza	MIC
196	Potosí	Nor Chichas	Cotagaita	MIC
197	Potosí	Chayanta	Ocurí	MIC
198	Potosí	Sur Lipez	San Antonio de Esmoruco	MIC
199	Potosí	Chárcas	Toro Toro	MIC
200	Potosí	Antonio Quijarro	Porco	MIC
201	Potosí	Tomás Frías	Yocalla	MIC
202	Potosí	Cornelio Saavedra	Tacobamba	MIC
203	Potosí	General Bilbao	Acasio	MIC

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
204	Potosí	General Bilbao	Arampampa	MIC
205	Potosí	Tomás Frías	Potosí	MIC
206	Potosí	José María Linares	Caiza "D"	Irrigation
207	Potosí	Cornelio Saavedra	Chaquí	Irrigation
208	Potosí	Rafael Bustillo	Chuquihuta Ayllu Jucumani	Irrigation
209	Potosí	José María Linares	Puna	Irrigation
210	Potosí	José María Linares	Ckochas	Irrigation
211	Potosí	Cornelio Saavedra	Betanzos	Irrigation
212	Potosí	Chayanta	Ravelo	Irrigation
213	Potosí	Chárcas	San Pedro	Irrigation
214	Potosí	Chayanta	Pocoata	Irrigation
215	Potosí	Chayanta	Colquechaca	Irrigation
216	Potosí	Nor Lipez	Colcha "K"	Irrigation
217	Potosí	Rafael Bustillo	Uncía	Irrigation
218	Potosí	Rafael Bustillo	Chayanta	Irrigation
219	Santa Cruz	Guarayos	Urubicha	Risks
220	Santa Cruz	Ichilo	Buena Vista	Risks
221	Santa Cruz	Velasco	San Rafael	Risks
222	Santa Cruz	Velasco	San Miguel	Risks
223	Santa Cruz	Vallegrande	Postrervalle	Risks
224	Santa Cruz	Guarayos	El Puente	Risks
225	Santa Cruz	Ñuflo De Chávez	San Antonio de Lomerio	Risks
226	Santa Cruz	Angel Sandoval	San Matías	Risks
227	Santa Cruz	Germán Busch	El Carmen Rivero Tórrez	Risks
228	Santa Cruz	Sara	Colpa Bélgica	Risks
229	Santa Cruz	Ichilo	San Juan	Risks
230	Santa Cruz	Ñuflo De Chávez	San Javier	Risks
231	Santa Cruz	Ñuflo De Chávez	San Ramón	Risks
232	Santa Cruz	Florida	Mairana	Risks
233	Santa Cruz	Obispo Santistéban	General Saavedra	Risks
234	Santa Cruz	Warnes	Okinawa Uno	Risks
235	Santa Cruz	Florida	Samaipata	Risks
236	Santa Cruz	Florida	Quirusillas	Risks
237	Santa Cruz	Cordillera	Boyuibe	Risks

N°	DEPARTMENT	PROVINCE	MUNICIPALITY	SUBCOMPONENT
238	Santa Cruz	Vallegrande	Pucará	Risks
239	Santa Cruz	Manuel María Caballero	Saipina	MIC
240	Santa Cruz	Manuel María Caballero	Comarapa	MIC
241	Santa Cruz	Florida	Pampa Grande	Irrigation
242	Santa Cruz	Cordillera	Cuevo	Irrigation
243	Santa Cruz	Vallegrande	Moromoro	Irrigation
244	Santa Cruz	Vallegrande	Trigal	Irrigation
245	Santa Cruz	Cordillera	Lagunillas	Irrigation
246	Santa Cruz	Cordillera	Gutiérrez	Irrigation
247	Santa Cruz	Cordillera	Camiri	Irrigation
248	Santa Cruz	Cordillera	Charagua	Irrigation
249	Tarija	Arce	Bermejo	Risks
250	Tarija	Avilés	Uriondo	MIC
251	Tarija	Méndez	El Puente	MIC
252	Tarija	Arce	Padcaya	MIC
253	Tarija	O'Connor	Entre Ríos	MIC
254	Tarija	Méndez	San Lorenzo	MIC
255	Tarija	Cercado	Tarija	MIC
256	Tarija	Avilés	Yunchará	Irrigation

ANNEX 6: GHG Analysis

A. Background and Methodology

1. The proposed project aims to improve integrated water resources management at the basin level and increase the country's resilience to climate variability of vulnerable rural farmers in selected micro watersheds. The total project costs USD 171.5 million. The project will include four components: (i) water resources planning and pre-investment studies; (ii) climate resilient infrastructure investments; (iii) technical assistance and capacity building activities to enhance water governance at theregional and basins levels: and (iv) project management. The calculation of the GHG emissions balance is solely focused on the investment component that finances climate resilient infrastructure investments (with a total value of USD 140 million). However, the remaining investments are critical to ensure that the infrastructure investments will be implemented and operated in a sustainable manner.

2. As per the World Bank corporate mandate to conduct greenhouse gas (GHG) emissions accounting for investment lending, the project's net emissions balance was calculated with the EX-ACT tool (version 9.3), that was developed by the Food and Agriculture Organization of the United Nations (FAO). The tool provides an ex-ante assessment of the Project's net carbon balance, defined as the net balance of CO_2 equivalent GHG that would be emitted or sequestered because of implementing the project ("with project"). The carbon stock changes (emissions or sinks), were expressed in equivalent tons of CO_2 total, per hectare and year.

3. The ex-ante GHG analysis considered the information sources available at the project design stage and the pre-selected models and subprojects to be financed during implementation. Since subprojects were at different degrees of development, and the project will offer demand-led support, it is likely that some assumptions and data made during the ex-ante analysis may change during project implementation. At the time of appraisal, the GHG analysis mainly focused on the first two types of climate resilient investments as lack of data precludes a GHG analysis of the third subcomponent.

B. Inputs into the GHG Analysis

4. The proposed climate resilient infrastructure investments will contribute to improving net carbon balances via investments oriented to rehabilitate degraded land, as well as the use of improved agricultural practices and technologies that reduce the occurrence of soil erosion and promote the accumulation of carbon in the soil. It will also increase water use efficiency through irrigation, whereas it invests in measures to protect water sources. In a "without project" scenario, soil erosion will worsen resulting in increased flood and drought risks, damage to persons and property, while reducing the area available for cultivation. The deterioration in livelihoods in the "without project" scenario will result in migration as the land is increasingly less able to sustain the livelihoods of rural farmers.

5. The GHG analysis considers the following assumptions to calculate the impact of the project on the net carbon stock. The timeframe for project implementation is 5 years, and the capitalization phase is 20 years; thus, the analysis period is set for 25 years. Most of the subprojects will be in the Andean and inter-Andean valley areas, where the climate is defined as cool, temperate, and dry. The dominant soil type used in the analysis is described as low activity clay soils. "Tier 1" data values were used considering the time limitations and access to information. This means that default coefficients for the EX-ACT estimation were used. The construction of the "without project" and "with project" scenarios is based on average technical references taken from secondary sources available at the time of the analysis (sometimes dating back several years) complemented by experts' opinions.

6. The primary source of data used to carry out the GHG analysis was the information used for the cost benefit analysis, as well as technical inputs prepared within the country. These inputs provide a detailed assessment of the technical approaches of the subprojects that the project will support. The team has used the data from the existing portfolios to extrapolate the impact of GHG emissions for the total project. As mentioned earlier, the availability of data varies across the different types of investment subprojects, and as such the results of the GHG analysis will focus only on the first two types of subprojects (irrigation and watershed management subproject), which make up 85 percent of the total investment portfolio.

C. Results of the GHG Analysis

7. The project would result in a significant net reduction in GHG emissions. The estimated net carbon balance resulting from GHGs emitted or sequestered/reduced during the project implementation and capitalization period (25 years) will bring a mitigation benefit of 341,991 tCO_2e/year compared to a business-as-usual baseline scenario. This is equivalent to annually reduced GHG emissions of 10 tCO_2e/year per hectare. After 25 years, GHG mitigation benefits would be generated to a reduction of 8,549,784tCO_2e. The main results of this GHG analysis are summarized in **Table A.15.**

8. The main carbon sources come from agricultural inputs. As we have no information about how and whether climate smart agricultural practices will be used in the various subprojects and various ecological zones where the project will be active, this may result in an underestimation of the possible reduction of GHG emissions. The sequestration benefits come from land use changes linked to afforestation and/or reforestation, (land-use changes).

Table A.15 Results of the Ex-Act GHG Analysis

Component	Total Impact over 25 years			Annual Impact		
	Without Project	With Project	Balance	Without Project	With Project	Balance
Land use change	0	-12,335,215	-12,335,215	0	-493,409	-493,409
Annual Cropland Management	-4,980	-79,007	-74,207	-199	-3,160	-2,961
Inputs and Investments	0	3,859,458	3,859,458	0	154,378	154,378
Total Emissions (tCO_2/e)	**-4,980**	**-8,554,458**	**-8,549,784**	**-199**	**-342,191**	**-341,991**
Total Emissions (tCO_2/e/hectare)	**-0.1**	**-250.7**	**-250.6**	**0**	**10.0**	**-10.0**

Table A.16 Uncertainty in estimations (percent)

Uncertainty Level of Estimations	tCO_2-e/year	Percent
Without	-199	44%
With	-342,191	37%
Impact	-341,991	30%

ANNEX 7: Operational aspects of the Gender Action Plan

1. Below is a summary of the Operational Aspects of the Gender Action Plan (GAP). The GAP identifies concrete actions related to each of the agreed specific objectives for the mainstreaming of the gender approach. It is based on the identified gender gaps, and the proposed actions will be applied in the different Project components (as shown by Table A.17 below).

Table A.17 Operational aspects of the Gender Action Plan

Specific Objective	Concrete Actions	Application
Motivate the creation of women's organizations that strengthen the instances of water governance in the beneficiary communities.	Register/ Mapping of women's organizations within ETAs that contribute to water governance.	Component 3
	Organize a water governance congress involving women leaders of the ETAs. This activity will include "soft-skills" workshops for women to improve their leadership and communication skills, aiming at changing social norms around the perception of men as better leaders.	Component 3
Include the participation of women in positions that allow them to access spaces of power and equal decision-making.	Register of the percentage of project funding allocated for subprojects managed (in majority) by women.	Component 2
	Specific work-tables for women leaders of the ETAs on both, leadership and project content and strategies to ensure they participate in decision-making on irrigation management, the definition of roles and responsibilities of OGCs, and water regulations.	Component 3
	Training workshops for female farmers on irrigation management, roles and responsibilities of OGCs, and water regulation.	Component 3
Establish guidelines that allow equal access to employment in the Project.	Gender parity for new hirings within the Project (men and women).	Components 1 and 4
	Development of a gender manual or guidelines for third parties involved in the Project, considering existing manuals.	Components 2 and 3
Develop mechanisms that mitigate and raise awareness about reproductive roles and the double workload of women.	Workshops with the joint participation of women and men to raise awareness on the contribution and value of the work of female users and time management in household chores as a couple aimed at beneficiary families.	Components 2 and 3
	Workshops for male leaders and irrigation services users to raise awareness on the importance of a gender focus in OGCs and on water policies with an emphasis on gender equity.	Component 3
	Consideration of the double workload of women in the community (daycare centers, training, other hours, etc.) in the planning and development of project activities.	Component 3
	Establish a mechanism in case of having contracted personnel who are in a state of gestation to obtain the corresponding benefits.	Component 4
Establish concrete actions to achieve equality between men and women in access to productive resources and technology, and to education and training.	Agree and establish mechanisms that allow women equal access to funding, including agreements with government agencies to issue identity cards for women and other vulnerable groups in dispersed rural areas.	Component 2
	Establish technical trainings with schedules and timings in which women can get involved.	Component 3
Define strategies that mitigate the differentiation of	Develop gender-sensitive proposals and methodologies at the subproject level to avoid gender stereotypes in subproject planning and implementation.	Component 2
	Include women in technical trainings.	Component 3

Specific Objective	Concrete Actions	Application
specific activities by gender.		
Include guidelines that allow equal remuneration between men and women.	Establish a gender manual or guidelines for third parties involved in the project through ToRs for contractors, codes of conduct, etc.	Component 2
	Guidelines include mandates for third parties to prohibit gender-based compensation discrimination and adhere to principles of equal pay for equal work.	Components 1, 2, and 3
Achieve an internal mechanism that prevents any type of violence against women within the project.	Map the gender violence prevention services available in the Project's municipalities.	All components
	Establish a referral mechanism for cases of violence in the Project.	All components
	Training in sensibilization for risks of GBV for beneficiaries and staff working with the Project. Training in sensibilization for risks of GBV exclusively for men from ETAs.	All components
Source: Gender Action Plan for Project 178861		

ANNEX 8: Paris Alignment Assessment

1. The IPF operation is aligned with the goals of the Paris Agreement on both mitigation and adaptation. The proposed operation is consistent with Bolivia's Second Nationally Determined Contribution (NDC) (submitted to the UNFCC on 04/15/2022).

2. The proposed program is designed to improve integrated water resources management in water stressed basins and increase the resilience[58] to climate variability of vulnerable[59] rural families in selected micro basins. Several project activities and expected outcomes, including improved water management, water harvesting, productive and efficient approaches to agriculture, increased food security, and afforestation/reforestation, are mentioned directly in the NDC as national goals. Almost all activities envisaged under the program are on the Universally (Paris) Aligned list, while the fertilizer interventions are expected to lead to a low risk of carbon lock-in.

3. **Assessment and reduction of adaptation risks:** The Project will adopt an integrated approach to building resilience to climate change, from basin planning to micro-basin planning, and will include investments for water management at the micro-basin level, investments for hydrological risk management, as well as investments to secure adequate water for irrigation of rain-fed crops, increasing farmers' ability to improve food security and reducing their vulnerability to the increasing, climate change-induced rainfall variability. The activities or subprojects will be identified and prioritized by the communities with the active participation of the municipal governments and the OGCs, which will help ensure that resilience planning is based on local conditions and beneficiaries' specific climate-related needs. The project's main climate and disaster risks are floods, droughts, and landslides due to soil erosion and other climate-related factors. These risks may impact project activities with disruptions in service delivery for short periods of time, and consequently, brief delays in the implementation of activities in certain areas. The provision of technical assistance and capacity building activities may also experience delays. However, given the integrated approach contemplated in the implementation of the activities, these delays are not expected to jeopardize the achievement of the project objectives ~~(PDO)~~. Additionally, the Project will take climate-related factors into account, both Components 1 and 2 include a major focus on increasing understanding of the hydrology of the local micro-basins, which will increase the ability of the client and beneficiaries to adapt to increased flood and drought risk. Resilience planning principles will be included in engineering designs. In addition, investments in improved land management, soil management, and climate-smart agriculture will reduce the risk of soil erosion, while providing natural landscapes that provide a buffer against flood risks. Investments in rainwater harvesting, water capture, and improved irrigation access will also help improve beneficiaries' capacity to adapt to drought risk. Investments in river defenses and deflectors, water erosion control, gully and flood control, will boost resilience to climate change impacts, protect land and communities against extreme hydrological events, including flooding, and to conserve, restore and manage soil degraded by erosion. In addition, the project will fund technical assistance (TA) and capacity building activities to enhance water governance at the national, macro, regional and basin levels including climate change education and awareness. As part of project planning, the recommendations given in the *Resilient Water Infrastructure Design Brief* will be considered when designing physical infrastructure. Adopting some of the hard and soft measures recommended by the brief will increase the reliability of irrigation providers, as service disruptions resulting from infrastructure damaged by climate-related shocks will be less likely to happen. As a result of these interventions, the increased adaptive capacity of the

client and beneficiaries through the project's investments will put the project at low risk of climate risks undermining the ability to meet the PDO.

4. **Assessment and reduction of mitigation risks:** The project is expected to lead to significant overall net emissions reductions due to greater carbon sequestration in soil and biomass. Efforts to improve currently degraded land (and prevent further degradation) through afforestation and/or reforestation with native vegetation and grassland management will increase soil carbon sequestration and will be the largest source of sequestration through the project. Additionally, low-GHG and climate-smart agriculture practices are being adopted, alongside the conservation of natural habitats and ecosystems, with a careful approach to avoid expanding into areas of high carbon stocks or high biodiversity areas No new land will be brought under agricultural practices, thus no land use changes that would have a negative impact on carbon sequestration are expected to occur under the project. Instead, existing land under cultivation will be used more intensely, efficiently, and in a climate-informed manner. Any energy use under the project will not rely on on-site diesel generation, while many of the crops will be rainfed or will receive water from low-energy storage solutions. While the project is expected to lead to increases in fertilizer use, Bolivians currently have the lowest per capita fertilizer use rate in the LAC region and one of the lowest in the world, according to the FAO. The project's increase in fertilizer use is therefore justifiable in the Bolivian development context as a necessary condition to increase food security. Even when accounting for the emissions due to increased fertilizer use, the project is still expected to lead to significant emissions reductions of -8,549,784 tCO2-eq over the project's economic lifetime. Most of these interventions are already covered under the Universally Aligned list. The fertilizer interventions will lead to a low risk of carbon lock-in.