GEF/UNDP/ASEAN Project on Reducing Pollution and Preserving Environmental Flows in the East Asian Seas through the Implementation of Integrated River Basin Management (IRBM) in ASEAN Countries



STATE OF RIVER BASIN REPORT

Nam Tha River Basin

2026

DRAFT, NOT TO BE CITED

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State of River Basin Report: Nam Tha River Basin 2026

June 2026

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Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) is a regional coordinating mechanism for the sustainable coastal and marine development in the East Asian Seas Region.

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Message from the Department of Water Resources

The State of River Basin (SORB) Report of Nam Tha River Basin (NTRB) is one of the core outputs of the GEF/UNDP/ASEAN Project on Reducing Pollution and Preserving Environmental Flows in the East Asian Seas through the Implementation of Integrated River Basin Management (IRBM) in ASEAN Countries. It is an indicator-based monitoring, evaluation and reporting tool that supports the implementation of integrated river basin management/integrated water resources management (IRBM/IWRM) program in NTRB. It establishes the baseline governance and management status and trends including progress, achievements and challenges in the implementation of the NTRB Management Plan and other relevant socioeconomic development and environmental management plans in the basin. The SORB report provides recommendations for the continual improvement of the governance and management of NTRB.

The SORB report provides a detailed assessment of status and trends of the 32 governance and management indicators and offers recommendations for further improvement of the IRBM program in NTRB.

The SORB Report is an important management and monitoring tool for national agencies responsible for the water sector, the local governments of Oudomxay, Luang Namtha and Bokeo Provinces and other relevant stakeholders. It provides inputs for the continual planning and implementation of action plans for the integrated management and development of the water resources in NTRB.

The Department of Water Resources (DWR), sincerely thank the Minister of the Ministry of Agriculture and Environment (MAE) and the Provincial Governors of Oudomxay, Luang Namtha and Bokeo Provinces for the active guidance and strong support in the implementation of the Nam Tha River Basin Action Plan (2021-2025) and the GEF/UNDP/ASEAN IRBM Project. The DWR extends its appreciation to all central and local government agencies, partners and stakeholders including all villages in the NTRB who recognized the importance of developing this report and worked closely with the team, provided the required information and actively cooperated throughout the process of developing this report.

I express my special thanks to PEMSEA Resource Facility for its technical assistance and support to GEF, UNDP and the ASEAN Secretariat for the project oversight support and guidance in the implementation of the IRBM Project.

Finally, I join the Provinces of Luang Namtha, Oudomxay and Bokeo in strongly encouraging all relevant stakeholders to continue supporting future technical studies and the periodic updating of the SORB Report as a means of measuring and reporting our progress in implementing the Nam Tha River Basin Management Plan.



Mr. Oudomsack Philavong
Director General, Department of Water Resources
Ministry of Agriculture and Environment

Message from the Provincial Departments of Agriculture and Environment of Luang Namtha, Oudomxay and Bokeo

The Provincial Departments of Agriculture and Environment of Luang Namtha Province, Oudomxay, and Bokeo highly appreciates the preparation of the Nam Tha State of River Basin Report under the framework of the GEF/UNDP/ASEAN Project on Integrated River Basin Management. This report represents a valuable achievement resulting from the close collaboration among central and local government agencies, development partners, technical experts, and communities within the basin.

The report provides a comprehensive overview of the current status of the Nam Tha River Basin, including its physical characteristics, water resources, socioeconomic development, environmental conditions, disaster risks, and institutional arrangements for river basin management. It serves as an important reference document for policymakers, planners, and stakeholders to better understand the opportunities and challenges facing the basin and to formulate effective strategies for sustainable water resources management and environmental protection.

The Department recognizes the increasing pressures on water resources and ecosystems arising from socioeconomic development, land-use changes, pollution, and climate variability. Addressing these challenges requires stronger coordination among sectors and administrative levels, enhanced public awareness, improved monitoring and information systems, and active participation of local communities in the conservation and sustainable management of natural resources.

In conclusion, the Provincial Departments of Agriculture and Environment of Luang Namtha, Oudomxay and Bokeo fully support the findings and recommendations presented in this report and reaffirm their commitment in promoting integrated river basin management in

the Nam Tha River Basin. We encourage all relevant stakeholders to continue strengthening cooperation and partnerships to ensure the sustainable use, protection, and restoration of water resources and ecosystems. Through our collective efforts, the Nam Tha River Basin will continue to support economic growth, environmental sustainability, and improved livelihoods for present and future generations.

Provincial Department of Agriculture
and Environment of Luang Nam Tha

Provincial Department of Agriculture
and Environment of Oudomxay

Provincial Department of Agriculture
and Environment of Bokeo

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The SORB Report of the Nam Tha River Basin (NTRB) is the result of a collaborative effort of many people and partners. The report was prepared with the support of Mr. Phathmany Southammavong, an Independent Consultant, in close coordination with and guidance by the technical team from the Department of Water Resources (DWR) led by Mr. Thanongxay Douangnoulak and Mrs. Soukphaphone Soodtharavong, the designated IRBM Project Manager and Coordinator for the IRBM Project at DWR, respectively; Dr. Keoduangchai Keokhamphui, IRBM Project National Coordinator, and the PEMSEA Resource Facility, which hosts the Regional Project Management Unit (RPMU) particularly Ms. Nancy Bermas, Regional Project Manager, Ms. Daisy Padayao, Technical Officer and the rest of the RPMU team.

The National and Provincial Project Steering Committees (PSC) provided guidance in the preparation of the SORB report, including the review and approval of the report. The national PSC is chaired by the Director General of DWR with the involvement of relevant departments at the national level. The PSCs in Oudomxay, Luang Namtha and Bokeo Provinces are chaired by the Provincial Vice Governors and involve relevant provincial departments, District Vice Governors and the Head of the Natural Resources and Environment in all districts within the NTRB.

In particular, the process of developing the report benefited from the guidance of key members of the national and provincial PSCs, namely: Mr. Oudomsak Philavong, Director General, DWR, Mr. Khonesy Xaygnamone, Deputy Director, Provincial Office of Natural Resources and Environment (PONRE) of Oudomxay Province, Mr. Souksan Phonpadit, Deputy Director, PONRE of Luang Namtha Province, and Mr. Saysomphone Chanthasomboun, Deputy Director, PONRE of Bokeo Province.

More than a hundred staffs from the central, provincial and district Offices of Natural Resources and Environment provided important contribution throughout the process of report development, from planning to primary and secondary data collection. In particular, the Directors of the Water Sector of the Provincial Office of Natural and Resources and Environment (PONRE; currently the Provincial Department of Agriculture and Environment); Mr. Thavela Outthilath (Oudomxay Province), Mr. Somboun Xaychantha (Luang Namtha Province), and Mr. Sifong Phommasack (Bokeo Province) are duly acknowledged. The full list of team members is provided at the end of the report.

The preparation of the SORB report is part of the implementation of the GEF/UNDP/ASEAN Integrated River Basin Management Project, which is being executed by the PEMSEA Resource Facility, in coordination with the DWR, MONRE (currently the Ministry of Agriculture and Environment).

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List of Acronyms and Abbreviations

AMS	–	ASEAN Member States
AMSL	–	Above Mean Sea Level
ASEAN	–	Association of Southeast Asian Nations
BOK	–	Bokeo Province
DWR	–	Department of Water Resources
PDONRE	–	Provincial Department of Natural Resources and Environment
GEF	–	Global Environment Facility
GIS	–	Geographic Information System
GoL	–	Government of Lao PDR
GoV/GOV	–	Government
EAS	–	East Asian Seas
IQQM	–	Integrated Quantity-Quality Model
IRBM	–	Integrated River Basin Management
IWRM	–	Integrated Water Resources Management
Lao PDR	–	Lao People's Democratic Republic
LNT	–	Luang Namtha Province
MAE	–	Ministry of Agriculture and Environment
MONRE	–	Ministry of Natural Resources and Environment
MRC	–	Mekong River Commission
NA	–	National Assembly
NBCAs	–	National Biodiversity Conservation Areas
NTFP	–	Non-Timber Forest Product
NTRB	–	Nam Tha River Basin
ODX	–	Oudomxay Province
PDR	–	People's Democratic Republic
PEMSEA	–	Partnerships in Environmental Management for the Seas of East Asia
PITT	–	Project Implementing Technical Team
PMO	–	Prime Minister's Office
PGoN	–	Provincial Governor
PONRE	_	Provincial Office of Natural Resources and Environment
PRF	–	PEMSEA Resource Facility
RPMU	–	Regional Project Management Unit
S2S	–	Source-to-Sea
SORB	–	State of River Basin
TWG	–	Technical Working Group
UNDP	–	United Nations Development Programme

Executive Summary

Overview

The Lao People's Democratic Republic (Lao PDR) is a small landlocked country located in the middle mainland of Indochina Region and at the heart of Mekong River. About 80 percent of total area (236,800 km^2) of the country is hilly and mountainous. About 90.5 percent of the country is part of the Mekong River Basin (MRB) and accounts for 26.9 percent of the total area (795,000 km^2) of the basin (MRC, 2024).

The Nam Tha River Basin has a total area of 8,918 km^2 and considered the 7th largest river basin in the country. Located in the mountainous area, the basin encompasses three provinces: Luang Namtha, Oudomxay and Bokeo. The NTRB consists of 328 villages with a total population of 226,182 in 2020, of which 83.5 percent live in rural areas. Development in the NTRB started only in the recent decades and is mainly concentrated in the urban areas in the three provinces. Economic activities in the basin include hydropower development, mining, industries, rubber tree plantation and cultivation of other economically important crops, tourism and other services.

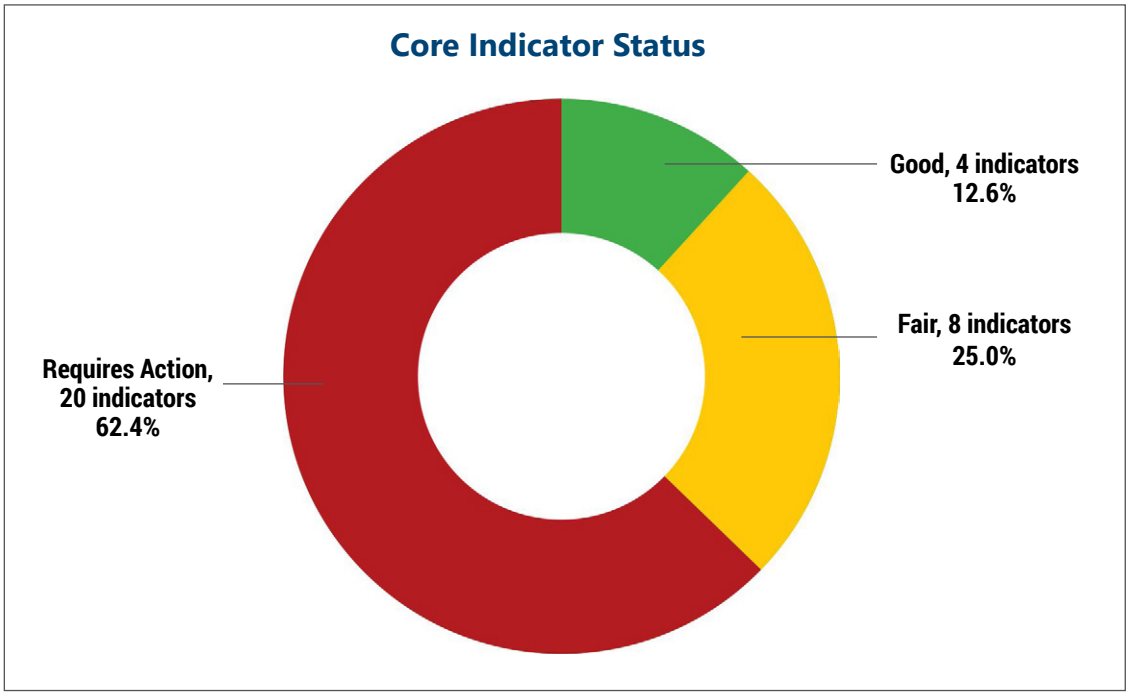
The State of River Basin (SORB) report of NTRB is one of the key outputs of the GEF/UNDP/ASEAN Integrated River Basin Management (IRBM) Project in Lao PDR. The SORB report assesses the status of the NTRB relative to the 18 governance indicators and 14 sustainable development aspects indicators. It evaluates the progress of implementing the NTRB Management Plan 2021-2025, the Socioeconomic Development Plans of Bokeo, Luang Namtha and Oudomxay Provinces, including its contribution in the implementation of the National Socioeconomic Development Plan, the National Green Growth Strategy, the Mekong River Basin Management Plan and the UN SDGs.



Photo by John Castillo/PEMSEA

Key Findings

The figure below summarizes the status of the 18 governance and 14 sustainable development aspects indicators of the NTRB SORB Report. For the governance aspects, Indicator 004 (coordinating mechanism for IRBM), Indicator 005 (formal recognition that sector-based government agencies support integrated approaches for river basin management), Indicator 007 (IRBM enabling legislation), and Indicator 009 (environmental cases filed/resolved) showed good status. A total of eight indicators (governance: river basin strategy and action plan; benefits derived from cooperation, degree of stakeholder participation and human resource capacity; and four sustainable development aspects (SDA) indicators: status of environmental assets, water use and supply management, water flow conditions, and economic performance of water-related sectors) showed fair status while 20 indicators (10 governance and 10 SDA indicators specifically on the degree of vulnerability to disasters, level of preparedness for disasters, social and economic losses due to disasters, climate change trends and extremes, and adaptation to climate change) indicated requiring action.



Governance Core Indicators			Core Indicator Status	Core Indicator Trend
Policy, Strategies and Plans	**001**	River Basin Profile and Environmental Risk Assessment		↗
	002	River Basin Strategy and Action Plans		↑
	003	Local Government Development Plan, including River Basins, Associated Watersheds and Adjacent Coastal and Marine Areas		↗
Institutional Arrangements	**004**	Coordinating Mechanism for River Basin Management		↗
	005	Formal Recognition that Sector-based Government Agencies Support Integrated Approaches for River Basin Management		↗
	006	Benefits Derived from Cooperation		↑
Legislation	**007**	IRBM Enabling Legislation		↗
	008	Administration, Enforcement of Legislation and Compliance Monitoring and Inspection		→
	009	Environmental Cases Filed/Resolved		↗
Information and Public Awareness	**010**	Effective Platform/Mechanisms for Collecting, Storing and Sharing IRBM Related Information to Relevant Stakeholders		↗
	011	Education and Public Awareness Schemes for a Range of Stakeholders		↗
	012	Public Participation and Mobilization		↗
	013	Degree of Stakeholder Participation and Gender Equality and Social Inclusion in Decision Making Process for River Basin Management		↗
Financing Mechanism	**014**	Budge Allocation for Integrated River Basin Management		↗
	015	Sustainable Financing Mechanisms		→
	016	Self-financing of River Council/Committee		→
Capacity Development	**017**	Availability/Accessibility of Capacity Development and Training Opportunities for Key Stakeholders		↗
	018	Human Resource Capacity		↗

Core Indicator Status Levels:

- Good
- Fair
- Requires Action

Core Indicator Trend:

- ↑ Significantly Improved
- → Slightly Improved/Constant
- ↗ Moderately Improved
- ↓ Worsened

Sustainable Development Aspects Core Indicators			Core Indicator Status	Core Indicator Trend
Climate Change and Disaster Risk Reduction	019	Degree of Vulnerability to Disasters		↗
	020	Level of Preparedness to Disasters		↗
	021	Social and Economic Losses due to Disasters		↗
	022	Greenhouse Gas Emissions		↗
	023	Climate Change Trends and Extremes		↓
	024	Adaptation to Climate Change		↗
Habitat Protection, Restoration and Management	025	Status of Environmental Assets		→
Water Use and Supply Management	026	Water Use and Supply Management		↗
	027	Water Flow Conditions		→
	028	Economic Performance of Water-related Sectors		↗
Food Security and Livelihood Management	029	Living Conditions and Well-being		→
	030	Livelihoods, Employment/economic Stability, Gender Equality and Education		↗
Pollution Reduction and Waste Management	031	Pollution Control and Waste Management		→
	032	Water Quality and Sediment Conditions		→

Core Indicator Status Levels:

- Good
- Fair
- Requires Action

Core Indicator Trend:

- ↑ Significantly Improved
- ↗ Moderately Improved
- → Slightly Improved/Constant
- ↓ Worsened

Key challenges in the NTRB include the following:

Governance Aspects

1. Policy, Strategies and Plans: Lack of disaster risk assessments, NTRB profile needs updating, unclear source of funding for the implementation of NTRB Management Plan, and weak IRBM integration into local government socioeconomic development plan.
2. Institutional Arrangements: Inefficient sectoral coordination.
3. Legislation: Weak enforcement of water management regulations, ineffective monitoring of compliance to environmental and water-related regulations, lack of systematic recording of environmental cases.
4. Information and Public Awareness: No proper data-sharing platform, limited private sector involvement, and strengthening public-awareness raising programs.
5. Financing Mechanism: Limited sustainable financing mechanism for river basin management.
6. Capacity Development: Continuing capacity building for government staffs and stakeholders.

Sustainable Development Aspects

1. Climate Change and Disaster Risk Reduction: High flood risks, no disaster response plan, poor early warning systems, and lack of record on socioeconomic losses due to disasters.
2. Habitat Protection, Restoration and Management: Deforestation resulting from shifting cultivation, wildlife trafficking, unsustainable agriculture practices, and pollution.
3. Water Use and Supply Management: No sustainable funding for water resource management, unclear regulations for the operations of hydropower reservoir, and lack of economic data on water-related sectors.
4. Food Security and Livelihood Management: Unsustainable practices on shifting cultivation, fishing, and non-timber forest products (NTFPs) harvesting, limited sustainable livelihood activities and income sources.
5. Pollution Reduction and Waste Management: Poor waste disposal, water contamination, and use of harmful agricultural chemicals.

Recommendations

A river basin profile report of NTRB was prepared in 2022. This SORB Report of NTRB was developed using secondary data and information provided by local authorities and concerned agencies in the basin. However, there is still limited information on volume of greenhouse gas emission, water quality and disaster risks index in the basin. It is recommended to update NTRB SORB Report when information will be available during the period 2026 to 2027 when the new population census report, the Five-Year Socioeconomic Development Plan 2026-2030 of the provinces and districts in the basin, the ongoing waste assessment report, other required technical

study reports, and the report/records on performance of NTRB's information management and sharing platform will be available. A set of required actions, records, information and reports for future updating of NTRB SORB Report include but not limited to the following:

1. Population, socioeconomic features, investment project, pollution load, meteorology, hydrology and water quality in the basin including installation and improvement of existing meteorology, hydrology and water quality monitoring stations in the basin and strengthening capacity for maintenance and operation of the monitoring stations.
2. Technical study or assessment of vulnerability to disasters and/or disaster risk assessment for NTRB together with identification and mapping of the population living in high-risk areas and making available detailed topographic map and flood prone area maps in various scenarios in scale not less than 1:2000.
3. Technical study or assessment of greenhouse gas generation in NTRB.
4. Systematic recording of socioeconomic losses from disasters including flood, drought, storm and landslide.
5. Integration of the NTRB Management Plan (2026-2030) into the Five-Year Socioeconomic Development Plan 2026-2030 of the provinces and districts in NTRB.
6. Improvement of other water-related data/information collection and maintenance in the basin as part of the establishment of the basin information management and sharing center.
7. Continuing capacity strengthening in data/information collection and SORB Report preparation for government officials.

The NTRB Management Plan 2021-2025 was prepared during the COVID-19 pandemic with insufficient field information and needs assessment. The NTRB Management Plan 2021-2025 was approved by the Prime Minister in 2022, with implementation commencing in late 2023 with limited funding. The issues identified in this SORB Report will provide inputs in the development of the NTRB Management Plan (2026-2030) building on the identified areas for improvement of the current Management Plan.

Based on the results of the SORB report, short- and medium-term recommendations for the refinement of the NTRB Management Plan (2026-2030) are provided in **Chapter 7**.



Photo courtesy of Sivonxay Manbouapha

CHAPTER 1

Introduction

The Lao People's Democratic Republic (Lao PDR) is a small landlocked country, with a total area of 236,800 km^2. The country is rich in natural resources and located in the middle of the Indochina region and at the heart of Mekong River. The topography is generally hilly and mountainous, accounting for about 80 percent of the area, which forms increasingly steep terrains and dense river networks throughout the country. About 90.5 percent of the county's territory is located in the Mekong River Basin (MRB) and accounts for 26.9 percent of the total area (795,000 km^2) of the basin (MRC, 2024).

The country has a total of 62 river basins, of which 55 are sub-basins of the MRB. The river basins are categorized into large (14 basins; above 4000 km^2 in area), medium (19 basins; 1000 km^2 to 4000 km^2), and small basins (29 basins; 1000 km^2).

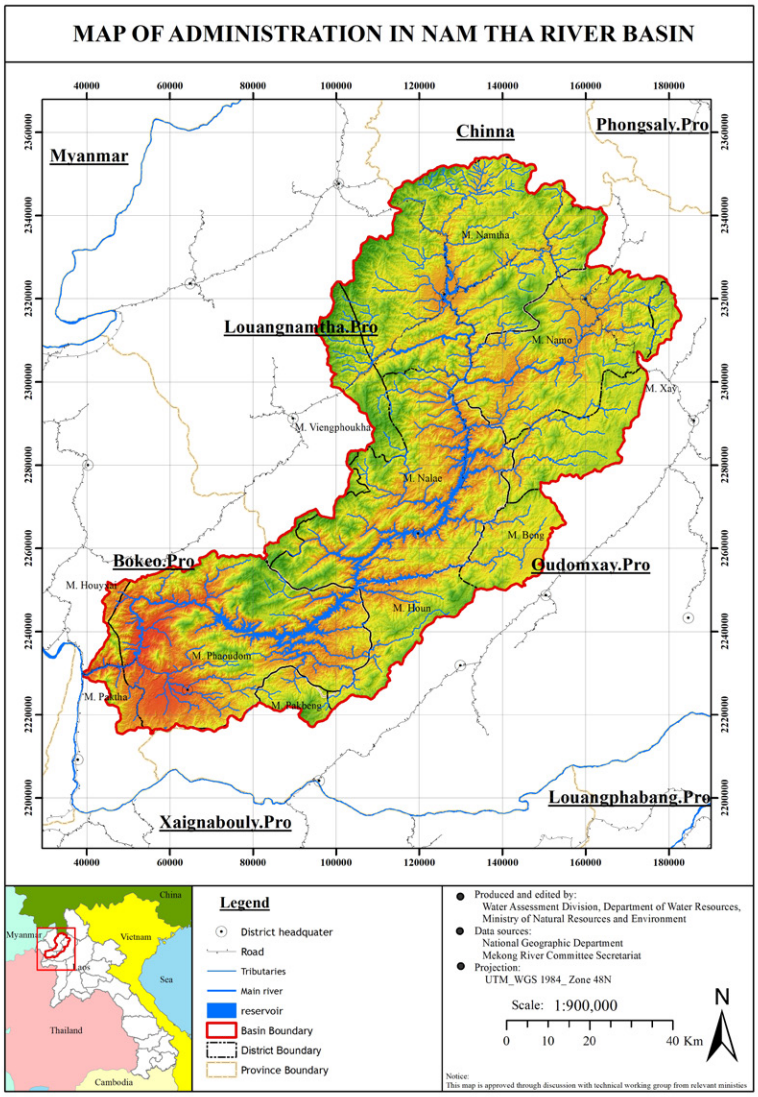


Figure 1.1 Administrative Map of Nam Tha River Basin
(*Source: DWR*)

The Nam Tha River Basin (NTRB) is one of the 11 tributaries of the MRB with a basin area larger than 4,000km^2. The NTRB has a total area of 8,918 km^2 and is considered the 7th largest basin in the country. Located in the northwestern part of the country, the basin encompasses three provinces, namely: Bokeo, Luang Namtha and Oudomxay (**Figure 1.1**).

NTRB has been selected as the priority river basin for the GEF/UNDP/ASEAN Project on Reducing Pollution and Preserving Environmental Flows in the East Asian Seas through the Implementation of IRBM in the ASEAN Countries, a 5-year project (2023-2027) participated in by six ASEAN Member States, i.e., Cambodia, Indonesia, Lao PDR, Malaysia, Philippines and Viet Nam.

The Project aims to establish functional river basin mechanisms in the priority river basins in the six ASEAN countries for reducing pollution and sustaining freshwater environmental flows as well as adapting to climate change vulnerabilities. In NTRB, the project addresses sustainable management of forests and pollution reduction through the implementation of IRBM and IWRM.

1.1. Objectives of SORB Report

The SORB report of NTRB aims to: (a) establish the baseline conditions in the NTRB, including changes that are climate-related; (b) assess progress, achievements and shortcomings of ongoing programs on river basin management by determining changing conditions with respect to governance and social and economic conditions, including gender gaps as well as trends and/or emerging environmental issues; and (c) provide recommendations for the continual improvement of river basin management programs including, ensuring gender equality and responsiveness for consideration by national and local governments and other relevant stakeholders in the river basin.

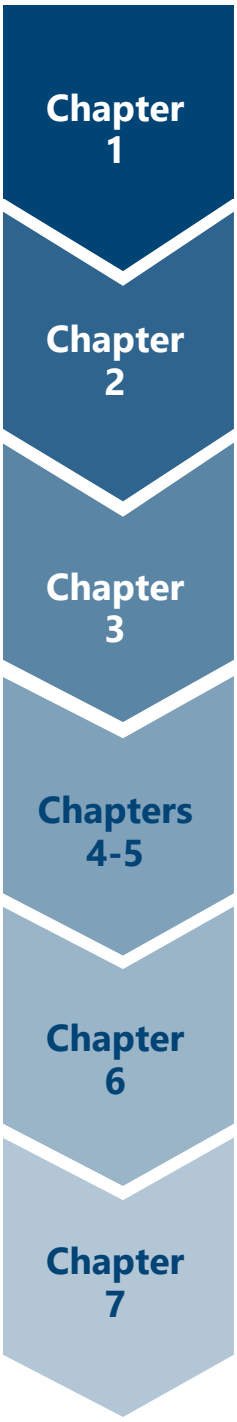
1.2. Scope of SORB Report

The SORB Report establishes the baseline condition of the NTRB relative to the 18 core governance and 14 core sustainable development aspects indicators.

Some data/information presented in the SORB Report were collected at the provincial-level and may not necessarily be limited within the delineated boundaries of the basin. Data and information were sourced from funding and technical organizations, international and regional organizations, government agencies, water and water resource users, and other beneficiaries.

1.3. Structure of SORB Report

The NTRB SORB Report is structured according to the agreed SORB report template and framework of the GEF/UNDP/ASEAN IRBM Project and are organized in seven chapters.



Chapter One introduces the SORB reporting: its significance, purpose, scope, intended audience and structure, including its contribution to subnational and national goals and alignment with the UN Sustainable Development Goals (SDGs) and related targets.

Chapter Two provides an overview of the methodological framework and process employed in developing the SORB report, particularly in assessing and evaluating the conditions and trends across the basin.

Chapter Three provides the setting and context for IRBM development and implementation in the river basin; the assessment of conditions and trends and the relevance of the assessment within the development and institutional frameworks, physiography, demographics, socioeconomic profiles, and major environmental challenges in the river basin.

Chapters Four and Five provide the detailed results of the assessment of the core indicators: the rationale; status, trends and progress; the implications of the results and recommendations for addressing the changing conditions across the basin. Chapter Four assesses the 18 core indicators of governance while Chapter Five assesses the 14 core indicators for sustainable development aspects.

Chapters Six provides a synthesis and overall assessment of the results presented in Chapters 4 and 5 and comparing them against established local and national targets. It provides an overall analysis of the implications of the results and recommendations for addressing the identified challenges and changing conditions, and guide future actions and improvements in IRBM and IWRM implementation.

Chapter Seven summarizes the major findings and conclusions, providing key insights into the status, progress, and remaining challenges in meeting the goals and targets established for the river basin and key recommendations for priority actions to further strengthen existing IRBM and IWRM programs.

1.4. Contribution to National and Global Development Goals

1.4.1. Contribution to Local and National Socioeconomic Development Plans

The NTRB Management Plan (NTRB MP) 2021-2025 was prepared in parallel with the five-year Socioeconomic Development Plans of the three provinces in the basin and the GoL. It integrates the objectives of the National Green Growth Strategy and the Strategy on Management and Consumption of Water and Water Resources until 2030 of GoL in the context of NTRB management.

The SORB reporting supports the implementation of the NTRB MP 2021-2025 by providing information on the status and trends of the 32 core indicators that are useful in reviewing the action programs included in the Plan. It also provides information on key areas for consideration in the development of the next cycle of NTRB MP, including the socioeconomic development planning of the Provinces of Bokeo, Luang Namtha and Oudomxay.

1.4.2. Contribution to the Mekong River Basin Development Strategy

Lao PDR is a member country of the Mekong River Commission. As a major sub-basin of Mekong River, the NTRB MP 2021-2025 was prepared in alignment with the Mekong River Basin Development Strategy 2021-2030. The Mekong River State of River Basin Report and the NTRB SORB Report are complementary.

1.4.3. Contribution to the UN Sustainable Development Goals

As a UN Member State, GoL has adopted the 2030 Agenda for Sustainable Development with 17 global goals. In addition to the 17 goals, GoL has included the reduction of impacts of unexploded bombs (UXO) to promote the development of the country. GoL therefore has 18 national SDGs.

The NTRB MP 2021-2025 includes six action plans that are environmental and water-related SDGs. Under the six action plans there are 18 development targets and 72 planned activities to be carried out which are in line with the eight strategic plans of the Strategy on Management and Consumption of Water and Water Resources until 2030, the National Green Growth Strategy of GoL and the national SDGs of Lao PDR.

The SORB Report of NTRB contributes in evaluating the progress of management and development of NTRB towards the UN SDGs, the NTRB MP 2021-2025 and National Green Growth Strategy.



Photo by John Castillo/PEMSEA



Photo by John Castillo/PEMSEA

CHAPTER 2

Methodology

2.1. SORB Reporting Framework

The NTRB SORB Reporting employs the SORB reporting framework developed by the IRBM Project as elaborated in the SORB Guidebook.

The step-wise approach in developing the NTRB SORB Report is presented in **Figure 2.1**. The six-step process include: 1) identifying the need or rationale for preparing the SORB report; 2) establishment of technical team and developing a detailed workplan; 3) collection of the data requirements for the SORB indicators; 4) data analysis, synthesis and interpretation of the results; 5) validation and consensus building on the contents of the draft of SORB report through stakeholder consultations; and 6) finalization, publication and dissemination of the SORB report.

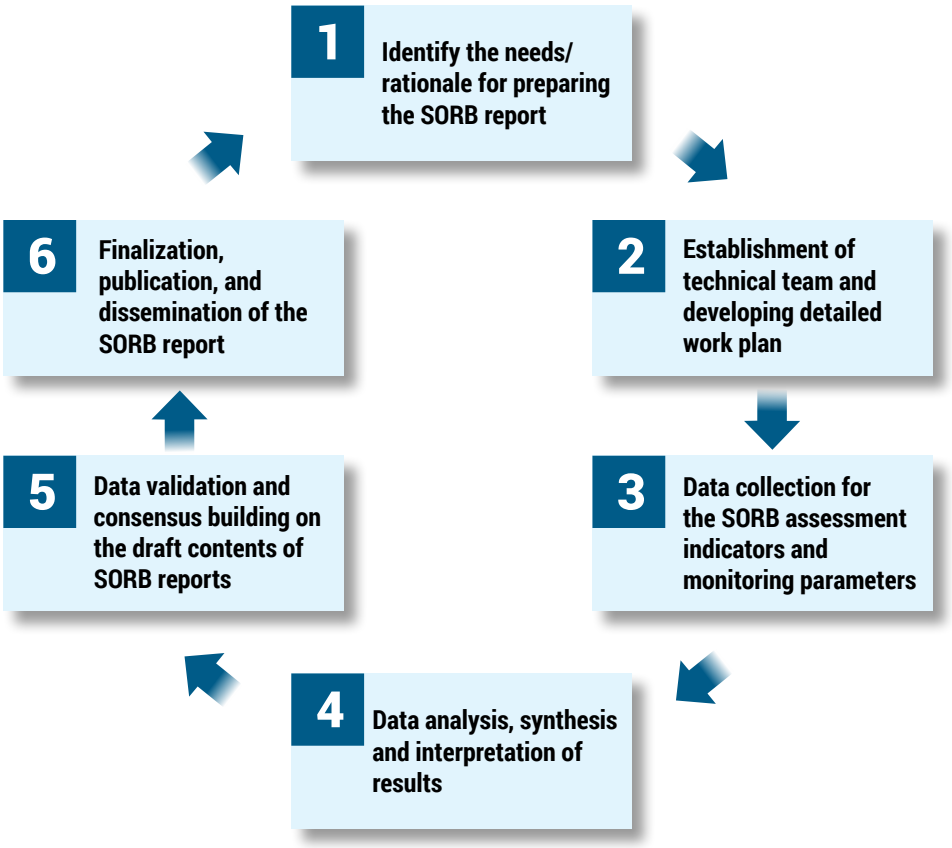


Figure 2.1 Step-wise Approach for Developing the SORB Report

The development of the SORB reporting is based on the Framework for Sustainable Development (SD) of River Basins, Associated Watersheds and Adjacent Coastal and Marine Areas through Source to Sea Management, as shown in **Figure 2.2**. The SD framework covers a system of governance and five sustainable development aspects or issue-specific management programs that are critical to achieving the sustainable development of river basins, the associated watersheds and adjacent coastal and marine areas.

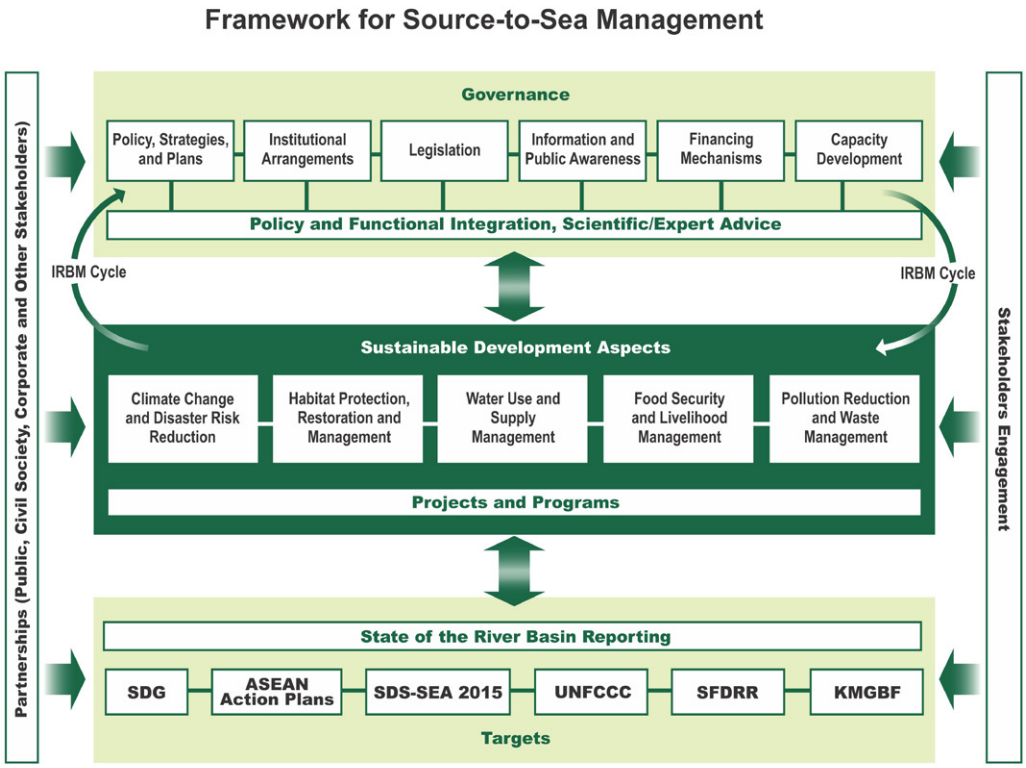


Figure 2.2 Framework for Sustainable Development of River Basins, Associated Watersheds and Adjacent Coastal and Marine Areas through Source to Sea Management.

2.2. Core Indicators for the SORB Reporting System

The SORB Reporting system includes 32 core indicators comprising 18 governance indicators and 14 sustainable development aspects indicators that were considered as essential in evaluating the progress of IRBM/IWRM program implementation. The 32 indicators relate to each of the components of the SD Framework as shown in **Figures 2.3** and **2.4**.

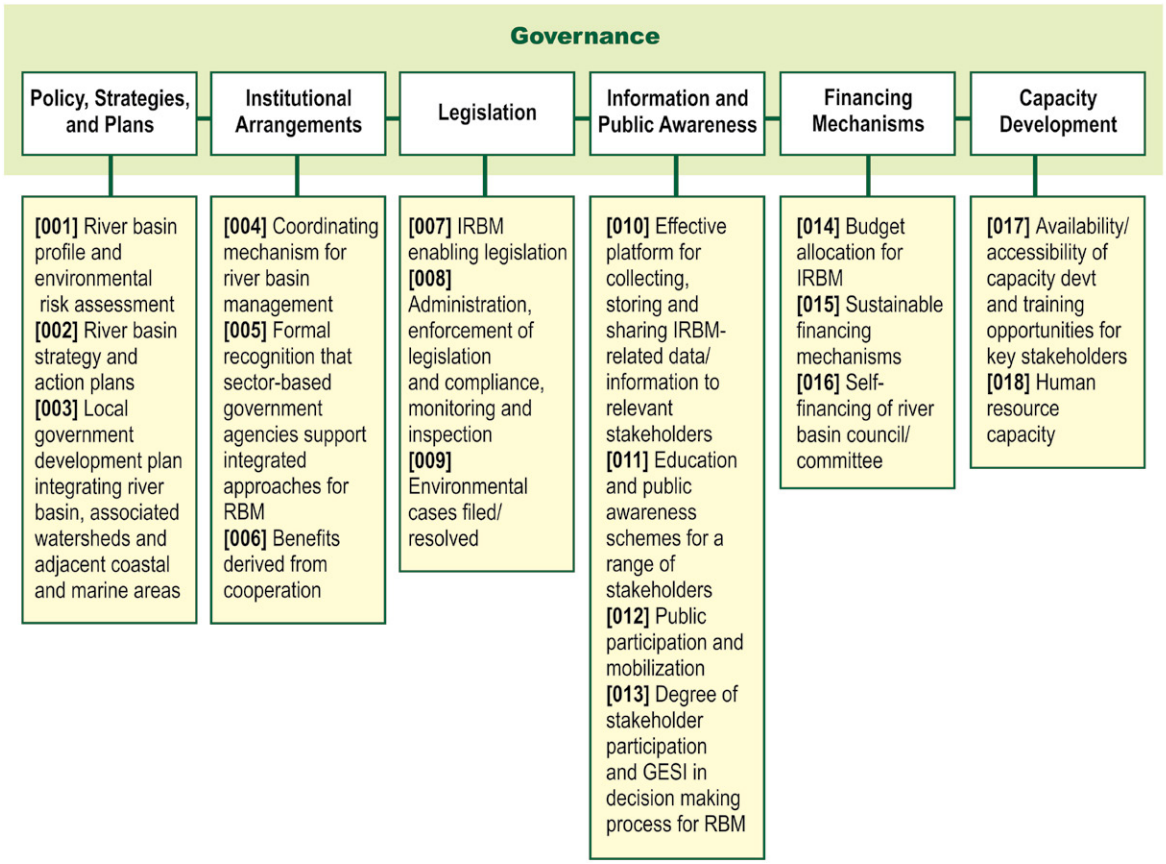


Figure 2.3 Core Indicators for the Governance Elements of the SD Framework

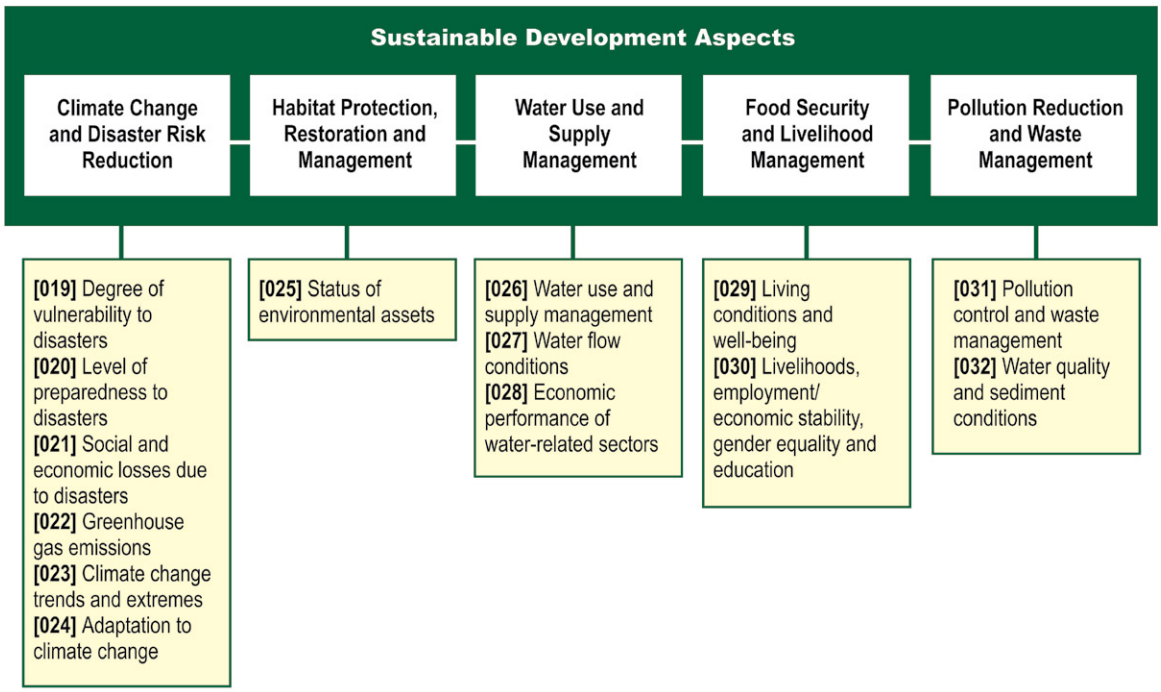


Figure 2.4 Core Indicators for the Sustainable Development Aspects of the SD Framework.

2.3. Assessment Approach and Methodology

This section outlines the method for rating the status of the basin, i.e., relative to the SORB core indicators including rating the overall status for specific governance elements and the sustainable development aspects. The detailed methodology in preparing the SORB report including the assessment and ratings of specific indicator and overall rating for the governance elements and sustainable development aspects is given in **Annex 1**.

The assessment of the current status of the basin relative to specific indicator was done through evaluating the rating for each of the data requirements (**Figure 2.5**). This method of assessing/ rating the Core Indicators for the Governance and Sustainable Development Aspects is similar to what is being applied in other river basins including the Mekong River Basin, which could facilitate the harmonization of basin status assessment that will feed into the refinement of the basin management plan for NTRB.

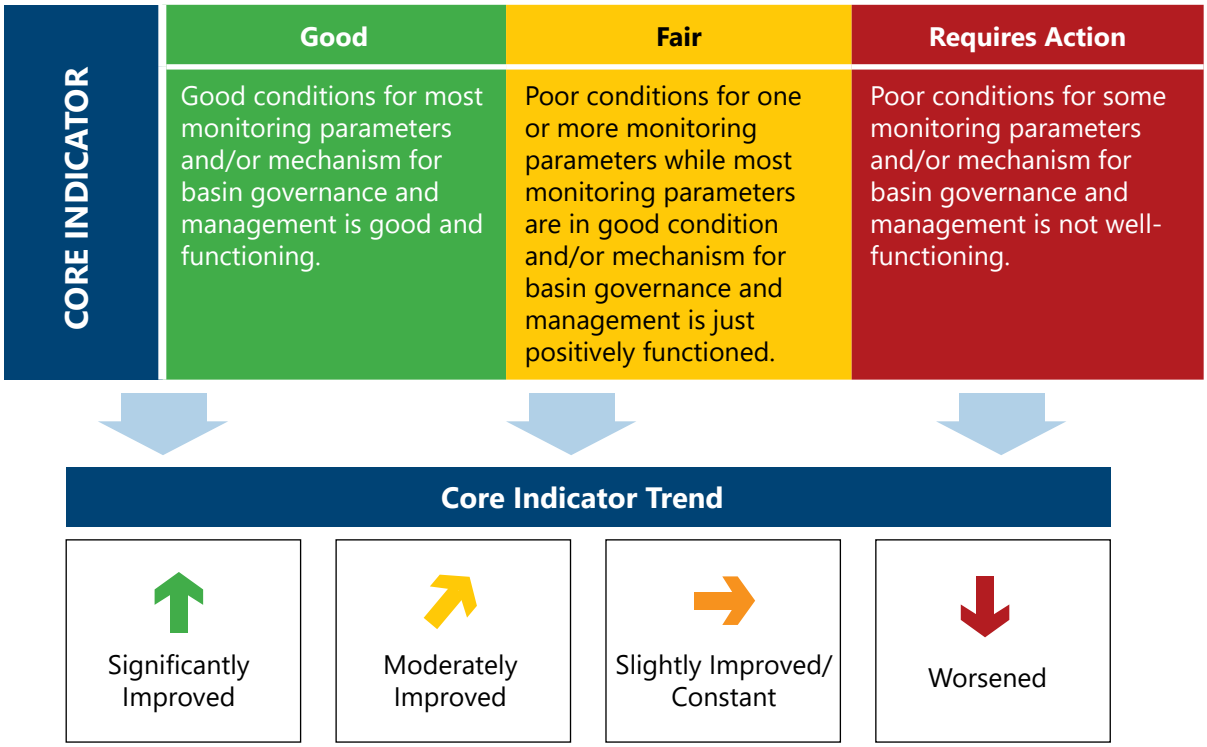


Figure 2.5 Basin Assessment Framework for NTRB SORB Reporting



Photo by John Castillo/PEMSEA



Photo courtesy of DWR

CHAPTER 3

Profile of Nam Tha River Basin

3.1. Development Setting

The Nam Tha River Basin has a total area of 8,918 km^2 and considered the 7th largest river basin in the country. Located in the mountainous area, the basin encompasses three provinces: Luang Namtha (LNT), Oudomxay (ODX) and Bokeo (BOK). The NTRB consists of 328 villages with a total population of 226,182 in 2020, of which 83.5 percent live in rural areas. Development in the NTRB started only in the recent decades and is mainly concentrated in the urban areas in the three provinces.

NTRB is located in the provinces that share borders with China, Myanmar and Thailand. The upper basin borders with China through the Boten-Mohan international check point. Socioeconomic development in the area is notable due to its accessibility to Boten, an special economic zone, through the Lao-Kunming high speed railway.

Two hydropower plants are currently operational in the NTRB, including the 168 MW Nam Tha 1 HPP and the 1.25 MW Nam Tha 3 HPP. The 28.4 MW Nam Tha Hard Muak HPP is currently under construction with other hydropower development projects in the pipeline. Other economic activities in the basin include mining, industries, rubber tree plantation and cultivation of other economically important crops, tourism and other services.

In general, the NTRB is on the road to economic modernization. The National Green Growth Strategy until 2030 aims to exclude Lao PDR from the list of Least Developed Countries (LDCs) as part of the country's commitment to the UN SDGs. Luang Namtha's Socioeconomic Development Plan for 2021-2025 is targeting to reduce the family poverty rate below 14 percent from 24.4 percent in 2019 and elevate the economic conditions in Luang Namtha, Nale and Viengphoukha Districts. The plan also targets to maintain environmental equilibrium, ensuring environment sustainability and green growth, and reduce disaster risks.

Some of the key challenges in the NTRB as reflected in the LNT socioeconomic development plan includes poverty and impacts of climate change that threatens socioeconomic development particularly in the hydropower, mining, industry and agriculture sectors. The implementation of the NTRB Management Plan (2021-2025) following the IRBM approach will contribute to balancing socioeconomic development and environmental sustainability.

3.2. Legal and Institutional Frameworks

Lao PDR has a long history of establishing the legal and institutional framework for the water sector. The Law on Water and Water Resources was adopted in 1996 and amended in 2017. The Water Resources and Environment Agency (WREA) was established in 2009 and evolved into the Ministry of Natural Resources and Environment (MONRE) in 2011. Until 2015, GoL has developed and promulgated the 8th Five-year National Socioeconomic Development Plan

2016-2020 and Vision Until 2030. The 10-Year Strategy (2016-2025) of the Natural Resources and Environment Sector has a vision of: *"Coordinated, optimized and sustainable development and use of water resources, protection of the environment and improvement of social well-being"*. Through this plan and strategy, the IWRM approach is identified as an essential tool for water resources management in Lao PDR. River basin mapping was established comprising 62 river basins, 14 of which were identified as priority river basins in the natural resources and environment sector for 2021-2025. Legal and institutional frameworks for river basin management in Lao PDR have been updated. Policies and strategies pertaining to river basin management in Lao PDR include:

- Water and Water Resources Law (2017);
- Decree on River Basins and Reservoirs Management, No. 20/GoV, 20 January 2021;
- 9th Five-year National Socioeconomic Development Plan 2021-2025;
- 10-Year Strategy (2016-2025) of the Natural Resources and Environment Sector with Vision to 2030, (2015), and
- Strategy on Management and Consumption of Water and Water Resources until 2030, with Vision to 2040 (2023).

The Strategy on Management and Consumption of Water and Water Resources until 2030 with vision to 2040 aims to: *"Manage and consume water and water resources in integrated approaches/principles, ensure good quality and sufficient quantity for support drinking, consumption and sustainable development and inclusive of minimization of damages from water"*. The strategy includes eight strategic plans, 17 goals, 28 priority action plans, and 82 activities. Strategic Plan 1 focuses on integrated river basin management.

The Nam Tha River Basin Management Plan 2021 – 2025 was endorsed in late 2022 with the vision: *"Manage NTRB to ensure sufficient quantity, good water quality, support the development of the economy, society and livelihood of ethnic groups in the green growth and sustainable development direction, and reduce the impact of floods and droughts"*.

According to Decree No. 20/GoV, MONRE, currently the Ministry of Agriculture and Environment (MAE), is directly responsible and serves as the central coordinating agency in implementation of river basins and reservoirs works in coordination with the Ministry of Energy and Mines, the Ministry of Agriculture and Forestry, and other organizations and related local government agencies. Agencies responsible for the management and monitoring of river basins and reservoirs consist of MONRE, PONRE and DONRE and where necessary, Coordinating Committee can be established for the implementation of the river basins and reservoirs work. The Natural Resources and Environment Sector is directly responsible for the development of policies, strategies and management plans for river basins and reservoirs, including assessment and monitoring and water use allocation and permitting. The Energy and Mines Sector is mainly responsible for the assessment, planning, use, management and

monitoring of water and water resources in the reservoirs for hydropower, thermal power and mining. The Agriculture and Forestry Sector is responsible for the assessment, planning, use, management and monitoring of water and water resources in the reservoirs for irrigation, fishery, agricultural production, forest and water source forest protection purposes. Other sectors and local government authorities are responsible for the management, monitoring and implementation of water and water resources related activities in the reservoirs.

In support of the implementation of the NTRB MP 2021-2025 and the GEF/UNDP/ASEAN IRBM Project, the central and provincial governments of ODX, LNT and BOK have issued agreements on the establishment of coordinating committees for the project.

3.3. Physiographic Characteristics

The NTRB is the 7th largest river basin in Lao PDR with a total area of 8,918 km^2 and covers about 3.77 percent of the country's territory. The basin is situated in the northern part of the country across the provinces of ODX, LNT and BOK, which occupies 30.71 percent, 46.75 percent and 22.54 percent of the basin area, respectively (**Figure 3.1**). About 18.83 percent of NTRB is in Nam Ha and Nam Kan NBCA and about 47 percent covers two National Protection Forest Areas (NPTFs), namely Phou Samyord-Yord Nam Park NPTF and Yord Nam Tha NPTF. The NTRB is characterized by a variety of natural resources and ecosystems. It has diverse physiography, with varying combinations and characteristic of land features such as slopes, soils, topography, and vegetation.

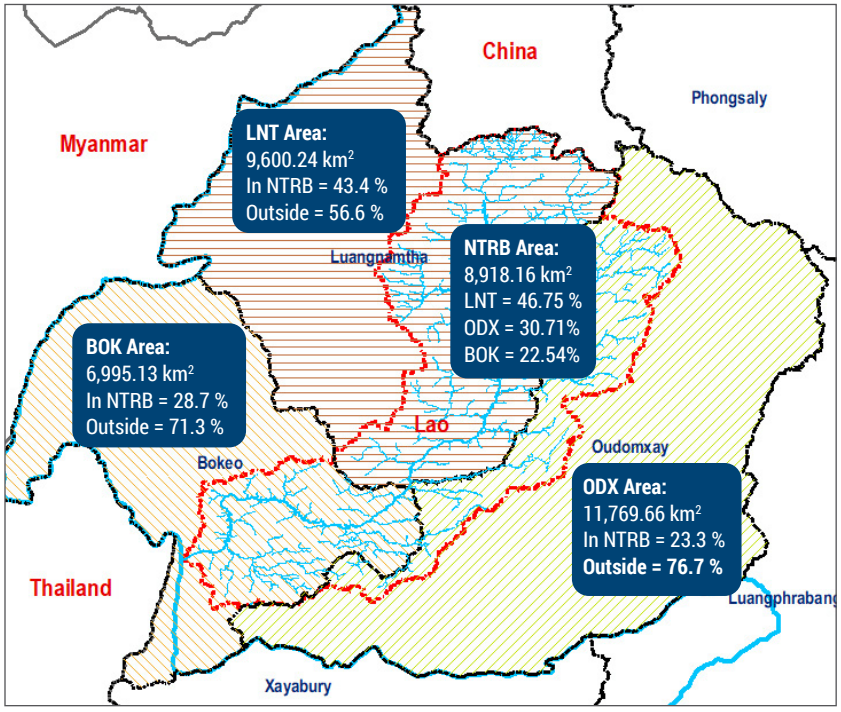


Figure 3.1 Area Coverage of the Three Provinces in the NTRB.

3.3.1. Topography, Geology, and Soils

NTRB has a steep and mountainous geography with elevations ranging from 300 m to 1,900 m amsl. A network of streams, creeks, brooks and gullies is formed over the basin that consist of Nam Tha mainstream and 31 tributaries. Nam Tha River originates from Kouysoung village in Luang Namtha district with an elevation of about 1,200 meters above mean sea level on southern portion of the mountain ridge near the national border with China (**Figure 3.2**). Nam Tha mainstream and its dense tributaries steeply flow and meander through the hillsides of the Provinces of LNT, ODX and BOK with a total length of 325 km and merge at confluence of Mekong River at Ban Paktha in Paktha District of BOK. NTRB is dominated by land slope range of 10 to 35 percent. The percentage of each slope class include plain and low slope land (0 – 10 percent) at 15 percent, middle slope land (10 – 15 percent) at 16 percent; high slope land (15 – 25 percent) at 42 percent; and very high slope land (25 - 35 percent) at 23 percent.

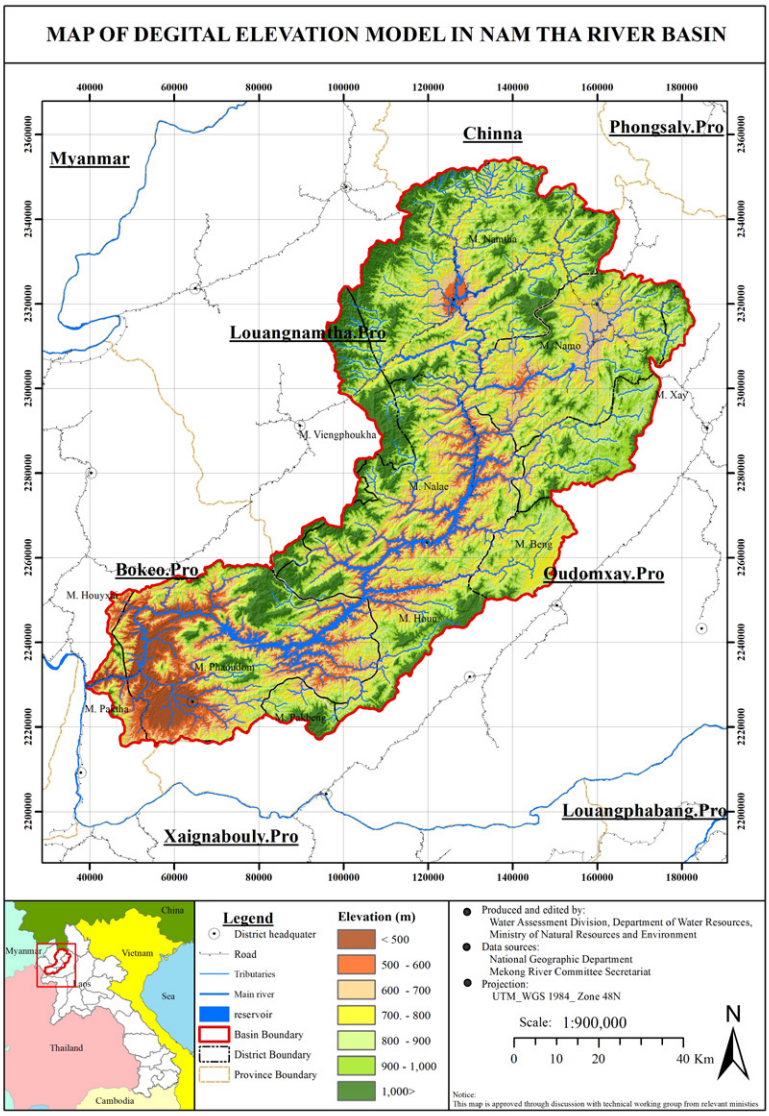


Figure 3.2 Map of Digital Elevation Model in NTRB.

The northern part of Lao PDR as well as NTRB has a complex geological structure. The rock layer of Paleozoic era includes shale, siltstone and sandstone combined with volcanic rocks in various forms such as Andesite, Dacite and Rhyolite. Among them, there are layers of limestone from the Permian to Carboniferous period of the Paleozoic era that can be found in the area. The group of rocks of the Permian period of Paleozoic era largely extend from the northeast through the southwest portions of the basin. Those from the Mesozoic era is largely in the northern part of the basin and scattered in marginal areas of the basin. There is alluvial and mudstone of quaternary era in small part of central Luang Namtha district. The group of sedimentary rocks that mostly cover the basin includes 72 percent sandstone and conglomerate cover; 4 percent limestone cover and 6 percent shale and impermeable rock cover (**Figure 3.3**).

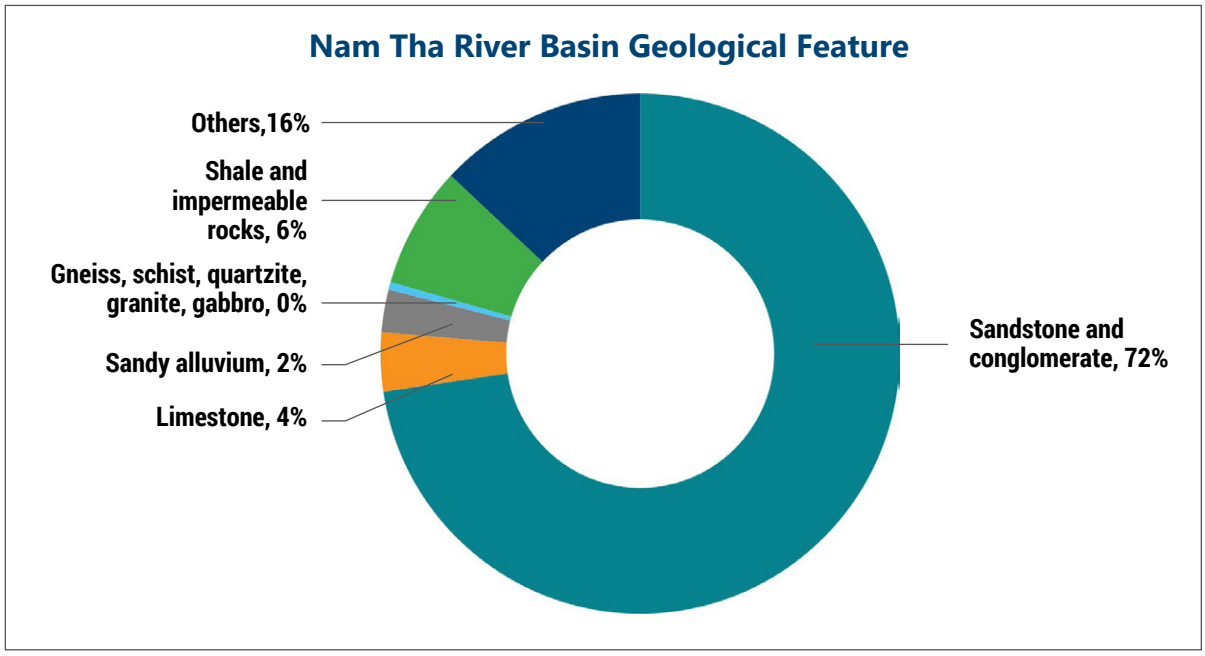


Figure 3.3 Geological Features of the NTRB.

Groundwater in Lao PDR is stored in eight broad types of aquifers. NTRB lies predominately within the Mesozoic and Late Paleozoic Sedimentary hydrogeological groups. Geohydrological aquifer of NTRB based on its geologic system includes about 0.5 percent alluvial, 2 percent karstic of Permian period of Paleozoic era; 54 percent Sedimentary rocks of Paleozoic era and 43.5 percent Sedimentary rocks of Mesozoic era of the basin area (**Figure 3.4**). The Mesozoic and Late Paleozoic Sedimentary hydrogeological groups normally yield ground water recharge with a rate of 0.1 – 1.5 L/sec. Within NTRB, the water table in lowland areas is very shallow. Seepage and spring from groundwater are seen on the surface scattered over the basin especially in hills and valleys during the wet season. Local people harvest water from shallow sources, with well depth in the range of 3 – 8 meters, as their main source of water for domestic use. Ground water level in the basin during the dry season therefore is less than eight meters in depth.

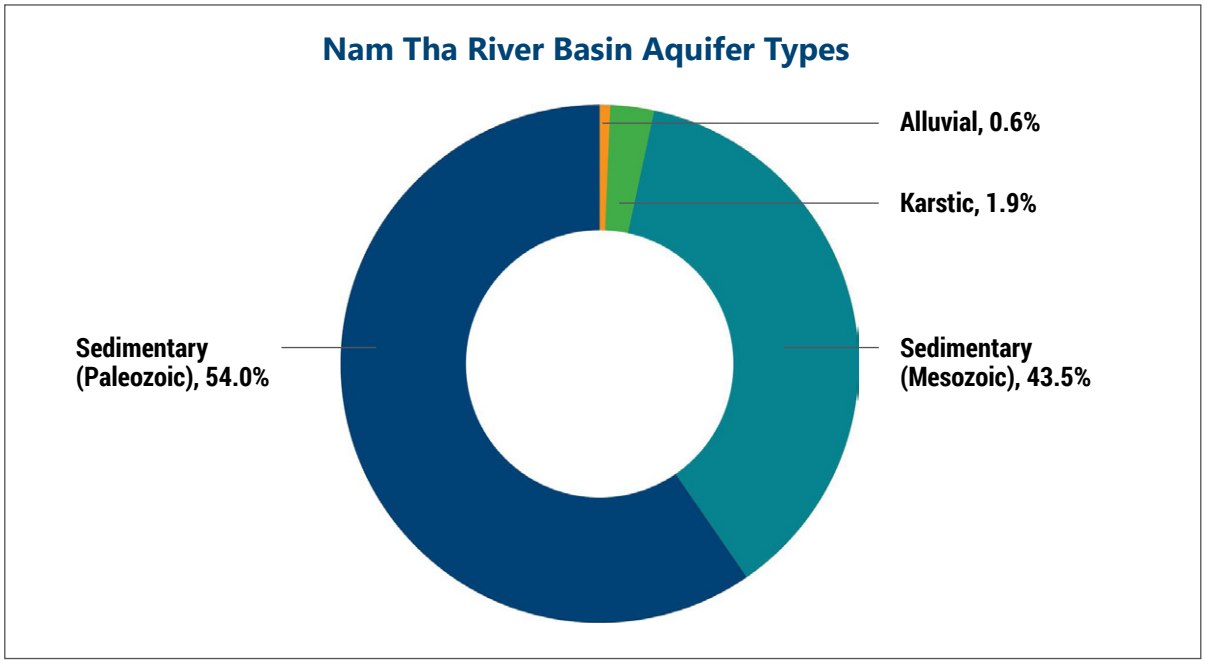


Figure 3.4 Aquifer Types in NTRB.

There are two main groups of soil in NTRB, Acrisols and Cambisols, based on the soil group classification by the Food and Agriculture Organization (FAO) of the United Nations. NTRB is covered by 67 percent Haplic Acrisols, 25.6 percent Dystric Cambilsols, 4.5 percent Ferric Acrisils, and less than 3 percent for the other types of soil. Haplic Acrisols soil is extensively found on the right side of the mainstream from upstream to downstream while the Cambisols soil is scattered over the left side of the mainstream of Nam Tha River.

3.3.2. Geomorphology

The shape of NTRB is wider in the upstream and narrower in the middle and downstream parts of the basin. The mainstream deeply cut across high mountains and drain at low altitude forming steep longitudinal profile section of the mainstream. NTRB comprises four sub-systems with distinct morphological, hydrological, biological and settlement characteristics that vary from the highland down to the river confluence.

High land sub-system: represents the marginal areas of the basin and mountain areas scattered within the basin. This sub-system is characterized by mountain range with abundant mixed-deciduous or evergreen forest; habitats with high biodiversity; subtropical climate; high humidity; high precipitation and remote areas with settlement of ethnic groups that rely on upland cultivation and harvesting of Non-Timber Forest Product (NTFP). The sub-system is characterized by deforestation and high soil erosion.



High land sub-system. (*Source: https://luangnamthatourism.org/luangnamtha/about/nalae/*)

Valley sub-system: occupies the lower parts of the mountains, brooks, streams and floodplain along tributaries of the rivers. Ground slope ranges 10 – 25 percent and ground elevation ranges 600 – 1,000 m amsl. This sub-system is characterized by chains of low mountains; transition of climate zones from tropical savanna climate zone to humid subtropical climate zone; high humidity; abundant watercourses and vegetation; high sedimentation along streams; remote areas with settlement of ethnic groups that rely on multiple crops cultivation in valley areas, upland cultivation, and NTFP harvesting.



Valley sub-system.
(*Source: https://www.asiakingtravel.com/attraction/luang-namtha*)

Plain sub-system: characterized by the lowland plains as well as flood plain of the mainstream Nam Tha River and its major tributaries, including the central district of Na-Mor, Luang Namtha, Nale and Paktha; tropical savanna climate zone; very dry in dry season; extensive paddy fields; district municipality has more developed infrastructures and utility services.



Plain sub-system.
(*Source: http://phouiu-ecotourism-laos.com/luang-namtha/*)

Watercourse sub-system: represents the shallow flood plain areas along the mainstream and river banks with steep mainstream sections. Characterized by settlement on river banks and tropical savanna climate zone.



Watercourse sub-system.
(*Source: https://kpl.gov.la/EN/detail.aspx?id=77291*)

3.3.3. Meteorology and Hydrology

NTRB is situated in the mountainous area and the mainstream has relatively steep longitudinal profile with ground elevations ranging from 300 meters to 1,900 m amsl. It is situated in the Tropical Savanna (Aw) Climate zone and Temperate, dry winter, hot summer (Cwa) climate zone or the Monsoon-influenced humid sub-tropical (Cwa) climate zone. The lowland area southwest of the basin is situated in the Aw climate zone and the high land area in the north in Cwa climate zone (**Figure 3.5**).

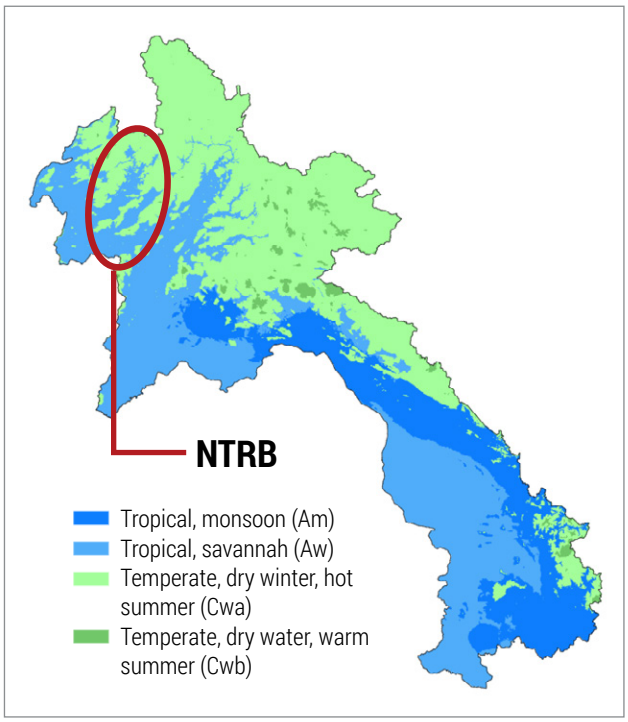


Figure 3.5 Köppen-Geiger Climate Classification Map for Laos (1980-2016). *(Source: Beck, H.E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. https://en.m.wikipedia.org/wiki/File:Koppen-Geiger_Map_LAO_present.svg)*

The tropical savanna or Wet and dry climate zone in the lowland area of NTRB is characterized by pronounced wet and dry seasons. In summer, the temperature is between 25°C and 30°C, while in the winter, the temperature is between 20°C and 30°C, but remains above an 18°C mean. In the driest month, precipitation falls below 60 mm/month. For more than three dry season months, the total annual precipitation range from 1,000 – 1,500 mm. Dry season can become severe, with some months with no rainfall, and drought conditions prevail during the course of the year.

The high land area of NTRB has a temperate, dry winter and monsoon-influenced hot and humid summers. Temperature during the coldest month is 0°C and 18°C. Moderate winter temperatures do not produce snow cover. Summers are typically long, hot and humid. The mean temperature during the warmest month is 22°C or higher. Monthly mean summer temperature ranges from 24 - 27°C.

Meteorological and rainfall information collected during the years 1990 – 2020 from meteorological stations in NTRB is shown in **Figure 3.6**. Maximum monthly temperature ranges from 24.6 – 31.6°C. Mean monthly temperatures range from 18.5 – 25.8°C. Minimum monthly temperature ranges from 11.6 – 21.7°C. For ODX, data precipitation in the months of January, April and October are higher than that of February, May and November. Minimum precipitation falls within the range of 10.04 – 14.73 mm/month in the month of February with the highest range of 303.1 – 311.51 mm/month recorded in the month of August. Annual rainfall are 1,473m m, 1,449 mm and 1,463 mm/year in ODX, LNT and BOK, respectively.

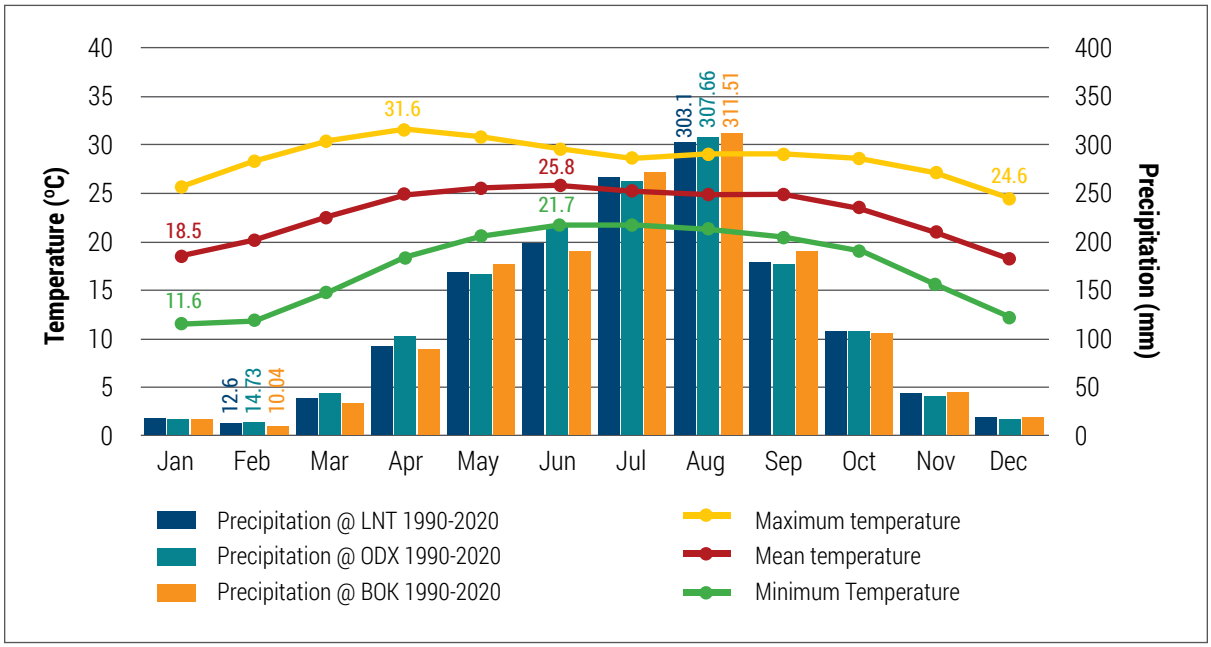


Figure 3.6 Monthly Precipitation and Temperature in Aw Zone in NTRB during 1990 – 2020.

The hydrological system of Nam Tha River is influenced by the shape of the wider upstream basin; steep upper course and gentle middle course; the river morphology; climate zoning and land cover, including the occurrence of occasional flood. Water elevation at the Pak Tha hydrological station recorded in 1985-2008 and 2010-2019, indicated that Nam Tha River drains water into Mekong River at an average of about 3,570 million m^3/year or about 233 m^3/s with a maximum flow recorded on 11 August 1991 at about 4,310 m^3/s. The maximum daily average flow during the period 1985-2008 was 459 m^3/s and the minimum daily flow was 58 m^3/s. The average monthly flow is about 158 m^3/s; the highest average is 1,207 m^3/s and the lowest is 43 m^3/s (DWR, 2022).

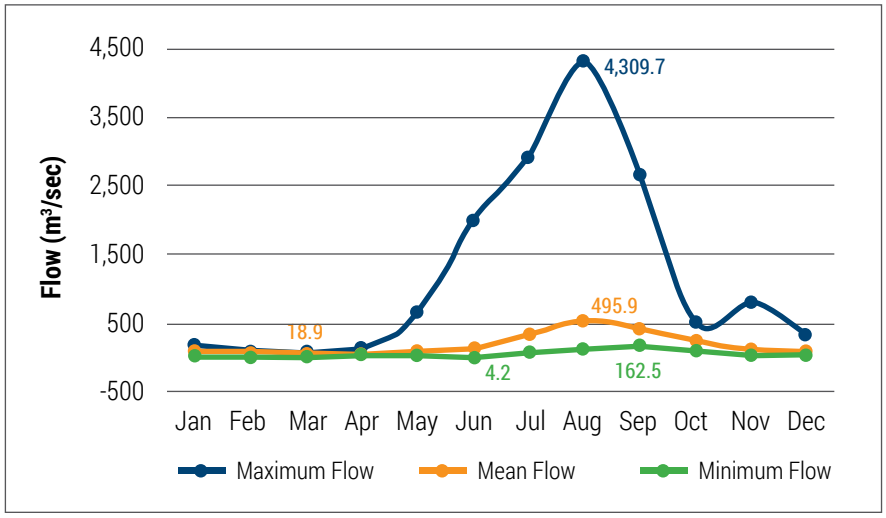


Figure 3.7 Monthly Outflow of Nam Tha during 1985-2008 and 2010-2019.
(Source: DWR, 2022)

3.3.4. Land Cover and Terrestrial Biodiversity

NTRB harbors primitive forest types with high biodiversity and a variety of ethnic groups. Protected areas which include conservation areas, protection forest and production forest at national, provincial and district levels cover about 76.38 percent of the basin. The Nam Ha National Biodiversity Conservation Area (NBCA), a national protected area located in Namtha Province, is home to a variety of ethnic groups and diverse animal and plant species. Nam Kan NBCA on the other hand is a protected area located in Bokeo Province. Dry evergreen forest and mixed deciduous forest can be seen over the basin.



Nam Ha NBCA
(*Source: https://www.dreamstime.com/lush-tropical-forest-nam-ha-national-protected-area-laos-npa-located-luang-namtha-province-laos-first-park-asean-image127284283*)



Nam Kan NBCA
(*Source: https://www.dreamstime.com/lush-tropical-forest-nam-ha-national-protected-area-laos-npa-located-luang-namtha-province-laos-first-park-asean-image127284283*)

A total of 1,678.89 km^2 or 18.82 percent of the basin area in the northwest and north is in the Nam Ha NBCA and Nam Kan NBCA. Protection forests which cover about 47 percent of NTRB include Nam Tha National Protection Forest (Nam Tha NPTF), Phousamsoum-Yord Nam Phak NPTF, and other protection forest in provincial and district levels. National level Production Forest (NPF) such as Phou Let – Long Moun NPF and PhouViengxay NPF cover about 9 percent of NTRB.

The NTRB including Nam Ha NBCA is home to a variety of animals, plants and birds, a number of which are globally threatened by hunting and increasing habitat loss. It harbors a unique and highly diverse flora with 64 families, 145 genera, and 189 plant species distributed in the Nam Ha National Biodiversity Conservation Area. A total of 56 families, 117 genera, and 148 plant species which comprise more than 78 percent of the total plant species were identified as endemic plants to Lao People's Democratic Republic (ScienceDirect, 2024). It was also reported that there at least 38 species of large mammals, over 22 endangered mammal species and about 297 bird species. Some of the more spectacular mammals found in the protected area are tigers, clouded leopard, macaques, pangolins, wild Asian elephants, Asiatic black bears, Malayan sun bears, gaur, and wild boar (Nam Ha-NPA.Org, 2024).

NTRB has a dense forest cover where about 54.55 percent of its total area consist of primary forest and 37.2 percent regenerated forest forming a total of 91.67 percent forested land in the basin. Forests area in NTRB has decreased by about 2.5 percent during the period 2005-2010 due to increasing conversion to agricultural land. Until 2015, the forest cover in the basin was relatively higher than in 2005 (**Figure 3.8**).

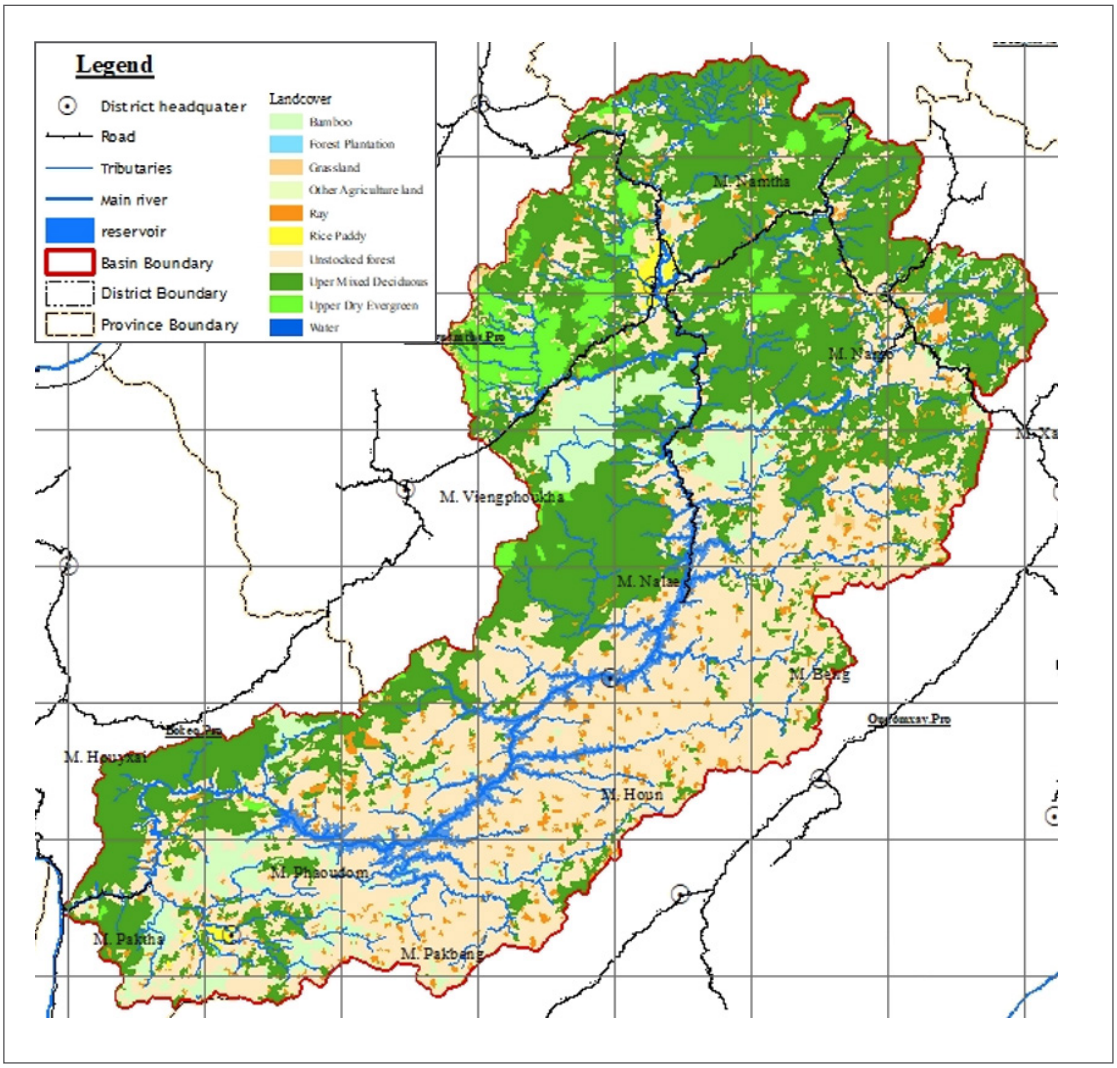


Figure 3.8 Land Cover in NTRB in 2019.

3.4. Demographic Profile

3.4.1. Population

NTRB covers 11 districts of the provinces, of which three districts, namely Luang Namtha, Nale and PhaOudom are located entirely within the basin and about 76 percent of Na-Mor

district. The remaining eight districts are partially located in the basin with only 1.2 percent of the villages of Houay Say district. In 2022, the 11 districts which cover 762 villages have a population of 554,349 with 103,718 households. Within the NTRB, the 328 villages have a population of 226,182 with 40,190 households. Rural population in the 295 villages is 188,858 accounting for 83.5 percent of the total population in the rural areas (**Table 3.1**).

Table 3.1 Population in the NTRB in 2022.

No.	Province	District	Population in NTRB						Rural Population			
			Total no. of village in district	% of total village	Village	Families	Households	Persons	Village	Households	Persons	% of Total Population
1	Oudomxay	Xai	21/97	21.6%	21	2,848	1,950	12,900	21	1,950	12,900	100%
2		Na-mor	48/63	76.2%	48	9,629	6,521	38,558	44	5,501	32,700	84.8%
3		Beng	11/57	19.3%	11	1,864	1,428	7,692	11	1,428	7,692	100%
4		Houn	21/93	22.6%	21	2,071	1,865	13,009	21	1,865	13,009	100%
5		Pakbeng	8/53	15.1%	8	844	588	4,513	8	706	4,513	100%
6	Louang Namtha	Luangnamtha	78/78	100%	78	15,228	12,777	64,811	63	8,952	46,199	71.3%
7		Nale	58/58	100%	58	5,926	4,718	25,427	58	4,718	25,427	100%
8		Viengphoukha	9/46	19.6%	9	948	742	4,272	9	742	4,272	100%
9	Bokeo	Paktha	7/34	20.6%	7	1,084	965	5,252	2	212	1,521	29%
10		PhaOudom	66/66	100%	66	10,055	8,520	48,590	57	6,830	39,467	81.2%
11		HouayXay	1/82	1.2%	1	246	116	1,158	1	116	1,158	100%
TOTAL			**328/727**	**45.1%**	**328**	**50,743**	**40,190**	**226,182**	**295**	**33,020**	**188,858**	**83.5%**

Settlement in the NTRB is characterized by dense population in the districts along the main road and rivers and on the plain, notably in Na-Mor, Luang Namtha and PhaOudon districts. In other areas, the communities are scattered over the basin. All villages in the district of Xai, Beng, houn, Pakbeng, Nale, Viengphoukha and Houay Day are located in rural areas. There are 33 villages which account for 16.5 percent of total basin population that are located in district municipality of Na-Mor, Luang Namtha, Paktha and PhaOudom (**Figure 3.9**).

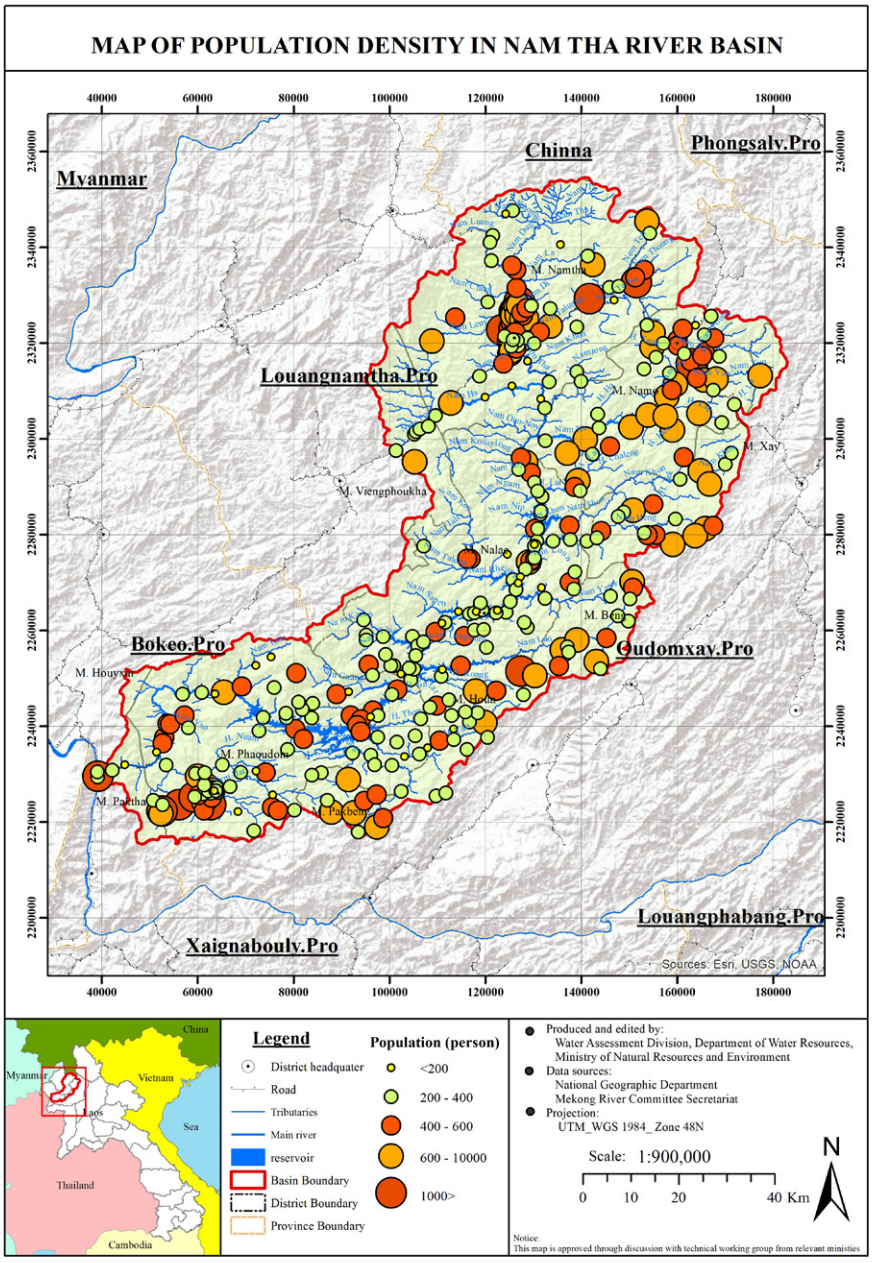


Figure 3.9 Map of Population Distribution in NTRB. *(Source: DWR, 2022)*

3.4.2. Diversified Ethnicities in NTRB

With formal recognition by the National Assembly (NA), there are 50 ethnic groups that are classified into four ethno-linguistic families: Tai-Kadai, Hmong-Mien, Tibeto-Burman and Mon-Khmer. Of the 50 ethnic groups, eight are in Tai-Kadai, two in Hmong-Mien, seven in Tibeto-Burman and 33 in the Mon-Khmer family. Under the ethnic groups, there are 149 ethnic branch groups.

In northern Lao PDR, LNT hosts the highest number of ethnic groups. The Five-Year Socioeconomic Development Plan 2021-2025 of Luang Namtha Province and all districts in NTRB indicates that there are 17 ethnic groups in LNT and in the 11 districts in NTRB and 16 ethnic groups are scattered over NTRB. The 17 ethnic groups include Lao (Phouan), Tai (Tai Dam), Lue (Tai Lue), Yuan (Nyouan), Yang (Yeuang), Tai Neua, Khmou, Bit, Lamet, Saam Tao, Hmong (Hmong Dam), Il-mien (Laen Taen), Akha, Singsali (Phounoi), Lahu (Kui), Sila (Sida), and Ho (Hor). Only Ho (Hor) ethnic group is the only ethnic group that is not in NTRB. The proportion of each ethnic group in the NTRB is shown in the **Figure 3.10**.

Information on the settlements and way of life of the ethnic groups in NTRB is provided in **Annex 2**.

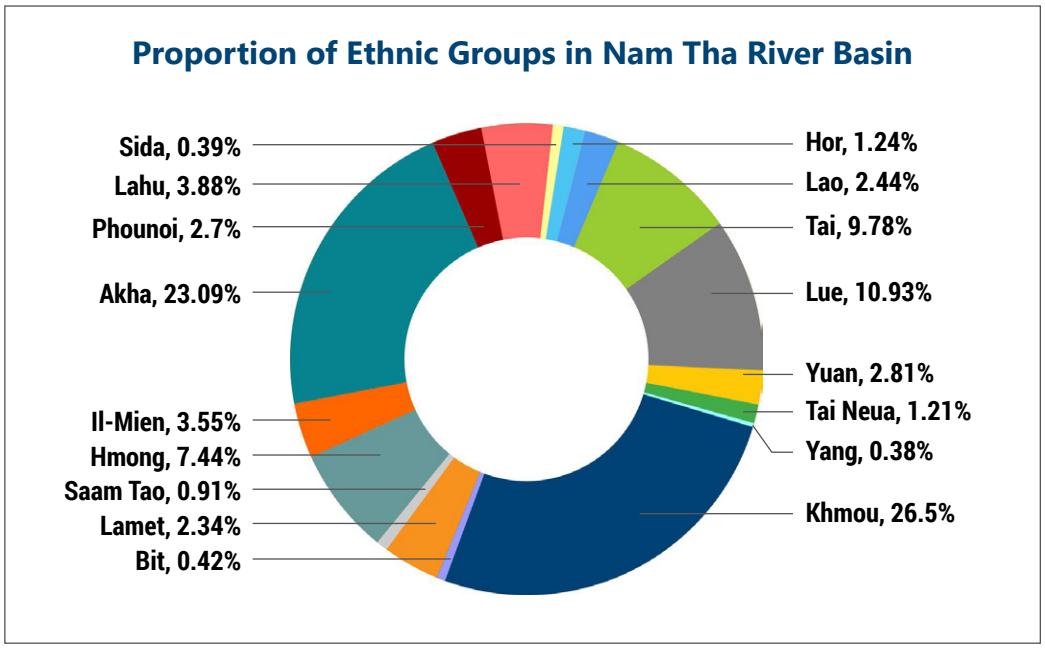


Figure 3.10 Proportion of Ethnic Groups in NTRB.

3.5. Economic Profile

3.5.1. Socioeconomic Context

There are three districts situated within the basin of NTRB namely Luang Namtha, Nale and PhaOudom districts while other eight districts are partially located in the basin. The provincial capital of LNT is located in NTRB while the other two provinces are outside NTRB. During the period 2015-2019, the GDP growth rates of districts in NTRB were between 4.51 percent and 8.50 percent with an average of 7.00 percent. The GDP per capita of each of the 11 districts

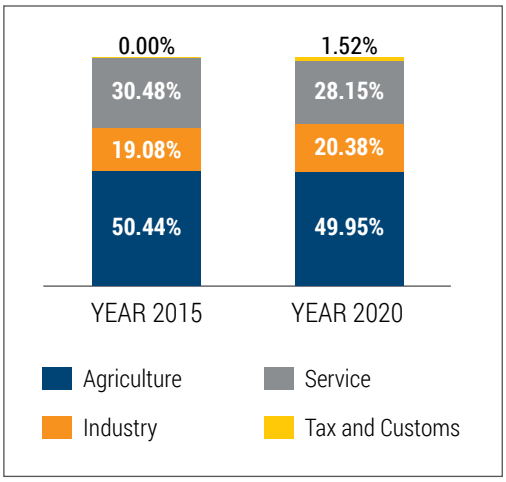
were between US$ 822 and US$ 1,873 with an average of US$ 1,163 (**Table 3.2**). All 11 districts with 265 villages were considered poor villages. About 25,755 households, estimated at 24.8 percent were poor households. The proportion of the poor villages and households have been consistently decreasing over the years.

Table 3.2 Population and GDP per Capita of NTRB (2015 and 2019).

No.	Province	District	Population (in 2019)	GDP per capita in 2015 (US$/yr)	GDP per capita in 2019 (US$/yr)	GDP growth (2015-2019)
1	Oudomxay	Xai	84,918	n.a.	1,588	7.00%
2		Na-mor	42,697	1,081	1,319	6.39%
3		Beng	41,721	n.a.	1,163	4.51%
4		Houn	87,583	n.a.	1,873	8.00%
5		Pakbeng	32,993	n.a.	825	6.82%
6	Luang Namtha	Luangnamtha	59,016	n.a.	1,753	8.50%
7		Nale	25,969	n.a.	1,145	7.93%
8		Viengphoukha	25,586	n.a.	1,032	6.60%
9	Bokeo	Paktha	21,232	n.a.	1,159	6.70%
10		PhaOudom	45,905	n.a.	822	7.11%
11		HouayXay	84,132	n.a	1,820	7.60%
TOTAL/Average			**554,349**	**n.a.**	**1,163**	**7.00%**

During the period 2016-2020, the GDP of LNT was 3,114.42 billion KIP (Exchange rate US$ 1= 8,500 KIP in 2018) with a GDP growth of 8.56 percent and GDP per capita of US$ 1,897.51. The GDP of agriculture sector grows at 8.84 percent, industry at 7.87 percent and service sector at 3.10 percent. The composition structure of the three sectors including tax and custom has slightly changed where the service sector has been decreasing while an increase in the industrial sector was noted. The agriculture sector takes up 49.95 percent of the economy of LNT (**Figure 3.11**).

Figure 3.11 Economic Structure of Luang Namtha Province, 2015 and 2020.



The agricultural products include rice, other agricultural plant and economic crops such as sweet potatoes, potatoes, taro, corn, sugarcane, beans among others, and meat. Agriculture contributes significantly to the livelihood of communities in NTRB and to the provincial economy.

The socioeconomic development in NTRB has two pillars: macro investment development and community development. Under macro investment development, industrial and service economy are prominent in the central provincial area particularly in Luang Namtha district and some parts of Na-Mor district. Hydropower and mining development are spread over the basin. Investments in hydropower, mining and other industries and services are driven by private sectors. Infrastructures and utility services development and urbanization on the other hand are driven by the government authorities. In the hydropower sector, there are three hydropower projects in NTRB that are operational: 168 MW Nam Tha 1 HPP and 1.25 MW Nam Tha 3 HPP 1.25 MW and under construction is the 28.4 MW Nam Tha Hard Muak HPP. There is lack of information on the number of development projects in the other sectors such as mining, industrial factory, agricultural, and urbanization.

The community development pillar is largely influenced by the ways of life and perceptions of the ethnic groups in relation to their livelihood and well-being. Communities inhabiting the lowland and valleys have opportunities for enhancing household income through cultivation of rice, corn, sugar cane and rubber. The highland communities are engaged in diversified crops production, livestock breeding, handicraft making and NTFP harvesting.

The water resources of Nam Tha River and its tributaries are indispensable to the lives and livelihood of the people. The way of life and livelihoods of the basin communities are reflected in the land use and land cover proportion in the basin. There are 682.26 km^2 agricultural land area which accounts for 7.70 percent of total area of NTRB and 1.34 ha/family which can be considered large for agricultural production. Within the agricultural land, there are 89.01 km^2 of lowland paddy field with an average of 0.175 Ha/family and 0.22 Ha/household which are considered relatively small. Communities in NTRB largely rely on upland agriculture.



Local Communities in NTRB.
(*Source: https://laolandinfo.org/en/luang-namtha-province/*)

The Five-Year Socioeconomic Development Plan of the 11 districts shows that in late 2019 or 2020, about 88.4 percent of the households were connected to electrical power grid. In PhaOudom and Pakbeng Districts, 18-20 percent of the villages had no access road; 97.3 percent of households had access to safe water; 83.5 percent of households were equipped with improved sanitation facilities; 19 percent of children under 5 years of age were undernourished; children under 5 years of age had mortality rate of 10.5 person per 1,000 people; the mean primary school enrollment rate was 98.9 percent, and the mean lower secondary school enrollment rate was 89.5 percent.

3.6. Environmental Challenges in Nam Tha River Basin

In 2017 – 2019, DWR conducted an assessment of NTRB for the preparation of a basin profile report and a management plan paving the way for evidence-based action planning and programming for water resource management and development in the basin. Key issues identified included: (i) land use change; (ii) hydropower development; (iii) unsustainable agricultural practices; (iv) urbanization and industrial development; (v) infrastructure development; (vi) flooding and drought; (vii) soil erosion; (viii) mining; and (ix) Unexploded Ordnance (UXO).

More recently, additional key issues identified included: (i) improper waste management; (ii) uncontrolled fishing and hunting; (iii) climate change effects; and (iv) changes in geomorphology and shape of the basin.

3.6.1. Climate Change and Variability

Based on the information from the World Bank, the average temperature of the three provinces in NTRB is increasing. During the period 1901-1950, temperatures tended to be higher and peaked in the 1930's. Average temperature during the period 1950-1970 was lower during the last 20th century. Since the 1970s, the temperature in the NTRB increased on average from 22 to 24°C. Additionally, the average precipitation during the period 1901 - 2018 ranges from 1,350 – 1,600 mm/year while annual precipitation ranges from 1,100 – 1,750 mm. Fluctuation in temperature was observed every 5 – 10 years. Precipitation was recorded at 1350 mm/year in 1990s with no distinct changes (DWR, 2021).



Flood in Central Luang Namtha District on 11 September 2024.

An assessment of national climate change vulnerability conducted by MONRE in cooperation with the United Nations Human Settlement Program (UN HABITAT) in 2019 revealed that

Luang Namtha, Oudomxay and Bokeo Provinces are vulnerable to various climate related hazards (DWR, 2021). It is widely recognized that climate change has become a major concern. From the recorded precipitation in NTRB during the period 1985 – 2018 and the recorded floods and drought occurrence in NTRB, it was found that the intensity of torrential rainfall in the basin has been increasing every two to three years. The more evident one was the severe flood in LNT during 9-15 September 2024 due to typhoon Yagi.

Key issues described above have influence the health of the basin causing it to be more vulnerable to the impacts of climate change.

3.6.2. Increasing Pressures on the Natural Resource Base

NTRB has an advantage over other areas in Lao PDR in terms of geographical location, climate, water resources and biodiversity. Several factors, however, are exerting pressures to the natural resources in the basin.

◊ Economic investments (hydropower, industry, mining, infrastructure, urbanization, services)

Investments in the sector of hydropower, industry, mining, infrastructure, urbanization and services have been increasingly in the basin over the last decades. These developments have affected water quality and hydrology; enhanced soil erosion and sedimentation and biodiversity loss among others.

Hydropower: The operations of Nan Tha 1 HPP and Nam Tha 3 HPP and other irrigation weirs in the mainstream of NTRB and its tributaries has created reservoirs and elevated the water level in the mainstream. With limited information to the public on regulating the reservoirs, vulnerability to flooding is imminent when releasing water downstream. Hydropower development can further impact the ecology, hydrology, enhance soil erosion and sediment flow and changes in quality of water downstream. Additionally, hydropower development reduces water availability and cause decline in quality water in resettlement village, reservoir banks erosion and low water quality in the reservoir.

Urbanization and industrial development: The development of industrial and service areas such development of the new modern industrial zone in Luang Namtha District and the Special Economic Zone (Boten Dan Kham) near the Laos-China border will lead to biodiversity loss and deterioration of ecological resources due to the discharge of wastewater from various industrial factories such as paper mill factories, rubber mill factories, stone crushing plants, mineral processing plants, including increase in solid waste generation. Wastewater and solid waste discharges from the urban areas with increasing population also contributes to the deterioration of natural resources, both aquatic and terrestrial, and water quality.

Infrastructure development: The growth of urban areas, the construction of roads to the rural areas and the connection between urban areas and provinces such as the construction of the railway through Oudomxay and Luang Namtha (Xay, Na-Mor and Luang Namtha district); the planned construction of highway along the path of the railway and the R3 road; the expansion of a new settlement area for those displaced from the development of the hydroelectric power plant in Nale and PhaOudom District and the construction of new settlement sites for the affected people displaced from the railways areas and the railway station have potentials for negatively impacting the condition of NTRB particularly altering the flow and flow rate of watercourses in the basin, including soil erosion and sedimentation.

Mining development: The mining and processing of gold ore in Nale District and the mining of other ores in Na-Mor District such as barite ore, zinc ore, copper ore and iron ore have negative consequences for the upper basin. In addition, the chemicals used in the processing of gold ore in the upper basin in Pakbeng district could pose high risk on the water resources and ecosystem in NTRB.

◊ Losses of vegetation cover and unsustainable agricultural practices

Unsustainable agricultural practices: Commercial plant crops cultivation and shifting cultivation that involve forest clearance, use of fertilizers, herbicides, insecticides and pesticides, fungicides and other chemicals in the basin, especially in the banana, rubber, corn and other production areas in agriculture are increasing rapidly in the basin.

Loss of vegetation cover: Change in land use and loss of forest cover in the basin from expansion of agricultural land, investments in industrial trees and crop plantation, including shifting cultivation, encroachment in forest land, loss of forest land by development of hydropower and resettlement sites.

Local livelihoods and deforestation nexus: Limitations in agricultural production and ensuring survival of the diversified ethnic groups inhabiting the high land areas of the basin force them to do upland cultivations and forest products harvesting. Their livelihoods are linked with shifting cultivation that resulted to deforestation in remote areas with good forest cover. With the increasing demand and market accessibility by the local people, there has been a noticeable increase in commercial agricultural products that can be translated to increased deforestation.

◊ Unsustainable fishing and hunting practices

With the demand of economically valued natural resource foods including fishes, wildlife and NTFPs, fishing and hunting are not only practiced for the local communities' consumption but also for their livelihood. Unsustainable fishing and hunting practices continue to exert pressures on the wildlife, fishes and other important economically important resources in the NTRB.



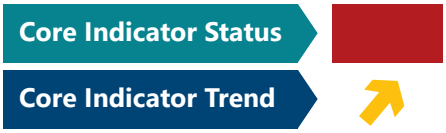
Photo by John Castillo/PEMSEA

CHAPTER 4

Status and Trends on Governance Aspects

GOVERNANCE

4.1 Policy, Strategies and Plans



[001] River Basin Profile and Environmental Risk Assessment

Description

This indicator shows the availability of river basin profile and results from environmental impact/risk assessment, in order to identify priority issues or threats to sustainable and integrated river basin management, including natural resources management within the basin.

Rationale

Effective river basin management relies on planning that takes into account strategic and scientific assessment of the area, including social, cultural, political, economic, environmental, and policy issues, and the identification of priority concerns for river basin managers and policymakers. This strategic assessment should be the basis for developing strategies and action plans for river basin management.

Data Requirements

- Evidence of the availability of river basin profile in the form of published reports/documents/papers
- Evidence of available environmental impact/risk assessment report of the river basin
- Priority issues identified

Results

Since the adoption of the ASEAN Strategic Plan of Action on Water Resources Management in 2005, the GoL has progressively improved the governance mechanism for water resources management, including the river basin management assessment and planning.

River basin profiles for priority river basins including the NTRB were prepared starting in 2010. Recent available assessment and profile reports on the status of NTRB include:

River Basin Mapping for Lao PDR (2015)

The river basin mapping for Lao PDR was conducted by DWR in cooperation with line departments of MONRE and concerned sectors in 2015. The mapping delineated the boundaries, including areas and other parameters of the 62 river basins in Lao PDR, including the Nam Tha River Basin. The river basin maps are publicly accessible at DWR and its webpage.

Nam Tha 1 HPP Environmental Impact Assessment (2007)

Nam Tha 1 Hydropower Project Environmental Impact Assessment (Nam Tha 1 HPP EIA) (2007) was conducted by Earth System Consulting Pty. Ltd. to determine the key environmental issues, the significant cumulative impacts on socio-economic and cultural environments and identify commendations to avoid, mitigate and manage adverse environmental impacts.

Identified environmental issues include:

- Impacts to terrestrial and aquatic biodiversity;
- Changes to downstream hydrology associated with impoundment;
- Impacts associated with sediment transport;
- Impoundment water quality and changes to downstream water quality, and
- Environmental issues associated with road transport.

Nam Tha River Basin Water Resources Assessment Report (April 2021)

The NTRB Water Resources Assessment Report (April 2021) was prepared by the Natural Resources and Environment Research Institute (NRERI) under MONRE with technical assistance from the Earth Systems Consulting Pty. Ltd. The study was part of a program of developing and updating the water resource assessments for eight priority river basins in Lao PDR. The objectives of the program included: (i) Provide recommendations for basin modelling improvements including ground-based data collection and use of previous data; (ii) Update and develop river basin models based on current climate and development conditions; (iii) Develop possible scenarios for potential future developments and climate change, and (iv) Prepare the water resource assessment reports.

Conclusions from the assessment included:

- There is abundant surface water availability in NTRB that far exceeds consumptive water demands and that extractive water use is very low and there may be opportunities to further utilize Nam Tha River water resources.
- Water availability and extractive water demand vary geographically across NTRB with the highest extractive water uses occurring in the Nam La, Nam Xe, and Nam Hat sub-catchments.

- Evaporation losses from hydropower are negligible in NTRB and represent a very low proportion of water availability but losses from evaporation and infiltration are high compared to some other basins in southern Lao PDR. Due to an absence of flow gauge data, these losses are not able to be verified.
- Modelled high, low, and median flows at the Nam Tha River outlet into the Mekong River for current basin conditions (2010 – 2019) are: drought river flow (1st percentile): 0.26 m^3/s; low river flow (10th percentile): 0.57 m^3/s; median river flow (50th percentile): 12.76 m^3/s; high river flow (90th percentile): 328.67 m^3/s; and peak river flow (99th percentile): 1,196.52 m^3/s.
- Modelled outflows from the Nam Tha River are 3,482 million m^3/year, which is comparable to existing studies of the Nam Khan River which range between 2,489 and 7,500 million m^3/year.
- SWAT model results indicate that the annual sediment transport of the NTRB into the Mekong River is approximately 150 million ton/year.

Nam Tha River Basin Profile Report (December 2022)

Previous river basin profiles for other priority basins in the country were prepared in separate volume from the river basin management plant and prepared in English. In the case of NTRB, both the profile report and management plan are in Lao language and the findings in the profile report were incorporated into the management plan.

Nam Tha River Basin Profile Report (December 2022) was prepared by DWR from data collected during the period 2017 – 2022. The key components of the profile report included: (i) context and setting of the basin; (ii) assessment of water resources, inventory of water use by the water related sectors; (iii) assessment of water and water resources against water uses, and (iv) conclusions on opportunities and challenges and recommendations. Assessments in the profile report covered physiographic, biological, demographic, and socio-economic information. It also included details on topography, meteorology, hydrology, geology, forests cover, land use, surface water, ground water, water quality, climate change, flood, drought, economy, societies, current water use by all water related sectors, future forecasted water demand for each water related sectors, and balance of available water against future water demand.

The report identified nine key challenges in the basin including:
- Changes in land use and loss of forest cover;
- Development of hydropower project;
- Unsustainable agricultural practices;
- Urbanization and industrial development;
- Basic infrastructure development;
- Flood, flashflood, and drought;
- Mining development, and
- UXO.

The profile identified the following opportunities:

(i) Abundant water quantity and flow compared to water demand in the basin.
(ii) Water and water resources in NTRB have potential for socio-economic development in several sectors such as hydropower in the middle and lower basin; agricultural production in the districts of Luang Namtha, PhaOudom, Na-Mor and others districts; development of special economic zones and trade centers, transport, service and urban area.
(iii) Development of standardized quality reservoir (dam), would help manage and increase water during the dry season and protection from flooding during the wet season resulting from climate change impacts and support tourism industry in the basin.

The river basin profile report of NTRB, is in the process of updating. The SORB report can complement the river basin profile report of NTRB.

There are available assessment reports on the NTRB including the Nam Tha 1 Hydropower Project Environmental Impact Assessment that was prepared in 2007 and the NTRB River Basin Profile that was published in 2022. In terms of environmental risk assessment, the Nam Tha 1 HPP Impact Assessment covered risk assessment for certain portions of the river basin. The river basin profile also covered risk assessment, however there were limited field assessments since the report was prepared during the COVID-19 pandemic. There is available country-wide risks profile, which includes NTRB. Given the frequency of disaster occurrence in the basin, the inclusion of a detailed risk assessment in the updating the river basin profile is seen as necessary.

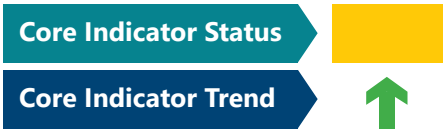
Implications and Recommendations

A river basin profile and the baseline SORB report have been prepared for the NTRB. The socioeconomic development plans of the provinces which is updated every five years identify issues and management measures to address them.

This SORB report provides update on the NTRB river basin profile. The regular updating of the SORB report should be considered, including the necessary technical assessments, systematic data collection and environmental risk profiling. The updating of the river basin profile and SORB report should consider the results of disaster risk assessment, including the identification and mapping of disaster-prone areas related to flooding, seismic activity, land slide, drought and other technical studies to support disaster risk management.

GOVERNANCE

4.1 Policy, Strategies and Plans



[002] River Basin Strategy and Action Plans

Description

This indicator helps to evaluate the existence, adequacy, and implementation of strategic and action plans for river basin management.

Rationale

It is critical to ensure that strategic planning and actions are in place to address river basin management challenges effectively.

Data Requirements

- Existence of a comprehensive river basin strategy document (Yes/No)
- Year the strategy was last updated (Year)
- Existence of action plans derived from the strategy (Yes/No) and their timeline for the implementation
- Number of action plans implemented (Count)
- Percentage of action plan goals achieved (Percentage)
- Funding allocated for the implementation of action plans (US$)
- Stakeholder groups involved in the strategy and action plan development (Number of Groups)
- Mechanisms for public consultation in strategy and action plan development (Yes/no)
- Reports on progress and evaluation of action plan implementation (Yes/No; Number of Reports)

Results

The GoL through DWR, MONRE has prepared a comprehensive river basin strategy and action plan, including legal and institutional arrangements for its implementation covering all river basins in the country.

The 10-Year Strategy (2016-2025) and Vision until 2030 of the Natural Resources and Environment Sector was promulgated in 2015 and updated in 2023 as the Strategy on Management and Consumption of Water and Water Resources until 2030 with Vision until 2040.

By implementing the 8th Five-year National Socioeconomic Development Plan 2016-2020 and the Vision Until 2030 and the 10-Year Strategy (2016-2025) of the Natural Resources and Environment Sector, the IWRM approach has been promoted as an essential tool for water resources management in Lao PDR. River basin mapping has been conducted for the 62 river basins, 14 of which were identified as priority river basins in the natural resources and environment sectors for 2021-2025.

Other relevant strategies and action plans on river basin/water resources management include:

- National Green Growth Strategy of Lao PDR until 2030;
- Decree on River Basins and Reservoirs Management, No.:20/GoV issued on 20 January 2021;
- Strategy on Management and Consumption of Water and Water Resources until 2030 with Vision until 2040;
- Nam Tha River Basin Management Plan 2021-2025;
- Water and Water Resources Strategy with eight strategies, 17 goals, 28 action plans, and 82 activities for the sustainable development and management of water and water resources through integrated approaches. The strategies include:
  - Integrated river basin management;
  - Management of IT system and assessment of water and water resources;
  - Protection and rehabilitation of water and water resources;
  - Ground water management;
  - Water use related infrastructure development for climate resilience;
  - Development of financial mechanism;
  - Human resource development, and
  - Global and regional partnerships.

The NTRB Management Plan (2021-2025), which was adopted through the PM decree No:373/PM on 28 December 2022, was prepared to craft the vision and identify strategies with guidance from the Water and Water Resources Strategy into specific sets of actions for NTRB and addressing the issues identified in the NTRB profile that was developed in 2022. The Action Plan includes six priority areas, 18 targets and 72 activities.

Box 1 NTRB Management Plan (2021-2025)

Action Plan 1: Establish basin governance mechanism and capacity strengthening

- Target 1.1: Institutional and human resource development
- Target 1.2: Public involvement and awareness
- Target 1.3: Support activity on socio-economic development and conservation of culture related to water resources

Action Plan 2: Water and water resources use management

- Target 2.1: Water allocation
- Target 2.2: Defining of minimum ecosystem flow
- Target 2.3: Management of reservoir operation
- Target 2.4: Management of ground water

Action Plan 3: Water and water resources information management

- Target 3.1: Assessment, inventory and management of water resource information
- Target 3.2: Renovation, installation of hydrological monitoring stations, surface water quality monitoring stations and groundwater monitoring stations

Action Plan 4: Conservation and rehabilitation of water resources and water

- Target 4.1: Protection and management of water and water resource conservation areas
- Target 4.2: Rehabilitation of water and water resources
- Target 4.3: Management of water quality

Action Plan 5: Minimization of the impacts from flooding and drought disasters and climate change effects

- Target 5.1: Management of flooding and drought disaster
- Target 5.2: Resilience and minimization of the impacts from climate change effects

Action Plan 6: Management of lands, forests and environment

- Target 6.1: Management of wetlands
- Target 6.2: Management of forest resources
- Target 6.3: Management and allocation of land
- Target 6.4: Management of wastes

The estimated budget required to implement the NTRB Management Plan is six billion LAK (US$ 276,574),[1] with funding from the Government and other sources. The plan defines the institutional arrangements for implementation, including monitoring and evaluation, and stakeholder involvement. Notable implementation progress have been observed for Targets 1.1 (institutional and human resource development); 1.2 (public involvement and awareness); 3.1 (assessment, inventory and management of water resource information), and 5.1 (management of flooding and drought disaster). Information is unavailable on the evaluation of progress and funding allocation for the implementation of the Management Plan. The COVID-19 pandemic stalled the implementation of the Management Plan.

Implications and Recommendations

Majority of the actions plans in the MTRB MP were not fully implemented. Report on the status of implementation of the action plans was not available during the SORB report preparation. Additionally, the required funding for the implementation of the action plans is yet to be defined.

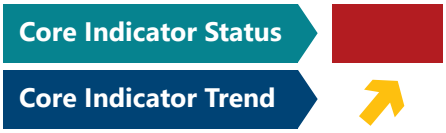
Progress of Plan implementation

The NTRB is one of the priority river basins of the GEF/UNDP/ASEAN Integrated River Basin Management Project. Through the Project, the implementation of the Management Plan can be facilitated, including the evaluation of progress and updating the Management Plan covering 2026-2030 to address emerging concerns, e.g., disaster risks particularly flooding, the identification of required budget and potential funding sources to ensure the implementation of planned activities.

[1] US$ = LAK 21,694 (November 2025)

GOVERNANCE

4.1 Policy, Strategies and Plans



[003] Local Government Development Plan, including River Basins, Associated Watersheds and Adjacent Coastal and Marine Areas

Description

This indicator examines how local government development plans incorporate river basin management goals and strategies.

Rationale

Promotes the integration of river basin management into local development planning processes.

Data Requirements

- Availability of development plan at the provincial/city/municipal/district level (Yes/No)
- Presence of integration elements related to IRBM in local government development plans (Yes/No)
- Specific sections/pages in development plans dedicated to river basin management (Number)
- Year of latest plan revision incorporating integrated river basin management (Year)

Results

Lao PDR has two main governance and administrative levels, i.e., national and local, which is further sub-divided into provincial, district, and village levels. These administrative levels are enabled through government agency counterparts at different administrative levels.

The geographic boundaries of a river basin do not necessarily follow the demarcated administrative boundaries of the provinces and districts. Annual and Five-year Socioeconomic Development Plans including monitoring and evaluation of their implementation are developed at the national, provincial and district levels. The Plans detail the strategies and actions for each thematic areas and sectors in each administrative levels but not at the river basin boundary.

The socioeconomic development plans incorporate the water resources and environment aspects under the sector of natural resources and environment, which is one of the top priorities of GoL. Specific development programs or projects are incorporated into the development plans of the implementing agency/sector, e.g., hydropower development project and integrated into the socioeconomic development plan of the energy sector.

The Decree on River Basins and Reservoirs Management was promulgated through No.:20/GoV on 20 January 2021 and the Vision to 2040 and the Strategy on Management and Consumption of Water and Water Resources until 2030 was adopted in 2023, which mandates that the management and uses of water and water resources shall apply an integrated approach and integrated in socioeconomic development planning.

Implications and Recommendations

In general, socioeconomic development plans at the provincial and district levels integrate various elements of IRBM. It is recommended that the integration of IRBM into the Provincial and District Socioeconomic Development Plans 2026-2030 should consider the requirements of the Decree on River Basins and Reservoir Management.

4.2 Institutional Arrangements

Core Indicator Status

Core Indicator Trend



[004] Coordinating Mechanism for River Basin Management

Description

This indicator facilitates the evaluation of the structure and effectiveness of coordination mechanisms and arrangements within the river basin, both horizontally among different sectors and vertically across different levels of government.

Rationale

Effective coordination ensures IRBM practices are harmonized across sectors and administrative levels, addressing potential conflicts and fostering cooperation.

Data Requirements

- Existence of formal coordination mechanisms, with clear and specific roles and responsibilities of each different entities and stakeholders (Yes/No)
- Number of meetings held under these mechanisms per year (Meetings/Year)
- Evidence of tangible signs of transboundary/inter-provincial cooperation such as joint protected area declarations, water-sharing policies, local government networks, alliances, etc.
- Existence of provincial/national and/or international coordination arrangements (in case of cross-nations river basin) (e.g., dialogues, memoranda of understanding, joint programs of action) between provinces/cities for river basin
- Existence of quality control mechanisms to avoid bias in monitoring, planning and management through coordination of a range of central and local governmental agencies, academic and research institutions/ universities, and private NGO bodies
- Evidence of the presence of an established river basin organization (RBO) and that the RBO has the mandate (which specify authority of RBO to coordinate entities) to ensure they take the 'big picture' in river basin management
- Evidence of clear specification of the roles, responsibilities and functions of RBO and roles are distinguished from those of other entities
- Existence of guidelines/protocols issued by the RBO to enact natural resources and environment management by local governments

Results

The Water Resources Division under the Natural Resources and Environment sector in the four administrative levels of the government is responsible for river basin management.

The management of the NTRB is categorized at the national level scale and considered as one of the priority river basins in the country. The management is being coordinated by the Department of Water Resources as outlined in the Decree on River Basins and Reservoirs Management, No. 20/GoV issued on 20 January 2021.

As part of the implementation of the GEF/UNDP/ASEAN IRBM Project and in support of the implementation of the NTRB Management Plan, Steering Committees and Technical Teams have been established and Project Coordinators have been designated at the national and provincial levels to provide oversight, technical support and coordinate project implementation. Details on the establishment of the coordinating and implementing mechanisms are provided below:

- Decision No. 3088/MONRE dated 24 October 2023 issued by the MONRE Minister establishing the Steering and Technical Committees for project implementation.
- Decision No. 0575/DWR-MONRE dated 5 June 2024 issued by DWR establishing the Technical Teams at the national and local government levels for project implementation.
- Decision No. 1118/ODX dated 22 September 2023 issued the Provincial Governor of Oudomxay establishing the provincial-level Steering Committee and Technical teams and designating the Project Coordinators for project implementation in the province.
- Decision No. 597/LNT, dated 20 September 2023 issued by the Provincial Governor of Luang Namtha establishing the Provincial-level Steering Committee and Technical teams, and designating the Project coordinators for project implementation in the province.
- Decision No. 906/BOK, dated 7 September 2023 issued by the Provincial Governor of Bokeo establishing the Provincial-level Steering Committee and Technical teams and designating the Project Coordinators for project implementation in the province.

The provincial level PSCs, technical teams and Project Coordinators consist of relevant provincial departments and district offices and designated focal persons to support project implementation. In addition, the NTRB Management Plan 2021-2025 has comprehensively defined the coordinating mechanism for river basin management including the relevant stakeholders, their roles and responsibilities and monitoring and evaluation process.





1st Project Steering Committee Meeting in Lao PDR. *(Photo by Daisy Padayao/PEMSEA)*

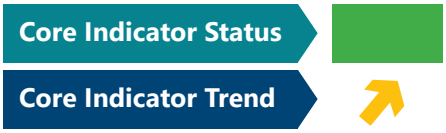


Photo by Daisy Padayao/PEMSEA

Implications and Recommendations

Sustaining the operations of the Water Resources Division in the four administrative levels of the government responsible to coordinate river basin management can be impacted by limited funding. The coordinating mechanisms established to support the implementation of the GEF/UNDP/ASEAN IRBM Project, a project-based mechanism, can provide the necessary support to the Water Resources Division by reviewing and recommending actions to institutionalize the mechanism. The Government should also consider allocating the necessary resources to sustain the operations of the coordinating mechanism beyond the project's life.

4.2 Institutional Arrangements



[005] Formal Recognition that Sector-based Government Agencies Support Integrated Approaches for River Basin Management

Description

This indicator assesses whether there is formal recognition by the highest levels of government that sector-based government agencies must pursue integrated approaches in relation to river basin management, which includes the establishment of a multi-sectoral coordinating bodies with representation from various government levels, civil society, and the private sector.

Rationale

Formal recognition ensures a commitment to IRBM principles across all sectors and levels of government, fostering a collaborative environment necessary for effective river basin management.

Data Requirements

- Official government statements, policies or directives acknowledging the need for integrated approaches;
- List of diverse members and representatives (Male/Female) from different stakeholder groups in coordinating bodies;
- Number of agencies and institutions in the coordinating body which incorporated IRBM implementation plans in their work programs
- Number of staff (Male/Female) allocated by the agencies to support the coordinating body's operation

Results

The GoL recognizes the need for integrated approaches in river basin management, which is clearly stipulated in the Strategy on Management and Consumption of Water and Water Resources until 2030 and Vision to 2040, to wit: *"Manage and use water and water resources in integrated approaches/principles, ensure good quality and sufficient quantity for support drinking, consumption and sustainable development and inclusive of minimization of damages from water"*.

The NTRB Management Plan 2021-2025, which was adopted through Prime Minister Decree No. 20/GoV in December 2022 further recognizes the need for integrated management of river basins and reservoirs and defines the relevant stakeholders at the national and local levels that should be involved, including 18 government sectors, media, educational and research institutes, international organizations and partnerships, private entities, village authorities and communities.

Implications and Recommendations

It is evident that the Government has formally recognized that sector-based government agencies must pursue integrated approaches for river basin management as outlined in various strategies and legislations, including the NTRB management plan.

The government should continue to promulgate necessary strategies, action plans and legislations and implement existing ones to further strengthen the integrated management of the NTRB.

4.2 Institutional Arrangements

Core Indicator Status

Core Indicator Trend



[006] Benefits Derived from Cooperation

Description

Evaluates the benefits and outcomes of cooperative efforts in river basin management, including joint projects, shared knowledge, and improved conflict resolution among stakeholders.

Rationale

Cooperation among river basin stakeholders enhances the efficiency and effectiveness of water management and conflict resolution.

Data Requirements

- Records of cooperative projects/efforts
- Outcomes from these collaboration efforts
- Mechanisms for conflict resolution
- Types of benefits achieved, including particular benefits for women, men (qualitative description)
- Stakeholder satisfaction level (% satisfied with cooperation outcomes)

Results

The preparation of river basin profile and action plan for the integrated management of the NTRB was conducted in 2017-2019. Due to the COVID-19 pandemic, the river basin profile and action plan were only adopted and their implementation initiated in 2022. The implementation of the GEF/UNDP/ASEAN IRBM Project in the NTRB on the other hand was only initiated in 2023, thus benefits and outcomes from cooperation in river basin management cannot be determined at this time.

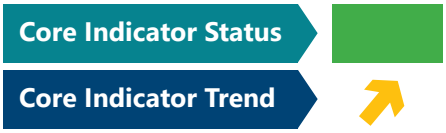
However, through the collaborative implementation of the GEF/UNDP/ASEAN IRBM Project, it provides opportunities for project personnel to participate, share information in conferences, training, sites visits, gain insights on various aspects of IRBM implementation, and identify networking opportunities and potential collaboration for river basin/water resources management.

Implications and Recommendations

Although the implementation of the GEF/UNDP/ASEAN IRBM Project has recently been initiated, it is anticipated that positive socioeconomic and environmental benefits and outcomes will be derived from the collaborative arrangements.

The benefits derived from cooperation arrangements can be further realized if river basin management plans including its implementation and stakeholder engagement are integrated into the provincial and district socioeconomic development plans.

4.3 Legislation



[007] IRBM Enabling Legislation

Description

This indicator assesses the existence and effectiveness of legal frameworks that enable the practice of IRBM. It looks at how laws facilitate the coordination, management, and conservation of river basins.

Rationale

A solid legislative foundation is critical for effective IRBM, providing the legal authority necessary for implementing strategies, enforcing regulations, and engaging stakeholders.

Data Requirements

- Existence of specific legislation at either national or provincial/city/municipal/district level to enact or support IRBM implementation (Yes/No)
- Year of enactment or latest amendment (Year)
- Legislation specifies functions, structure, financial arrangements & accountability mechanisms for integrated river basin management
- Evidence of policy integration (vertical -- from national to local) and functional integration (horizontal -- across sectors)

Results

Following the promulgation of the 8th Five-year National Socioeconomic Development Plan 2016-2020 and the Vision Until 2030 and the 10-Year Strategy (2016-2025), GoL has enacted a number of IRBM enabling legislations, as outlined below:

- Water and Water Resources Law (2017), amended in 2020 and 2022
- Decree on River Basins and Reservoirs management, No. 20/GoV; dated 20 January 2021
- Decree on endorsement and promulgation of the River Basin Management Plan of the Nam Tha, Nam Khan, Xe Bangfai, and Xe Banghiang River, No. 373/PM, dated 28 December 2022

As a formal practice, all legislations are endorsed and promulgated, and aligned with strategic plans. Consolidation of similar legislations is also pursued. In the context of state management and administration, the (i) National Green Growth Strategy of Lao PDR until 2030 (December, 2018); (ii) Strategy on Management and Consumption of Water and Water Resources until 2030 with Vision until 2040, and (iii) 9th Five-year National Socio-economic Development Plan 2021-2025 (2020) provide the platforms for integration and alignment of IRBM enabling legislations, including institutional and financial arrangements.

Implications and Recommendations

A comprehensive set of IRBM enabling legislations have been enacted at the national and local government levels in support for IRBM in NTRB. All legislations promote consensus building among sectors and mainstream gender issues.

The government should continue to develop and promulgate legislation in consideration of emerging issues in the NTRB and to evaluate the effectiveness of existing legislations for necessary updating.

4.3 Legislation

Core Indicator Status

Core Indicator Trend



[008] Administration, Enforcement of Legislation and Compliance Monitoring and Inspection

Description

This indicator evaluates the mechanisms in place for the administration and enforcement of IRBM-related legislation, including monitoring and inspection activities to ensure compliance.

Rationale

Effective administration and enforcement are essential to ensure that IRBM principles are translated into practice. Monitoring and inspection are necessary to assess compliance with legislation and to identify areas for improvement.

Data Requirements

- Frequency of monitoring and inspection of compliance for surface/groundwater use and extraction and pollution discharge points to ensure compliance with governmental regulations.
- Number of compliance inspections conducted per year (Inspections/Year)
- Number of enforcement actions taken against non-compliance with water legislation, including fines, penalties, or legal actions, per year (Actions/Year)
- Percentage of entities (industries, municipalities, etc.) that comply with water-related legislation and regulations within the river basin.
- Evidences of team/office established for monitoring and inspection (e.g., environmental compliance, etc.)

Results

Financial and human resource capacity particularly at the local level to effectively conduct enforcement and monitoring of compliance to legislations is limited.

The Natural Resources and Environment Agency and its national, provincial and district-level offices are responsible for monitoring and inspection of compliance to environmental,

water and water resources-related laws. Specific division within the organization has defined responsibilities, as outlined below:

- **Environment Division:** review and approval of ESIA including issuance of Environmental Compliance Certificates (ECCs) for development and investment projects/programs, as well as abrogation of ECCs in cases of serious non-compliance with legislation and standards.
- **Water Resources Division:** monitoring and/or inspection of water and water resources, water use and wastewater discharge of development and investment projects; review and approval of water use and management plan of development and investment projects/ programs including issuance of water use permits and abrogation of water use permits in cases of serious non-compliance with legislation and standards.
- **Natural Resources and Environment Monitoring Division:** monitoring and inspection of all aspects of the natural environment and pollution discharge from development and investment projects/programs.

Based on the Decree on Environmental Impact Assessment No. 389/GoV issued on 20 October 2022, the monitoring and inspection of development and investment projects/programs shall be conducted 2- 4 times/year by the District Office of Natural Resources and Environment (DONRE); 1 – 3 times/year by the Provincial Office of Natural Resources and Environment, and as necessary by MONRE. The decree also defines the fines and penalties including compensation and measures for rehabilitation of environmental losses and impacts. MONRE, now MAE, is preparing the Prime Minister Decree on fines and penalties on violations and non-compliance to relevant laws and regulations on natural resources and environment.

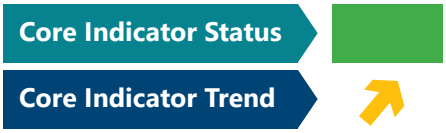
Information or records on the number of cases of non-compliance with water and environmental legislation and standards in NTRB are unavailable during the preparation of this report.

Implications and Recommendations

In general, relevant legislations and standards on natural resources, environment, water and water resources including mechanism for administration, enforcement, monitoring and inspection of compliance are in place. However, human resources and financial capacity to undertake monitoring, inspection and reporting of non-compliance is still limited.

The government should identify measures to address the limitations on financing and human resources for effective enforcement of relevant laws and regulations including implementation of monitoring, inspection and reporting of compliance.

4.3 Legislation



[009] Environmental Cases Filed/Resolved

Description

This indicator examines the number and nature of environmental cases filed and resolved within the context of IRBM, including disputes over water usage, pollution incidents, and conflicts between stakeholders.

Rationale

The ability to effectively resolve environmental disputes is a key aspect of IRBM, reflecting the system's capacity to address conflicts and enforce regulations.

Data Requirements

- Environmental cases filed per year (Cases/Year)
- Environmental cases successfully resolved per year (Cases/Year)

Results

As described in the previous indicators, relevant line agencies and local government offices are responsible in the enforcement of specific laws and regulations. Special Committees are established for the implementation of specific law or PM Decree at the provincial and district levels. These include: (i) Investment Management Committee, (ii) Resettlement and Compensation Committee; (iii) Disaster Management Committee, and other committees as deemed necessary.

A grievance redress mechanism and procedures are established at the national, provincial, district and village levels. In the event of any grievance or complaint, the issue is addressed/resolved at the village or district levels without elevating it into a legal case.

For investment or development projects/programs, e.g., the development of Nam Tha 1 HPP, the project review starts with the Investment Management Committee, then forwarded for technical and environment review by the Hydropower Division and the Natural Resources

and Environmental Division at the national level. The provincial level Resettlement and Compensation Committee review the management and monitoring of environmental and socioeconomic impacts and losses including compensation and resettlement.

The mechanism and procedures described above ensure judiciousness, rationality, fairness, peace, unity and order in the community. There are currently no reported environmental cases in the NTRB.

Implications and Recommendations

There are no reported environmental cases in the NTRB during the preparation of this report. Environmental complaints are generally resolved at the district and provincial levels and there are no reported serious environmental cases during the preparation of this report. However, putting in place a mechanism for systematic recording and reporting of environmental cases including capacity building of relevant staff for the establishment and operation of such information management system should be considered in support of river basin planning and management.

4.4 Information and Public Awareness

Core Indicator Status

Core Indicator Trend



[010] Effective Platform/Mechanisms for Collecting, Storing and Sharing IRBM-related Data/Information to Relevant Stakeholders

Description

Evaluates the existence and functionality of platforms or mechanisms for the collection, storage, management, and sharing of IRBM-related information and data to all relevant stakeholders and the public.

Rationale

Efficient data and information management and sharing are fundamental for informed decision-making, stakeholder engagement, and transparency in river basin management.

Data Requirements

- Existence of a centralized platform for data collection and sharing (Yes/No)
- Number of stakeholders (Women/Men) with access to the platform
- Guidelines on information and data collection, presentation, and exchange; existence of a robust monitoring and evaluation system.

Results

The Division of Water Resources Assessment under the DWR has developed a database and data sharing platform on water and water resources but access is limited within DWR. The database does not currently capture relevant data/information on the SORB indicators.

DWR has completed a number of guidelines, reports and plans on IRBM/IWRM, including the Guideline on the assessment and preparation of management and action plans for river basins in the country.

The Natural Resources and Environment Research Institute under MONRE has completed a number of technical studies, including the water resource assessment of NTRB in 2021 and has extensive data/information on water and water resources.

The Department of Meteorology and Hydrology (DMH), MONRE maintains a daily meteorological and hydrological data in NTRB. The data can be accessed with corresponding fees.

The provincial, district and village level departments also maintain their respective data/information, records and reports. Pertinent socioeconomic data/information and records are maintained by the Planning and Investment offices. The Natural Resources and Environment offices maintain data/information and records on natural resources and environment. As of the preparation of this report, there is no publicly accessible systematic centralized platform for data collection and sharing at the local government level. Data/information are accessed through formal request to relevant departments.

Currently, there is difficulty in compiling and/or consolidating required data/information for planning and decision making.

Implications and Recommendations

Government agencies at the national and local levels have their respective data/information sharing platforms but with limited accessibility to the public. The data/information contained in the databases are also very limited. There are currently no effective platform/mechanisms for collecting, storing and sharing of IRBM-related information to relevant stakeholders. Access to available data/information can only through formal request to a specific agency/department.

With the enactment of IRBM enabling legislations, the platform/mechanism for collecting, storing and sharing IRBM-related information to relevant stakeholders in the NTRB is expected to improve. The government should endeavor to improve the system and establish a basin information management center with corresponding capacity building of relevant staff.

4.4 Information and Public Awareness

Core Indicator Status

Core Indicator Trend



[011] Education and Public Awareness Schemes for a Range of Stakeholders

Description

Evaluates the effectiveness of education and public-awareness programs targeting a broad range of stakeholders, including local communities, industries, and government entities, to increase knowledge and support IRBM practices.

Rationale

Education and public awareness are crucial for fostering a culture of sustainability and participation among all basin stakeholders, ensuring widespread support and understanding of IRBM principles.

Data Requirements

- Number of education and public-awareness programs implemented per year (Programs/Year)
- Range/diversity of stakeholders targeted by these programs (Number and type of stakeholder types)
- Participation rates
- Materials distributed
- Feedback from participants

Results

The NTRB Management Plan 2021-2025 includes activities or programs on awareness raising and capacity building.

The implementation of the GEF/UNDP/ASEAN IRBM Project has engaged different stakeholders, both male and female, at the national, provincial, district and village levels in various project activities, including vulnerable and marginalized groups. These include the preparation of the SORB report and consultations on the establishment of the project

coordination committees, and technical working groups in central, provincial and district levels. Education and public awareness strengthening schemes for government officials are on track and satisfactory.

The involvement of the private sector particularly those in the water sector is currently limited.

A number of IRBM-related government/international organization-funded programs and projects have implemented community education and awareness raising and capacity building activities on sanitation and hygiene, vaccination, nutrition promotion, community forest development, waste management, land use and land titling, agricultural development, ethnic diversity and customary promotion, and local handmade handicraft development.

The NTRB is characterized by a diversity of ethnic groups with variations in settlement, livelihood, way of life and customs limitations in the quality of life, literacy, sustainable agricultural practices, sanitation, disease prevention, among others. These communities can benefit from targeted education and public-awareness raising programs.

Implications and Recommendations

Various stakeholders have been involved in the implementation of the GEF/UNDP/ASEAN IRBM Project as part of capacity strengthening and awareness raising on river basin management. Awareness raising activities on various social and environmental aspects have been implemented and supported either by the government or in partnership with different international organizations. The participation of the private sector however is still very limited. Ethnic groups in the NTRB also have limited access to awareness raising activities.

4.4 Information and Public Awareness

Core Indicator Status

Core Indicator Trend



[012] Public Participation and Mobilization

Description

Measures the extent and effectiveness of public participation and mobilization in decision-making and implementation processes of IRBM.

Rationale

Active and meaningful public participation ensures that the interests and knowledge of local communities are integrated into river basin management, leading to a more sustainable and accepted outcomes.

Data Requirements

- Number of public participation events related to IRBM implementation held per year (Events/Year)
- Level of public mobilization achieved
- Existence of stakeholder engagement plan to empower local organizations and individuals
- Evidence that river basin management plan is driven by bottom-up water sector initiatives with strong NGO and village level management
- Evidence of clear specification of private sector involvement and links to basin decision systems

Results

The national and provincial governments have enacted IRBM enabling policies and legislations, which include support for strengthening public participation and mobilization for river basin management.

The NTRB Management Plan (2021-2025) was prepared during the COVID-19 pandemic, hence, stakeholder or public participation was very limited. The preparation of the Plan mainly involved the national and local governments.

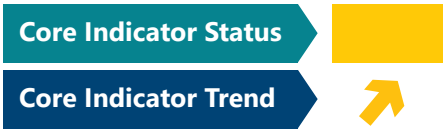
For the implementation of different activities of the GEF/UNDP/ASEAN IRBM Project, including the preparation of this SORB report, relevant government departments at the national, provincial and district levels, authorities and representatives from the villages and other water users are involved. A Stakeholder Engagement Plan has also been developed for the implementation of the project. In the development of the demonstration program in targeted villages, the villagers and village authorities take charge for preparing the program proposal while the local governments take charge in prioritizing the activities in the targeted villages.

Implications and Recommendations

The participation of stakeholders particularly the private sector in decision making for river basin management is currently limited. The implementation of the NTRB Management Plan (2021-2025) needs a mechanism for public and private sector participation, and a feedback mechanism from local communities in IRBM planning and decision making. The updating of the NTRB Management Plan (2026-2030) should consider the inclusion of a comprehensive stakeholder engagement plan ensuring that a wide range of stakeholders are involved including the different ethnic groups. Mechanisms to strengthen public and private sector participation should also be put in place. More bottoms-up feedback from the communities should be facilitated and integrated in IRBM planning and decision making.

The implementation of the GEF/UNDP/ASEAN IRBM Project provides an opportunity to strengthen public participation and mobilization in the management of the NTRB.

4.4 Information and Public Awareness



[013] Degree of Stakeholder Participation and Gender Equality and Social Inclusion in Decision Making Process for River Basin Management

Description

Assesses the level of stakeholder participation in IRBM, focusing on the inclusivity of decision-making processes and the representation of gender balance and marginalized groups.

Rationale

Inclusive participation ensures equity and diversity in IRBM processes, fostering decisions that are fair, representative, and considerate of all community segments.

Data Requirements

- Degree of stakeholder participation in decision-making processes (qualitative assessment)
- Gender balance in decision-making entities (percentage of female and male participation)
- Mechanisms to include marginalized voices

Results

In Lao PDR, the equal role of men and women in decision making is well-recognized. The MONRE Minister from March 2021-March 2025 was female. Men and women have also equal rights and participation in planning and management of the NTRB. The IRBM Project Steering Committee that was established in Oudomxay Province involves four females out of the total 22 members. While NTRB is characterized by diversified ethnicities, there are no marginalized groups since all the ethnicities have equal rights to protect, preserve and promote their own customs and cultures as stipulated in the country's constitution.

Through the implementation of the IRBM Project, a gender analysis was also undertaken in the NTRB and results were included in PEMSEA's Gender Equality and Social Inclusion (GESI) Analysis Report (PEMSEA, 2024).




Focused group discussions were conducted in Lao PDR for the Gender Equality and Social Inclusion Analysis of the IRBM Project. *(Photo courtesy of DWR)*

Implications and Recommendations

The equal rights of men and women is well-recognized in the country, as well as in planning and management of the NTRB. The diverse ethnic groups also have equal rights in protecting, preserving and promoting their respective customs and cultures.

The implementation of the GEF/UNDP/ASEAN IRBM Project provides an opportunity to further strengthen stakeholder participation and mainstreaming GESI in IRBM planning and decision making. For example, the GESI Analysis Report included information on GESI-enabling legislations, mechanisms and plans of Lao PDR. It also includes details on GESI context at the basin level in relation to gender and social disparities in river resource use, access and control; access to financing, training and information to gain benefits from river resource use; decision making on river resource use; impacts of climate change and environmental degradation and threats. The report also provides recommendations in closing the gender gap and mainstreaming GESI into IRBM programs.

The degree of stakeholder participation and GESI in decision making process for river basin management in IRBM approach through implementation of the GEF/UNDP/ASEAN Project has moderately improved. The results of the GESI report for NTRB should be utilized during the preparation of the NTRB MP 2026-2030 to ensure active gender equality and social inclusion in decision making process for river basin management.

4.5 Financing Mechanism

Core Indicator Status

Core Indicator Trend



[014] Budget Allocation for Integrated River Basin Management

Description

This indicator measures the financial resources specifically allocated for IRBM activities, reflecting the commitment and capacity of governments and organizations to implement IRBM.

Rationale

Adequate funding is critical for the successful implementation of IRBM strategies and actions, covering necessary research, infrastructure, management, and conservation activities.

Data Requirements

- Budget documents detailing allocations for IRBM from various sources (governmental, donor, private sector) (US$/Year)
- Existence/presence of long-term financial planning for integrated river basin management programs/initiatives
- Grants from financing institutions
- Loans
- Government investment for environmental infrastructure
- Co-financing with partner private sector and civil society organization
- Other relevant financial planning documents

Results

The NTRB Management Plan 2021-2025 has a budget requirement of six (6) billion KIP or approximately US$ 347,000.[2] However, there was no estimated breakdown of the required annual budget. Funding sources identified included the state budget, private/investment projects in the basin, ODAs, and other sources.

[2] US$ 1 = 17,275 - 17,300 KIP (December 2022)

MONRE is the main responsible agency, in cooperation with MEM, MFA, other ministries, organizations and concerned local governments to implement the NTRB Management Plan 2021-2025, which include among their responsibilities securing additional sources of financing. Supporting funds from donors and financing institutions, including co-financing arrangements with partner private sector and civil society organization remain untapped.

The GEF/UNDP/ASEAN IRBM Project supports the implementation of the NTRB Management Plan 2021-2025 and facilitating the review and evaluation of the accomplishments in preparation for the updating of the plan to cover 2026-2030, including identifying financing sources. A counterpart co-financing is provided by GoL in the form of in-kind contribution for the implementation of the IRBM Project, which also directly contributes to the implementation of the NTRB Management Plan.

Implications and Recommendations

The implementation of NTRB Management Plan is facing constraints due to limited funding.

There is no clear annual budget allocation for the implementation of the NTRB Management Plan. The funding allocation for Lao PDR from the GEF/UNDP/ASEAN IRBM Project leverages some support in the implementation of the Management Plan and its updating. Identification of budgetary requirements for the various action programs, including funding sources and partnership arrangements are necessary to ensure that the Management Plan for 2026-2030 is effectively implemented.

4.5 Financing Mechanism

Core Indicator Status

Core Indicator Trend



[015] Sustainable Financing Mechanisms

Description

Evaluates the presence and effectiveness of sustainable financing mechanisms to support long-term IRBM initiatives, such as grants, loans, government investments, and co-financing arrangements.

Rationale

Sustainable financing ensures that IRBM programs can be maintained over the long term, addressing ongoing and future management needs.

Data Requirements

- Evidence of financial mechanisms in place (e.g., grants, loans, environmental user fees);
- Documentation on cost-sharing arrangements and transparency mechanisms for revenue streams.
- Types of sustainable financing mechanisms identified
- Funds generated through sustainable financing mechanisms per year (US$/Year)

Results

State budget remains the main source of funding for the implementation of NTRB Management Plan 2021-2025. The Ministry of Finance is responsible for state budget management at the central level in line with the relevant laws of Lao PDR. The Department of Planning and Finance of MONRE is responsible for budget management of the ministry. While the GEF/UNDP/ASEAN IRBM Project has budget allocation that supports the implementation of the NTRB Management Plan, funds are available only within the duration of the project.

Funds for water resources management from hydropower development projects in NTRB are available to support the implementation of the hydropower project catchment area management plan.

Furthermore, the national, provincial and district levels have their respective financial management and arrangement mechanisms with the central government providing the necessary funding. As a general practice, budget for the implementation of activities on water resources management is allocated by the local governments, i.e., provincial and district levels in accordance with their socioeconomic development plans.

Implications and Recommendations

The implementation of the NTRB Management Plan relies mainly from government funding and some support from donor-funded and development projects. MONRE particularly DWR plays an important role in identifying sources of funds to ensure financial sustainability for the implementation of the Plan.

There is a need for MONRE to establish a financial mechanism to ensure long-term financial sustainability for the implementation of the NTRB MP 2026-2030.

4.5 Financing Mechanism

Core Indicator Status

Core Indicator Trend



[016] Self-financing of River Council/Committee

Description

Assesses the financial autonomy of the river council by examining the proportion of its budget funded through national contributions versus its ability to generate its own revenue.

Rationale

Financial autonomy is crucial for the river council's operational independence, allowing for more flexible and responsive management actions.

Data Requirements

- Proportion of river council budget funded by national contributions (Percentage)
- Amount of self-generated revenue per year (US$/Year)

Results

A River Basin Council to oversee the implementation of the NTRB Management Plan has not been established. The Steering Committees that were established at the national and provincial levels are providing oversight function for the implementation of the GEF/UNDP/ASEAN IRBM Project. The operations of the Steering Committees are supported by project funds.

Implications and Recommendations

The Steering Committees that were established for river basin management in NTRB were project-based and mainly rely on project funds for their operations.

It is recommended that the project-based coordinating mechanism for river basin management be institutionalized through their integration into the provincial and district governance structure and providing funding for their operation.

4.6 Capacity Development

Core Indicator Status

Core Indicator Trend



[017] Availability/Accessibility of Capacity Development and Training Opportunities for Key Stakeholders

Description

Evaluates the availability and accessibility of training and capacity development programs for stakeholders involved in IRBM.

Examines the ongoing efforts to enhance the skills base of key stakeholders through training and capacity-building initiatives.

Rationale

Building the capacity of stakeholders through training and development programs is essential for empowering them with the necessary skills and knowledge for effective river basin management.

Continuous training and capacity-building are vital for keeping pace with evolving IRBM practices, technologies, and methodologies.

Data Requirements

- Number of capacity development and training programs available (Programs/Year)
- Sex-disaggregated participation statistics of those who have access to these programs
- Feedback on program effectiveness
- Budget allocation for capacity development and research
- Evidence that the RBO leadership is well-trained, articulate, responsible and has 'listening skills'
- Number of ongoing training and capacity-building programs (Programs/Year)
- Number of stakeholders participating in these programs (Participants/Year) – male/female
- Participant feedback and effectiveness assessments

Results

The NTRB Management Plan 2021-2025 includes activities on awareness raising and capacity building for government officials, communities and stakeholders, including developing and issuing guidelines for capability strengthening of local government officials.

Most of the capacity building activities identified in the NTRB Management Plan are yet to be implemented. Less than 10 (ten) trainings and meetings were recorded in NTRB during the preparation of this report, which were participated in by a good mix of participants, including women. It is anticipated that the participants' skills and knowledge have improved as a result of their participation in training activities.

During the preparation and implementation of the GEF/UNDP/ASEAN IRBM Project, the central and provincial government staffs of the provinces in NTRB have participated in training, workshops and/or conferences organized in Lao PDR and in MONRE or DWR's projects supported by Mekong-Lancang Cooperation (LMC) and the World Bank on water management-related capacity building activities.

The GEF/UNDP/ASEAN IRBM Project also provides opportunities for national and local officials and project partners and stakeholders in participating in international and regional conferences and meetings including training and capacity strengthening. Among the activities of the project with participation from national and local officials and partners include: i) preparation of SORB Report; ii) education and public-awareness programs at the targeted villages in NTRB; iii) river basin management activities demonstration program, and iv) field visit/observation for data and information gathering in the three provinces in NTRB.

Implications and Recommendations

Capacity building activities identified in the NTRB Management Plan have been initiated but requires continual action.

While capacity building activities identified in the NTRB Management Plan 2021-2025 need to be implemented, the updating of the Action Plan should consider the necessary training and capacity building activities on IRBM for relevant stakeholders including government personnel and youth, including detailed plan for their implementation.

4.6 Capacity Development

Core Indicator Status

Core Indicator Trend



[018] Human Resource Capacity

Description

Assesses the sufficiency and quality of human resources dedicated to IRBM, including their skills, knowledge, and competencies.

Rationale

Adequate human resource capacity is critical for the effective implementation and sustainability of IRBM initiatives.

Data Requirements

- Number of people (women and men) at the provincial/city/municipal/district level trained (formal and informal training) in IRBM.
- Level of expertise of personnel involved in IRBM
- Gaps in skills and knowledge, training needs assessment

Results

The NTRB is classified as a priority river basin of the national government and thus its management requires highly qualified human resources.

At the central level, three committees have been established, which include a high-level Steering Committee consisting of four high ranking personnel of DWR (2 PhDs); Technical Planning Committee comprising 15 persons (5 females, 1 PhD), and Technical Team for project implementation comprising nine persons from DWR (3 females), eight persons from ODX (1 female), five persons from LNT (1 female), six persons from BOK (1 female).

In Oudomxay, the Provincial Steering Committee comprises 22 persons (4 females) and chaired by the Vice Governor. The Coordinating and Technical Committees comprise 20 persons (7 females) and led by the Head of PONRE and includes district level officials.

The Provincial Steering Committee in Luang Namtha comprises 15 persons and chaired by the Vice Governor. The Coordinating and Technical Committees comprise 13 persons (3 females) and led by the Head of PONRE and includes district level officials.

In Bokeo, the Steering Committee comprises 18 persons (1 female) and chaired by the Vice Governor. The Coordinating and Technical Committees comprise 15 persons (2 females) and led by the Deputy Head of PONRE and includes district level officials.

Majority of the members of the above established committees are presumed to be highly qualified government personnel for river basin management at the central, provincial and district levels.

Implications and Recommendations

As a priority river basin of the national government, the NTRB requires qualified human resources for its management. MONRE, DWR and the governors of the three provinces in the basin have issued agreements on the establishment of steering committees, coordinating committees, and technical teams comprising 130 persons to support the implementation of the GEF/UNDP/ASEAN IRBM Project.

Disparity on knowledge and skills for river basin management may exist among the three provinces. It is therefore necessary to build the capacity of key stakeholders at the provincial, district and village levels including government staff and youth on IWRM/IRBM to sustain river basin management initiatives.

Through the implementation of the identified training and capacity building activities in the NTRB Management Plan 2021-2025 and other training programs supported by different projects such as the GEF/UNDP/ASEAN IRBM Project, the human resource capacity in NTRB is expected to improve.



Photo by Daisy Padayao/PEMSEA



Photo by John Castillo/PEMSEA

CHAPTER 5

Status and Trends on Sustainable Development Aspects

5.1 Climate Change and Disaster Risk Reduction

Core Indicator Status

Core Indicator Trend



[019] Degree of Vulnerability to Disasters

Description

Evaluates the vulnerability of the river basin to natural disasters, considering factors like population density in flood-prone areas, the state of critical infrastructure, and environmental degradation.

Rationale

Understanding vulnerabilities is essential for targeting interventions and building resilience against natural disasters.

Data Requirements

- Vulnerability index (score)
- Availability of multi-hazard (landslides, storms, floods) maps (Yes/No) (Please specify)
- Population living in high-risk areas (% of total population)
- Number of people (Women/Men) relocated or moved away from hazard prone areas

Results

Based on the INFORM 2019 Index for Risk Management developed by the European Commission, Lao PDR has a hazard and exposure index of 3.0 and vulnerability index of 3.6 from a risk index scoring of 0-10. Lao PDR ranks 98th and 88th out of 191 countries in the world in exposure and vulnerability, respectively. The exposure risk index for flood, tropical cyclone and drought was reported at 9.1, 3.3 and 2.4, respectively, and were ranked at 6th, 47th and 115th from a total of 191 countries, respectively. The trends of risks exposure and vulnerability are seen to be constant for the period of 2020 to 2025 (European Commission, 2019).

The location and topographical features of NTRB define its vulnerability to natural disasters, including storm, flood, drought, landslide and earthquake while settlement, means of livelihood, socioeconomic development and political factors influence its vulnerability to both natural and man-made disasters like flood wildfire and even UXO (Unexploded Ordnance).

Based on the National Risk Profile of Lao PDR (November 2010), NTRB is located along the zone classified under degree VII for natural and man-made hazards; i.e. earthquake occurrence in a 250-year return period; low to medium susceptibility to landslide; 0 – 0.04 number of UXO/ sq. km land; tropical depression (<62 km/hr storm velocity) to tropical storm (63 - 118 km/hr storm velocity); and 5-15 percent susceptibility to severe drought in dry season.

In 2010, the National Disaster Management Committee reported the susceptibility of Oudomxay to earthquake, flood, drought and epidemics, while LNT and BOK are susceptible to earthquake and epidemics (National Disaster Management Committee Government of Lao PDR, 2010).

In 2024, the percentage of the total area of the provinces of ODX, LNT and BOK, which were affected by flooding is at 7.2 percent, 1.5 percent and 9.8 percent; drought at 55.8 percent, 37.8 percent and 62.5 percent and landslide at 4.4 percent, 1.1 percent and 11.7 percent, respectively (Center for Excellence in Disaster Management and Humanitarian Assistance, 2024). There is no available information on specific assessment of vulnerability index of population living in high-risk areas, and number of people relocated from flood and landslide hazard prone areas.

Flooding and Storm

The NTRB is located in the northwest of Lao PDR, barred by a mountain range, which makes it less susceptible to seasonal storms compared to other areas in the country. The NTRB receives lesser amount of annual precipitation and lesser occurrence of monsoon rains due to its geographic location. Occasional southeast and east tropical monsoon happen, which cause continual torrential rain in the basin.

The NTRB is characterized by a wider upstream and narrower middle and downstream basin. The topography of the basin is generally low lying, which makes it prone to seasonal flooding particularly in Namtha, Na-Mor and Nale districts.

There are multiple ethnic communities with their own characteristic livelihood and settlement in the basin. The settlements of the communities are located mainly along the river in areas suitable for agriculture, upland cultivations and highlands with abundant NTFP. This settlement characteristics cause lowland communities prone to seasonal flooding and highland communities prone to minor landslides. The communities adapt to flood risks and landslides by building their houses or shelters in forms that can be easily relocated and rebuilt. It also allows them to easily evacuate with minor losses.

Due to its topography, geographical and social and environmental characteristics, the basin experiences both floodplain flooding and mountain valley or hillside flashfloods. Flood prone areas in the floodplains of NTRB are mainly located along the river bank in Luang Namtha, Na-Mo, Nale, PhaOudom and Paktha districts. The areas of PhaOudom and Paktha districts experienced flooding mainly from the overflow of the Mekong River.

Flooding in flood prone areas in the NTRB are reported once every three years. The reported flooding events in flood prone areas in Luang Namtha, Na-Mor and Nale districts were caused mainly by continuous torrential rains. The flooding incident in Luang Namtha District in July 2021 was caused by flash flood, which occurred due to the continuous torrential rains for more than three days with total precipitation of 316 mm/4 days and maximum of 164 mm/day on 20th July 2021 in the basin.

On 7-11 Sep 2024, Typhoon Yagi hit northern Lao PDR, which caused severe flooding in floodplains along the river bank of Nam Tha River and nearby districts. The flooding severely affected more than 35 villages in LNT especially in the urban areas.

Based on the flash flood occurrence in July 2021, the recorded daily precipitation from January 2009 – September 2024 was analyzed and compared with the result of hydrological model. The results showed that flooding in floodplain areas in the NTRB will happen when the daily precipitation and four day-total precipitation from continuous torrential rains rise to a level greater than 80 mm/day and 130 mm/4 days, respectively. Flooding will also occur when the result of multiplying these two indicators exceeds 10,000 $mm^2/4d^2$ and the Nam Tha outflow rises up to about 980 m^3/s (**Table 5.1**). However, there are other contributing factors to the flooding in NTRB, which need to be determined for more conclusive results.



Flood in Central Luang Namtha District on 11 September 2024.



Flood Overflowing at Nam Tha 3 HPP dam, on 9 Sep. 2024.

Table 5.1 Analysis of Torrential Rains and Cases of Flooding in the NTRB.

Year	Date/Month		Period of torrential raining			Max. 4 days of torrential raining				Flood [Y/N]	Remarks
	From	To	Days of Torrential Rain	Total Precipitation [mm]	Max Precipitation [mm/day]	Total Precipitation [mm]	Max Precipitation [mm/day]	Pak Tha Peak Flow [m³/sec]	Date		
2009	27-May	9-Jun	14	224.1	72	123	72	187.5	29-May	N	Dry season
2009	27-Jun	6-Jul	10	276.3	83	100	80	639.4	5-Jul	N	
2010	24-Aug	28-Aug	5	130.4	81	129	81	1,597	28-Aug	Y	
2011	23-Jun	28-Jun	6	125.0	60	112	60	868	27-Jun	N	
2011	13-Sep	26-Sep	14	202.1	55	105	55	867	17-Sep	N	
2012	22-Jul	31-Jul	10	178.2	90	151	90	986	25-Jul	Y	
2013	31-Aug	9-Sep	10	213.7	89	154	89	1,067	5-Sep	Y	
2014	12-Aug	21-Aug	10	144.2	63	94	63	962	13-Aug	N	
2024	14-Sep	21-sep	7	104.5	54	85	54	833	19-Sep	N	
2015	15-Jul	30-Jul	16	265.2	43	132	43	329	26-Jul	N	
2015	1-Aug	7-Aug	7	204.8	116	179	116	1,502	1-Aug	Y	
2015	26-Aug	4-Sep	10	154.3	42	103	42	730	27-Aug	N	
2016	3-Aug	21-Aug	19	401.0	74	149	74	2,400	19-Aug	Y	Severe
2017	-	-	-		No extreme		-	-	-	-	
2018	23-Jul	9-Aug	18	214.4	62	109	62	1,587	29-Jul	Y	Severe
2018	11-Aug	19-Aug	8	203.2	81	158	81	2,172	17-Aug	Y	Severe
2019	-	-	-		No extreme		-	-	-	-	
2020	10-Aug	21-Aug	12	153.9	46	107	46	n. a	n. a	N	
2021	18-Jul	21-Jul	4	316.4	164	316	164	n. a	n. a	Y	Severe
2021	24-Jul	30-Jul	7	143.2	108	128	108	n. a	n. a	Y	
2022	19-May	24-May	6	173.6	49	146	49	n. a	n. a	N	
2023	-	-	-		No extreme		-	n. a	n. a	n. a	n. a
2024	16-Aug	25-Aug	10	217.6	58	122	58	n. a	n. a	N	
2024	7-Sep	13-Sep	7	244.7	106.8	201.7	106.8	n. a	n. a	Y	Tremendous

Flooding not only occurs in floodplain areas but frequent flashfloods are also experienced in the mountainous valley areas of NTRB. Flashfloods were reported in PhaOudom and nearby districts due to the continuous torrential rains on 12-14 June 2021.

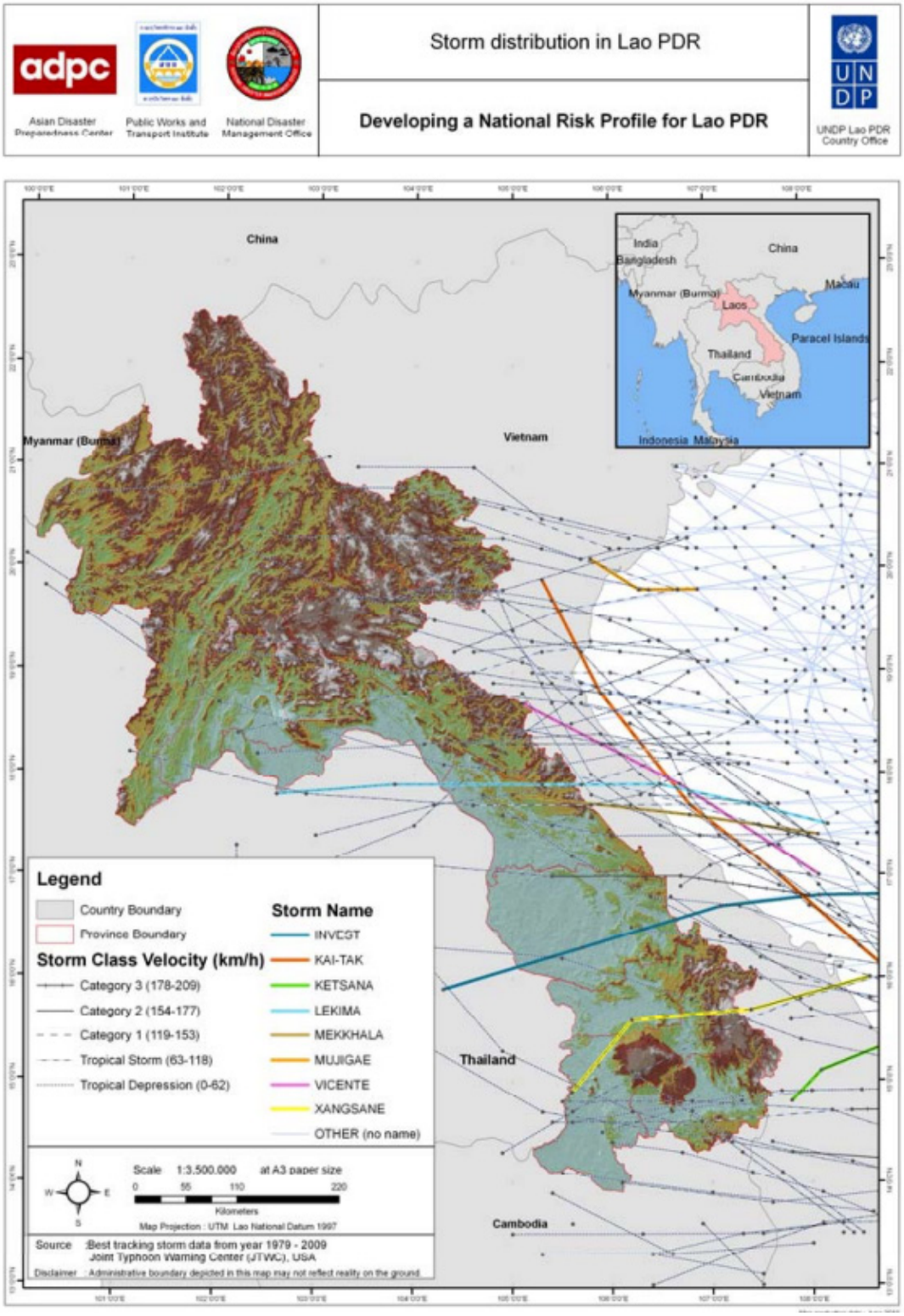


Figure 5.1 Tracks of Tropical Storms in Lao PDR during 1979-2009. *(Source: National Disaster Management Committee Government of Lao PDR (2010). https://www.unescap.org/sites/default/files/Final%20Report%20DRR%20from%20LAO.pdf)*

Landslide Hazard

The occurrence of destructive landslide is directly linked to severe storm, flooding, land cover, geography, geo-hydrology and seismicity. In NTRB, the reported destructive landslides are driven by three main factors such as settlement, land cover and occurrence of flash floods. Local communities relying on upland cultivation settle on hillsides and/or mountainous valleys, which are more exposed to landslides caused by flash floods. Communities settled in floodplains occasionally experience landslide along river banks due to extreme flooding. The three provinces in the NTRB have low to medium susceptibility to landslide as shown in **Table 5.2**. Bokeo has lower susceptibility to landslide compared with ODX and LNT.

Table 5.2 Landslide Hazard Susceptibility in Percentage in Each Province in NTRB.

Province	Percent of susceptibility to landslide (%)				
	Negligible	Low	Medium	High	Very High
Oudomxay	0.01	48.46	49.33	2.20	0
Luang Namtha	0.42	54.77	43.68	1.13	0
Bokeo	3.42	72.57	23.36	0.34	0

Source: National risk profile of Lao PDR, November 2010.

Drought Hazard

Based on the National Risk Profile of Lao PDR (November 2010), NTRB has less than 5 percent susceptibility to severe and extreme annual drought, and less than 10 percent susceptibility to moderate annual drought.

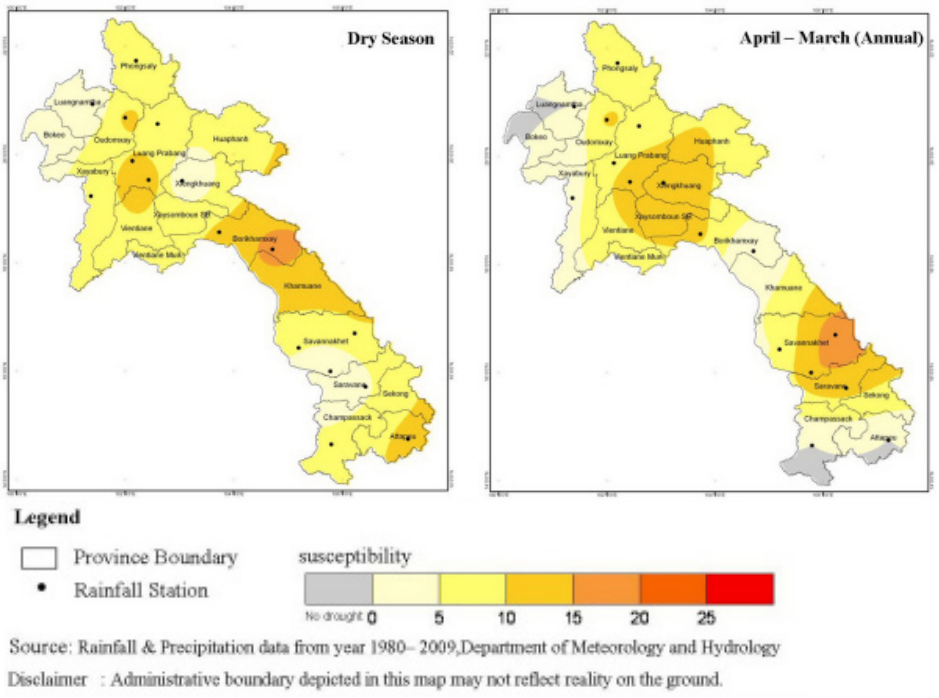
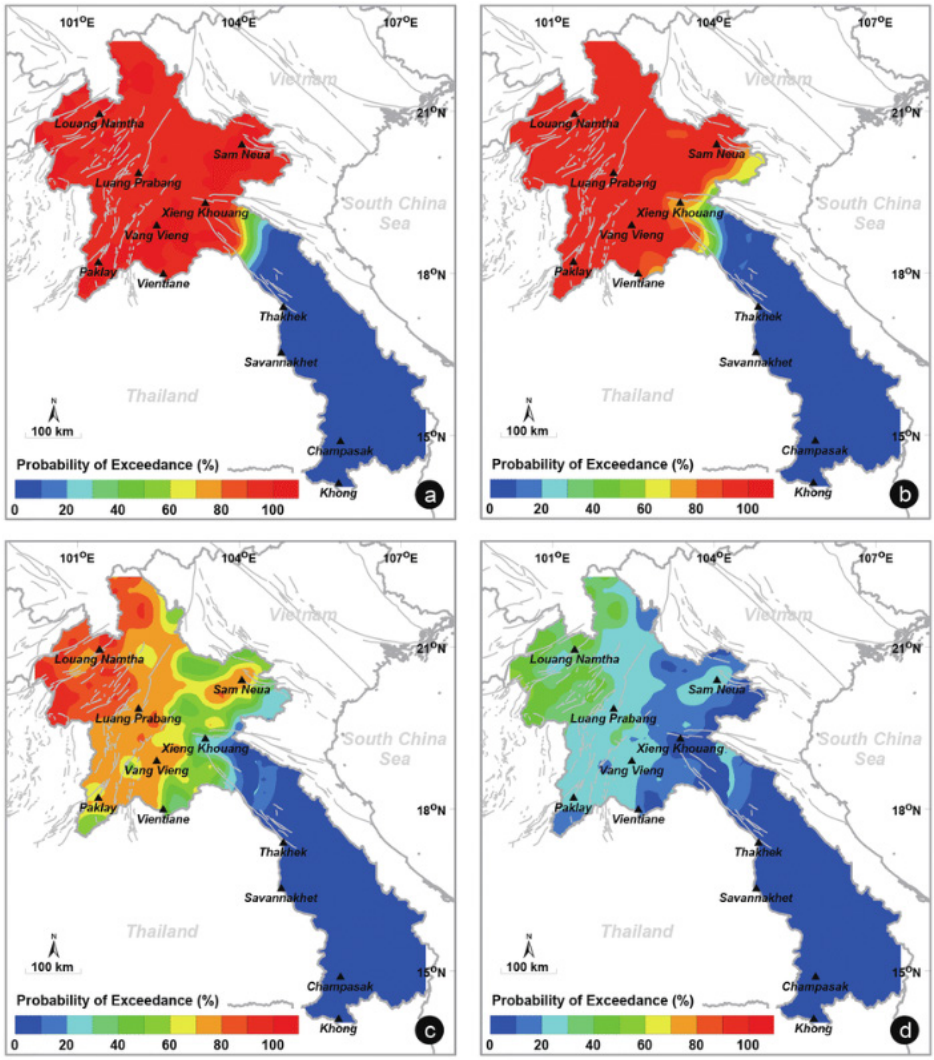


Figure 5.2 Maps of Susceptibility to Moderate Drought during 1980-2009.

(Source: National Disaster Management Committee Government of Lao PDR (2010). https://www.unescap.org/sites/default/files/Final%20Report%20DRR%20from%20LAO.pdf)

Seismic Hazard and/or Earthquake

Based on the recorded earthquakes in the past 38 years, northern Lao experienced several small and moderate scale earthquakes with one major earthquake with magnitude greater than seven. Seismic hazard assessments conducted by different organizations reflect that the northeastern region of Lao especially NTRB is prone to moderate to high earthquake risk. Based on the earthquake hazard map developed by UNOCHA in Modified Mercalli Intensity (MMI) scale and assessment result by the National Disaster Management Committee Government of Lao PDR (2010), the NTRB is located in the zone with 70-90 percent and 30-50 percent probability of ground shaking with MMI levels not less than VI and VII, respectively (**Figure 5.3**).



Probabilistic seismic hazard maps of Laos showing the probabilities (%) that ground shaking will be equal to or greater than MMI levels of (a) IV, (b) V, (c) VI, and (d) VII in the next 50 yr. (Color online only)

Figure 5.3 Probabilistic Seismic Hazard Maps of Lao PDR in MMI Levels of IV, V, VI and VII for 50 Years Return Period. *(Source: ResearchGate, 2024. https://www.researchgate.net/figure/Probabilistic-seismic-hazard-maps-of-Laos-showing-the-probabilities-that-ground_fig6_321828355)*

Implications and Recommendations

There is no available vulnerability index to disasters in the NTRB and the population living in high-risk areas have yet to be identified. Rapid assessment indicated that NTRB is prone to both flash flood and floodplain flooding and landslide caused by flash floods. The region is highly vulnerable to seismic hazard, with almost 100 percent probability of exceedance to MMI level VI in 50 years return period.

The GoL demonstrates strong commitment to disaster management and response in the NTRB, which is prone to flooding. It is recommended that hazards and risks assessment be conducted including the identification of hazard prone areas.

Establishing additional meteorological and hydrological observation stations in NTRB is necessary to allow accurate flood simulation and prediction. In the conduct of technical study on flood risk, a more detailed topographic survey and mapping in scale not less than 1:2000 is further required to be able to identify and map the population living in high-risk and vulnerable areas.

5.1 Climate Change and Disaster Risk Reduction

Core Indicator Status

Core Indicator Trend



[020] Level of Preparedness to Disasters

Description

Assesses the preparedness of the river basin to respond to natural disasters, including the existence of early warning systems, emergency response plans, and community awareness programs.

Rationale

Preparedness minimizes the impact of disasters on communities, infrastructure, and the economy.

Data Requirements

- Natural/man-made disaster/environmental emergency response plan available (Yes/No) (Please specify)
- Scope of natural/man-made disaster/environmental emergency response plan (e.g., floods, landslides, earthquakes, oil spill, etc.). (Please specify)
- Both mitigation and adaptation strategies are clearly identified in the plan (Please specify)
- Consideration of climate change and disaster risks in relevant infrastructure design and maintenance. (Please specify)
- Institutional mechanism for the implementation of the emergency response plan (Yes/No). (Please specify)
- Number of trained and non-trained personnel allocated (number of people, women and men)
- Early warning system in place (Yes/No)
- Adequate equipment available (Yes/No)
- Budget allocation for natural/man-made disaster (US$/Year)

Results

The Ministry of Labor and Social Welfare (MLSW) particularly the National Disaster Management Office (NDMO), which was established in 1997 under the Ministry, is responsible for disaster

management with support from relevant government offices, e.g., environment, national defense, etc., the Lao youth union and other sectors. The NDMO is responsible for relief operations, disaster management planning, information and dissemination and training. The NDMO receives support from international organizations, including UNDP.

Disaster management and response plan is developed by the MLSW and integrated in the socioeconomic development plans at the national, provincial and district levels. The disaster management and response plan is also integrated in river basin management plans of the Mekong sub-basins in Lao PDR, including NTRB. Furthermore, environmental emergency response is also integrated in the management plan of the natural resources and environment sector. Development projects, which are subject to environmental risk and hazard are required to complete risk assessment and the environmental and hazards management and response plan to address the risks including monitoring plan.

The NTRB Management Plan 2021-2025 includes two targets and nine main activities on flood and drought management, and climate change adaptation and mitigation, including mitigation and adaptation strategy and plan, institutional arrangement, assessment and design of flood protection infrastructures, establishment of information sharing center and early warning system, awareness and capacity building on disasters prevention and response, and others.

Implications and Recommendations

Early warning system is yet to be established in NTRB. There is currently inadequate equipment and budget allocation for the conduct of feasibility study and construction of flood protection infrastructures. The Department of Meteorology of MONRE has a national monitoring of agro-climatology, meteorology, climate extremes and storms but public information sharing needs to be improved.

Although there is a mechanism in place and allocated personnel, there is inadequate equipment and funding for early warning, emergency response, and post-disaster relief in the NTRB. The identified actions in the NTRB Management Plan 2021-2025 on mitigating the impacts from floods and droughts and climate change resilience need to be implemented.

5.1 Climate Change and Disaster Risk Reduction

Core Indicator Status

Core Indicator Trend



[021] Social and Economic Losses due to Disasters

Description

Quantifies the socio-economic impacts of disasters within the river basin, including loss of life, economic damages, and impacts on livelihoods and infrastructure.

Rationale

Measuring the socio-economic losses from disasters helps to understand their impact on communities and economies and informs recovery and resilience-building efforts.

Data Requirements

- Data on economic losses/damages due to natural and man-made disaster incidents (typhoons, storm surges, floods, harmful algal blooms, etc.) (US$) (Please specify)
- Human (Women/Men) casualties (number of deaths and injuries)
- Displaced persons (number of people displaced, women, men)
- Data on infrastructure damage (US$)
- Frequency of disaster incidents by type. (Please specify)
- Number of people (Women/Men) severely affected by natural/ man-made disaster incidents

Results

Floodplain flooding and mountain valley or hillside flashflood frequently occurred every year in NTRB and caused losses to life, livestock and assets. Both types of floods are reported to be more frequent in the recent years. Frequent flashfloods are reported in scattered areas in the basin while floodplain flooding frequently happens in the Nam Tha river bank and its tributaries, especially in Luang Namtha, Pha Oudom, Nale and Na-Mor Districts.

The assessment and register of losses from natural and man-made disasters in NTRB are not systematically recorded. Records of direct and indirect socioeconomic losses from droughts, floods and storms are not in available the basin.

The database of the Office of the United Nations Organization for Disaster Risk Reduction and statistics recorded by the Ministry of Labor and Social Welfare, floodplain floods and flashfloods, which have impacts on the basin are indicated in **Table 5.3**.

Table 5.3 Recorded Floodplain Floods and Flashfloods per District.

District	Years of Occurrence		
	Floodplain flood	**Continuous torrential rains causing flashflood and damages**	**Tropical storm**
Luang Namtha	• 2004 • 2006 • 2007 • 2008 • 2010	• 2002 • 2006 • 2008 • 2010	• 2000 • 2005 • 2010
Nale	• 2008	• 2006 • 2010 • 2015	• 2010 • 2011
Pha Udom	• 2005 • 2006 • 2007 • 2008 • 2010		• 2005 • 2009 • 2010 • 2012 • 2015
Na-Mor	• 2006 • 2008 • 2010		• 2007 • 2011 • 2012 • 2016 • 2017 (Sonca Tropical Storm, including Xay District
Hun, Bang, Pakbeng and Xay[3]	• 2008		

In NTRB, continuous torrential rains frequently happen causing severe flooding. Luang Namtha and the nearby districts of Nale, Na-Mo, Long, Viengphoukha are oftentimes affected by flooding. The most severe flood plain flooding, flashflood and landslide occurred in LNT on 21-22 July 2021 due to tropical storm Sonca. Total precipitation in four days was about 316 mm with maximum daily precipitation of 164 mm on 20 July, which caused the Namtha River to rise to about 8 meters on 21 July 2021 exceeding the 7.5 meters critical level. Relevant authorities had warned the residents along the Nam Tha, Thoung, Ma and Mekong riverbanks to relocate in higher areas. The flooding incident affected residences and agricultural lands in several villages in Luang Namtha District, including Ban Mai, Khone, Luang, Vieng Tai, and Pasack. The incident resulted to one (1) casualty, 14 houses swept away, and several hundred hectares of farmland inundated (Vientiane Times, July 27, 2021).

[3] Severe flooding in Xay District. Most of the flooding occurred in areas of the district outside of the NTRB.

Typhoon Yagi, which was experienced in NTRB on 8 -15 Sep 2024 caused one of the most severe flood occurrences in 50 years return period and caused severe losses to communities in NTRB.

There are two water level monitoring stations along Nam Tha River in Luang Namtha District, i.e., one at the upstream in Ban Done-Samphan and another at the downstream in Ban Mai and with about 5.8 Km linear distance from each other. The water levels during the flooding incident on 9 – 10 September 2024 were recorded as follows: On 9 September at the Ban Done-Samphan monitoring station, water levels were recorded at 5.00 m with highest level recorded at 7.20 m at 12:00 AM and 5:00 PM, respectively (Warning level is 4.50 m and Emergency level is 5.50 m). At the Ban Mai station, water levels were recorded at 4.64 m, 6.36 m, 7.63 m, and 8.44 m at 11:00 AM, 2:24 PM, 4:20 PM, and 5:20 PM, respectively. Upon reaching 8.44 m, the water level monitoring station was no longer operational. The water level was highest at around 01:00 AM on 10 September 2024 with a height of 14.00 m (Warning level is 6.00 m and Emergency level is 7.00 m).

Following few days of normal rain in the basin, Typhoon Yagi hit in the morning of 8 Sep 2024 causing Nam Tha 3 HPP dam to overflow, which severely affected the communities in central Luang Namtha District and other districts in the basin.

While the situation was closely monitored and emergency warnings were issued by the responsible agencies at the central and local governments, the local communities did not expect the extent of the rise in water level and the overwhelming effect of the flooding incident.

Evacuation procedures and other pre-emptive measures were greatly overwhelmed by the flooding incident.



Rescue and evacuation from flooded areas.



Evacuation and relocation of local communities.



Authorities rescue mission during flooding.



Temporary evacution site for communities affected by flood.

The Disaster Management Committee, relevant government agencies and the private sector had conducted large-scale relief operations and assistance in the basin. The incident resulted to two (2) casualties and huge economic losses to the state and the communities. There were no records of the number of people injured and the assessment of the total value of economic losses has not been completed as of the preparation of this report.

Reports indicated that the flooding incident affected 31 villages with 8,054 families and 33,606 individuals in Luang Namtha District and Nalea District. There were also reports of landslides which affected two villages in Viengphoukha District.

Seasonal droughts are also frequently experienced in NTRB affecting the local communities and plant crops. Majority of the ethnic groups rely on highland agriculture where water is crucial for domestic use. The seasonal droughts had caused insufficient supply of water for household consumption and agriculture resulting to decline in agricultural production. Severe droughts were reported in Nale, Beng and Pakbeng districts in 2010, PhaOudom District in 2009 and Na-Mo, Nale and Houn districts in 1996.

Implications and Recommendations

Floods, droughts and landslides are frequently experienced in the NTRB, which result to huge socioeconomic losses such as the flooding incident brought about by Typhoon Yagi on 9– 15 Sep 2024. Occasional seasonal droughts also result to high economic losses among local communities. The NTRB Management Plan 2021-2025 identifies actions on mitigating the impacts of floods and droughts including strengthening climate change resilience that should be proactively implemented.

Socioeconomic losses due to disasters can be reduced through capacity strengthening; improving disaster preparedness and response; applying the lessons learned from previous disaster incidences, and building a more resilient communities through inclusive social and economic development.

Systematic recording of socioeconomic losses from disasters including flood, drought, storm and landslides is necessary to inform the development and implementation of appropriate and timely responses by the government and other key stakeholders, including the communities.

5.1 Climate Change and Disaster Risk Reduction

Core Indicator Status

Core Indicator Trend



[022] Greenhouse Gas Emissions

Description

Measures the amount of greenhouse gas emissions attributed to water-related activities, including agriculture, industry, and energy production, as well as assess the environmental impact of these sectors.

Rationale

Identifying the sources and volumes of emissions is essential for developing strategies to reduce the carbon footprint of water-related activities.

Data Requirements

- Data on greenhouse gas emissions by water-related sector (tons CO_2-equivalent/year)
- Available of mitigation strategies, and progress towards reduction targets (quantitative assessment).
- Reduction in GHG emissions from baseline (%)

Results

Lao PDR has prepared and submitted its Nationally Determined Contribution (NDC) to UNFCCC in 2015 and 2021. The first NDC reported the GHG emissions at 51,000 $ktCO_2e$ in 2000, with emissions from land use change and forestry and agriculture responsible for over 95 percent of the total emission. In the second NDC in 2021, it was estimated that the GHG emission will increase to 82,000 $ktCO_2e$ in 2020, 104,000 $ktCO_2e$ in 2030, and more than 120,000 $ktCO_2e$ in 2050. However, in the recently published technical recommendations for Lao PDR's long-term low-emission development strategy, the World Bank Group estimated that GHG emissions would be 70.2 $MMtCO_2e$ in 2019 and will increase to 111 $MMtCO_2e$ in 2050 by using GACMO model [WB, 2024].

The forestry sector's emissions resulting from deforestation, forest degradation, and selective logging has the highest contribution to the total GHG emission, i.e., 35.1 percent of the total GHG emissions or 24.6 $MMtCO_2e$ in 2019.

GHG emission from agriculture, particularly from enteric fermentation, rice cultivation, manure management and agricultural soils came 2nd accounting for 21.8 percent of the GHG emission or 15.3 $MMtCO_2e$ while the energy sector came 3rd accounting for 19.3 percent of the total GHG emissions or 13.5 $MMtCO_2e$, which mainly came from coal electricity generation with a small portion from coal mining.

The technical report categorized the emissions from eight sectors, namely: Energy Supply, Industry, Transport, Household, Service, Agriculture, Forestry, and Waste. In the transport sector, emissions are generated mainly from road transportations. In the industrial sector, emissions are generated from fuel consumption and industrial processes. In the residential and commercial sectors, use of fuel in households (residential) fuel combustion is the largest source, followed by services (commercial) fuel combustion. In the waste sector, emissions come from wastewater and solid waste.

The GHG emissions in NTRB were estimated based on the technical report described above and shown in **Table 5.4**. There are no coal power generation in NTRB hence the emission for the energy sector is zero. Emissions from industry, transport, service, waste, and households were computed based on NTRB's population; the emission from the forestry sector was based on forest-covered land area, and the emission from agriculture were computed from agricultural land area and the number of livestock. From this assumption, the total GHG emission in NTRB in 2019 was estimated at 2.38 $MMt\text{-}CO_2e$.

Box 2 **Estimation of GHG Emissions from Different Sectors in NTRB**

A. Agriculture

The percentage of agricultural land in NTRB to that of the country is 3.36 percent. According to the 3rd Lao Census of Agriculture 2019/2020, the primary livestock, cows, and buffalos are 2,165,000 and 541,000, respectively. The average livestock ownership in Luang Namtha, Oudomxay, and Bokeo Provinces is 1.5, 1.8, and 4.4 for cows and 0.6, 0.4, and 0.9 for buffalo [Statistic Bureau, 2021]. The number of cows and buffalo in NTRB are estimated by multiplying the average livestock ownership with the number of households in each area of NTRB. The percentage of both major livestock related to GHG emissions in NTRB to that of the country is 4.32 percent. Therefore, GHG emissions from agriculture in NTRB is estimated to be in the range of 3.36 – 4.32 percent of that of the agricultural sector of Lao PDR. The percentage, 4.32 percent, was used to calculate the emission from the agriculture sector in NTRB.

Box 2 Estimation of GHG emissions from the different sectors in NTRB. (cont)

B. Water-related sectors

The estimation of GHG emission from water consumption involves calculating the energy consumption associated with water supply, treatment, distribution, and wastewater treatment, and then converting that energy use into GHG emissions using appropriate emission factors. According to statistics, the water supply in 11 districts of the NTRB was 8,607,081 m^3 in 2020 (DWS, 2021). If we multiply this number with the CO_2 emission factor of water 0.279 Kg-CO_2/m^3, the GHG emission in the water supply sector in NTRB will be 2405 t-CO_2e. The CO_2 emission factor of water was calculated from the energy consumption rate for water supply 0.499 kwh/m^3 (Shimizu et.al., 2012) and the grid emission factor 0.56 KgCO_2/kWh (ADB, 2017).

The estimation of GHG emissions from hydropower involves several steps, as these emissions can occur at different stages of a hydropower project's lifecycle, including reservoir emissions, construction emissions, and operational emissions. The IPCC states hydropower has a median GHG emission intensity of 24 g CO_2e/kWh (International Hydropower Association 2022). In the NTRB, two hydropower plants such as 168 MW Nam Tha 1 HPP (average 759 GWh/year) and the 1.25 MW Nam Tha 3 HPP (average 6GWh/year), have been in operation, which could produce about 18,360 t-CO_2e per year.

Table 5.4 Estimation of GHG Emission in NTRB in 2019.

Category	Description	Lao PDR	NTRB
Parameter for calculation	Population (Persons)	7,346,533	226,182
	Agriculture area (km^2)	20,310	682
	Major livestock		
	- Cow	2,165,000	93,599
	- Buffalo	541,000	23,347
	Forestry area (km^2)	165,955	8,175
GHG emission from each sector (MMtone-CO_2e)	Energy Supply	13.5	-
	Industry	7.3	0.225
	Transportation	4.5	0.139
	Households	2.7	0.083
	Services	0.8	0.025
	Waste	1.4	0.043
	Agriculture	15.3	0.660
	Forestry	24.6	1.212
	Total	**70.1**	**2.386**

** GHG emission of Lao PDR is adapted from the full report of technical recommendations for Lao people's Democratic Republic Long Term Low-emission Development Strategy, 2024.*

The GHG emissions for the water supply sector in NTRB amount to 2405 t-CO2e, which was estimated based on the total volume of water supply in 11 districts in NTRB in 2020. The two hydropower plants in the NTRB, i.e., 168 MW Nam Tha 1 HPP (average 759 GWh/year) and the 1.25 MW Nam Tha 3 HPP (average 6GWh/year) are estimated to produce about 18,360 t-CO2e per year.

GHG emissions for water-related sector in NTRB that utilizes water for domestic consumption, agriculture, hydropower, industry and mining, tourism, and water transportation are unavailable. GHG emissions are generally estimated from the agriculture, energy, land use change, and forestry inventories.

There are at least 50 industrial and 23 mining companies in the NTRB, which include paper mills, rubber mills, stone crushing, mineral processing, agriculture product processings, pharmaceuticals, salt processing, cement, mining and processing of gold ore, barite, zinc, copper, iron, etc. However, specific data on GHG emissions from each factory are not available. Most of these factories are small scale and GHG emissions are estimated as small and could be in the same level or less than that shown in **Table 5.5**.

The tourism in NTRB is mainly eco-tourism such as camping in the forest and river bank, wildlife observation, kayaking, boat traveling along the Nam Tha river and its tributary, visiting cultural and historical places and homestay, for example, eco-tourism program in Nam Ha NPA. The GHG emission from this tourism is estimated as negligible.

Thus, the total GHG emissions from water-related sector in NTRB is estimated at 996,500 t-CO_2e and shown in **Figure 5.4**, of which agriculture was the highest contributor.

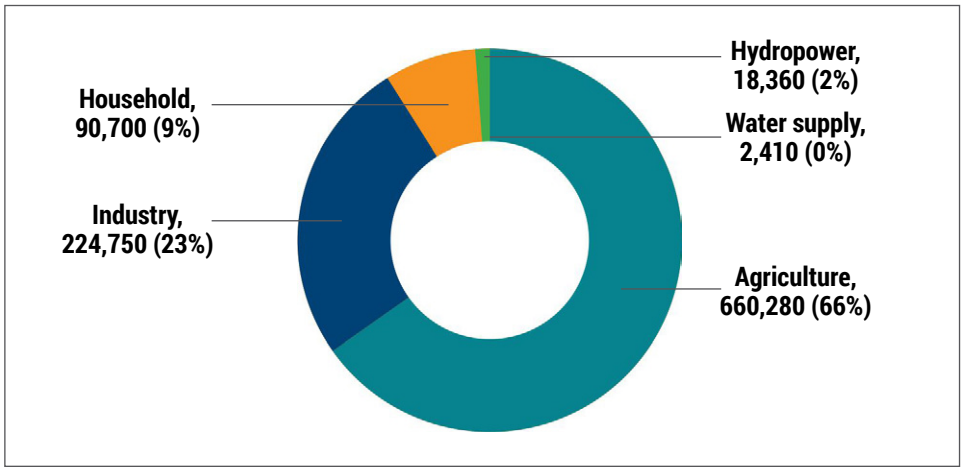


Figure 5.4 Estimation of GHG Emission from the Water-related Sector in NTRB in 2019. (unit: t-CO_2e/year)

GHG emission in the country and in NTRB and water-related sector in the basin is small compared to the global GHGs emission as shown in **Table 5.5**, i.e., 0.1385 percent, 0.0047 percent, and 0.0020 percent, respectively.

Table 5.5 Comparison of GHG Emission in the Region and NTRB to the Global GHG Emissions.

Area	GHG emissions ($t\text{-}CO_2e$/year)	Percentage to global GHG emissions (%)
Globe	50,600,000,000	100
Mekong River basin	425,000,000	0.8399
Lao PDR	70,100,000	0.1385
NTRB	2,247,550	0.0044
Water-related sector in NTRB	996,500	0.0020

It is estimated that under business as usual (BAU) conditions, the main contributors of GHG emissions in Lao PDR in 2050 include agriculture (21.5 percent), industry (19.7 percent), forestry (19.4 percent), energy supply (18.2 percent), and transportation (13.5 percent) [WB, 2024]. Lao PDR has the unconditional target to reduce 60 percent of GHG emission by 2030 or around 62,000 kt CO_2e in 2030 and about 34 percent reduction from the baseline GHG emission in 2020. The target emission reduction will come from land use, land-use change and forestry by 1.1 $MtCO_2eq$/year through decreasing deforestation, increasing hydropower capacity from 5.5 GW to 13 GW, introducing the use of 50,000 energy-efficient cookstoves and building a new bus rapid transit system in Vientiane and a new railway to China.

The three provinces in the NTRB have priority plans to manage and utilize natural resources and forestry sustainably in response to climate change and moving towards green growth. A target of increasing the area of forest cover to 70 percent has been set and promote tree planting and development and utilization of renewable energy. Target for GHG reduction is currently not included in the provinces' development plans and in the NTRB Management Plan.

Lao PDR is actively involved in carbon credit initiatives to combat climate change by reducing GHG emissions. One significant effort is the Forest Carbon Partnership Facility that the World Bank administers. In July 2024, the country received a payment of US$16 million for reducing 3.2 million metric tons of carbon emissions in an area that spans six northern provinces between 2019 and 2021. This initiative is part of the REDD+ mechanism, which aims to enhance carbon stocks in the forest sector [WB, 2024]. The Ministry of Agriculture and Forestry issued

an agreement on Forest Carbon Management in September 2024 [MAF, 2024]. This could promote investment in forest carbon credit, reduce GHGs, and enhance forest management in NTRBs in the near future.

Implications and Recommendations

Report on GHG emissions in the three provinces in NTRB is currently not available. GHG emissions were not described in the province's development plans nor in the management plan of NTRB.

Technical study on GHG emission in the NTRB is necessary for future updating of NTRB SORB Report. The inclusion of GHG emission strategies in NTRB Management Plan and in the provincial development plans and building the capacity of provincial staff in GHG emissions calculation and GHG inventory should be considered.

5.1 Climate Change and Disaster Risk Reduction

Core Indicator Status

Core Indicator Trend

[023] Climate Change Trends and Extremes

Description

Examines the recent trends in climate variables relevant to the river basin, such as temperature and precipitation patterns, and the frequency and intensity of extreme weather events.

Rationale

Understanding climate trends and extremes is crucial for adapting water management practices to changing environmental conditions.

Data Requirements

- Changes in average temperature (over a defined period)
- Changes in precipitation patterns (% change over a defined period)
- Frequency of extreme weather events (number of events/year)

Results

The World Bank Climate Change Knowledge Portal provides country and basin-level historical data on temperature based on the global ERA-5 re-analysis dataset, which combines vast historical observations based on global estimates using advanced modeling and data assimilation systems (MRC, 2024). The historical temperature data in each province of NTRB were obtained and analyzed from 1970 to 2020.

Average Air Surface Temperature

Figure 5.5 shows the annual average maximum, mean, and minimum temperature in the three provinces from 1970 to 2020. The annual average maximum temperature is between 27.6-29.9 °C, annual average mean temperature 21.9 - 23.9 °C, and annual average minimum temperature 16.1 -18.1 °C. It is observed that the temperature has increased in the past 50 years, with an increase of 0.0187 °C/year for average maximum temperature, 0.022 °C/year for annual average mean temperature, and 0.0248 °C/year for annual average minimum temperature. These numbers are close to the reported rate of temperature increase in Lao PDR in the third national communication on climate change (NDC3), which reported 0.017°C/

year for average maximum temperature, 0.022°C/year for annual average mean temperature, and 0.023°C/year for minimum temperature over the past 30 years (1976-2005). The increase in average minimum temperature in NTRB is slightly lower than that of the Mekong River Basin, with an increasing rate of 0.0266 °C/year from 1970 to 2020 (MRC, 2024). The annual average maximum, mean, and minimum temperature in the three provinces of NTRB over the past 50 years increased by 0.9, 1.1, and 1.24 °C.

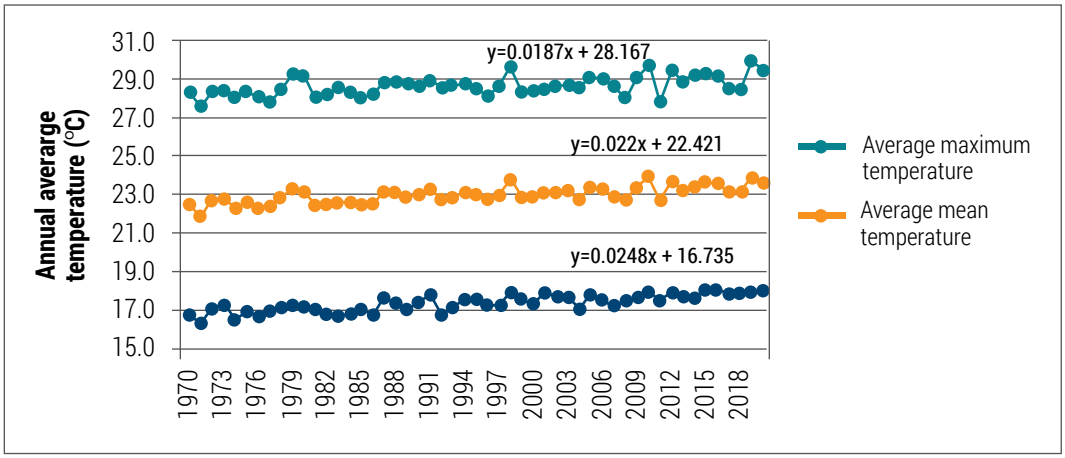


Figure 5.5 Annual Average Maximum, Mean, and Minimum Temperature in Three Provinces (ODX, LNT, BOK) from 1970 to 2020. (*Source: Temperature in each province was obtained from the World Bank Climate Change Knowledge Portal. The temperature for NTRB was represented as the average temperature in the three provinces.*)

For the air surface temperature from 1901 to 2020, the annual average mean temperature was 22.8 °C. Temperature was lower than 22.8 °C in 68 years and higher than 22.8 °C in 52 years. From 1901 to 1970 (21 years); from 1971 to 2020 (31 years), and from 1991 to 2020 (21 years) the temperatures were recorded as higher than 22.8 °C. It showed that higher temperatures were recorded in the NTRB in the last 30 years. The minimum, mean, and maximum temperatures showed increasing trends in the NTRB and extreme temperatures were observed more frequently in the last 30 years. The warming climate presents a range of challenges, including the need to adapt agricultural practices to increased crop heat stress and water consumption through evapotranspiration. Fragile ecosystems and human livelihoods and well-being may be negatively impacted by increasingly hotter conditions (MRC, 2024).

Precipitation Patterns

Figures 5.6 and **5.7** show the annual and average precipitation in ODX, LNT, and BOK from 1970-2020, respectively. It is observed that the annual precipitation fluctuates between 1136 mm and 1947 mm, except for the years 2019 and 2020, where low rainfall between 943 and 1199 mm were recorded. There is an observed increase and decrease every 5 – 10 years cycle, which is consistent with the DWR report that the average five-year precipitation during 1901 – 2018 is 1,350 – 1,600 mm/year, while annual precipitation is 1,100 – 1,750 mm. Precipitation was recorded at 1350 mm/year in the 1990s with no distinct increase (DWR, 2022).

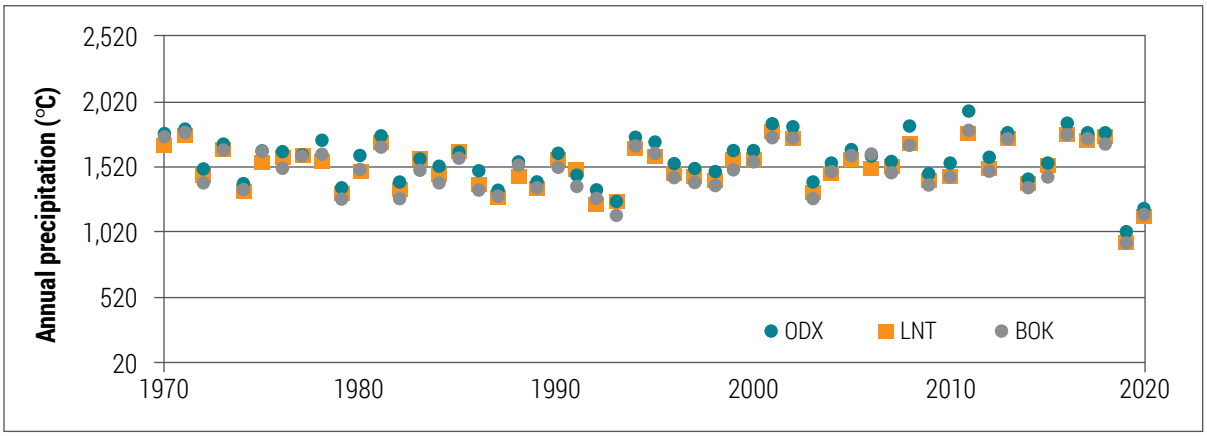


Figure 5.6 Annual Average Maximum, Mean, and Minimum Temperature in Three Provinces (ODX, LNT, BOK) from 1970 to 2020.

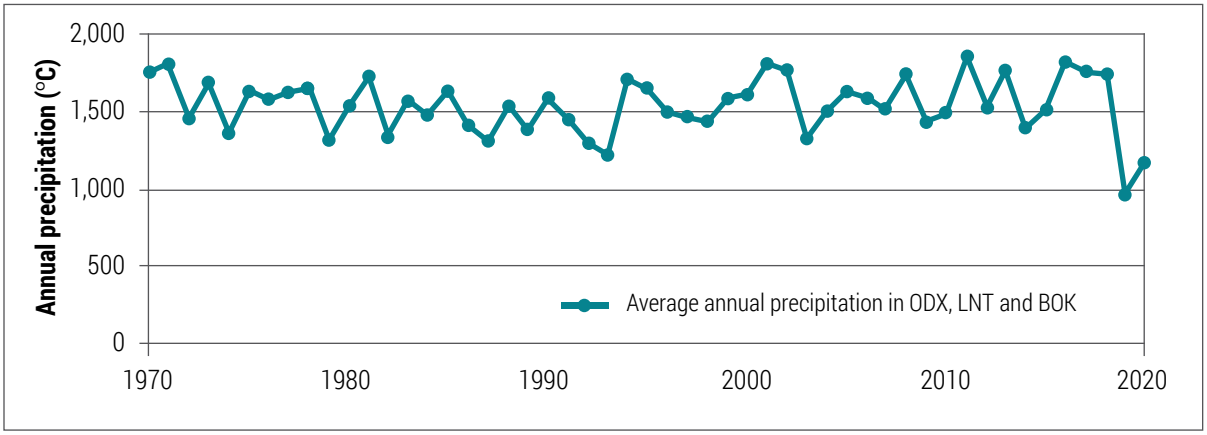


Figure 5.7 Annual Average Maximum, Mean, and Minimum Temperature in Three Provinces (ODX, LNT, BOK) from 1970 to 2020.

Although there has been no considerable change in the annual precipitation from 1970 to 2020, floods have frequently occurred in the lower areas, particularly in the Luang Namtha District, Phaoudom District, and tributaries in the Na Mor District. From the recorded precipitation in NTRB from 1985 to 2018, it was found that the intensity of torrential rainfall is increasing and occurs mostly every two or three years. Reported maximum daily precipitation from 1997-2028, i.e., 243.3 mm (1997), 187.5 mm (1999), 150.4 mm (2008), 172.5 (2013), and 149.9 (2018), which caused flooding in several places in Bokeo province [ISP&LUP of Bokeo, 2020]. In July 2021, a flash flood happened in Luang Namtha District caused by continual torrential rains brought by a tropical storm, with total precipitation amount to 316 mm in four days and a maximum of 164 mm/day on 20th July 2021. Typhoon Yagi, which hit northern Lao PDR on 8th – 10th Sep 2024 also caused severe flooding in the NTRB particularly in the urban area and 35 villages in LNT.

The NTRB Management Plan identifies strategies and activities to minimize the impact of floods, drought, and climate change, including:

1. Analyze existing data to identify high risk areas for flood and drought, including data/ information sharing on disaster and climate change;

2. Conduct assessment and FS on the design of projects in addressing flooding, drought and soil erosion;
3. Establish early and emergency warning systems in high-risk areas;
4. Establish a committee for disaster preparedness and response including coordination with project developer;
5. Promote and enhance understanding and awareness of people to prepare them in adapting and responding to natural disasters, and
6. Conduct surveys and exploration of ground water availability in areas experiencing seasonal drought.

In adapting to climate change, the following activities are identified:

1. Conduct capacity building on climate change adaptation and mitigation;
2. Establish a center for data and information and provide access to the people, and
3. Establish a committee responsible for dissemination of emergency and early warning information to the public.

Implications and Recommendations

The temperature in the NTRB is increasing in the past 50 years with significant increase observed in the past 30 years. The precipitation pattern has not shown significant change. However, incidence of torrential rains has increased and occurs mostly every 2 or 3 years causing flooding and economic losses in the NTRB.

According to the third national communication on climate change (MONRE, 2024), based on the assessment in 2016, Lao PDR will experience an increased temperature for both short-term (2021-2050) and long-term (2070- 2099) under both RCP 4.5 and RCP 8.5 scenario. Under the RCP 4.5 scenario, for the short term (2021- 2050) or 2030s, the average maximum temperature will increase by 0.98 to 1.35 °C, and the northern part of the country will experience more temperature increase compared with the southern part. The projection of the minimum temperature showed that the temperature increases around 1.05 °C to 1.4 °C in several provinces, including Phongsaly, Luang Namtha, and Bokeo Provinces, for short-term (2021-2050) or 2030s in comparison with the baseline 1975-2005 or 1990s. Under RCP 8.5, the minimum temperature change is between 1.45 °C to 1.55 °C for the north, e.g., Phongsaly, Luang Namtha, Bokeo, Oudomxay, and Xayabouly Provinces. Projection in the precipitation based on the rainfall historical or baseline data 1975-2005 under RCP 8.5 scenario projection showed that change in precipitation ranges from 100 to 150 mm/day in Xayabouly, Bokeo, Luang Namtha, and Oudomxay Provinces. Projected seasonal precipitation between May and October using historical data from 1975 to 2005 under RCP 4.5 scenario projection indicates that there will be 145 to 180 mm per day in the northwest part of the country, where the NTRB is located.

SUSTAINABLE DEVELOPMENT ASPECTS

5.1 Climate Change and Disaster Risk Reduction

Core Indicator Status

Core Indicator Trend



[024] Adaptation to Climate Change

Description

Assesses the implementation and effectiveness of adaptation strategies to climate change, including changes in water management practices, infrastructure improvements, and community adaptation measures.

Rationale

Effective adaptation measures are key to reducing the vulnerability of river basins to the impacts of climate change.

Data Requirements

- Climate change adaptation strategy documents
- Reports on adaptation measures, and assessments of adaptation effectiveness
- Number of awareness-raising activities for local communities on adaptation measures
- Investment in adaptation (US$)
- Vulnerability level for floods, droughts and storms
- Flood and drought protection measures in place

Results

Lao PDR has developed and implemented policies, strategies, plans, and measures on climate change adaptation since 2010. Related laws and decrees include: Law on Environmental Protection (2013); Meteorological and Hydrological (2017); Water Resources (2018); Disaster Risk Management (2019); Decree on Climate Change (2019), and Environmental Impact Assessment (EIA) (2019).

The Environmental Protection Law (EPL) (2013) identifies climate change adaptation as one of the objectives of environment protection. The Decree on EIA (2019) includes climate hazards and disaster risks assessment as components of EIA. The Decree on Climate Change (2019) outlines the principles, regulations and measures to prevent, protect and reduce the

potential impacts of climate change in each sector as well as on lives, properties, environment, biodiversity and infrastructure. The Meteorological and Hydrological, Water Resources, and Disaster Risk Management laws also promote adaptation through monitoring, development and operation of an effective early warning system, and disaster preparedness and response to climate and hydrological hazards, including floods and droughts (MONRE, 2024). Lao PDR has submitted a National Determined contribution (NDC) to UNFCCC in 2016 and 2021 with an increasing level of ambition to reduce greenhouse gas emissions as described in Indicator 22 on Greenhouse gas emissions.

The key climate change adaption strategies and plans include:

- National Adaptation Program of Action to Climate Change (NAPA) and those defined in the Second National Communications (SNC) to the UNFCCC;
- National Strategy on Climate Change (NSCC);
- Nationally Determined Contributions (NDC);
- Climate Change Strategy Action Plan (CCSAP 2013-2020);
- Technology Action Plan (TAP) for Climate Change Adaptation in Agriculture, Forestry, and Water Resources;
- 9th NSEDP (2021-2025);
- National Green Growth Strategy to 2030, and
- Sectoral strategies such as the 10-Year Natural Resources and Environment Strategy 2016-2025, Urban Development Strategy to 2030, Agriculture Development Strategy to 2025 and Vision to 2030, Strategy on Climate Change and Health Adaptation 2018-2025 and Action Plan 2018-2020, and the Mekong Climate Change Adaptation Strategy and Action Plan and the Basin Development Strategy 2021-2030.

The provinces in NTRB have several climate change adaptation plans for the implementation of the Lao PDR strategy and the direction of green growth. The NTRB Management Plan includes strategies and actions to minimize the impact of floods, drought, and climate change as also described in Indicator 23 on climate change trends and extremes. However, few activities have been implemented due to limitations in budget and human resources.

Oudomxay Province was listed as one of the drought risk areas from October to March in the strategy on natural disaster risk reduction 2021-2030. The assessment of vulnerability to climate change is included in the provincial Integrated Spatial Plan and Land Use Plan. The vulnerability of five districts in NTRB has been categorized as low (Xay District), medium (Houn District), and high (Districts of Na-mor, Beng, and Pakbeng).

Oudomxay Province has the following plans for 2021-2025:

1. Improvement and establishment of the disaster committees at the provincial and district levels.
2. Completion of the provincial strategy for the management of natural disasters and climate change.
3. Creation and completion of the resilience plans for natural disasters at the provincial and district levels.
4. Promotion of reduction of GHG emissions in each sector
5. Integration of natural disaster and climate change work in the sectors of water, environment, agriculture and forestry, and related sectors.
6. Dissemination, capacity building, and enhancement of understanding on disaster and climate change in the province.

Bokeo Province has established the committees on disaster prevention and management at the provincial and district levels and has developed guidelines outlining the responsibilities of the provincial committee on disaster prevention and management and the implementation of the 2019 disaster adaptation plan. High risk areas to natural disasters include 33 locations for flooding, eight for typhoon, seven for drought, seven for landslide, and seven roadway damage in the five districts have been identified. The province has the following targets for natural disaster management and climate change adaptation from 2020-2025:

1. Completion of the provincial strategy for the management of natural disasters and climate change.
2. Integration of natural disaster and climate change work in the major sectors of natural resource and environment, agriculture and forestry, public work and transportation, public health, energy and mining, education and sports.
3. Dissemination, capacity building and enhancement of understanding on disaster and climate change at the local level.
4. Assessment of natural disasters and vulnerability to climate change and creation of hazard maps on natural disasters and climate change.
5. Consolidation of annual natural disaster information.

Lao PDR has received multilateral climate fund from 2003- 2022 through 32 projects with a total budget of US$ 127.27 million including grants and loans. From these, 26 projects were approved from 2013-2022 with a total budget of US$ 102.14 million (MRC, 2024). However, data on investments on climate change adaptation at the provincial levels are not available. The estimated budget for the implementation of activities to minimize the impacts of floods, drought, and climate change as outlined in the NTRB Management Plan 2021-2025 is 600 million LAK (about US$ 30,000), which is relatively limited to support the implementation of the identified action programs.

Implications and Recommendations

There are several key policies, strategies, plans, measures, and laws supporting the adaptation of climate change at the national level. The three provinces in the NTRB have also included adaptation to climate change in their respective development plans for 2020-2025. Committees on natural disasters and climate change have been established in Bokeo Province and included in the plans of Oudomxay Province for 2020-2025. The provinces have integrated natural disaster management and climate change adaptation in the major sectors including information and public awareness, and capacity building. However, implementation of adaptation strategies is limited due to financial and human resources limitations.

At the national level, the National Strategy on Climate Change Towards 2030 was endorsed in 2023, which outlines the goals, targets, fundamental principles, priority programs, and projects to strengthen the implementation of climate change adaptation and resilience, including greenhouse gas mitigation, mainstreaming climate change in the development plans of all relevant sectors, and creating enabling mechanisms for climate change management.

There is a need to strengthen the integration of disaster preparedness and response including climate change adaptation in the plans and programs of relevant sectors, including information and public awareness and capacity building. Forging cooperation at the regional and international levels is necessary to strengthen the implementation of the NTRB Management Plan 2021-2025 and in addressing climate change issues.

5.2 Habitat Protection, Restoration and Management

Core Indicator Status

Core Indicator Trend



[025] Status of Environmental Assets

Description

Assesses the condition of key environmental assets within the river basin, including biodiversity, ecosystems, and natural resources.

Rationale

The conservation and enhancement of environmental assets are central goals of IRBM, reflecting its commitment to sustainability and ecological health.

Data Requirements

- Information on the status of biodiversity and abundance (fish, flora and fauna, habitats) (both qualitative and quantitative information/data)
- Conditions of critical habitats (wetlands, riparian zones), and health of fish communities (both qualitative and quantitative descriptions)
- Area of critical habitats protected (km^2)
- Number of species at risk (count)
- Ecosystem health index (score)

Results

The NTRB has two established national protected areas (NPA): Nam Ha NPA in Luang Namtha Province and Nam Kan NPA, which spans the in provinces of Bokeo (Huayxay, Meung, Pha Oudome) and Luang Namtha (Vieng Phu Kha).

The Nam Ha National Biodiversity Conservation Area (NBCA) is one of the 20 NPAs in Lao PDR, which is located approximately 20 km southwest of Luang Namtha. Nam Ha NBCA was designated an ASEAN Heritage Park in 2003, and the only one in Lao PDR. It has a total area of 222,400 hectares and spans five districts in Luang Namtha Province, namely: Muang Long, Muang Sing, Luang Namtha, Nale, Vieng Phukha. The area consists of evergreen gallery forests, semi-evergreen forests, subtropical Castanopsis forest, sub-montane forests on the higher peaks, mosaic of grasslands, limestone forests on the karst portions, caves, freshwater streams, secondary scrub, and village lands [Asean Center for Biodiversity].

The Nam Ha NBCA provides habitat for approximately 37 mammals, with at least 19 of significant national and regional value to biodiversity conservation. Globally endangered species within the NBCA include the Asian elephant, tiger, and black-cheeked gibbon (Duckworth et al., 1999; Johnson et al., 2005). Other species with conservation significance include the sun bear and Asiatic black bear and six ungulate species including the Guar and Serow, both of which are vulnerable status (Ling, 1998; Tizard et al., 1997). There is also a high diversity of birds, with at least 288 species, including a number of species listed as vulnerable such as the Blyth's kingfisher, green peafowl, and the short-tailed parrotbill.

Aquatic resources are highly diverse and are a primary source of dietary protein for communities along the Nam Tha River. More than sixty fish species have been identified in the Nam Tha. Carp and catfish species are the most abundant groups. Conditions in Nam Tha are very good for spawning of many species, including local species and migratory species from the Mekong River. The succession of rapids and pools, and the presence of sand and gravel alluvium along the river, are known to provide important spawning sites during the wet season (Acres / RSW / HQI, 1997).

To date, little information has been collected on the small mammal, reptile, amphibian and fish fauna of the protected area. In addition, it was estimated that the area has about 2,000 species of plants. The unique floras are Aquilaria trees, cardamom, Jewel orchid, *Cinnamomum sp.*, bamboos and rattans, dipterocarp trees, and Castanopsis stands. Twenty-five villages are located within the boundaries of the Nam Ha NPA. The lives of people in these villages have been integrated with the forests for centuries. People use the forest for their daily subsistence needs, but also protect it, recognizing the need to sustain it for future use. As such, the villagers are both exploiters and stewards of the forest. In the process of creating the regulations for the NPA, the villagers play an important long-term supervisory role [Nam Ha NPA, https://namha-npa.org/].

The Nam Kan NPA is located along National Road No.3 in Bokeo Province within the boundaries of the NTRB. There is very limited information available on the Nam Kan NPA. It covers approximately 136,000 hectares, with large areas of mixed-deciduous forest and consists of mountainous terrain ranging from 500 m to 1500 m in elevation. The reserve is rich in biodiversity, with a range of birds, insects, and mammals including one of the only remaining populations of the globally endangered black-cheeked gibbon.

The ecosystem health index of NTRB is not yet available. However, there is evidence that the basin is rich and supporting a variety of natural resources and ecosystems, i.e., wetlands, lowlands, highlands, etc.) as described above.

Several initiatives to protect the ecosystems have been implemented in the area. For example, UNESCO and the Lao National Tourism Administration started the Nam Ha ecotourism project in 1999, which linked ecosystem conservation to improving the potential of local ecotourism, contributing to the economy of the area's 57 villages and 3,451 households. Community members are trained as eco-guides and operate village-based lodges and forest camps. They are also

trained to monitor threats to biodiversity in the protected area, supporting the work of the critically under-resourced Protected Area Management Unit. The project was a recipient of UNDP's Equator prize winner in 2006, which recognized the advancement of local sustainable development solutions for people, nature, and resilient communities (United Nations Development Program, 2012). At present, the ecotourism activities in Nam Ha NPA is being managed by the National Tourism Authority in cooperation with the Ministry of Information and Culture, the Ministry of Agriculture and Forestry, and tourism companies in Luang Namtha province (https://namha-npa.org/about-us/).

The management of wetland and forest resources are included under the two targets of Action plan 6 in the NTRB Management Plan 2021-2025. The identified activities for the management of forest resources include:

1. Establishment conservation area in the upstream forest;
2. Develop guidelines for the management and protection of the upstream forest especially along the main tributaries area of Nam Tha River;
3. Set up signboards and posters in highly restricted areas to protect wildlife and biodiversity;
4. Dissemination of information on regulations, rules, laws, and legislation on forest protection, and
5. Regular patrolling in the upstream forest.

The identified activities for the management of wetlands include:

1. Delineate the surveyed forest areas, wetlands, including peat land;
2. Putting up signboards in the wetlands and peat lands;
3. Develop and pass regulations for the management of the wetlands, and
4. Develop, adopt and implement the wetlands management plan.

Luang Nam Tha Province has allocated 692,271 hectares (74 percent of the land area) for natural resources preservation, which includes production forest, protection forest, and protection area, which is one of the eight targets in the strategy toward 2025 [Luang Nam Tha Province, 2021]. In the province's Socioeconomic Development Plan 2021-2025, the following priorities have been identified:

- Recover the forest cover area to 68.27 percent of the province's land area;
- Target 500 ha as the potential forest area to recover;
- Continue the rehabilitation of production forest in two areas: Phou Led-Longmoun, Viengphouka District and Na Lea district, Production Forest Nam Fa, Long district;
- Develop a management plan allocating areas for forest utilization for 100 villages in five districts;
- Strictly monitor and manage the wood exploration, illegal shipment of forest natural resources and non-timber forest products, and

- Protect and ensure that the environment is balanced and resilient to disaster through the implementation of 26 projects (118,600 million Kip) from MAF, MONRE and Ministry of Information, Culture, and Tourism.

Implications and Recommendations

The NTRB has two important national protected areas that are rich in biodiversity with species of significant national and regional value to biodiversity conservation. The management of wetlands and forest resources is included in the NTRB Management Plan 2021-2025. The provinces have also allocated areas for natural resource protection and are implementing initiatives to increase forest cover. However, several activities are posing threat to the protected areas and natural resources, including shifting cultivation, overharvesting of NTFPs, wildlife trafficking, investment projects in the forest areas, and overharvesting and trading of wildlife.

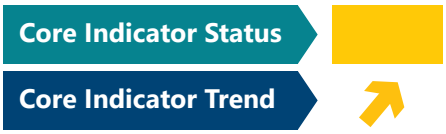
Several legal instruments on forestry and biodiversity conservation have been enacted, namely:

- Amended Law on Wild Animals (2023): aims to avoid the negative impact on nature and habitats and restrict the decrease and extinction of wild animal species
- Law on Aquatic and Fisheries (2023)
- Decree on Forest Conservation (2023): seeks to preserve the beauty of natural landscapes, the forest ecosystem services and biodiversity; protect the environment in line with green and sustainable direction; improve the livelihoods of the peoples of various ethnicities, and contribute to the national socio-economic development
- Roadmap for National Protected Areas Management and Sustainable Financing (2024): serves as the reference guide for all PA stakeholders. One of the roadmap's priorities is to ensure biodiversity has no net loss when using forests, such as applying concrete methods for forest users to ensure their activities cause no net loss of biodiversity and ecosystem value. The enforcement of these instruments marks a significant milestone for better management and governance of biodiversity-rich areas including the NTRB.

It is recommended that the next iteration of the NTRB Management Plan for 2026-2030 will consider the following:

- Continual management of shifting cultivation, overharvesting of NTFPs, overfishing, overhunting, and wildlife trafficking.
- Encourage more active involvement of wide range of stakeholders in decision making and management of investment projects in the basin.
- Continual management and control of unsustainable agricultural practices especially the use of pesticide (insecticide), fungicide and herbicide and other chemicals, which negatively impact the quality of soil and water as well as terrestrial and aquatic ecosystem health.

5.3 Water Use and Supply Management



[026] Water Use and Supply Management

Description

Assesses the management and efficiency of water use and supply, including water conservation practices and the distribution of water resources among various sectors.

Rationale

Efficient water use and sustainable supply are foundational to successful IRBM, supporting economic activities and ecosystems.

Data Requirements

- Information on water resources availability
- Existence of water management plans, and conservation strategies
- Total annual water withdrawal (m^3/Year)
- Water withdrawal by sector (agriculture, industry, domestic, m^3/Year)
- Water efficiency use (% improvement or change over a defined period) in different sectors such as agriculture, industry, and domestic consumption.
- Existence and clear mitigation and adaptation strategies with concrete action plans
- Staff allocation for water conservation and management (number of staff, women and men)
- Budget allocation for water conservation and management (US$)
- Water use per capita (liter per capita per day)
- Population with access to improved water sources (%, and equivalent people)
- Water pricing per cubic meter (US$/$m^3$)
- Whether water resource affected by saltwater intrusion (Yes/No)

Results

One water level station was installed in Luang Namtha District in 2020 and four stations are being planned to be established in Luang Namtha Province between 2021-2025.

Relevant water-related studies that were used in the preparation of the NTRB Management Plan include:

- 2019: Lao National Mekong River Committee's River flow study using the IQQM model
- 2021: Institute of Natural Resource and Environment and Earth System' modeling using the Soil and Water Assessment Tool (SWAT) and water resource model using Source software in 2021 to undertake an assessment of the current status of water resources.

The amount of available surface water in the NTRB is about 3.570 million m^3/year. Modeling results indicate that the average annual rainfall inflow into the NTRB before losses is 12,579 million m^3/year; losses to evapotranspiration and groundwater infiltration account for 9,009 million m^3/year or 71.62 percent of rainfall inflow into the NTRB, and the inflows minus losses to infiltration and evapotranspiration is 3,570 million m^3/year on average (**Table 5.6**).

Based on modeling results, the total surface water extraction for irrigation is 117 million m^3/year, of which 33 million m^3/year (28 percent) is returned to the river via return flows; and approximately 3,482 million m^3/year (27.68 percent) of total available surface water is discharged from the Nam Tha River into the Mekong River. This volume represents the total water available for future growth in irrigation, domestic, industrial, and environmental water use (**Table 5.6**).

Table 5.6 Water Balance in NTRB.

Flow	Water balance component	Volume (million m^3/year)
Inflows	Rainfall	12,579
Outflows	Irrigation water extraction	117
	Irrigation return flow	33
	Net irrigation water use	84
	Domestic water use	4
	Losses to evaporation from Nam Tha 1 hydropower projects	<1
	Losses (infiltration and evapotranspiration)	9,009
	Surface available water	3570
	River outflow	3,482

The allocation of water in the NTRB is based on the principle of equitable access; maintaining the balance of the ecological system of the basin and ensuring sufficient water supply to meet the local socioeconomic development and needs of the various sectors:

1. Domestic consumption not exceeding four million cubic meters/year.
2. The agriculture sector particularly for irrigation use not exceeding the maximum water withdrawal of about 118 million m^3/year.
3. The two hydropower dams in the NTRB, namely: Namtha 1 and Namtha 3, consume less than 1 million m^3/year.
4. There is currently no systematic monitoring and data collection on the amount of water consumption/withdrawal in the industrial and mining sectors in the NTRB.

The estimated water consumption of the different sectors in 2020 is shown in **Table 5.7**. The amount of available water supply, i.e., 3,570 million m^3/year, is still large compared to the current water consumption of the different sectors in the basin. With the current water consumption in the basin, the amount of available water supply is 2,785 million m^3/year or 78 percent of the total volume of water supply. The available water supply in each of the sub-basins is about 80-91 percent, which indicates that water is sufficient to sustain the ecosystem and economic development in the basin.

Table 5.7 Water Volume and Allocation in the NTRB and Subbasins in 2020 (million m^3/year).

No.	Water volume and allocation	Nam Tha	Nam La	Nam Talan	Nam Leu	Nam Xae	Nam Heang	Nam Had	Houy Poung	Nam Khon
1	Total water	12,579	1,142	767	437	1,253	470	976	471	572
2	Natural loss water	9,009	641	497	260	914	364	763	390	407
3	Available water volume	3570	501	270	177	339	106	213	81	165
4	Minimum volume for sustain ecosystem and environment	662.3	37.84	18.92	15.77	20.02	6.31	15.77	6.31	6.31
5	Water that can be used for allocation	2,908	463	251	161	319	100	197	75	159
6	Consumption	4	0.65	0.3	0.18	0.59	0.23	0.6	0.19	0.18
7	Agriculture-Irrigation	118	32	5	18	19	6.4	17	2.3	2.4
8	Agriculture-Irrigation in dry season (80% scenario)	47.2	12.8	2	7.2	7.6	2.56	6.8	0.92	0.96
9	Agriculture-Irrigation in wet season (100% scenario)	59	16	2.5	9	9.5	3.2	8.5	1.15	1.2
10	Hydropower	1								
11	Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	Remain available water	2785	430	246	143	299	93	179	73	156
13	Percentage to available water volume	78	86	91	81	88	88	84	90	95

Table 5.8 shows the estimates of the volume of available water supply and consumption in the different sectors in 2020 and 2040. It is expected that water use will increase by about 3 million m3 in 2040. The estimated volume of water consumption in the urban and rural areas, agriculture and irrigation is shown in **Tables 5.9** and **5.10**, respectively. Despite the increase in agricultural land, population growth, the development of special economic zones, industrial areas, modern cities, and hydropower dams, the amount of available water to meet the demands of the different sectors will be sufficient.

Table 5.8 Estimation of Water Volume and Utilization in 2020 and 2040 (million m^3/year).

Water volume and utilization	2020	2040
Total Water volume	12.579	11.950
Water volume for Domestic Consumption	3,72	4,66
Water volume for Hydropower	<1	1
Water volume for Agriculture-Irrigation	118.2	121.5

Table 5.9 Estimation of Water Volume for Consumption in Urban and Rural Area.

Urban/rural	Water volume needs (x1000 m^3/day)			
	Year 2015	Year 2020	Year 2030	Year 2040
Urban	2,2	2,38	2,71	2,99
Rural	7,2	7,80	8,87	9,78
Total	**9,4**	**10,19**	**11,57**	**12,77**

Table 5.10 Estimation of Water Use for Agriculture and Irrigation (million m^3/year).

Estimation of use	2020	2030	2040
Agriculture area (km^2)	687	688	689
Annual water use for irrigation (million m^3/year)	118.2	120.7	121.5
Dry season water use for irrigation (million m^3/Year)	47.4	48.3	48.6

Water resources conservation and management is included in the NTRB Management Plan. Some of the priority activities identified for implementation in 2024 include: encouraging business entities and projects that utilize water to register and obtain permits on water utilization and wastewater discharge; conducting water quality monitoring at major sampling points in each district at least four times annually and the implementation of international projects such as the Langcang-Mekong River Special Fund and the GEF/UNDP/ASEAN IRBM Project.

Water use per capita increases with population growth. In many rural areas, access to tap water remains limited. In cities or urban areas, tap water is used not only for basic needs but for other activities including car washing, watering gardens, and industrial processes. The water use per capita based on the size of a town is shown in **Table 5.11**. Larger cities with dense populations and greater industrial activity exhibit significantly higher water consumption compared to smaller rural communities. On average, daily water use per person is approximately 50 liters in villages, 90 to 160 liters in small towns, and up to 225 liters in major cities such as Vientiane. When broken down by classification, urban areas show an average per capita water use of 165 liters per day, while rural areas average around 70 liters per person per day.

Table 5.11 Water Use Per Capita in Lao PDR.

Type	Urban / rural classification	Number of people supplied	Per capita water demand (litres / person / day)
Capital	Urban	>100,000	200 - 250
Large town		50,000 – 100,000	120 – 200
Medium town		20,000 – 50,000	100 – 120
		Urban average	**165**
Small towns (high capacity for socio-economic development)	Rural	5,000 – 20,000	80 – 100
Small towns (low capacity for socio-economic development)		2,000 – 5,000	60 – 80
Community		<2,000	40 – 60
		Rural average	**70**
		Overall average	**117.5**

Source: Data provided by NRERI (2020)

The estimated water use per capita in Lao PDR was evaluated against the neighboring countries to validate their accuracy (**Table 5.12**). The rural water usage and the overall average are consistent with external estimates. However, water use per capita in urban areas appeared to be significantly higher than that of Vietnam and Cambodia. Nonetheless, the population in all NTRB towns is below 5,000, thus the water use per capita is comparable with estimates in the other countries.

Table 5.12 Comparative Per-capita Water Use Estimates for Lao PDR.

Country	Data source	Reference year	Per capita water use (litres / person / day)
Lao PDR	FAO AquaStat (2016)	2003	63
	MRC (2010)	2000	64
		2007	106
	eWater (2018)	2005	60
			138 (inclusive of industrial use)
Thailand	MRC (2010)	2007	166
Vietnam			65
Cambodia			92

In the NTRB, there are seven tap water processing plants primarily located in central districts and larger villages, collectively serving 49 out of 328 villages or 14.9 percent. Specifically, 37 villages in Luang Namtha District, four in Nalea District, and eight in PhaOudom District currently have access to tap water.

However, many rural villages and those in other districts have limited access to tap water services. Despite this, most communities rely on safely managed water sources for their daily supply. More detailed data is needed at the district level to assess coverage.

According to the 9-Year Water Supply and Sanitation Sector Development Strategy (2022–2030), 77 percent of the urban population in Lao PDR had access to safely managed water sources in 2020. The government aims to increase the access to safe water supply in urban areas to 90 percent by 2030.

Implications and Recommendations

Current and projected water availability, water allocation and sectoral demands are described in the NTRB Management Plan. Activities for water resource conservation and management are outlined in the NTRB Management Plan. However, information on sources of funding for the implementation of these activities were not available during the preparation of this report.

The agreement on water utilization has also been endorsed in 2022, which requires water-related entities and projects to secure permits and licenses on the use surface water and groundwater outlines. The implementation of this agreement will allow the collection of a more detailed information on water use in support of better water resources management.

It is recommended that the updating of the NTRB Management Plan will consider the identification of financing mechanism for the implementation of water resource management plan. The updating of the Management Plan should also consider strengthening stakeholder engagement in decision-making processes related to river basin planning and management. The updated plan should promote transparency in regulations for hydropower reservoir, improve flood management strategies, and ensure the long-term sustainability of aquatic ecosystems within the basin.

5.3 Water Use and Supply Management

Core Indicator Status

Core Indicator Trend



[027] Water Flow Conditions

Description

Measures the conditions of water flow, including discharge rates, water levels, and velocity profiles, to assess the health and management of the river basin.

Rationale

Understanding water flow conditions is critical for effective water management, disaster risk reduction, and maintaining ecological health.

Data Requirements

- Mean annual river discharge (m^3/s)
- Seasonal variability of water flow (% change)
- Frequency of extreme flow events (number of events/year)
- Average water levels (m)
- Velocity profiles (m/s)

Results

According to data from the Lao National Mekong Committee using the Integrated Quantity-Quality Model (IQQM) model, the average daily water flow to the Mekong River at Pak Tha is about 233 m^3/s, based on two data periods (1985–2008 and 2010–2019). The highest recorded flow was 4,310 m^3/s on August 11, 1991 (**Figure 5.8**).

From simulations covering 1985–2008, the monthly average flow was 158 m^3/s; the highest monthly average was 1,207 m^3/s while the lowest was 43 m^3/s (**Figures 5.9 and 5.10**).

The monthly average flow in the years 2007, 2020 and 2040 remains constant at 158 m^3/s. However, during January to April, flow rates increased from 19-40 m^3/s in 2007 and 49-61 m^3/s in 2020. A slight decrease in the flow rates was observed during the rainy season. Projections for flow rates in 2040 show similar patterns to those in 2020 (DWR, 2022) (**Figure 5.11**).

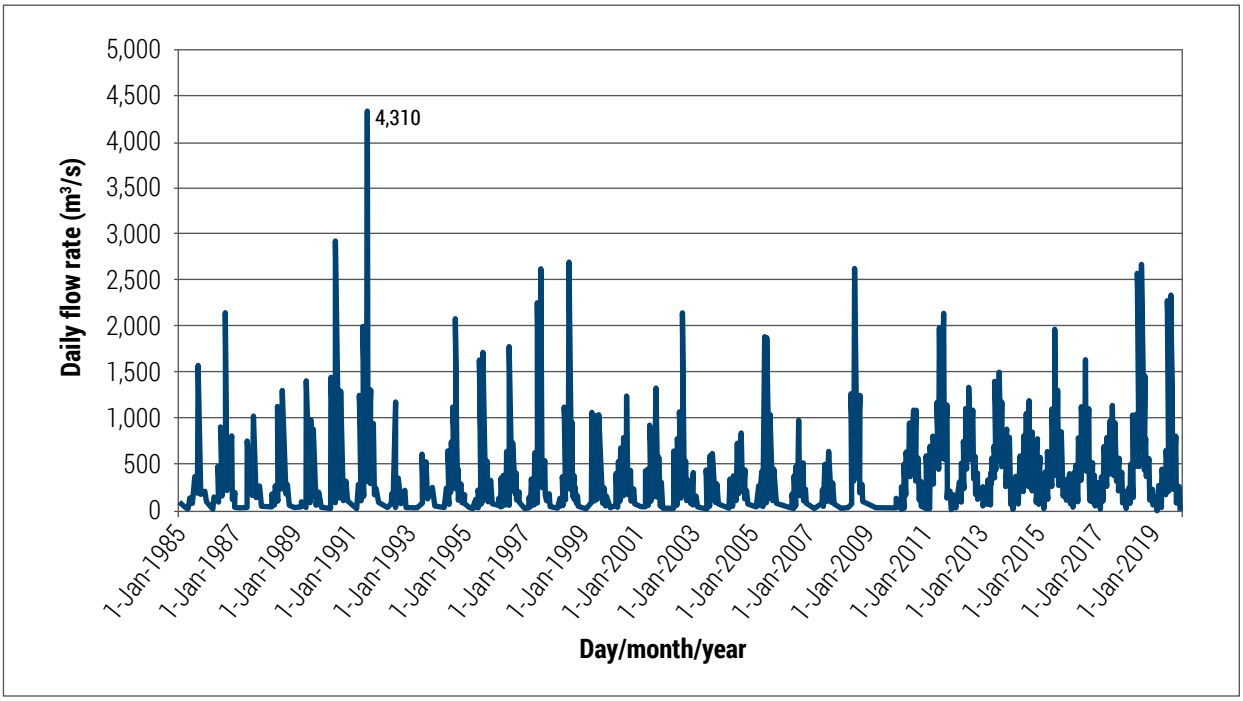


Figure 5.8 Daily Flow Rate in Nam Tha River Basin (1985-2019).

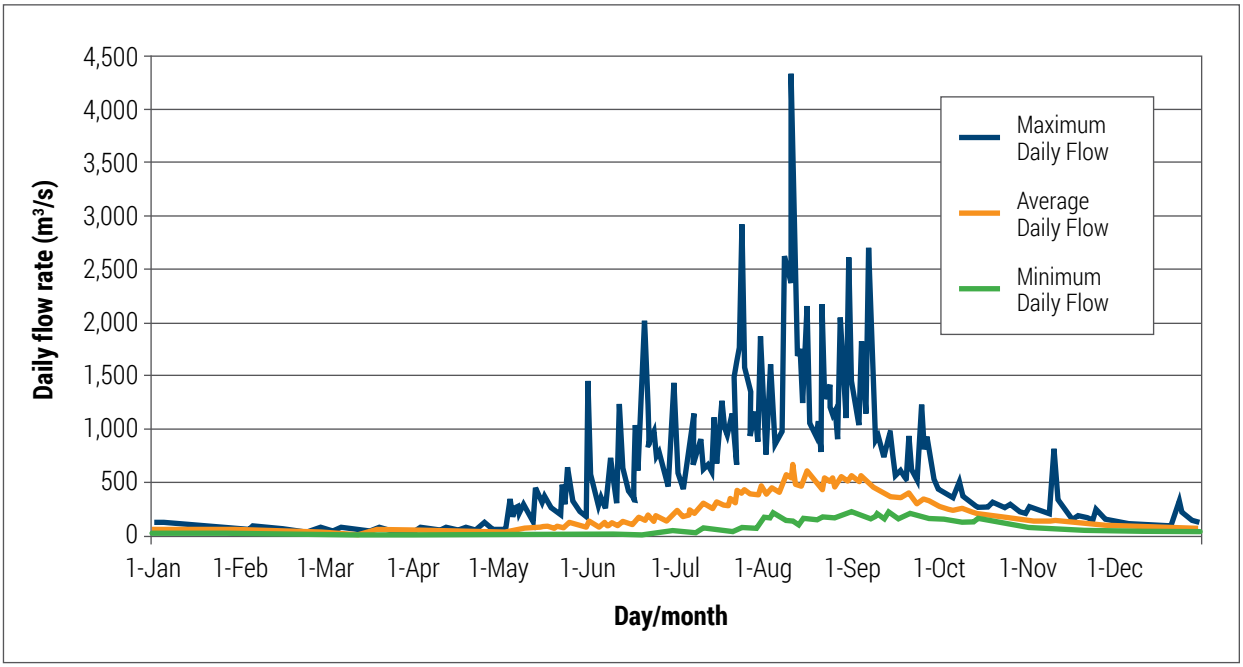


Figure 5.9 Average Daily Flow Rate in Nam Tha River (1985- 2008).

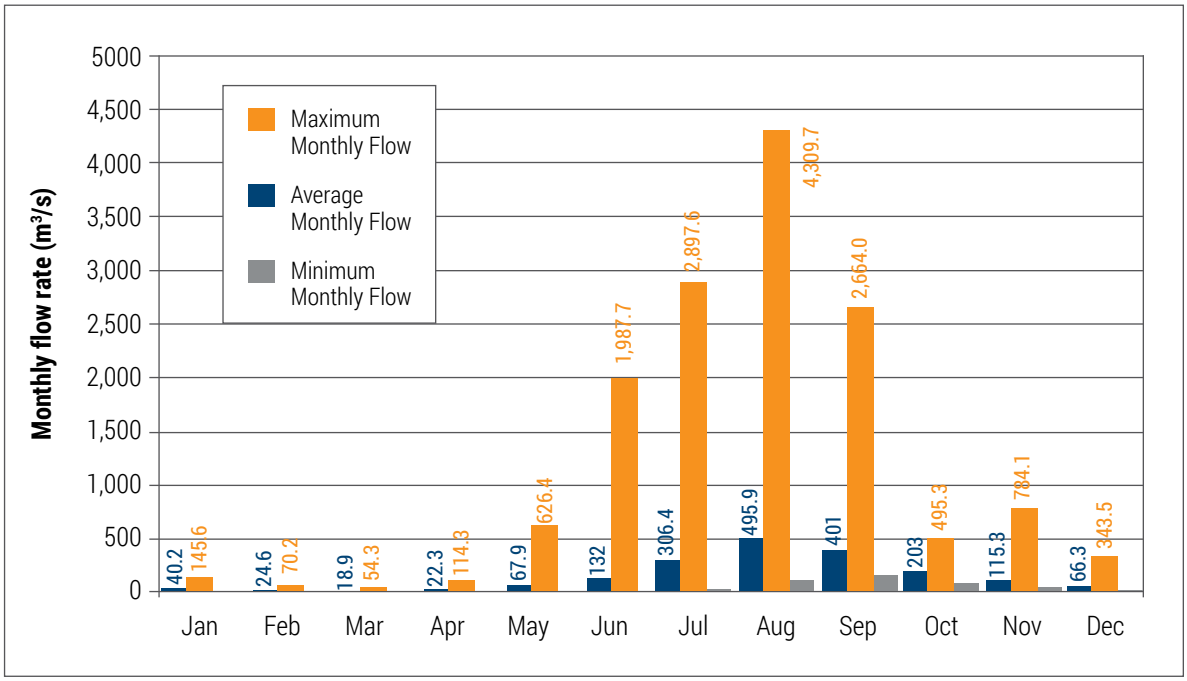


Figure 5.10 Average Monthly Flow Rate at Nam Tha River Mouth (1985-2008).
(Source: Lao National Mekong Committee, 2021)

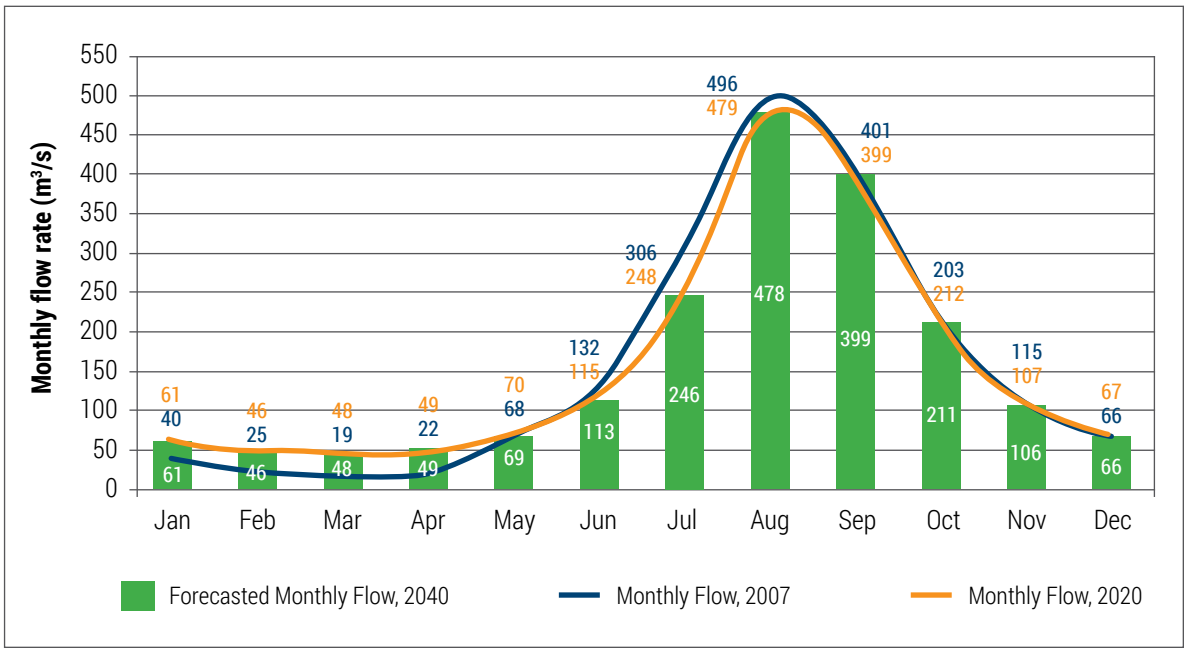


Figure 5.11 Average Monthly Flow Rate at Nam Tha River Mouth in 2007, 2020 & 2040.
(Source: Lao National Mekong Committee, 2021)

According to a 2021 study by Earth System Co., Ltd., the average monthly water flow in the NTRB from 2010 to 2019 decreased to 109.3 m^3/s, particularly during the dry season from November to April. Rainfall inflow in the basin varies seasonally, with 88 percent of inflow received during the wet season (May to October). The highest rainfall inflow is in July and August, reaching over 2,500 million m^3/month before losses. The lowest inflow is in January, of about 56 million m^3/month before losses (**Figure 5.12**).

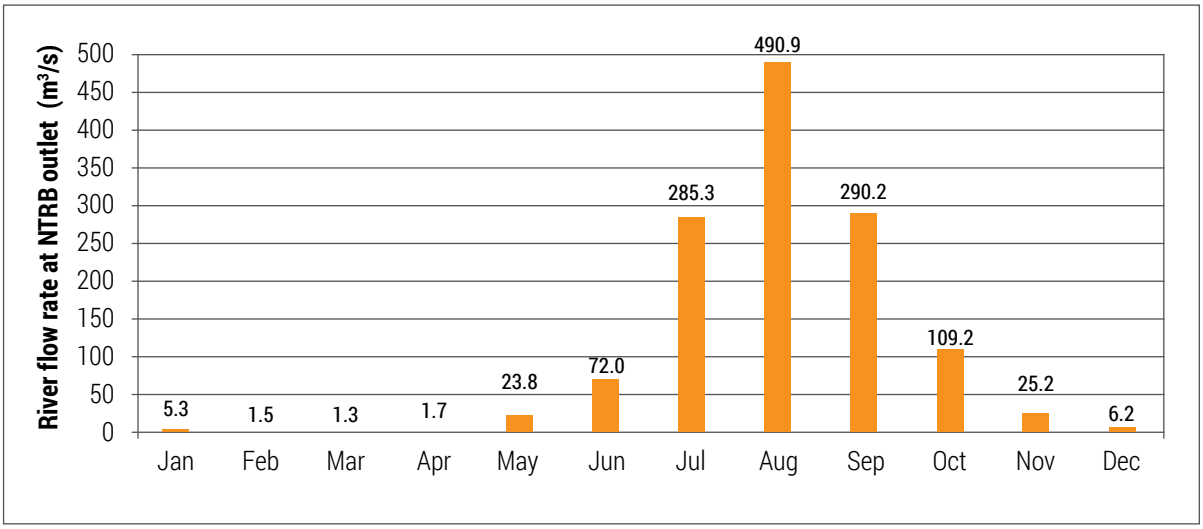


Figure 5.12 Modelled Average Monthly Flow in the Nam Tha River Outlet.

For current basin conditions (2010-2019), the model estimated the high, low, and median flows at the Nam Tha River outlet into the Mekong River:

- Drought flow (1st percentile): 0.26 m^3/s;
- Low flow (10th percentile): 0.57 m^3/s;
- Median flow (50th percentile): 12.76 m^3/s;
- High flow (90th percentile): 328.67 m^3/s, and
- Peak river flow (99th percentile): 1,196.52 m^3/s.

Figure 5.13 show some photos of the Nam Tha river.



Nam Ha, a right bank tributary of the Nam Tha, flowing from the Nam Ha NBCA.



Nam Xe, a major tributary of the Nam Tha



The Nam Tha at the confluence of the Nam Thip



Houay Hatsaphoun at the Nam Tha confluence.

Figure 5.13 Some Photos of the Nam Tha River.
(Source: Earth system & Natural Resources Environment Research Institute, Nam Tha River Basin Water Resource Assessment Report, (2021))

Despite changes in climate and land use, basin flow estimates based on rainfall and temperature are expected to remain stable until 2040. With low water demand—0.03 percent for domestic use, 0.93 percent for agriculture, and minimal industrial activity—it is expected that available water resources is sufficient to support economic growth and environmental protection.

Flooding occurs almost annually in the lower basin, particularly in Luang Namtha District, Phaoudom District, and tributaries in Na-Mor District. In recent years, floods have become more frequent and severe, causing loss of life, damage to assets, livelihoods, agricultural production, and infrastructure. Droughts have also affected the basin, reducing water availability during the dry season and impacting agricultural output. Notable droughts occurred in Na-Mor and Houn (1996), Phaoudom (2009), and Nalae, Baeng, and Pakbaeng (2010) (NTRB MP, 2022).

In the NTRB Management Plan, establishing minimum river flow is one of the four key objectives for water use and resources management and includes the following activities:

1) Setting minimum flow levels at the Nam Tha River's outlet and major tributaries;
2) Defining minimum flow requirements at dams along the Nam Tha River and its tributaries;
3) Monitoring water use for irrigation, including pumping water level during the dry and wet seasons, and
4) Evaluating areas for the installation of monitoring stations for river flow.

Implications and Recommendations

The water flow conditions, including mean annual river discharge, seasonal water flow rate, water levels, velocity profiles, etc., are available based on the results of several simulation models. It is necessary to establish more gauge stations and collect the actual river level/flow data to increase the accuracy of the models. The establishment of water gauging stations in Luang Namtha is currently being planned. The establishment of minimum river flow has also been identified as one of the priority targets in the NTRB Management Plan.

5.3 Water Use and Supply Management

Core Indicator Status

Core Indicator Trend



[028] Economic Performance of Water-related Sectors

Description

Evaluates the contribution of water-related sectors to the economy, considering aspects like GDP contribution, employment, and productivity within sectors such as agriculture, industry, and services dependent on water.

Rationale

Understanding the economic performance of these sectors highlights the importance of water resources to economic development and identifies opportunities for sustainable growth.

Data Requirements

- GDP contribution by water-related sectors (US$)
- Growth rate in water-related sectors (%)
- Investment in water infrastructure (US$/Year)

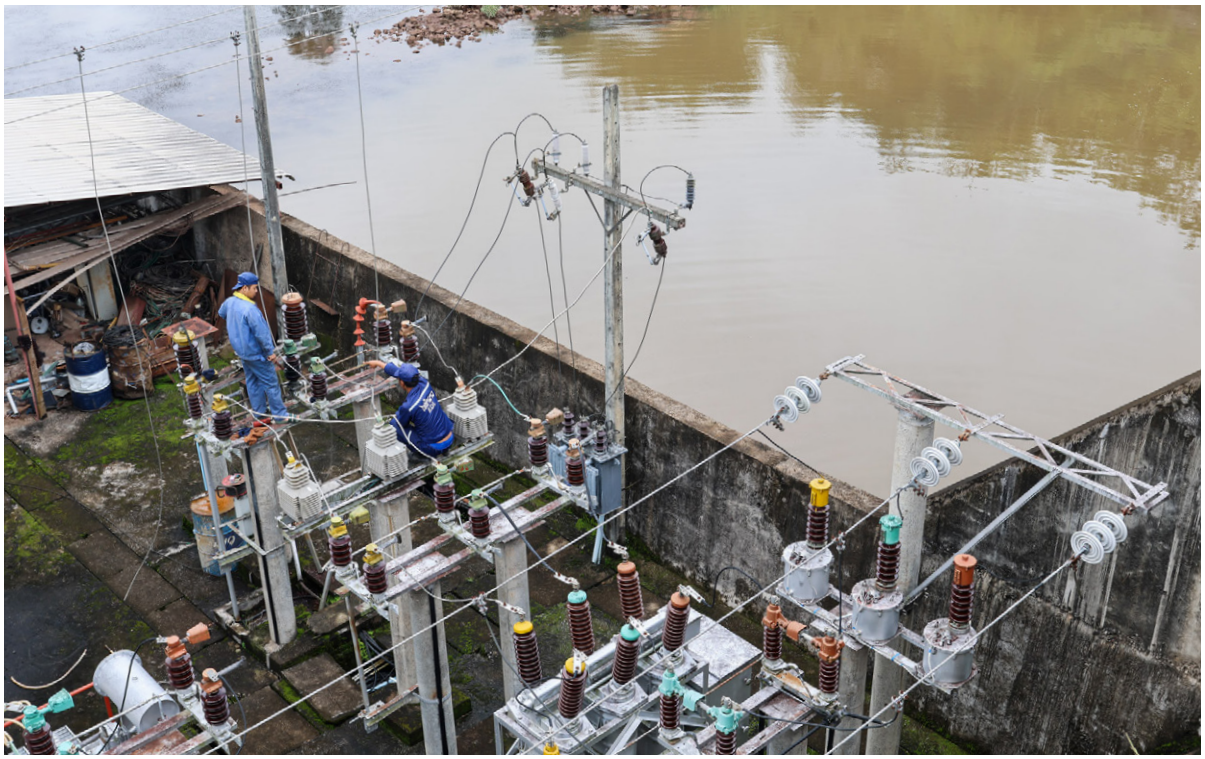
Results

In the NTRB, water-related sectors include: agriculture, hydropower, navigation, sand mining, wetlands, capture fishery, aquaculture, forestry, and tourism and recreation.

In order to assess the sustainable use and development of water and related resources, it is important to consider the economic value generated and the social and environmental conditions and trends. However, detailed data on the economic value and GDP contribution of all water-related sectors is lacking at the provincial and district levels while partial information is available for some sectors, such as hydropower and agriculture.

The GDP of LNT from 2016 to 2020 was 3,114.42 billion KIP (US$ 1 = 8,500 KIP; December 2018). The GDP grew by 8.56 percent compared to the 2011–2015 average, i.e., US$ 1,897.51. During this period, the agricultural sector grew by 8.84 percent, industry by 7.87 percent, and services by 3.10 percent. The economic structure between 2015 and 2020 has slightly shifted with decreased contributions from the service sector and increased contribution from the

industrial sector. In 2020, agriculture accounted for 49.95 percent of LNT's GDP, industry 20.38 percent, and services 28.15 percent. Key agricultural products contributing to GDP include rice, various crops (e.g., sweet potatoes, taro, corn, sugarcane, beans), and meat. These reflect the vital role of agriculture in the livelihoods of the communities in the NTRB. In addition, hydropower, a sub-sector of industry, contributed 324.57 billion KIP to GDP from electricity sales between 2016 and 2020, which represents 10.42 percent of LNT's total GDP.



Hydropower Dam in Luang Namtha Province. *(Photo by John Castillo/PEMSEA)*

Implications and Recommendations

Water-related and other economic sectors contribute significantly to the development of the provinces within the NTRB. Based on LNT's economy, GDP grew by 8.56 percent from 2011–2015 to 2016–2020. In 2020, agriculture contributed 49.95 percent, industry by 20.38 percent with hydropower contributing 10.42 percent, and services by 28.15 percent, of the total GDP.

While water-related sectors are believed to play a significant role in the basin's economic development, available data does not allow an assessment of their exact contribution.

5.4 Food Security and Livelihood Management

Core Indicator Status

Core Indicator Trend



[029] Living Conditions and Wellbeing

Description

Evaluates the impact of integrated river basin management on living conditions and wellbeing of the communities, including socioeconomic aspects such as income per person, prevalence of undernourishment, and access to clean water and sanitation.

Rationale

High-quality living conditions and wellbeing are essential outcomes of effective IRBM, indicating a holistic approach to environmental, social, and economic management within the river basin.

Data Requirements

- Prevalence of undernourishment (%)
- Access to clean water (% of population)
- Access to improved sanitation facilities (% of population)
- Income level (average income per capita, US$/Year)
- Number of incidences of waterborne diseases per year (Number)
- Death rates due to such diseases (Number)

Results

The NTRB covers 328 villages across 11 districts in three provinces, with 295 villages (89 percent) located in rural areas. According to the Government Decree No. 348 on poverty graduation and development, all 11 districts were classified as poor in 2019. Of the total 727 villages in the 11 districts, 265 (36.5 percent) were identified as poor. Out of 103,718 households, 25,726 (24.8 percent) were considered poor.

Generally, urban communities have better quality of life compared to rural areas. However, data is currently limited to allow accurate assessment of the living conditions in the basin.

Data on the different socioeconomic indicators at the district level in the NTRB area as follows:

- 87 percent of households have access to electricity;
- 100 percent of the villages have access roads;
- 97 percent have access to clean water;
- 85.5 percent have access to improved sanitation;
- 19 percent of children under five are undernourished (based on weight);
- Child mortality rate stands at 10 per 1,000 children under five;
- Primary school enrollment is at 98.9 percent, and
- Secondary school enrollment reaches 92.3 percent.

In Luang Namtha Province, data on key socioeconomic indicators are as follows:

- 9 percent of children under five are undernourished based on weight;
- 15 percent of children under five are undernourished based on height;
- Child mortality rate is 20 per 1,000 children under five;
- 90 percent of (children receive a complete set of vaccinations;
- 90.7 percent have access to clean water, and
- 82.7 percent have access to improved sanitation.

To date, there were 1,740 reported cases of malaria, with no reported deaths, in Luang Namtha Province. Control measures have been implemented in 65 affected villages in five districts in the province. No other waterborne diseases have been reported in the province.

Implications and Recommendations

The current data indicates that the quality of life and wellbeing vary between urban and rural areas, where urban areas generally have better living conditions. For remote communities, particularly the ethnic groups whose livelihoods are closely tied to natural resources, wellbeing cannot be measured by standard indicators alone. Their perceptions and cultural context must also be considered. Achieving better wellbeing requires support for enhancing basic livelihood assets and physical infrastructure, which highlights the need for targeted actions for improving the living conditions in the NTRB particularly in rural and remote areas.

Strengthening the monitoring and regulation of unsustainable practices such as shifting cultivation, fishing, hunting, and harvesting of non-timber forest products (NTFPs) is also necessary. While support for more sustainable livelihoods, diversified income sources and other economic opportunities should be provided for the communities in the NTRB.

5.4 Food Security and Livelihood Management

Core Indicator Status

Core Indicator Trend



[030] Livelihoods, Employment/economic Stability, Gender Equality and Education

Description

Assesses how IRBM affects livelihoods, employment, economic stability, gender equality, and education, including metrics on employment rates, gender employment ratios, and literacy rates.

Rationale

IRBM aims to support sustainable livelihoods and promote equitable social outcomes, including gender equality and educational opportunities.

Data Requirements

- Employment rate across the basin (% of population)
- Average household incomes/expenditure (US$)
- Sufficiency of household income and assets
- Evidence of legislation and policies on gender equality and social inclusion
- Gender employment ratio (ratio of female to male employees)
- Literacy rate (% of population, of women and men)
- School enrollment rates by gender (primary, secondary, and tertiary levels, %)

Results

At the provincial level, agriculture makes up nearly 50 percent of the economy and is the fastest-growing sector, generating about US$ 190 per person per year. Agriculture significantly drives economic development in the NTRB and remains the main livelihood for local communities. This means that agricuture significantly drive economic development in NTRB and that agriculture is the fundamental livelihood activities of local communities.

Based on the five-year socioeconomic development plans at the provincial and district levels, most households produce more agricultural goods than they consume and earn income by selling the surplus. While agriculture remains the main livelihood, many households also earn from wages, handicrafts, and harvesting non-timber forest products (NTFPs). The Government of Laos has set the minimum monthly wage at around 1.6 million KIP, or approximately US$ 960 per year.

Articles 3, 8, 35, and 37 of the 2015 Constitution of Lao PDR affirm equal rights for all ethnic groups and genders, and promote social inclusion. The Constitution is supported by various laws and decrees that uphold equality, integrity, and inclusion. These principles are reflected in practice, with women and individuals from diverse ethnic backgrounds holding high-level positions in government and the political party, including Ministers, Vice President, and President of the National Assembly.

According to the 2021–2025 socioeconomic development plan of Luang Namtha, 61,571 out of a total population of 193,096 were considered literate in 2019–2020, with women making up 38 percent of the literate group. School enrollment rates in the NTRB were reported as 98.9 percent in primary schools and 92.3 percent in secondary schools.

In PhaOudom District, which has a diverse ethnic population, data on school enrollment are as follows:

- Primary school: 7,000 students, including 3,455 girls (49.4 percent)
- Secondary school: 3,881 students, including 1,866 girls (48.1 percent)
- Tertiary education: 1,313 students, including 586 women (44.6 percent)

These reveal that the ratio of female to male in school enrollment is mostly equal in primary school but slightly to decrease to 1/1.08 in secondary school and 1/1.24 in tertiary school. In LNT Province, there a total of 3,466 government officials, which include 1,244 women representing 35.9 percent of the workforce. In 10 districts of the NTRB (excluding Na-Mor), the total labor force is 93,791, with women making up 49.2 percent or 46,163 individuals.

Implications and Recommendations

Based on the information described above, it can be gleaned that gender equality in the NTRB is relatively fair, including in education. High literacy rate was observed in the communities. However, their understanding and awareness of natural resources management and protection still need improvement. Employment has moderately improved due to the opening of the labor market and recent development in the area. The diverse ethnic groups in the remote areas continue to rely heavily on natural resources for their livelihoods hence the need to promote more sustainable livelihood options and diversified income sources to ensure the sustainable use and development of resources in the NTRB.

The continuing implementation of the local government's socioeconomic development plans integrating the concerns of the different ethnic groups and minorities in the NTRB is necessary. Strengthening the monitoring and regulation of unsustainable practices such as shifting cultivation, fishing, hunting, and harvesting of non-timber forest products (NTFPs) is also necessary. While support for more sustainable livelihoods, diversified income sources and other economic opportunities should be provided for the communities in the NTRB.

5.5 Pollution Reduction and Waste Management

Core Indicator Status

Core Indicator Trend



[031] Pollution Control and Waste Management

Description

Evaluates the effectiveness of pollution control measures and waste management practices within the river basin.

Rationale

Effective pollution control and waste management are crucial for protecting water quality, human health, and biodiversity.

Data Requirements

- Data on the existence and implementation of pollution management plans, monitoring programs, and resource allocation for pollution control (Please specify)
- Volume of waste and wastewater properly collected and treated (m^3/year)
- Compliance rate with national standards for both waste and wastewater (%)
- Number of waste management and wastewater treatment facilities (Number)
- Monitoring programs in place for pollution control (count and please specify)
- Budget allocation for pollution control and waste management (US$)
- Staff allocation for pollution control and waste management (number of staff, women and men)
- Population with access to improved sanitation (number of people and percentage compared to total population)
- Households connected to septic tanks (number of households)
- Volume of generated domestic/industrial/agricultural waste, wastewater and septage collected/treated/recycled/reused and properly disposed after treatment (Please specify for each item)
- Population served by public sewerage system (including both collection and treatment) (number of people and percentage compared to total population)

Results

The provinces in the NTRB implement pollution control and waste management based on the strategies of the Ministry of Natural Resources and Environment (MONRE) and the Ministry of Public Works and Transportation (MPWT).

MONRE's Natural Resources and Environment Sector Vision (NRESV) for 2030 and its Ten-Year Strategy (2016–2025) outline the government's strategies in promoting green economic growth and sustainable development, industrialization, and building resilience to climate change impacts and disasters. It serves as guide for the sustainable development and management of natural resources at the national, provincial, and district levels, and provides the framework for building synergies with other sectors in achieving the environmental goals and vision.

The MPWT approved a long-term vision to 2035, along with a Nine-Year Strategy (2022–2030) and a Four-Year Development Plan (2022–2025) for improving water supply and sanitation through Decision No. 6485/MPWT on March 18, 2022. These strategy and plan are in line with the Government's commitment of achieving the 2030 Sustainable Development Goals 6 on access to clean water and sanitation. Key targets include improving water quality through proper waste disposal, reduction in the use of harmful chemicals and hazardous waste, halving the volume of untreated wastewater, and increasing the use of recycled water by 2030.

The NTRB Management Plan (2021–2025) includes waste management as a key target under Program 6: Land, Forest, and Environment Management, with an estimated budget for implementation amounting to 100 million LAK (about US$ 5,000). Planned activities include:

1) Establishing waste disposal sites;
2) Building waste management facilities, and
3) Monitoring of waste management practices.

Under Program 4: Water Quality Management, the following activities are identified:

1) Surveying, identifying and registering risk areas affected by water use particularly in upstream areas;
2) Developing water quality management and monitoring plans for the entire basin;
3) Installing and upgrading water quality monitoring systems, including provision of equipment at the provincial and district levels reporting, and the timely reporting of water quality status of priority areas;
4) Enforcing laws and regulations on wastewater discharge, and
5) Encouraging private sector and community engagement in pollution control, wastewater treatment, and reducing use of chemicals in agriculture.

In 2020, the three provinces in the NTRB officially adopted an integrated plan for land allocation and natural resource management. In 2021, Oudomxay Province issued a report on the status of environmental quality including air, noise, water, solid, liquid and hazardous wastes.

Solid Waste Management

Lao PDR currently produces about 910,000 tons of waste per year, which is expected to increase to 1.4 million tons by 2035 [World Bank, 2021]. In Oudomxay (ODX) Province, the reported volume of generated wastes varies by district:

- Xay: 52 tons/day (0.5–0.7 kg/person/day);
- Na-Mor: 576 tons/month;
- Houn: 80 tons/month (0.4 kg/person/day), and
- Beng: 0.22 kg/person/day

The waste generation per capita in Oudomxay was based on data from the urban areas where waste collection is practiced. Reliable data for rural areas is limited.

In cities in Lao PDR, the waste generation rates range from 0.7 to 1.4 kg/person/day. The World Bank reported 0.15 kg/person/day waste generation rate in rural areas and 0.7 kg/person/day in urban areas (World Bank, 2021), which were used in estimating the total waste generation in the NTRB. The total waste generation in NTRB is estimated at 54.5 tons per day (**Table 5.13**).

Solid waste in the NTRB provinces is managed by the Urban Development Administration Authorities (UDAAs). The municipalities or districts are responsible for waste collection, including waste collection coverage. Waste collection is either handled directly by the municipalities/districts or outsourced to private companies. Collected wastes are transported to landfills or dumpsites located 3 to 11 kilometers from urban centers. Each district has two to four staff members responsible for waste collection and transport (see **Table 5.14**).

Uncollected waste is often burned, buried, dumped along roads, waterways, and empty lots. In Oudomxay Province, most waste comes from households, which include food wastes, glass, cans, paper, textiles, metal, plastic, and electronics.

In Luang Namtha Province, the UDAA handles solid waste collection and disposal. The volume of waste at the provincial and district levels are increasing due to the limited practice of 3R – reduce-reuse-recycle, and the absence of recycling companies.

Improper waste disposal is one of the key challenges in the NTRB, which could impact human and ecosystem health, clogged drainage increasing the risk for flooding, among others. There are 14 small landfills/dump sites in the NTRB with areas ranging from 0.045 to 2.5 hectares (see **Table 5.14**). Most of these landfills are open dump sites, which lack bottom liners, leachate

treatment, and gas collection systems resulting to contamination of soil and water, and methane gas emission. Photos of landfills in Oudomxay Province are shown in **Figure 5.14**.

In order to address the issue, Oudomxay Province defined the responsibilities of the DONREs, UDAA and related departments on solid waste management, including the preparation of an urban development plan anchored on UDAA's Clean, Green, Beautiful program, awareness raising, mobilizing financial resources for implementation, enforcement of policies and regulation on environmental management, e.g., Regulation No. 652, dated 13 Sep 2007, and monitoring of waste management implementation.

Table 5.13 Waste Generation in Each Area of NTRB.

No.	Province	District	Population (Person)			Waste generation (kg/day)		
			Total	Rural	Urban	Rural	Urban	Total
1	Oudomxai	Xai	12,900	12,900	0	1,935	0	1,935
2		Namor	38,558	32,700	5,858	4,905	4,101	9,006
3		Beng	7,692	7,692	0	1,154	0	1,154
4		Houn	13,009	13,009	0	1,951	0	1,951
5		Pakbeng	4,513	4,513	0	677	0	677
6	Luang Namtha	Louangnamtha	64,811	46,199	18,612	6,930	13,028	19,958
7		Nale	25,427	25,427	-	3,814	-	3,814
8		Viengphoukha	4,272	4,272	-	641	-	641
9	Bokeo	Paktha	5,252	1,521	3,731	228	2,612	2,840
10		PhaOudom	48,590	39,467	9,123	5,920	6,386	12,306
11		HouayXay	1,158	1,158	-	174	-	174
TOTAL			**226,182**	**188,858**	**37,324**	**28,329**	**26,127**	**54,456**

Table 5.14 Information of Landfills in the Area and Number of Service Staff.

No.	Province	District	Landfill	Rural	Urban	Waste generation (kg/day) Rural
1	Oudomxai	Xai	1	2.500	8	3
2		Namor	1	2.200	5	2
3		Beng	1	1.000	3	4
4		Houn	1	0.800	11	4
5		Pakbeng	1	0.045		
6	Luang Namtha	Louangnamtha	2	n. a	n. a	n. a
7		Nale	1	n. a	n. a	n. a
8		Viengphoukha	3	n. a	n. a	n. a
9	Bokeo	Paktha	1	n. a	n. a	n. a
10		PhaOudom	1	n. a	n. a	n. a
11		HouayXay	1	n. a	n. a	n. a
TOTAL			**14**			



(a) Dumpsite in Na-Mor district



(b) Dumpsite in Baeng district

Figure 5.14 Photos of Dumpsites in Some Districts of NTRB.

Wastewater

Data on actual volume and quality of wastewater in NTRB is currently not available. The volume of wastewater was estimated as 80 percent of water used for domestic consumption and irrigation (**Table 5.15**). In 2020, annual domestic water consumption amounted to 3.72 million m^3, which produced an estimated 2.98 million m^3 of wastewater. Annual water consumption for irrigation was about 118.20 million m^3, which resulted to about 94.56 million m^3 of wastewater. The NTRB contributed approximately 2.26 percent of the total volume of wastewater generated in the country, i.e., 133.86 million m^3 in 2019 (DWS, 2019).

Table 5.15 Annual Water Use and Estimation of Wastewater (million m^3/year)

Water use and wastewater	Water use		Estimation of Wastewater	
Year	**2020**	**2040**	**2020**	**2040**
Annual water volume for consumption	3.72	4.66	2.98	3.73
Annual water volume for Agriculture-Irrigation	118.20	121.50	94.56	97.20
Total	**121.92**	**126.16**	**97.54**	**100.93**

Most of wastewater generated in Luang Namtha is discharged into public canals without proper treatment. Black water is collected in septic tanks, while grey water mixes with stormwater and flows into road drainage. Mixed stormwater and grey water eventually drain into the Nam Tha River, nearby ponds, and agricultural areas. About 85 percent of residents use septic tanks while the other 15 percent use other systems. There is currently no wastewater treatment in the province other than natural separation and use of septic tanks. The government and other private operators offer desludging services. Sludge is often disposed directly in rice fields or rubber plantations. A sludge disposal site is allocated in existing dumpsite but is inaccessible due to blockage from dumped garbage (City Alliance, 2019).

Based on LNT's 2020 strategic and land use plans, natural wastewater treatment in households in rural areas is through percolation. In lowland suburbs, natural wastewater treatment is by flowing them into nearby fields, ponds, and lakes, and absorbed by plants like rice. Small-scale treatment usually involves several tanks, while larger systems use tanks with equipment or chemicals for treatment. However, some factories still discharge untreated wastewater into rivers. Wastewater discharge from households and communities often fails to meet environmental standards.

In 2015, the percentage of population in Lao PDR that had access to improved sanitation facilities was 71 percent (WHO and UNICEF, 2015). Open defecation in Lao PDR dropped from 23.1 percent in 2015 to 16.9 percent in 2020. Latrine coverage in LNT, ODX, and BOK Provinces is 76.9 percent, 75.5 percent, and 88.9 percent, respectively (MPI, 2020). However, LNT and ODX did not meet the target for latrine coverage targets as outlined in the 8th Socioeconomic Development Plan (2016–2020), and would require more funding and focused efforts to reached 100 percent no open defecation target. In NTRB, about 83.5 percent of households have access to improved sanitation, which used septic tanks but does not include full sanitation services like sludge collection, transport, and safe disposal.

Some pilot decentralized wastewater treatment systems were installed in the Bokeo and Luang Namtha Provinces. Under the Second Greater Mekong Subregion Corridor Towns Development Project (GSM2) (ADB, 2015), DEWATS-Horizontal Planted Gravel Filter Constructed Wetland (HGF) was constructed in HouayXay district (BOK Province), and two DEWATS-Constructed Wetland-Aerobic (Maturation) Pond were constructed to treat community wastewater, and DEWATS for Horizontal Planted Gravel Filter Constructed Wetland for fecal-sludge treatment at landfill of LNT district (MPWT, 2022).

The Law on Water and Water Resources describes that wastewater discharge into the water sources by any individuals, legal entities, or organizations shall be treated and comply with the wastewater discharge standards and be subject to payment of fees and service charges. Based on the volume of wastewater and concentration of the chemical substances, three categories are identified: small, medium, and large-size wastewater discharge. The Presidential Decree on Registration and Service Fee No. 2 (dated 17 June 2021) (Government of Laos, 2021) describes the fee on environmental service for wastewater discharge following national environment standards as below:

1. The environmental service fee for the wastewater discharged from households is 15 Kip/ m^3.
2. The environmental service fee for the wastewater discharged from business based on COD is 10,000- 40,000 Kip/kg based on the discharged wastewater volume.

Each province has issued an agreement on the management of water, water resources and wetlands in 2022, which describes that the discharge of wastewater to the water source by individuals, legal entities, or organizations must be treated, monitored, and measured the water quality to be in line with the national environmental standard, and must get permission from DONRE or district office for NRE with payment of the fee as indicated in the law. The implementation is in the early stages, and some activities have started recently. For example, the DONRE of Bokeo Province conducted data collection on water and water source utilization and wastewater discharge with business entities such as companies and sewing factories in Huaxay district 35 times.

Implications and Recommendations

The NTRB Management Plan (2021–2025) includes waste and water quality management. Activities identified include establishing waste disposal sites, setting up waste treatment and monitoring facilities, enforcing regulations on wastewater discharge, and promoting private and community involvement in pollution reduction including improvement of wastewater treatment in industries and services. However, the implementation of activities is limited by funding and human resources. Reliable data on volume of waste and wastewater generated and quality are lacking.

Luang Namtha and Oudomxay Provinces would require more funding and focused efforts to meet the 100 percent sanitation coverage target.

The following actions are recommended:

- Develop and enforce measures to manage unsustainable agricultural practices such as the use of pesticides, fungicides, and herbicides that threatens the quality of soil and water and ecosystem health.
- Implement management measures in addressing improper waste disposal and poor-quality landfills.
- Implement proper treatment and management of wastewater from industries, especially from mining and processing operations.
- Implement comprehensive management of solid waste and wastewater including designation of suitable landfill area and implementation of wastewater treatment measures.

5.5 Pollution Reduction and Waste Management

Core Indicator Status

Core Indicator Trend



[032] Water Quality and Sediment Conditions

Description

Evaluates water quality and sediment conditions, focusing on compliance with national water quality standards and the impacts of pollutants.

Rationale

Good water quality and sediment management are essential for human health, environmental sustainability, and biodiversity.

Data Requirements

Monitoring data on key water quality parameters (e.g., DO, pH, BOD, COD, nutrients, heavy metals, coliforms, etc.) and sediment characteristics.

Results

In 2018, the country has updated its national water quality monitoring stations across 18 provinces. From a total of 54 stations, 10 are located in the NTRB, i.e., one in Oudomxay, four in Luang Namtha, and five in Bokeo (**Figure 5.16**). In 2020, water quality data was collected from the seven stations. Of which, basic physico-chemical parameters, i.e., temperature, pH, dissolved oxygen (DO), and electrical conductivity (EC) were collected in the three stations while more parameters were measured in the other four stations, including Chemical Oxygen Demand (COD), nutrients (i.e., nitrate, ammonium, total nitrogen, phosphate), hardness, and metals (i.e., iron, zinc, copper, lead, nickel) (MONRE, 2022). **Table 5.16** shows the water quality monitoring data in 2020. Data on Biological Oxygen Demand (BOD), coliform bacteria, and turbidity were not available.

Water quality in the NTRB is generally good and meets most standards for surface water category 2, which means that river water can be used for consumption after disinfection, and suitable for aquatic life, fisheries, and recreation. Most parameters, including nutrients

(i.e., nitrate, ammonium, phosphate), EC, and metals like zinc, copper, and nickel, are within acceptable limits. DO levels are mostly above 4 mg/L, which is also within the standard. However, there were some samples which exceeded the standards for Total Suspended Solids (TSS), COD and Lead, and below the standard for pH.

TSS and iron levels were relatively higher in August/September, which could be caused by sediment runoff during the rainy season. In Boten Village, Luang Namtha Province, the TSS and COD were higher than other sites, possibly due to untreated wastewater from densely populated areas. Past reports also showed that pH and EC levels in Boten Village sampling station exceeded the standard in 2016. Lead concentration in 11 out of 16 samples exceeded the environmental standard. Lead contamination is a concern due to its harmful effects on humans and aquatic life. More accurate and consistent monitoring of Lead including other water quality parameters, is necessary.



Figure 5.15 Water Sampling at Sampling Points in Nam Tha River Basin.
(Source: Water Quality Assessment Report, 2020)

In 2023, the MONRE issued the guideline on Water Quality Index (WQI) to help the public easily understand water quality levels in different areas. The WQI includes two types: one for human health and one for aquatic life, each rated on five levels—very good, good, fair, degraded, and significantly degraded. WQI for human health uses 10 parameters: pH, EC, ammonium, DO, COD, nitrate, phosphate, TSS, turbidity, and fecal coliform bacteria. WQI for aquatic life uses nine parameters: temperature, pH, EC, ammonia, DO, nitrate, phosphate, turbidity, and BOD. To be able to calculate WQI at sampling points in NTRB, three additional parameters, i.e., BOD, coliform, and turbidity are needed. Since BOD and coliform must be tested within 24 hours of sampling, establishing a local water quality laboratory with trained technical staff would improve monitoring efforts in the basin.

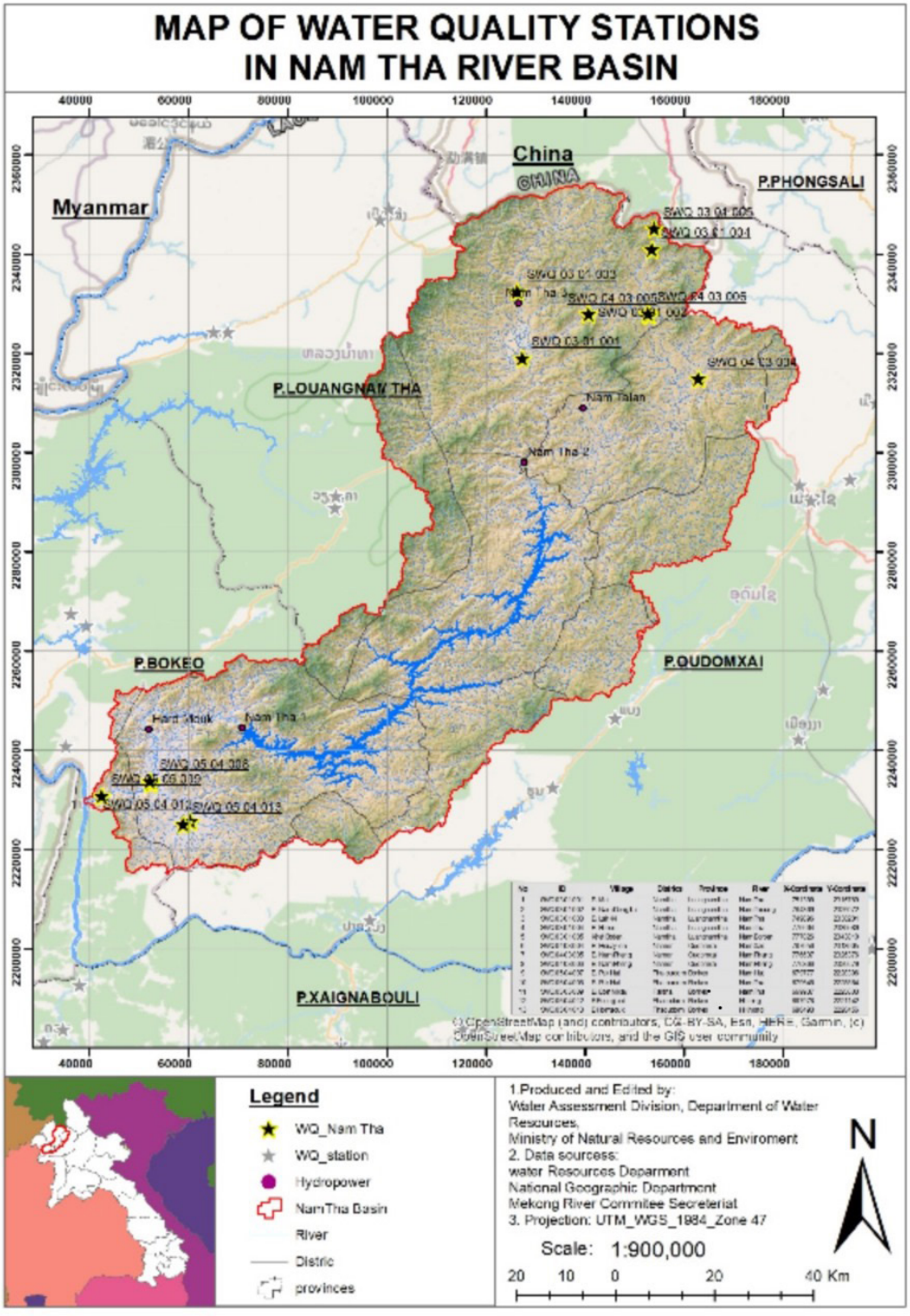


Figure 5.16 GIS Map of Water Quality Monitoring Stations in NTRB.

Table 5.16 Water Quality in Some Sampling Points in Nam Tha River Basin.

Province	District	Village	Sampling date	Temp	pH	DO	EC	TSS	COD	NO_3-N	NH_4-N	T-N	PO_4^3	Hardness	Fe	Zn	Cu	Pb	Ni
				(°C)	(-)	(mg/L)	(uS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Luang Namtha	Nam Tha	Mai village	13/03/2020	28.00	8.20		274	38.20	28.90	0.78	0.01			377.90	0.71	0.08	0.00	0.01	0.01
			11/08/2020	26.90	7.41		237	55.60	4.80	0.78	0.05	1.39	0.01	90.18	2.12	0.03	0.01	0.23	0.01
			29/10/2020	26.90	7.50		320	21.37	0.40	0.37	0.06	1.51	0.01	140	1.11	0.03	0.01	0.23	0.01
			22/12/2020	19.30	7.43		289	36.66	10.90	0.27	0.04	0.32	0.01	4.75	2.26	0.09	0.01	0.32	0.01
		Boten Village	13/03/2020	24.00	7.85	8.48	517	2.83	25.70	0.01	0.01			122.20	0.42	0.00	0.00	0.01	0.01
			11/08/2020	24.40	8.16	3.67	376	266.00	86.40	0.58	0.32	2.57	0.01	559.62	2.00	0.07	0.01	0.32	0.01
			29/10/2020	24.40	8.00	6.90	486	54.75	9.30	0.92	0.04	1.96	0.02	749	1.13	0.09	0.01	0.29	0.01
			22/12/2020	20.00	8.05		338	36.75	36.00	1.04	0.36	1.46	0.01	52.50	1.12	0.14	0.01	0.61	0.01
Oudomxay	Na mor	Huay On Village	10/03/2020	24.1	7.77	7.54	707	2.87	9.63	0.01	0.01			218.10	0.10	0.06	0.04	0.21	0.01
			27/08/2020	25.50	7.55	7.20	268	75.16	17.60	0.95	0.04	1.31	0.02	113.31	2.38	0.09	0.01	0.11	0.01
			30/10/2020	23.00	7.87	7.28	500	0.22	1.61	0.13	0.01	0.44	0.01	219.00	0.15	0.03	0.01	0.06	0.01
			24/12/2020	16.5	8.91	8.90	589	1.00	6.27	0.02	0.01	0.09	0.01	237.50	0.44	0.09	0.01	0.40	0.01
Bokeo	Pak Tha	Donmeexay village	19/03/2020	27.9	8.31	9.29	256		0.4	0.03	0.01			112.8	0.01	0	0	0.01	0.01
			11/09/2020	27.6	7.72	7.34	211		6.4	0.63	0.01	1.39	0.01	92.5	2.02	0.03	0.01	0.05	0.01
			21/10/2020	26.6	7.87	7.94	250		12.9	0.86	0.01	1.27	0.01	128	0.32	0.04	0.01	0.01	0.01
			18/12/2020	26.1	7.45	7.88	247	10.12	0.40	2.44	0.01	6.36	0.01	125.00	0.19	0.10	0.01	0.01	0.01
Environmental standard -Surface water category 2				-	6 - 8	≥6	<1000	25	5	5	0.5	-	0.5	-	-	1	1.5	0.01	0.1

Remarks: Highlight in green color: pass the standard; Highlight in yellow color: not pass the standard.

Source: modified from data in NTRB MP 2021-2025 [2022]

Implications and Recommendations

Water quality data from four national monitoring stations in the NTRB in 2020 showed that overall conditions were relatively good and within national environmental standards. However, several samples exceeded the standards for TSS, COD, and lead. TSS and COD levels were notably high in Boten Village, Luang Namtha Province, which may be due to untreated wastewater from densely populated areas. Lead concentrations exceeded the standards in 11 out of 16 samples, posing risks to both human health and aquatic ecosystems. More accurate and regular monitoring of lead and other water quality parameters in NTRB is necessary.

To support the implementation of WQI in the NTRB, measurements of three additional parameters, i.e., BOD, coliform bacteria, and turbidity, are required. Strengthening local monitoring capacity through the establishment of a local water quality laboratory with trained technical staff is necessary for timely and reliable monitoring in the NTRB.



Photo by John Castillo/PEMSEA

CHAPTER 6

State of River Basin

This chapter synthesizes the results presented in Chapters 4 and 5 and provides an overall assessment of the status of the river basin. It summarizes the trends and progress on the governance and sustainable development aspects, as well as comparing them against established local and national targets. It provides an overall analysis of the implications of the results and recommendations for possible interventions to address identified challenges and changing conditions, as well as guide future actions and improvements of the IRBM program.

6.1. Summary of Current Status and Trends of NTRB

6.1.1. Summary of Current Status and Trends in Governance Aspects of NTRB

Policy, Strategies and Plans

The overall policy and strategic framework for the sustainable development and management of the NTRB is well-established. Some of the key guiding documents the Strategy on Management and Consumption of Water and Water Resources until 2030 with Vision until 2024 and the NTRB Management Plan 2021-2025.

The NTRB Management Plan 2021-2025 and the river basin profile were completed in 2022. Assessment of disaster risks was not included in the river basin profile. The river basin profile identified nine key challenges, which informed the development of six action programs under the NTRB Management Plan 2021-2025. The total estimated budget for the implementation of the plan is about six billion KIP that will be funded from national government allocation and sourced from other funding sources. The plan defines institutional arrangement for implementation including indicators for monitoring, evaluation and reporting, and stakeholder involvement. However, due to the COVID-19 pandemic, the implementation of the NTRB Management Plan has been delayed. Notable progress of implementation was reported under Targets 1.1 (institutional and human resource development), 1.2 (public involvement and awareness); 3.1 (assessment, inventory and management of water resources information); and 5.1 (management of flooding and droughts). However, information on the evaluation of the overall implementation of the Action Plan including funding allocation was not available during the preparation of this report.

The NTRB Management Plan is not fully integrated into the socioeconomic development plans of the districts and provinces in the NTRB. Some priority activities identified in the action plan that should be integrated in the development plan include the installation of meteorological station in Nale District and water level observation station in Nale and Viengphoukha districts, capacity building and awareness raising.

Key Recommendations

1. Updating of the NTRB river basin profile to include disaster risks assessment.
2. Evaluation of the implementation of the NTRB Management Plan including the sources of funding for implementation for consideration in the updating/preparation of the next iteration of the Action Plan (2026-2030).
3. Integration of IRBM and the NTRB Management Plan into the local governments' socioeconomic development plan.

Institutional Arrangements

There is progress in establishing the necessary mechanisms for river basin management in the NTRB. Although project-based, Steering Committees at the national and provincial levels have been established as the coordinating mechanism for river basin management in the NTRB, including the implementation of the GEF/UNDP/ASEAN Integrated River Basin Management Project. The Government strongly recognizes that sectoral agencies should pursue integrated approaches to river basin management as outlined in Prime Minister Decree No. 2 issued in December 2022.

Institutionalizing the Steering Committees at the national and provincial levels including allocation of budget to sustain their operations after the IRBM Project's completion is necessary to facilitate integrated planning and coordination among relevant sectors in NTRB.

Legislation

The Government of Lao PDR has established mechanisms and procedures to ensure judiciousness, rationality, fairness, peace, unity and order in the society, in general, which are also applied in the management and protection of natural resources and environment. As a result, there have been no environmental cases reported in the NTRB related to river basin management and there are currently no urgent concerns to be addressed.

There is a comprehensive set of IRBM-enabling legislations at national and local levels. These legislations support collaboration among different sectors and promote consensus building and gender inclusion in river basin management.

River basin management-related legislations, regulations and mechanisms for enforcement and administration of laws including monitoring of compliance are in place in the NTRB. However, capacity to enforce and monitor the implementation these laws including systematic recording and reporting remain a challenge and should be further strengthened.

Information and Public Awareness

There is currently no effective platform or mechanism for collecting, storing and sharing IRBM-related information to relevant stakeholders. The limited data/information which are available can only be accessed through formal request. While a number of education and public-awareness programs are being implemented, the involvement of the private sector is still limited. The NTRB is home to diverse ethnic groups, which have poor living conditions, low literacy rates and limited access to information on sustainable agricultural practices, and sanitation and disease prevention services. Women have equal rights and participate in the NTRB management planning and implementation. There are no marginalized groups identified in the basin.

There is a need for more education and public-awareness raising programs targeting the different ethnic groups in the basin.

There is a need to develop stakeholder engagement plan and establish mechanisms for public and private sector participation in river basin planning and decision making.

Financing Mechanism

There is financial mechanism in place to support the implementation of the NTRB Management Plan 2021-2025, including funding from the national budget, the GEF/UNDP/ASEAN Integrated River Basin Management Project, and hydropower development projects in the basin. MONRE particularly the DWR plays a key role in identifying funding sources and applying for support to ensure long-term financial sustainability for the implementation of the Management Plan.

There is a need to consider the following to ensure sustainable financing for the management and sustainable development of the NTRB:

1. There is a need to evaluate and determine the sources of funds to support the continuing implementation of the NTRB Management Plan 2021-2025, including available grants and loans from donors and financing institutions, and financing support from the private sector and civil society organizations;

2. There is currently no sustainable financing mechanism that will sustain the operation of a River Basin Council or a multisectoral governance mechanism for river basin management in the NTRB. The Government should consider identifying financing options to institutionalize and operationalize a multisectoral governance mechanism for the management of NTRB.

Capacity Development

The NTRB Management Plan 2021-2025 includes activities on awareness rising, training, and capacity building. However, since the implementation of the Management Plan is still in early stages, most of the planned activities have yet to be undertaken. To date, less than 10 (ten) trainings and meetings have been conducted in the NTRB. The implementation of the GEF/UNDP/ASEAN IRBM Project involves around 130 technically qualified government personnel at the national, provincial and district levels as members of the Steering and Coordinating Committees and technical teams.

Capacity strengthening of government personnel, relevant stakeholders and the youth on river basin management should be continued to ensure the sustained implementation of river basin management programs.

6.1.2. Summary of Current Status and Trends in Sustainable Development Aspects of NTRB

Climate Change and Disaster Risk Reduction

Overall, the NTRB is highly vulnerable to flash flood and floodplain flooding and landslides, which are triggered by flashflood events. The basin is also located in a high-risk seismic zone, with nearly 100 percent probability of experiencing ground shaking at Modified Mercalli Intensity (MMI) Level VI within a 50-year return period.

In terms of disaster preparedness, an early warning system, including sirens is not yet in place. Equipment and budget allocations remain insufficient, particularly for the conduct of feasibility studies and the construction of flood protection infrastructure. The Department of Meteorology under MONRE is actively monitoring agro-climatology, meteorology, and extreme weather events nationwide. However, public information sharing still needs improvement. Mechanisms and personnel for early warning, emergency response, and post-disaster relief have been in place in the basin. However, limited funding and equipment remain a challenge.

Climate change impacts are increasingly evident in the NTRB, particularly with the severe flooding that occurred in September 2024. Communities and stakeholders are gradually learning to adapt, but essential foundation for effective disaster management and response planning in the basin is still lacking. There is currently no report on greenhouse gas (GHG) emissions for the three provinces in the NTRB. GHG emissions are not covered in the provincial development plans or in the NTRB Management Plan.

The following actions are recommended strengthen climate change adaptation and disaster risk reduction:

1) Establish additional meteorological and hydrological stations to improve flood simulation accuracy and to be able to identify and map populations living in high-risk flood areas;
2) Conduct a comprehensive vulnerability and disaster risk assessment, including identification and mapping of communities in high-risk areas;
3) Develop a comprehensive disaster management and response plan, including management measures for flooding, establishment of disaster management committees, and capacity-building activities;
4) Establish and early warning system with sirens, adequate equipment, and sufficient budget for disaster preparedness and response, and
5) Establish systematic recording of socioeconomic losses from floods, droughts, storms, and landslides, which should be integrated into recovery and mitigation planning.

Habitat Protection, Restoration and Management

The NTRB has two important national protected areas (NPA), i.e., the Nam Ha and Nam Kan NPAs, which are rich in biodiversity and host to species of significant national and regional conservation value. The management of wetlands and forest resources are included in the NTRB Management Plan with the provinces allocating areas for natural resource protection and implementing initiatives to increase the forest cover in their respective areas.
The following issues need to be addressed to further advance habitat protection, restoration and management in the NTRB:

1. Shifting cultivation, overharvesting of NTFPs, overfishing, overhunting, and wildlife trafficking.
2. Unsustainable agricultural practices particularly the use of pesticides and other harmful chemical which threatens the quality of soil and water and ecosystem health.

Water Uses and Supply Management

Water use, allocation, and future projections in the NTRB are outlined in the NTRB Management Plan. The approach emphasizes efficient and equitable sharing among all users, ensuring adequate supply to support socioeconomic development while maintaining ecological balance. Water availability in the basin is generally sufficient to sustain both ecosystems and economic activities. Streamflow is relatively abundant but varies significantly between wet and dry seasons. The hydraulic regime of the Nam Tha River has been altered due to water regulation by hydropower dams. There are currently no available data/information on the economic performance of water-related sectors in the basin. While a budget for water resource management activities has been estimated, funding sources remain unclear, and securing financial support for implementation may be challenging.

The following actions should be considered to strengthen water use and water resources management in the NTRB:

1) Identify financing mechanisms and secure sources funding from various sources to support the implementation of water resources management plan.
2) Establish clear and transparent rules for hydropower reservoir operations to support flood management and safeguard environmental sustainability.

Food Security and Livelihood Management

In terms of quality of life, livelihood strategies, employment, economic stability, gender equality and social inclusion, education, and community health, urban communities in the NTRB generally have better conditions than rural villages.

For remote and ethnic communities, well-being is not easily captured by standard indicators as it is closely tied to traditional cultural practices and perceptions. Gender equality is well recognized in the basin, and access to education is relatively fair. Literacy rates are high, but awareness and understanding of natural resource management and environmental protection still need improvement. Employment opportunities have moderately increased due to labor market expansion and recent development activities in the area.

Achieving high quality of life and wellbeing in the NTRB requires strong support for fundamental livelihood assets, including physical infrastructure and services. This is especially important for remote communities, where targeted actions are needed to improve their living conditions. The diverse ethnic communities continue to rely heavily on natural resources such as shifting cultivation, fishing, hunting, and harvesting non-timber forest products (NTFPs) to meet their basic needs. While these practices support subsistence, they do not guarantee long-term sustainability of the basin's natural resources and ecosystems. Promoting more sustainable livelihood options and diversified income sources will be essential to protect biodiversity and maintain ecological balance in the NTRB. The management and regulation of unsustainable practices should also be strengthened.

6.1.2.5. Pollution Reduction and Waste Management

The NTRB currently experiences low levels of industrial pollution and its natural systems have a high capacity to absorb pollutants. However, rapid socioeconomic growth in agriculture, industry, and services is currently being observed in the basin, all of which contribute to increased waste generation and environmental pollution. Despite some initiatives of the local governments in the NTRB, pollution reduction, waste management and improving water quality are priority issues that should be addressed in the NTRB.

The NTRB currently experiences low levels of industrial pollution and its natural systems have a high capacity to absorb pollutants. However, rapid socioeconomic growth in agriculture, industry, and services is currently being observed in the basin, all of which contribute to increased waste generation and environmental pollution. Despite some initiatives of the local governments in the NTRB, pollution reduction, waste management and improving water quality are priority issues that should be addressed in the NTRB.

The following issues need to be addressed in the pollution reduction and waste management programs in the NTRB:

1. Unsustainable agricultural practices particularly the excessive use of pesticides and other harmful substances.
2. Poor solid waste management including improper waste disposal and use of unsanitary landfill.
3. Inadequate treatment of wastewater from industries.
4. Prolonged retention of low-quality water due to overregulation of flow in the Nam Tha 1 HPP in Nale District that would result to deteriorating water quality.

6.2. Summary of Challenges and Recommended Measures

The assessment of the status of conditions, challenges is oriented towards considering progress towards the NTRB MP 2021-2025 Outcomes in order to provide recommendation for refinement of the implementation of the NTRB MP 2021-2025 over the remainder of the period to 2025. Recommendations are provided so that basin stakeholders working on water-related issues can consider them in the updating of their strategies, action plans and work activities over the remainder of the current NTRB MP 2021-2025 period and to facilitate cooperation among relevant parties towards common objectives. The summarized challenges and recommendations are provided in **Table 6.1**.

Table 6.1 Summary of Challenges and Recommended Priority Areas to Implement and Refine the NTRB MP.

Strategic Categories/ Core Indicators	Status/condition	Challenges	Recommended Priority Actions to Refine NTRB MP 2021-2025 Implementation
[1] Policy, Strategies and Plans			
• [001] River basin profile and environmental risk assessment • [002] River basin strategy and action plans • [003] Local government development plan, including river basins, associated watersheds and adjacent coastal and marine areas	Policy, strategies and action plans are in place, which include the Strategy on Management and Consumption of Water and Water Resources until 2030 and Vision until 2040.	1. Lack of disaster risks assessment and other supporting technical studies. 2. NTRB profile report lacks some details (e.g., disaster risk assessment) and needs to be updated. Wide range of information required in the NTRB SORB Report is still lacking, which also needs to be regularly updated. 3. Source of fund for the implementation of NTRB Management Plan 2021-2025, 4. Integration of IRBM into local government socioeconomic development plan.	1. Conducting disaster risks assessment and implementation of measures for disaster prevention and management particularly flooding 2. Regular updating of the NTRB SORB Report to inform the planning and decision making in the NTRB; 3. Identify sources of funds for the implementation of NTRB Management Plan 2021-2025; 4. Integration of IRBM into local government socioeconomic development plan.
[2] Institutional Arrangements			
• [004] Coordinating mechanism for river basin management • [005] Formal recognition that sector-based government agencies support integrated approaches for RBM • [006] Benefits derived from cooperation	There is existing coordinating mechanism for river basin management in the NTRB through the project-based Steering Committees that were established at the national and provincial levels; there is formal recognition that sector-based government agencies must pursue integrated approaches in to river basin management; early evidence of benefits derived from cooperation.	1. Financial allocation to sustain the operations of the coordinating mechanism for river basin management still need to be identified. 2. There is a need to strengthen the capacity for inspection of compliance water resources management as well as water uses by each sector and pollutions management in the basin. 3. The integrated planning and coordination among relevant sectors need to be improved for a more efficient implementation.	1. Measures for ensuring funding allocation to sustain the operations of the coordinating mechanism. 2. Implementation of capacity strengthening on inspection of compliance water resources management as well as water uses by each sector and pollutions management in the basin. 3. Enhance the collaboration between relevant departments and organizations for implementation of IWRM/ IRBM

Table 6.1 Summary of Challenges and Recommended Priority Areas to Implement and Refine the NTRB MP. (cont.)

Strategic Categories/ Core Indicators	Status/condition	Challenges	Recommended Priority Actions to Refine NTRB MP 2021-2025 Implementation
[3] Legislation			
• [007] IRBM enabling legislation • [008] Administration, enforcement of legislation and compliance monitoring and inspection • [009] Environmental cases filed/ resolved	There is a comprehensive IRBM-enabling legislations in place. There is currently no reported environmental case in the NTRB. However, there is limited capability of administration and enforcement of relevant laws and regulations including monitoring and inspection of compliance.	1. Limited capacity for monitoring and inspection of compliance of environment, water and water resources related laws and legislations. 2. Lack of systematic recording and reporting of environmental cases.	1. Issue and implement Prime Minister Decree on fines and penalties in natural resources and environment. 2. Implementation of capacity strengthening on effective monitoring and inspection of compliance to environment, water and water resources-related laws and legislations. 3. Establish mechanism for systematic recoding and reporting of environmental cases.
[4] Information and Public Awareness			
• [010] Effective platform for collecting, storing and sharing IRBM-related data/ information to relevant stakeholders • [011] Education and public awareness schemes for a range of stakeholders • [012] Public participation and mobilization • [013] Degree of stakeholder participation and GESI in decision making process for RBM	There is currently no effective platform/ mechanisms for collecting, storing and sharing IRBM related information to relevant stakeholders. While a number of education and public-awareness programs are being undertaken, the involvement of the private sector particularly those relevant to water and water resources is still limited. The diverse ethnic groups in the NTRB have poor living conditions, low literacy rates, and have limited access to information on sustainable agricultural practices, sanitation, diseases prevention, etc. Women have equal right and participation in NTRB management planning and implementation. There is no identified marginalized group in the NTRB.	1. No Effective platform/ mechanisms for collecting, storing and sharing IRBM related information to relevant stakeholders. Limited data/information can be accessible through formal request with relevant departments. 2. Limited participation and/or involvement of private sector in river basin planning and management. 3. Diverse ethnic groups in the NTRB have low literacy rates and limited access to information on, sustainable agricultural practices, sanitation, diseases prevention, etc. 4. Limited platform/mechanism for public and private participation in river basin planning and decision making.	1). Establish and operationalize a platform for data/information management and sharing. 2). Establish a platform/ mechanism to strengthen the engagement of public and private sector in river basin planning and decision-making. 3). Implement public awareness raising and education program for local communities and ethnic groups.

Table 6.1 Summary of Challenges and Recommended Priority Areas to Implement and Refine the NTRB MP. (cont.)

Strategic Categories/ Core Indicators	Status/condition	Challenges	Recommended Priority Actions to Refine NTRB MP 2021-2025 Implementation
[5] Financing Mechanism			
• [014] Budget allocation for integrated river basin management • [015] Sustainable financing mechanisms • [016] Self-financing of river basin council/ committee	The funding for the implementation of the NTRB Management Plan 2021-2025 comes from national budget allocation, implementation of the GEF/UNDP/ASEAN Integrated River Basin Management Project, and contributions from hydropower development projects in NTRB. MONRE particularly DWR plays an important role in identifying and applying for funding sources to ensure the implementation of the Management Plan.	1. There is a need to evaluate and determine the sources of funds to support the continuing implementation of the NTRB Management Plan 2021-2025, including available grants and loans from donors and financing institutions, and financing support from the private sector and civil society organizations 2. Sustainability of financial mechanism to support the long-term implementation of the NTRB Management Plan is not evident. 3. There is currently no sustainable financing mechanism that will sustain the operation of a River Basin Council or a multisectoral governance mechanism for river basin management in the NTRB. The Government should consider identifying financing options to institutionalize and operationalize a multisectoral governance mechanism for the management of NTRB.	1. Identify potential funding sources and establish financing mechanisms to support the continuing implementation of the NTRB Management Plan 2021-2025 and the overall management and sustainable development of the NTRB 2. Measures for ensuring sustainability of the financial mechanism supporting long term implementation of NTRB MP 2021-2025. 3. Identify financing options/mechanism to institutionalize and operationalize a multisectoral governance mechanism for the management of NTRB. 4. Prioritize activities for implementation.

Table 6.1 Summary of Challenges and Recommended Priority Areas to Implement and Refine the NTRB MP. (cont.)

Strategic Categories/ Core Indicators	Status/condition	Challenges	Recommended Priority Actions to Refine NTRB MP 2021-2025 Implementation
[6] Capacity Development			
• [017] Availability/ accessibility of capacity development and training opportunities for key stakeholders • [018] Human resource capacity	The NTRB Management Plan 2021-2025 includes activities on awareness rising, training, and capacity building. However, since the implementation of the Management Plan is still in early stages, most of the planned activities have yet to be undertaken. To date, less than 10 (ten) trainings and meetings had been conducted in the NTRB. The implementation of the GEF/UNDP/ASEAN IRBM Project involves around 130 technically qualified government personnel at the national, provincial and district levels as members of the Steering and Coordinating Committees and technical teams.	1). There is a need to implement training and/or capacity building program on IRBM targeting key stakeholders, government personnel and the youth.	1). Capacity strengthening of government personnel, relevant stakeholders and the youth on river basin management should be continued to ensure the sustained implementation of river basin management programs.
[7] Climate Change and Disaster Risk Reduction			
• [019] Degree of vulnerability to disasters • [020] Level of preparedness to disasters • [021] Social and economic losses due to disasters • [022] Greenhouse gas emissions • [023] Climate change trends and extremes • [024] Adaptation to climate change	NTRB is highly vulnerable to flash flood and floodplain flooding and landslides, which are triggered by flashflood events. The basin is also located in a high-risk seismic zone, with nearly 100% probability of experiencing ground shaking at Modified Mercalli Intensity (MMI) Level VI within a 50-year return period. In terms of disaster preparedness, an early warning system, including sirens is not yet in place. Equipment and budget allocations remain insufficient, particularly for the conduct of feasibility studies and the construction of flood protection infrastructure.	1. NTRB is highly vulnerable to flash flood and floodplain flooding and other types of disasters. 2. There is currently no vulnerability and disaster risk assessment in the NTRB, including the identification and mapping of communities in high-risk areas. 3. There is no comprehensive disaster preparedness and response plan. 4. There is limited early warning system, inadequate equipment and budget for disaster preparedness and response. 5. Limited capacity on GHG emissions inventory and calculation. 6. There is no systematic recording of socioeconomic losses from disasters.	1. Establish additional meteorological and hydrological stations to improve flood simulation accuracy and to be able to identify and map populations living in high-risk flood areas. 2. Conduct a comprehensive vulnerability and disaster risk assessment, including identification and mapping of communities in high-risk areas. Required a more detailed topographic survey and mapping in scale not less than 1:2000.

Table 6.1 Summary of Challenges and Recommended Priority Areas to Implement and Refine the NTRB MP. (cont.)

Strategic Categories/ Core Indicators	Status/condition	Challenges	Recommended Priority Actions to Refine NTRB MP 2021-2025 Implementation
[7] Climate Change and Disaster Risk Reduction			
	The Department of Meteorology under MONRE is actively monitoring agro-climatology, meteorology, and extreme weather events nationwide. However, public information sharing still needs improvement. Mechanisms and personnel for early warning, emergency response, and post-disaster relief have been in place in the basin. However, limited funding and equipment remain a challenge. . Climate change impacts are increasingly evident in the NTRB, particularly with the severe flooding that occurred in September 2024. Communities and stakeholders are gradually learning to adapt, but essential foundation for effective disaster management and response planning in the basin is still lacking. There is currently no report on greenhouse gas (GHG) emissions in the NTRB. GHG emissions are not covered in the provincial development plans or in the NTRB Management Plan.		3. Develop a comprehensive disaster management and response plan, including management measures for flooding, establishment of disaster management committees, and capacity-building activities; 4. Establish and early warning system with sirens, adequate equipment, and sufficient budget for disaster preparedness and response. 5. Establish systematic recording of socioeconomic losses from floods, droughts, storms, and landslides, which should be integrated into recovery and mitigation planning 6. Inclusion of GHG emission strategies in NTRB Management Plan and in provincial development plans and building the capacity of provincial staff in GHG emissions inventory and calculations. 7. Forge cooperation at the regional and international levels in addressing climate change issues.

Table 6.1 Summary of Challenges and Recommended Priority Areas to Implement and Refine the NTRB MP. (cont.)

Strategic Categories/ Core Indicators	Status/condition	Challenges	Recommended Priority Actions to Refine NTRB MP 2021-2025 Implementation
[8] Habitat Protection, Restoration and Management			
• [025] Status of environmental assets	NTRB has two important national protected areas (NPA), i.e., the Nam Ha and Nam Kan NPAs, which are rich in biodiversity and host to species of significant national and regional conservation value. The management of wetlands and forest resources are included in the NTRB Management Plan with the provinces allocating areas for natural resource protection and implementing initiatives to increase the forest cover in their respective areas.	1. Shifting cultivation, overharvesting of NTFPs, overfishing, overhunting, and wildlife trafficking. 2. Unsustainable agricultural practices particularly the use of pesticides and other harmful chemical which threatens the quality of soil and water and ecosystem health. 3. The development of an industrial area, service area, and smart city at new industry area and a special economic zone could impact the reduction of biodiversity and ecosystem resources due to the discharge of wastewater and the solid waste disposal from industrial factories.	The updating and preparation of the NTRB Management Plan 2026-2030 should consider the following: 1. Continual management of shifting cultivation, overharvesting of NTFPs, overfishing, overhunting, and wildlife trafficking. 2. Encourage more active involvement of wide range stakeholders into decision making and management of investment projects in the basin. 3. Continual management and control of unsustainable agricultural practices particularly the excessive use of pesticides and other harmful chemicals. 4. Refine the NTRB MP 2026-2030 on comprehensive management of solid waste and wastewater including designation of suitable landfill area and wastewater treatment measures.
[9] Water Use and Supply Management			
• [026] Water use and supply management • [027] Water flow conditions • [028] Economic performance of water-related sectors	Water availability in the NTRB is sufficient to sustain both ecosystems and economic activities. Streamflow is relatively abundant but varies significantly between wet and dry seasons. The hydraulic regime of the Nam Tha River has been altered due to water regulation by hydropower dams. There is currently no available data/information on the economic performance of water-related sectors in the basin. While a budget for water resource management activities has been estimated, funding sources remain unclear, and securing financial support for implementation may be challenging.	1. Financing mechanism and funding sources for securing budget for the implementation of water resource management plan. 2. Transparency in regulating the operations of hydropower reservoir for flood management in the basin and ensuring sustainability of the aquatic ecosystem. 3. Lack of information on economic performance of water-related sectors such as GDP from hydropower, agriculture and industry that related to water use, and water supply and sanitation etc.	1. Refine the NTRB MP 2026-2030 for ensuring financial mechanism and funding sources for securing a budget for the implementation of water resource management plan. [Recommendation 1, 5, and 10] 2. Refine the NTRB MP 2026-2030 for strengthening stakeholder participation in decision making in river basin planning and management that ensure transparency in regulating hydropower operations. 3. Refine the NTRB MP 2026-2030 on continual establishment and improvement of the system for collection of information on economic performance of water-related sectors.

Table 6.1 Summary of Challenges and Recommended Priority Areas to Implement and Refine the NTRB MP. (cont.)

Strategic Categories/ Core Indicators	Status/condition	Challenges	Recommended Priority Actions to Refine NTRB MP 2021-2025 Implementation
[10] Food Security and Livelihood Management			
• [029] Living conditions and well-being • [030] Livelihoods, employment/ economic stability, gender equality and education	Gender equality is well recognized in the basin, and access to education is relatively fair. Literacy rates are high, but awareness and understanding of natural resource management and environmental protection still need improvement. Employment opportunities have moderately increased due to labor market expansion and recent development activities in the area. The diverse ethnic groups in the remote areas continue to rely heavily on natural resources for their livelihoods. While these practices support subsistence, they do not guarantee long-term sustainability of the basin's natural resources and ecosystems.	1. Management and control of unsustainable shifting cultivation, fishing, hunting, NTFPs harvesting; 2. Offering more sustainable livelihood activities, income sources, and opportunities for household economic development for communities in the basin.	1. Strengthening the management and regulation of unsustainable practices, e.g., shifting cultivation, fishing, hunting, NTFPs harvesting; 2. Promote and support for more sustainable livelihood options and diversified income sources.
[11] Pollution Reduction and Waste Management			
• [031] Pollution control and waste management • [032] Water quality and sediment conditions	The NTRB currently experiences low levels of industrial pollution and its natural systems have a high capacity to absorb pollutants. However, rapid socioeconomic growth in agriculture, industry, and services is currently being observed in the basin, all of which contribute to increased waste generation and environmental pollution. Despite some initiatives of the local governments in the NTRB, pollution reduction, waste management and improving water quality are priority issues that should be addressed in the NTRB.	1. Unsustainable agricultural practices particularly the excessive use of pesticides and other harmful substances. 2. Poor solid waste management including improper waste disposal and use of unsanitary landfill. 3. Inadequate treatment of wastewater from mining and processing industries 4. Prolonged retention of low-quality water due to overregulation of flow in the Nam Tha 1 HPP in Nale District that would result to deteriorating water quality.	1. Formulate and implement appropriate measures to regulate and manage unsustainable agricultural practices particularly the excessive use of pesticides and other harmful substances. 2. Implement management measures to address improper waste disposal and use of unsanitary landfill. 3. Implement proper treatment and management of wastewater from mining and processing industries. 4. Formulate and implement appropriate measures to manage the water quality of the Nam Tha 1 HPP reservoir in Nale District.

6.3. Contribution to the National Sustainable Development Goals

This section assesses the progress of the water-related socio-economic development and water resources protection and management and governance of NTRB in comparison with the national SDGs or SDGs of the United Nations.

This assessment is made based in some cases on basin-level data and in some cases on national data, depending on what was available in each dimension of the SORB indicators framework as reported in **Chapters 3 to 5**. It should also be emphasized that the data available against the indicators of the SORB indicators framework are in many cases not an exact alignment with the data requirements of the SDG indicators. Challenges also arise in relation to the assessment of NTRB level conditions and trends and the assessment that might otherwise be made in relation to particular locations or groups in society if more disaggregated data were available.

Most 39 indicators of the total 12 SDGs considered most relevant for water resources management and development in the NTRB demonstrate improvements in **Table 6.2**, with five indicators are likely to be highly improved and to meet the SDGs, 15 indicators showing substantial progress that if continued would put the SDG within reach and three indicators showing progress which is unlikely to be sufficient to meet the SDG or are worsening. Eight indicators show some improvement and some decline in relation to different aspects, making the achievement of the SDG increasingly difficult to achieve. Six indicators do not have sufficient data available to evaluate progress in relation to the SDG indicator.

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals.

	Targets		Challenges	Current Status
SDG 1: End Poverty in All Its Forms Everywhere				
1.1	By 2030, eradicate extreme poverty for all people everywhere, currently measures as people living on less than $1.25 a day.	1.1.1	Proportion of the population living below the international poverty line by sex, age, employment status and geographic location (urban/rural).	 About 83.5 percent population in NTRB having habitats in rural area. All 11 districts in the basin are poor districts out of the total 148 districts in the country. As of the survey data on the population living below the international poverty line in year 2017 and estimated value for year 2021, there was 23.1 percent population in Lao PDR (1,713 thousand people in 2021) is multidimensionally poor while an additional 21.2 percent is classified as vulnerable to multidimensional poverty (1,573 thousand people in 2021). However, the extent to which progress is occurring across sex, age and employment status is not clear [Section 5.4.5].
		1.2.1	Proportion of population living below the national poverty line, by sex and age.	 The proportion of population living below the national poverty line in late 2022 was about 27.5 percent but it is considerably slightly progressively decreased. However, the extent to which progress is occurring across sex, age and employment status is not clear as considerable data gaps remain [Sections 3.5 and 5.4.5].
1.5	By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.	1.5.1	Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000.	 NTRB with approx. 200 thousand population experienced occasional severe floods. One death was reported in 2021 and two deaths in 2024 due to flash flood.
		1.5.2	Direct economic loss attributed to disasters in relation to global gross domestic product (GDP).	 Economic costs of floods in NTRB are high and increased from years 2010s to years 2020s. However, the economic costs is a lower proportion of GDP due to economic growth and confined area of flood.

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 1: End poverty in all its forms everywhere				
1.5	By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.	1.5.3	Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030.	... Insufficient data available to evaluate.
1.b	Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions.	1.b.1	Pro-poor public social spending.	... National government has strategy to reduce poverty rate to less than 5 percent by 2025. However, there is insufficient data available to evaluate the pro-poor public social spending in the basin.
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture				
2.1	By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.	2.1.1	Prevalence of undernourishment.	↑ Prevalence of undernourishment in each district in the basin is progressively declining. However, data is insufficient to evaluate if the SDG target can be reached in 2030 [Section 5.4.1].
		2.1.2	Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES).	↗ Prevalence of food insecurity appears to be declining including undernourishment and infant malnutrition due to improved access to energy supply, access road and markets as well as abundant natural resources in the basin [Section 5.4.1].

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture				
2.2	By 2030, end all forms of malnutrition, including achieving, by 2025, the international agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.	2.2.1	Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organisation Child Growth Standards) among children under 5 years of age.	↑ Prevalence of stunting is declining in the basin due to improvements in agricultural development [Sections 5.4.1 and 5.2.1].
		2.2.2	Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight).	↗ Prevalence of wasting is moderately declining in the basin due to adaptation of the way of life of the population in line with socioeconomic development [Section 5.4.1].
2.4	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.	2.4.1	Proportion of agricultural area under productive and sustainable agriculture.	→ Proportion of agricultural land especially lowland paddy and industrial plant crop areas in the basin has slightly increased while shifting cultivation area is decreasing. There still lack of capacity for adaptation to climate change and disaster [Section 3.3.4].
SDG 3: Ensure healthy lives and promote well-being for all at all ages				
3.3	By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.	3.3.3	Malaria incidence per 1,000 population.	↑ Malaria incidence in the basin has significantly declined [Sections 3.5.1 and 5.4.1].

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status	
SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all					
4.1	By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.	4.1.1	Proportion of children and young people: (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex.	↗	In the basin, the net enrollment rate in primary school is 98.9% while in lower secondary school is 89.5 percent. In LNT Province, the net enrollment rate in primary school is 98%; in lower secondary school is 85.6 percent, and in upper lower secondary school is 57.5 percent. It is seen to be slightly increased. However, there is insufficient data to evaluate proportion by sex.
SDG 5: Achieve gender equality and empower all women and girls					
5.a	Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws.	5.a.1	(a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure.	•••	Insufficient data available to evaluate.
5.c	Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.	5.c.1	Proportion of countries with systems to track and make public allocations of gender equality and women's empowerment.	•••	Lao PDR has legislation and mechanism in empowering women and protection of children rights and interests. However, data is insufficient for evaluation.
SDG 6: Ensure availability and sustainable management of water and sanitation for all					
6.1	By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	6.1.1	Proportion of population using safely managed drinking water services.	↑	There are a number of drinking water production factory in the basin and drinking water supplying survey cover almost villages in the basin. Rural communities have improved awareness on access to safe drinking water. About 97.3 percent population have access to clean water use [Section 3.5.1].

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 6: Ensure availability and sustainable management of water and sanitation for all				
6.2	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.	6.2.1	Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water.	↗ Access to safe sanitary facility in the last decade was limited and has rarely improved. Recently, about 83.5 percent of the basin population have access to sanitary toilets [Section 3.5.1].
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	6.3.2	Proportion of bodies of water with good ambient water quality.	→ NTRB still has abundant forest cover with healthy forest with good water quality. Water quality in 4 national stations with 16 parameters in 2020 indicated relatively good water quality when compared to environmental standards. However, TSS, COD and lead have exceeded the acceptable range. In general water quality in the basin is slightly declining [Section 5.5.2].
6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.	6.5.1	Degree of integrated water resources management implementation.	↗ The NTRB Management Plan and relevant legislations promote integrated water resources management. However, full implementation of the Management Plan is yet to occur [Section 4.2.2].
6.6	Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.	6.6.1	Change in the extent of water-related ecosystems over time.	→ There are two important national protected areas that are rich in biodiversity with species of significant national and regional value to biodiversity conservation. The provinces set the land for natural resource preservation and are making efforts to increase the forest cover area. However, it is also facing some challenges in protection, with critical threats to protected areas (PAs) such as shifting cultivation, overharvesting of NTFPs, and wildlife trafficking [Section 5.2.1].

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all				
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services.	7.1.1	Proportion of population with access to electricity.	↗ Access to electricity is moderately increasing in the basin. Approximately 88.4 percent households have access to power grid electricity [Section 3.5.1].
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix.	7.2.1	Renewable energy share in the total final energy consumption.	↗ Electricity grid line in the basin is supplied by hydropower power plants. There are no other types of electrical power production reported in the basin [Section 3.5.1].
SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all				
8.1	Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries.	8.1.1	Annual growth rate of real GDP per capita.	↗ The 11 districts in the basin have different GDP growth rates ranging from 6.60 percent - 8.00 percent and the GDP per capita are in range of 822 – 1,873 US$/Capita/year with the mean value of 1,163 US$/Capita/year.
8.5	By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.	8.5.2	Unemployment rate, by sex, age and persons with disabilities.	↗ There are economic development projects and services in the basin and nearby areas which create more jobs and employment opportunities in the basin. It is notable that the employment rate in the basin is almost 100 percent. However, there is insufficient data to evaluate the number of unemployed individuals.
8.9	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products.	8.9.1	Tourism direct GDP as a proportion of total GDP and in growth rate.	↗ The tourism sector is developing rapidly in Lao PDR especially cultural tourism in LNT Province, however, it was significantly affected by the COVID-19 pandemic. No data is available on the sustainability of the sector [Section 3.5.1].
SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation				
9.1	Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.	9.1.2	Passenger and freight volumes, by mode of transport.	↑ Navigation including cargo and passenger movement is growing steadily in the basin, especially in Cambodia and Viet Nam, with development of infrastructure capable of supporting trans-border shipments [Section 5.3.4].

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation				
9.a	Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States.	9.a.1	Total official international support (official development assistance plus other official flows) to infrastructure.	→ GoL has continuously received support from official international support especially in road construction and improvement including in NTRB.
SDG 13: Take urgent action to combat climate change and its impacts				
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.	13.1.1	Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population.	↓ NTRB with approximately 200,000 population experienced occasional severe flooding. One death was reported in 2021 and two deaths in 2024 due to flash flood.
		13.1.2	Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030.	... Insufficient data available to evaluate.
13.2	Integrate climate change measures into national policies, strategies and planning.	13.2.1	Number of countries with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the United Nations Framework Convention on Climate Change.	↗ GOL has a Strategy on Management and Consumption of Water and Water Resources until 2030 and Vision until 2040, the Five-year Socioeconomic Development Plan 2021-2025 and the NTRB Management Plan 2021-2025 that sets action for climate change adaptation. GoL has submitted its Nationally Determined Contribution (NDC) and National Communications to the UNFCCC. Adaptation Plans are in progress or already in place. However, more needs to be done to follow through with implementation, especially in relation to adaptation, which requires significant increase in financing, capacity building and greater policy coherence between sectors.
		13.2.2	Total greenhouse gas emissions per year.	→ Total basin greenhouse gas emissions are estimated to be mostly constant over the decade, although remain relatively small at a national and global scale [Section 5.1.4].

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainable manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss				
15.1	Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.	15.1.1	Forest area as a proportion of total land area.	→ There is about 54.55 percent of permanent forest and 37.2% of potential forests in NTRB. Luang Namtha Province has set 692,271.10 Ha (73.72 percent of land area) for natural resources preservation, which includes production forest, protection forest, and protection area. the province has set the priority work plan to recover the forest cover area to 68.27 percent of the province's land area [Sections 3.3.4 and 5.2.1].
		15.1.2	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas by ecosystem type.	→ There are biodiversity conservation areas at the national, provincial and district levels in NTRB (1.851.6 km^2 or 20.76 percent of NTRB). These include 2 NBCAs (Nam Ha NBCA and Nam Kan NBCA). There are also national protection forest and national production forest covering 4,960.29 km^2. These high value terrestrial ecosystems comprise 76.38 percent of total NTRB [Section 3.3.4].
15.2	By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.	15.2.1	Progress towards sustainable forest management.	↗ Several initiatives to protect the ecosystem have been implemented in the area. For example, UNESCO and the Lao National Tourism Administration started the Nam Ha ecotourism project in 1999. The project received UNDP's Equator prize winner in 2006 [Section 5.2.1].
15.5	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.	15.5.1	Red List Index	→ There is no significant change in the number of threatened fish species over last two decades.

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainable manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss				
15.9	Integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.	15.9.1	(a) Number of countries that have established national targets in accordance with or similar to Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 in their national biodiversity strategy and action plans and the progress reported towards these targets; and (b) integration of biodiversity into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting.	Lao PDR has national biodiversity strategies and action plans aligned with Aichi targets and have committed to the Kunming-Montreal Biodiversity Framework and its targets.
SDG 17: Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development				
17.9	Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation.	17.9.1	Dollar value of financial and technical assistance (including through North-South, South-South and triangular cooperation) committed to developing countries.	Financial support has been provided to NTRB to assist with climate change mitigation and adaptation with some projects having co-benefits with SDGs. However, financing gap remains to support adaptation measures [Section 4.5].
17.14	Enhance policy coherence for sustainable development.	17.14.1	Number of countries with mechanism in place to enhance policy coherence of sustainable development.	GOL has set its national sustainable development goals in the Green Growth Strategy, in the Socioeconomic Development Plan 2021-2025 and in the Strategy on Management and Consumption of Water and Water Resources until 2030 with Vision to 2040.

Table 6.2 Assessment NTRB Towards Achieving Water-related Sustainable Development Goals. (cont.)

	Targets		Challenges	Current status
SDG 17: Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development				
17.18	By 2020, enhance capacity-building to developing countries ... to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.	17.18.1	Statistical capacity indicator for Sustainable Development Goal monitoring.	Insufficient data available to evaluate. •••



Photo by John Castillo/PEMSEA

CHAPTER 7

Conclusions and Recommendations

This chapter presents the major findings and conclusions, including key insights on the status, progress and remaining challenges in meeting the goals and targets established in the NTRB Management Plan 2021-2025. It ends with key recommendations for priority actions to strengthen the existing IRBM program in the river basin, including the updating of the Management Plan for 2026-2030.

7.1. Conclusions

7.1.1. Current Status of Nam Tha River Basin

Figure 7.1 summarizes the status of the 32 governance and management core indicators. Four indicators in the governance aspects have good status: 1) formal recognition that sector-based government agencies support integrated approaches for integrated river basin management; 2) IRBM enabling legislation; 3) coordinating mechanism for IRBM, and 4) environmental cases filed/resolved, which represent 6.3 percent of the total core indicators. Eight indicators have fair status, which represent 25 percent while 15 indicators require action, which represent 46.9 percent of the total core indicators. These include: 1) river basin profile and environmental risk assessment; 2) local government development plan, including river basins, associated watershed and adjacent coastal and marine areas; 3) effective platform/mechanisms for collecting, storing and sharing IRBM related information to relevant stakeholders; 4) budget allocation for IRBM; 5) sustainable financing mechanisms; 6) availability/accessibility of capacity development and training opportunities for key stakeholders; 7) greenhouse gas emissions; 8) pollution control and waste management, and 9) water quality and sediment conditions. Five indicators under the sustainable development aspects require urgent action, including: 1) degree of vulnerability to disasters; 2) level of preparedness for disaster; 3) social and economic losses due to disasters; 4) climate change trends and extremes, and 5) adaptation to climate change.

Figure 7.1 Current Status of NTRB Relative to the SORB Indicators.

Governance Core Indicators			Core Indicator Status	Core Indicator Trend
Policy, Strategies and Plans	001	River Basin Profile and Environmental Risk Assessment	Requires Action	↗
	002	River Basin Strategy and Action Plans	Fair	↑
	003	Local Government Development Plan, including River Basins, Associated Watersheds and Adjacent Coastal and Marine Areas	Requires Action	↗
Institutional Arrangements	004	Coordinating Mechanism for River Basin Management	Good	↗
	005	Formal Recognition that Sector-based Government Agencies Support Integrated Approaches for River Basin Management	Good	↗
	006	Benefits Derived from Cooperation	Fair	↑
Legislation	007	IRBM Enabling Legislation	Good	↗
	008	Administration, Enforcement of Legislation and Compliance Monitoring and Inspection	Requires Action	→
	009	Environmental Cases Filed/Resolved	Good	↗
Information and Public Awareness	010	Effective Platform/Mechanisms for Collecting, Storing and Sharing IRBM Related Information to Relevant Stakeholders	Requires Action	↗
	011	Education and Public Awareness Schemes for a Range of Stakeholders	Requires Action	↗
	012	Public Participation and Mobilization	Requires Action	↗
	013	Degree of Stakeholder Participation and Gender Equality and Social Inclusion in Decision Making Process for River Basin Management	Fair	↗
Financial Mechanism	014	Budge Allocation for Integrated River Basin Management	Requires Action	↗
	015	Sustainable Financing Mechanisms	Requires Action	→
	016	Self-financing of River Council/Committee	Requires Action	→
Capacity Development	017	Availability/Accessibility of Capacity Development and Training Opportunities for Key Stakeholders	Requires Action	↗
	018	Human Resource Capacity	Fair	↗

Core Indicator Status Levels:

- Good
- Fair
- Requires Action

Core Indicator Trend:

- ↑ Significantly Improved
- → Slightly Improved/Constant
- ↗ Moderately Improved
- ↓ Worsened

Figure 7.1 Current Status of NTRB Relative to the SORB Indicators. (cont.)

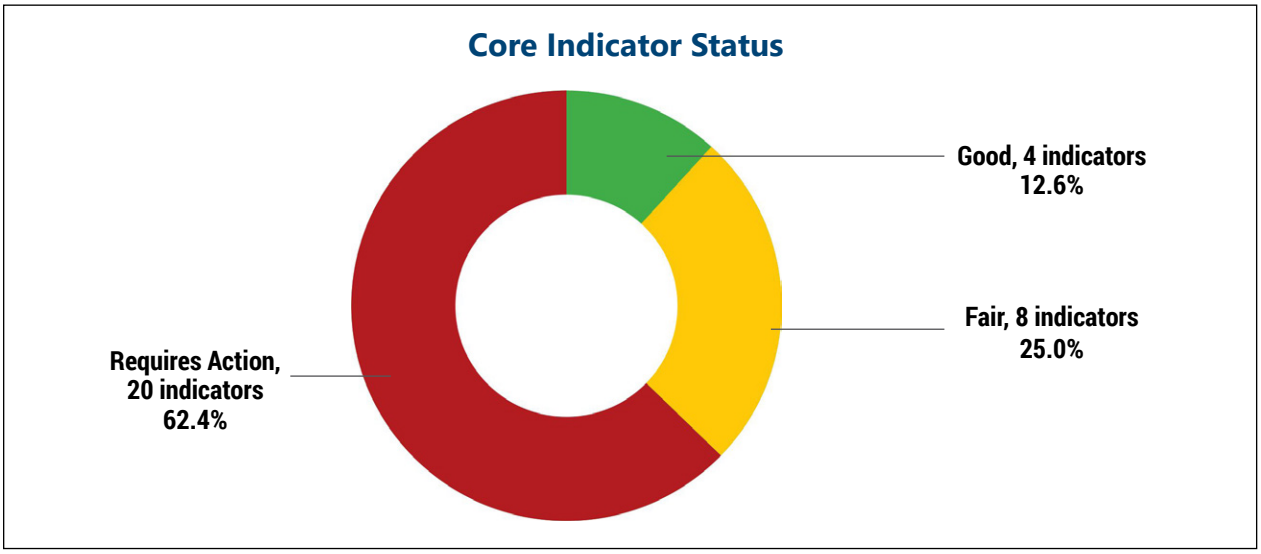
Sustainable Development Aspects Core Indicators			Core Indicator Status	Core Indicator Trend
Climate Change and Disaster Risk Reduction	019	Degree of Vulnerability to Disasters		↗
	020	Level of Preparedness to Disasters		↗
	021	Social and Economic Losses due to Disasters		↗
	022	Greenhouse Gas Emissions		↗
	023	Climate Change Trends and Extremes		↓
	024	Adaptation to Climate Change		↗
Habitat Protection, Restoration and Management	025	Status of Environmental Assets		→
Water Use and Supply Management	026	Water Use and Supply Management		↗
	027	Water Flow Conditions		→
	028	Economic Performance of Water-related Sectors		↗
Food Security and Livelihood Management	029	Living Conditions and Well-being		→
	030	Livelihoods, Employment/economic Stability, Gender Equality and Education		↗
Pollution Reduction and Waste Management	031	Pollution Control and Waste Management		→
	032	Water Quality and Sediment Conditions		→

Core Indicator Status Levels:

- Good
- Fair
- Requires Action

Core Indicator Trend:

- ↑ Significantly Improved
- → Slightly Improved/Constant
- ↗ Moderately Improved
- ↓ Worsened



7.2. Recommendations

7.2.1. Recommendations for Future Updating of NTRB SORB Report

There is a river basin profile report of NTRB prepared in 2022. The baseline SORB Report of NTRB was developed based on secondary data and information provided by local authorities and concerned agencies in the basin. However, there is still limited information to gain better understanding, particularly for indicators related to volume of greenhouse gas emission, water quality and disaster risks index in the basin. It is recommended that in the updating of the NTRB SORB Report, information from the following be considered: 1) results from the 2026 to 2027 population census; 2) the Five-Year Socio-economic Development Plan 2026-2030 of the provinces and districts in the basin; 3) results from the waste assessment activities; 4) other relevant technical studies, including the report/records from NTRB's information management and sharing platform. Below are recommended actions, data and information needs for updating the NTRB SORB Report:

1. Improvement of the baseline population, socioeconomic features, investment project, pollution load, meteorology, hydrology and water quality in the basin including installation more and improvement of existing meteorology, hydrology and water quality monitoring stations in the basin and strengthening capacity in maintenance and operation of those monitoring stations.
2. Technical study or assessment of vulnerability to disasters and/or disasters risk assessment for NTRB together with identification and mapping of the population living in high-risk areas and making available of more detailed topographic map and flood prone area maps in various scenarios in scale not less than 1:2000.
3. Technical study or assessment of greenhouse gas generation in NTRB.
4. Systematic recording of socioeconomic losses from disasters including flood, drought, storm and landslide.
5. Integrate the NTRB Management Plan into the Five-Year Socioeconomic Development Plan 2026-2030 of the provinces and districts in NTRB.
6. Improvement on the collection of other water-related data and information collection as part of the establishment of the basin information management and data sharing center.
7. Continuing capacity strengthening in data and information collection and SORB Report preparation for government officials.

It is further recommended that in the updating of the NTRB SORB Report, sufficient resources and time, ideally between eight to 12 months, should be allotted for data collection and consolidation, analysis and drafting the report, including the validation process.

7.2.2. Recommendations to Refine the NTRB Management Plan

The NTRB MP 2021-2025 was approved by the Prime Minister in 2022, with implementation commencing in late 2023. Progress in achieving the targets and outcomes was limited due to the COVID-19 pandemic and budgetary constraints. Activities for some action plans have yet to be implemented. It is recommended that the additional information and recommendations from the SORB report be considered in the refinement and updating of the NTRB MP 2021 2025, particularly those actions targeting current and emerging issues in the NTRB.

Moreover, through the process of assessment and comparison of the basin status with the NTRB MP 2021-2025 and the UN SDGs, several issues and areas of concern that were identified can provide guidance in the refinement of the NTRB MP and opportunities for relevant basin stakeholders to participate in contributing to achieving the outcomes set forth in the NTRB MP.

The recommendations are categorized into: (1) short-term actions for implementation over the remainder of the NTRB MP 2021-2025, and (2) medium-term recommendations for consideration in the updating and preparation of the NTRB MP 2026-2030 as provided in **Table 7.1**.



Photo by John Castillo/PEMSEA

Table 7.1 Recommendations for Short-term Actions for Implementation NTRB MP 2024-2025 and Medium-term Planning for the NTRB MP 2026-2030.

Recommendations for NTRB management actions and planning		
Category	**Short-Term Actions for Implementation the Remaining Action Plan of NTRB MP 2021-2025**	**Medium-term Recommendations for Consideration in the Refinement of the NTRB MP 2026-2030**
Policy, Strategies and Plans	**Action 1:** Conduct disaster risks assessment and implement measures for preventing and controlling of disasters, especially flood. **Action 2:** Update the NTRB profile report and NTRB SORB Report and implement NTRB MP's activities.	**Recommendation 1:** Source of funds for the implementation of NTRB MP 2021-2025. **Recommendation 2:** Integration of IRBM into the local government socioeconomic development plan.
Institutional Arrangements	**Action 3:** Implement capacity strengthening on inspection of compliance to water resources management as well as water uses by each sector and pollutions management in the basin. **Action 4:** Enhance collaboration between relevant departments and organizations for the implementation of IWRM in water-use sectors. **Action 5:** Formulate and implement the required measures for ensuring funding allocation for the coordinating mechanism.	**Recommendation 3:** Capacity strengthening on inspection of compliance to water resources management as well as water uses by each sector and pollution management in the basin. **Recommendation 4:** Elaborate on the roles and responsibilities of relevant departments and organizations in the preparation/updating and implementation of the NTRB Management Plan 2026-2030. **Recommendation 5:** Elaborate on the sources of funding and mechanisms for the development, updating and implementation of the NTRB MP 2026-2030.
Legislation	**Action 6:** Document environmental cases and organize information in the filing systems of concerned local authorities and river basin committees.	**Recommendation 6:** Define the filing system for environmental cases as part of information management and knowledge sharing to support the development of the NTRB MP.
Information and Public Awareness	**Action 7:** Establish functional information management and data sharing centre. **Action 8:** Engage a wide range of stakeholders, including the private sector in the planning and decision making processes of NTRB. **Action 9:** Public awareness raising and education program implementation for local communities.	**Recommendation 7:** Define the mechanism for the establishment and sustaining the information management and data sharing center to support the development of the NTRB MP 2026-2030. **Recommendation 8:** Strengthen the mechanism for stakeholder engagement including the private sector into the planning and decision making processes to support the development of the NTRB MP 2026-2030. **Recommendation 9:** Strengthen the communication, public awareness raising and education programs for local communities to support the development of the NTRB MP 2026-2030.

Table 7.1 Recommendations for Short-term Actions for Implementation NTRB MP 2024-2025 and Medium-term Planning for the NTRB MP 2026-2030. (cont.)

Recommendations for NTRB management actions and planning		
Category	**Short-Term Actions for Implementation the Remaining Action Plan of NTRB MP 2021-2025**	**Medium-term Recommendations for Consideration in the Refinement of the NTRB MP 2026-2030**
Financing Mechanism	**Action 10:** Funding structure for implementation of NTRB Management Plan 2021-2025 from donor such as loans, grants from financing institutions, and co-financing from partner private sector and civil society organization. **Action 11:** Measures for ensuring sustainability of the financial support sources, structure and mechanism supporting the implementation of NTRB MP 2021-2025. **Action 12:** Consider self-financing mechanisms of the NTRB committee. **Action 13:** Prioritize activities for implementation in consideration of budgetary constraints.	**Recommendation 10:** Identify the required financing support from loans and grants involving donors and private sectors to support the development and implementation of the NTRB MP 2026-2030. **Recommendation 11:** Identify measures to establish self-financing arrangements for the NTRB Committee to continue providing the necessary oversight in the development and implementation of the NTRB MP 2026-2030.
Capacity Development	**Activity 14:** Implement training and/or capacity building on IRBM for key stakeholders as well as government staffs especially for the youth for future sustainability.	**Recommendation 12:** Develop detailed plan on capacity development on IRBM for key stakeholders and government staff, including the youth to support the development and implementation of the NTRB MP 2026-2030.
Climate Change and Disaster Risk Reduction	**Activity 15:** Installation and more improvement of existing meteorological station and hydrological observation station in NTRB to facilitate establishing accurate flood simulation and identification and mapping of the population living in high-risk flood areas. **Activity 16:** Conduct vulnerability and risk assessment to disasters along with the identification and mapping of populations living in high-risk and flood-prone areas. Conduct detailed topographic survey and mapping with scale not less than 1:2000. **Activity 17:** Conduct a comprehensive disaster management and response planning, including implementation of flood protection, disaster management and capacity building activities. Availability of early warning system with warning siren, adequate equipment and budget allocation for preparation and response to disaster are essential. **Activity 18:** Establish a mechanism for systematic recording of socioeconomic losses from disasters.	**Recommendation 13:** Develop a plan for installation and continuing improvement of existing meteorological and hydrological facilities to support more effective management of the NTRB. **Recommendation 14:** Continue the conduct of vulnerability and risk assessment to disasters and mapping of populations living in high-risk and flood-prone areas to support the development and implementation of the NTRB MP 2026-2030. **Recommendation 15:** Continue the conduct a comprehensive disaster management and response planning, including implementation of flood protection, disaster management and capacity building activities and the installation of early warning systems to enhance timely disaster response in the NTRB. **Recommendation 16:** Further strengthen the documentation and reporting mechanism on on the socioeconomic losses from disasters.

Table 7.1 Recommendations for Short-term Actions for Implementation NTRB MP 2024-2025 and Medium-term Planning for the NTRB MP 2026-2030. (cont.)

Recommendations for NTRB management actions and planning		
Category	**Short-Term Actions for Implementation the Remaining Action Plan of NTRB MP 2021-2025**	**Medium-term Recommendations for Consideration in the Refinement of the NTRB MP 2026-2030**
Habitat Protection, Restoration and Management	**Action 19:** Implement appropriate measures to manage shifting cultivation, over-harvesting of NTFPs, overfishing, over-hunting, and wildlife trafficking. Over-hunting and trading of wildlife from forests are practiced by rural populations living within and nearby areas. **Action 20:** Implement appropriate measures to manage unsustainable agricultural practices especially the use of pesticide (insecticide), fungicide and herbicide that affect soil and water quality and the overall terrestrial and aquatic ecosystem health. **Action 21:** Implement appropriate measures to manage solid waste and wastewater, including the designation of suitable areas for sanitary landfill and wastewater facilities. **Action 22:** Consider including GHG emission strategies in the management plan of NTRB and the provincial development plan and build the capacity on GHG emissions calculation, including the GHG inventory for provincial staff.	**Recommendation 17:** Incorporate in the NTRB MP 2026-2030 measures to manage shifting cultivation, over-harvesting, over-hunting and trading of wildlife from forests. **Recommendation 18:** Incorporate in the NTRB MP 2026-2030 the established measures to manage unsustainable agricultural practices that affect the overall ecosystem health of NTRB. **Recommendation 19:** Incorporate in the NTRB MP 2026-2030 measures for managing solid and liquid wastes to protect the ecosystem health of NTRB.
Water Use and Supply Management	**Action 23:** Establish financial mechanism and identify funding sources to support the implementation of water resources management programs. **Action 24:** Implement measures that promotes transparency in regulating the operations of hydropower reservoir for flood management. **Action 25:** Establish a system for collecting of information on economic performance of water-related sectors.	**Recommendation 20:** Enhance the NTRB MP 2026-2030 by incorporating the sustainable financing mechanisms for water resources management. [Recommendations 1, 5, and 10] **Recommendation 21:** Further strengthen the mechanism established to promote transparency in regulating the operations of hydropower reservoir for flood management and incorporate the necessary actions in the NTRB MP 2026-2030. [Recommendations 8 and 9] **Recommendation 22:** Further strengthen the system established for collection of information on the economic performance of water-related sectors and incorporate the necessary actions on the NTRB MP 2026-2030.

Table 7.1 Recommendations for Short-term Actions for Implementation NTRB MP 2024-2025 and Medium-term Planning for the NTRB MP 2026-2030. (cont.)

Recommendations for NTRB management actions and planning		
Category	**Short-Term Actions for Implementation the Remaining Action Plan of NTRB MP 2021-2025**	**Medium-term Recommendations for Consideration in the Refinement of the NTRB MP 2026-2030**
Food Security and Livelihood management	**Action 26:** Provide sustainable livelihood opportunities and identify alternate and additional income sources to improve the household and community's social and economic well being.	**Recommendation 23:** Incorporate in the NTRB MP 2026-2030 actions on sustainable livelihood development for improvement of the household and community's social and economic well being.
Pollution Reduction and Waste Management	**Action 27:** Undertake appropriate measures to manage solid wastes generated by households and services, including uncontrolled waste dumping and improving the sanitary landfill operations. **Action 28:** Undertake appropriate measures to manage industrial wastewater including wastewater from mining exploration and processing activities. **Action 29:** Formulate and implement appropriate measures to control and/or manage water quality in the Nam Tha 1 HPP reservoir in the area of Nale District.	**Recommendation 24:** Incorporate in the NTRB MP 2026-2030 measures to manage solid wastes generated by households and services, including uncontrolled waste dumping and improving the sanitary landfill operations. **Recommendation 25:** Incorporate in the NTRB MP 2026-2030 appropriate measures to manage industrial wastewater including wastewater from mining exploration and processing activities. **Recommendation 26:** Incorporate in the NTRB MP 2026-2030 appropriate measures to control and/or manage water quality in the Nam Tha 1 HPP reservoir in the area of Nale District.

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Marketplace in Luang Namtha Province, Lao PDR. *(Photo by John Castillo/PEMSEA)*



Annexes

Annex 1: Detailed Methodology for NTRB SORB Reporting

Specific methods are formulatedand implemented for the assessment of the NTRB for SORB reporting, including data collection and field assessment, data compilation and analysis, basin status assessment, evaluation of the progress towards the basin development plan and in evaluation of progress towards the water related UN SDGs.

A1.1. Data Collection and Field Assessment Methodology

PEMSEA published the SORB Guidebook in 2024 with an Indicator Framework comprising 32 core indicators of governance and sustainable development aspects. The Guidebook also describes the rationale; provides detailed description for each indicator; the data requirements and guide questions to facilitate systematic data and information collection and consolidation; analysis and interpretation of results, and their implications to management.

Data and information for the NRTB SORB report preparation were collected in line with the SORB Indicator Framework. Required data and information were collected from both secondary and primary data sources in the form of government reports, technical reports, raw data, GIS data files, scientific papers and Internet sources. Required data and information on the governance aspects were mainly collected from government agencies. Primary data through field assessment and raw data available at concerned authorities from both central and local levels were also used in developing this report.

A coordination arrangement was established with the Steering Committees and Technical Working Groups at the central, provincial and district government levels providing the necessary guidance and technical support.

A1.2. Data Compiling and Analysis Methods

Data collected were compiled into the 11 categories or dimensions based on the governance and sustainable development aspects of the SORB Indicator Framework.

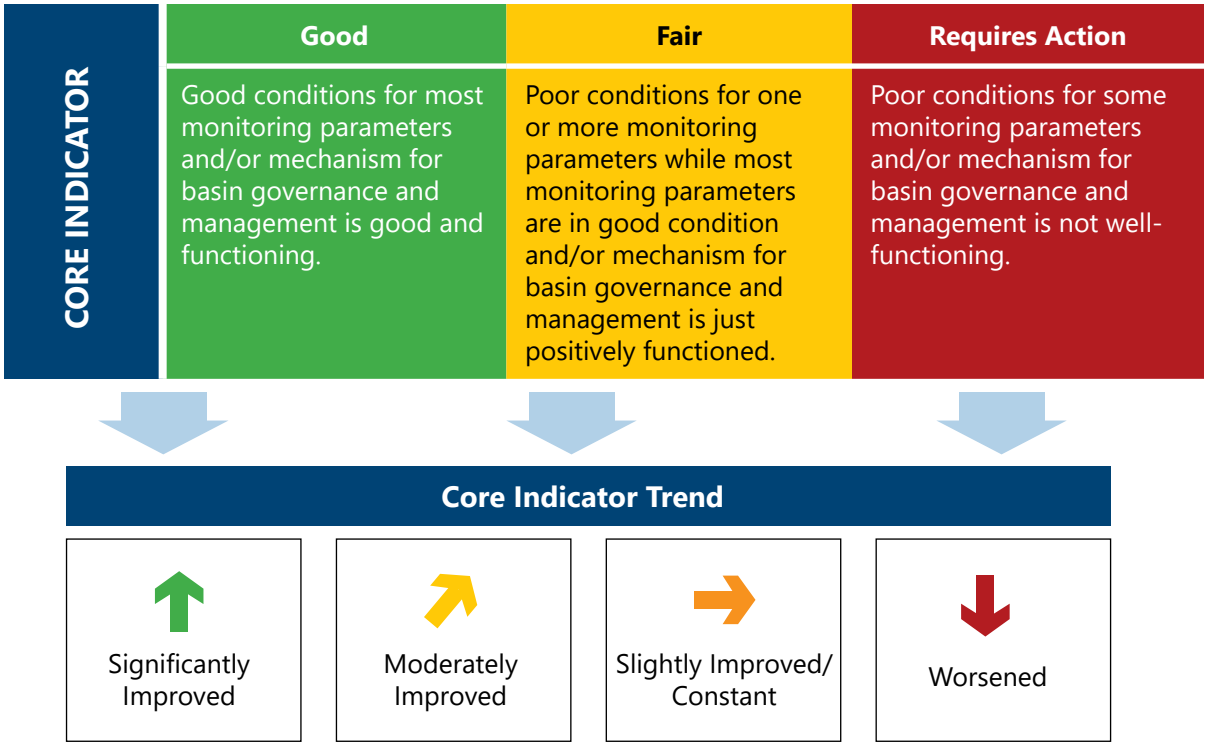
The Framework served as guide in grouping and compiling related data and information gathered for each indicator. For the creation and illustration of spatial imageries and graphical figures, GIS data were collected from technical agencies from provincial and central levels and used in generating GIS maps and modelling for the NTRB SORB Report.

For each indicator, the current state, trends, drivers of change and management responses were identified. Data analysis and interpretation as well as presentation of results were done in graphical or narrative format to ensure that the information can be easily understood.

Recommendations gathered from consultations were compiled; thoroughly reviewed and merged into a package of recommendation for further consideration in future SORB report preparation and improving the reporting process.

A1.3. Methodology in Basin Status Assessment and Evaluation

As a sub-basin of Mekong River Basin, assessment of the current status of NTRB for both governance and sustainable development aspects also considered the methodological framework for assessing/rating the Core Indicators or Categories as shown in **Figure A1-1** which is similar to the Mekong River Basin State of River Basin reporting to facilitate harmonization of the basin status assessment and basin management plan of NTRB.



A1.4. Methodology in Evaluating Progress Towards the Basin Development Plans

Chapter 2 of the SORB Report utilizes methodology which is useful in evaluating the progress in implementing the NTRB Management Plan 2021-2025 and the local and national socioeconomic development plans and targets. The evaluation is conducted by assessing the 11 Categories and 32 Core Indicators of the NTRB SORB Indicator Framework and comparing them against the six (6) Action Plans and 8 Development Targets of the NTRB Management Plan 2021-2025 and the recent Five-Year Socio-Economic Development Plan of ODX, LNT and BOK Provinces.

Table A1-1: Indicators of Progress and Guidance in Evaluating the Progress of Implementation of the NTRB MP 2021-2025 for each Category of the NTRB SORB Indicator Framework.

Indicator of Progress	Descriptive Evaluation Guidance
	**On track.** Gap on the 18 Development Targets of the NTRB Management Plan 2021-2025 is decreasing based on conditions and trends over the last few years. The close the gap to achieving the Targets is becoming less challenging.
	**Moderate improvement.** Gap is closing but likely insufficient progress to attain the 18 Development Targets. Challenges remain to achieve the Outcome.
	**No or only slight improvement.** Progress is short of requirements to achieve the 18 Development Targets and significant challenges remain.
	Gap on the 18 Development Targets of the NTRB Management Plan 2021-2025 is increasing based on conditions and trends over the last few years. The effort required to close the gap to achieving the 18 Development Targets of the NTRB Management Plan 2021-2025 is becoming more challenging.

It can be noted that the alignment of 11 dimensions and 32 Core Indicators of the NTRB SORB Report with the 18 Development Targets of the NTRB Management Plan 2021-2025 is not always a one-to-one relationship. In many cases the Core Indicators provide relevant information to evaluate progress towards more than one of 18 Targets of the NTRB Management Plan 2021-2025. As such, cross-referencing the results of evaluation against is provided.

Table A1-2: The Most Relevant NTRB SORB Core Indicators with the Action Plan No.01 of NTRB Management Plan 2021-2025.

NTRB Management Plan 2021-2025		NTRB SORB Indicators Framework	
Action Plan	**Targets**	**Categories**	**Core Indicators**
Action Plan 1: Establish basin governance mechanism and capacity strengthening	**T1.1:** Institutional and Human resource development	Institutional Arrangements	[004] Coordinating mechanism for IRBM
			[005] Formal recognition that sector-based government agencies must pursue integrated approaches for RBM
			[006] Benefits derived from cooperation
		Capacity Development	[017] Availability/accessibility of capacity development and training opportunities for key stakeholders
			[018] Human resource capacity
	T1.2: Public Involvement and Awareness	Information and Public Awareness	[010] Effective platform for collecting, storing and sharing IRBM-related data/ information to relevant stakeholders
			[011] Education and public awareness schemes for a range of stakeholders
			[012] Public participation and mobilization
			[013] Degree of stakeholder participation and GESI in decision making process for RBM
	T1.3: Support activity on Socioeconomic development and conservation of culture related to water resources	Food Security and Livelihood Management	[029] Living conditions and well-being
			[030] Livelihoods, employment/economic stability, gender equality and education

Table A1-3: The most relevant NTRB SORB Core Indicators with the Action Plan No.02 of NTRB Management Plan 2021-2025

NTRB Management Plan 2021-2025		NTRB SORB Indicators Framework	
Action Plan	**Targets**	**Categories**	**Core Indicators**
Action Plan 2: Manage the use of water and water resources	**T2.1:** Water use allocation	Water Use and Supply Management	[026] Water use and supply management
	T2.2: Define minimum flow for environmental flow	Water Use and Supply Management	[026] Water use and supply management
			[027] Water flow conditions
		Habitat Protection, Restoration and Management	[[025] Status of environmental assets
	T2.3: Management and administration of reservoirs	Water Use and Supply Management	[026] Water use and supply management
			[027] Water flow conditions
	T2.4: Management of groundwater	Pollution Reduction and Waste Management	[032] Water quality and sediment conditions

Table A1-4: The most relevant NTRB SORB Core Indicators with the Action Plan No.03 of NTRB Management Plan 2021-2025

NTRB Management Plan 2021-2025		NTRB SORB Indicators Framework	
Action Plan	**Targets**	**Categories**	**Core Indicators**
Action Plan 3: Management of information on water and water resources	**T3.1:** Assessment, inventory and management of information on water resources	Climate Change and Disaster Risk Reduction	[020] Level of preparedness for disasters
		Habitat Protection, Restoration and Management	[025] Status of environmental assets
		Water Use and Water Supply Condition	[027] Water flow condition
	T3.2: Improvement and installation of meteorology and hydrology stations and the surface and groundwater quality monitoring stations	Climate Change and Disaster Risk Reduction	[020] Level of preparedness to disasters
		Habitat Protection, Restoration and mManagement	[025] Status of environmental assets
		Water Use and Water Supply Condition	[027] Water flow condition

Table A1-5: The most relevant NTRB SORB Core Indicators with the Action Plan No.04 of NTRB Management Plan 2021-2025.

NTRB Management Plan 2021-2025		NTRB SORB Indicators Framework	
Action Plan	**Targets**	**Categories**	**Core Indicators**
Action Plan 4: Protection and rehabilitation of water and water resources	**T4.1:** Protection and management of water and water resources conservation areas	Information and Public Awareness	[010] Effective platform for collecting, storing and sharing IRBM-related data/ information to relevant stakeholders
			[011] Education and public awareness schemes for a range of stakeholders
			[012] Public participation and mobilization
			[013] Degree of stakeholder participation and GESI in decision making process for RBM
		Capacity Development	[017] Availability/accessibility of capacity development and training opportunities for key stakeholders
			[018] Human resource capacity
		Habitat Protection, Restoration and Management	[025] Status of environmental assets
		Water Use and Supply Management	[027] Water flow conditions
	T4.2: Rehabilitation of water and water resources	Habitat Protection, Restoration and Management	[025] Status of environmental assets
		Water Use and Supply Management	[027] Water flow conditions
	T4.3: Management of water quality	Pollution Reduction and Waste Management	[032] Water quality and sediment conditions

Table A1-6: The most relevant NTRB SORB Core Indicators with the Action Plan No.05 of NTRB Management Plan 2021-2025.

NTRB Management Plan 2021-2025		NTRB SORB Indicators Framework	
Action Plan	**Targets**	**Categories**	**Core Indicators**
Action Plan 5: Minimization of impacts from flood and drought hazards and climate change	**T5.1:** Control of flood and draught hazards	Capacity Development	[017] Availability/accessibility of capacity development and training opportunities for key stakeholders
			[018] Human resource capacity
		Climate Change and Disaster Risk Reduction	[019] Degree of vulnerability to disasters
			020] Level of preparedness to disasters
			[023] Climate change trends and extremes
			[024] Adaptation to climate change
	T5.2: Resilience with and mitigate the impacts of climate change	Capacity Development	[017] Availability/accessibility of capacity development and training opportunities for key stakeholders
			[018] Human resource capacity
		Climate Change and Disaster Risk Reduction	020] Level of preparedness to disasters
			[024] Adaptation to climate change

Table A1-7: The most relevant NTRB SORB Core Indicators with the Action Plan No.06 of NTRB Management Plan 2021-2025.

NTRB Management Plan 2021-2025		NTRB SORB Indicators Framework	
Action Plan	**Targets**	**Categories**	**Core Indicators**
Action Plan 6: Management of land, forests and environment	**T6.1:** Management of wetlands	Habitat protection, restoration and management	[025] Status of environmental assets
		Food security and livelihood management	[029] Living conditions and well-being
			[030] Livelihoods, employment/economic stability, gender equality and education
		Pollution reduction and waste management	[031] Pollution control and waste management
			[032] Water quality and sediment conditions
	T6.2: Management of forest resources	Habitat protection, restoration and management	[025] Status of environmental assets
		Food security and livelihood management	[029] Living conditions and well-being
			[030] Livelihoods, employment/economic stability, gender equality and education
	T6.3: Land management and allocation	Food security and livelihood management	[029] Living conditions and well-being
			[030] Livelihoods, employment/economic stability, gender equality and education
	T6.4: Waste management	Pollution reduction and waste management	[031] Pollution control and waste management
			[032] Water quality and sediment conditions

A1.5. Method for Evaluating Progress Towards the Water-related Sustainable Development Goals

This section provides a guidance in assessing the progress, challenges, changing conditions on the governance and management aspects of NTRB in comparison with the water-related national Sustainable Development Goals (SDGs) and UN SDGs (**Table A1-8**).

Table A1-8: Descriptive Guidance for Evaluating the Progress of Water-related Socioeconomic Development and Water Resources Protection and Management and Governance of NTRB Towards the SDGs.

Indicator of progress	Descriptive Evaluation Guidance
↑	Reached the SDGs, on track or rapid improvement of recent conditions and trends of the Strategic Dimensions /Categories of the governance and management aspects of the basin.
↗	Moderate improvement and having conditions and trends to reach the SDGs with the required period of the Strategic Dimensions /Categories of the governance and management aspects of the basin.
→	None or only slight improvement of the water-related socio-economic development and water resources protection and management and governance of the basin.
↓	Declining progress and having challenges to reach the water-related socioeconomic development of the basin.
•••	Insufficient information to evaluate progress.

Annex 2: Settlement and Way of Life of Ethnic Groups in NTRB.

As of formal recognition by the National Assembly (NA), there are 4 Ethno-Linguistic Families in total including the Tai-Kadai, Hmong-Mien, Tibeto-Burman and Mon-Khmer family; and comprising 50 ethnic groups. Of the 50 ethnic groups, eight belong to Tai-Kadai, two in Hmong-Mien, seven in Tibeto-Burman and 33 in Mon-Khmer family. Under the ethnic groups, there are no less than 149 linguistic branches that are sometimes called 149 local naming ethnic groups.

In Northern Lao PDR, LNT hosts the highest number of ethnic groups. Through the process of reviewing LNT's Five-Year Socioeconomic Development Plan 2021-2025 and all districts in NTRB, it was apparent that there is discrepancy in the manner of counting the number of ethnic group, i.e., combination of name of ethnic groups and ethnic branch groups or local naming ethnic groups.

The Five-Year Socio-Economic Development Plan 2021-2025 of Luang Namtha Province reported that there are 17 ethnic groups in the province namely, Lao, Tai, Lue, Yuan, Yang, Tai Neua, Khmou, Bit, Lamet, Saam Tao, Hmong, Il-mien, Akha, Phounoi, Lahu, Sida, and Hor, which comprise 2.44 percent Lao, 9.78 percent Tai, 10.93 percent Lue, 2.81 percent Yuan, 0.38 percent Yang, 1.21 percent Tai Neua, 26.50 percent Khmou, 0.42 percent Bit, 2.34 percent Lamet, 0.91 percent Saam Tao, 7.44 percent Hmong, 3.55 percent Il-mien, 23.09 percent Akha, 2.70 percent Phounoi, 3.88 percent Lahu, 0.39 percent Sida, and 1.24 percent Hor ethnic group. Within the 11 districts that are within and partially located in the basin also consisted 17 ethnic groups similar to those of LNT but there with different proportion.

The following is the list of ethnic groups and local naming ethnic groups in the three provinces in NTRB or within NTRB, including their ethnic branch groups or local naming ethnic groups in brackets:

- Lao (Phouan, Kaloeng, Bo, Yoi);
- Tai (Tai Dam, Tai Daeng, Tai Khao, Tai Moey, Tai Mene, Tai Thaeng, Tai Et);
- Lue (Kheun, Tai Lue, Tai Kadai);
- Yuan (Nyouan, Klom, Mgeaw);
- Yang (Yeuang);
- Tai Neua (Tai Neua);
- Khmou (Khmer);
- Bit (Bit);
- Lamet (Lamet);
- Saam Tao (Saam Tao, Doi);
- Hmong (Hmong Khao, Hmong Laay, Hmong Dam);
- Il-mien (Laen Taen, Yao Phom May, Yao Daeng, Yao Khao);
- Akha (Omaa, Khoe, Mutoen, Cicaw, Pulii, Pana, Free, Nu Kui, Luuma, Oepaa, Cipia, Mucii, Yaa Oe, Kong Saat);

- Singsali (Phunoi, Bisu, Phu Nyot, Tapaat, Ban Tang, Caho, Lao Seng, Phai (Phongsali), Lao paan, Phong ku, Phong Set);
- Lahu (Lahu Dam, Lahu Khaaw, Kui (Kui Suung, Kui Luang), Musoe);
- Sila (Sida);
- Ho or Hor or Haw.

Eleven (11) districts in NTRB and LNT Province are home to 17 ethnic groups. In the NTRB, there are 16 ethnic groups in NTRB that are scattered in the basin. A total of 13 ethnic groups are in Luang Namtha District although it was reported that there are 16 ethnic groups due to the way of naming the ethnic groups. There are three ethnic groups in Nale District; eight ethnic groups in Viengphoukha District; five ethnic groups in Paktha District; 11 ethnic groups in PhaOudom District,; ten ethnic groups in Houay Say District; 11 ethnic groups in Na-Mor District; six ethnic groups in Houn District, and 4 ethnic groups in Pak Beng District. Data is unclear for the Districts of Xai and Beng (**Table A2-1**).

Table A2-1: Ethnic groups in each district in NTRB in 2024.

Mon-Khmer Ethno-Linguistic Family																					
No.	Province	District	Tai-Kadai Ethno-linguistic Family						Mon-Khmer Ethno-linguistic Family				Hmong-Mien		Sino-Tobetan Ethno-linguistic Family					Total Ethnic Groups	Level of Classification
			Lao	Tai (Tai Dam, Tai Daeng)	Leu (Tai Leu, Tai Kadai)	Nyouan	Thai Neua	Yang (Nhang or Yeuang)	Khmou	Lamet	Saam Tao	Bit	Hmong	Iu-Mien (Laen Taen)	Akha (Kui, Pana, Kor)	Phounoi (Singsali)	Lahu (Kui, Musoe)	Sida (Sila)	Ho (Haw)		
1	Oudomxay	Xai	29.0						48.0				16.0		7.0					9	District
2		Na-mor	Y	Y	Y	-	-	Y	Y	-	-	Y	Y	Y	Y	Y		-	Y	11	District
3		Beng	29.27						54.33				14.5		-	-		-	-	n.a.	District
4		Houn	Y	Y	Y	-	-	-	Y	-	-	-	Y	-	-	Y		-	-	6	District
5		Pakbeng	Y	-	Y	-	-	-	Y	-	-	-	Y	-	-	-		-	-	4	District
6	Louang Namtha	Luangnamtha	5.3	25.6	5.3	5.3	-	-	21.7	-	0.4	1.6	9.4	8.5	8.9	4.8		1.3	1.0	16	District
7		Nale	18.0	-	-	-	-	-	72.0	10.0	-	-	-	-	-	-		-	-	3	District
8		Viengphoukha	12.1	-	4.26	-	-	2.8	51.0	6.2	0.9	-	3.7	-	19.1	-		-	-	8	District
9	Bokeo	Paktha	18.8	-	9.90	-	-	-	30.9	-	-	-	28.4	1.20	-	-		-	-	5	District
10		PakOudom	10.3	2.1	5.9	0.03	0.02	-	43.6	27.5	0.02	-	10.5	-	0.01	0.01		-	-	11	District
11		HouayXay	26.2	1.7	12.7	4.9	-	-	24.2	3.2	6.0	-	18.3	0.94	-	-	1.9	-	-	10	District

In term of the integrated management of NTRB through the IRBM approach, the characteristics of the diversified ethnic communities in the basins are crucial information. The settlements, way of life or livelihood strategy of ethnic communities in NTRB presented in this section are based from information available from the Department of Ethnicity, Lao Front for National Development, Lao PDR (2015).

Lao Ethnic Group





Settlements on plainland.

Main livelihood includes cultivation of rice in lowland areas and other plant crops and vegetables; animal raising, trading and/or mercantile.

Tai (Tai Dam) Ethnic Group





Settlements on plainland.

Main livelihood includes cultivation of rice in upland and lowland areas and other crops and vegetables; gardening on river banks for sweet potatoes, beans, cabbage, onions, chilies, etc; raising large and small animals; special handicraft making and planting mulberry for silk weaving.

Lue Ethnic Group





Settlements on plainland.

Main livelihood focuses on agriculture, including cultivation of rice in upland and lowland areas and other plant crops and vegetables; animal raising; specialized in handicraft weaving, and planting mulberry for silk weaving.

Yuan (or Nyuan) Ethnic Group





Settlements on plainland along the river bank especially in suitable lowland paddy areas.

Main livelihood includes cultivation of rice in lowland areas and other plant crops and vegetables and raising large and small animals. Yuan women are specialized in planting mulberry for silk weaving.

Yang Ethnic Group





Settlements on plainland and in valleys.

Main livelihood includes rice cultivation and other plant crops and vegetables; rice farming in terraces and orchards; animal raising; handicraft making, weaving and blacksmithing

Tai Neua Ethnic Group





Settlements near river banks with continuous water flow for irrigation.

Main livelihood includes cultivation of rice, other plant crops and vegetables and animal raising. They specialize in producing soy sauce, rice noodles and Luang Namtha's fermented beans.

Khmou Ethnic Group





Settlements on mountainside or mountain saddle areas.

Main livelihood includes shifting rice cultivation in combination with other plant crops and vegetables and animal raising. They specialize in hunting and NTFPs harvesting.

Bit Ethnic Group





Settlements in valleys.

Main livelihood includes shifting rice cultivation in upland areas in combination with lowland rice farming and plant crops and vegetables and animal raising. They specialize in handicraft making, fishing, hunting and NTFPs harvesting.

Lamet Ethnic Group





Settlements on foothills in valleys.

Main livelihood includes shifting rice cultivation in combination with starchy and herbal (non-permanent) crops, raising animals, handicraft making and blacksmithing. They specialize in hunting.

Saam Tao Ethnic Group





Settlements in valleys and on mountainsides near river banks.

Main livelihood includes shifting rice cultivation in lowland areas, raising animals, handicraft making, weaving and blacksmithing.

Hmong Ethnic Group





Settlements on highlands near river banks.

Main livelihood includes shifting rice cultivation in combination with corn and vegetables, animal raising, handicraft making, weaving and blacksmithing.

Il-Mien Ethnic Group





Settlements on highlands and steep slopes with stream.

Main livelihood includes shifting rice cultivation in combination with other crops, such as corn, yam, sweet potatoes, beans, vegetables and orchards; animal husbandry and weaving and trading.

Akha Ethnic Group





Settlements on highlands especially on mountain ridges with stream.

Main ivelihood includes shifting rice cultivation in combination with other crops such as corn, yam, peanuts, beans and other vegetables; trading, and weaving. They also raise animals for traditional ceremonies.

Phounoi Ethnic Group





Settlements on mountain slopes and foothills with nearby stream.

Main livelihood includes shifting rice cultivation in combination with other crops such as corn, yams, peanuts, beans and other vegetables; trading and weaving. They also raise animals for traditional ceremonies.

Sida (Sila) Ethnic Group





Settlements on remote highlands or mountain slopes with nearby stream.

Main livelihood includes upland rice cultivation especially in terraced rice field and raising animals. They specialize in handicraft making, blacksmithing and carpentry.

Hor Ethnic Group





Settlements on highlands at elevation 1000-1500 masl.

Main livelihood includes rice shifting cultivation, integrated upland crops cultivation, and raising animals. They specialize in handicraft making and weaving.

Lahu Ethnic Group





Settlements on mountain ridges or slopes at 1000 masl elevation or higher.

Main livelihood includes rice shifting cultivation and NTFP harvesting. They specialize in handicraft making and weaving.

About the Integrated River Basin Management (IRBM) Project

Supported by the Global Environment Facility, the Integrated River Basin Management (IRBM) Project is working to set-up functional management mechanisms in priority river basins of six ASEAN countries to reduce pollution and sustain freshwater environmental flows as well as adapt to climate change vulnerabilities. The regional Project is being implemented by the United Nations Development Programme Bangkok Regional Hub, and executed by Partnerships in Environmental Management for the Seas of East Asia, in collaboration with ASEAN.