COMPONENT 1

POLICIES AND MARKET INCENTIVES IN SUPPORT OF NATURAL CAPITAL

THE INTEGRATION OF NATURAL CAPITAL ACCOUNTING IN PUBLIC AND PRIVATE SECTOR POLICY AND DECISION-MAKING FOR SUSTAINABLE LANDSCAPES

NATURAL CAPITAL

Funded by

gef UN environment programme

Executing Agencies

TDRI THAILAND DEVELOPMENT RESEARCH INSTITUTE

COMPONENT 1

POLICIES AND MARKET INCENTIVES IN SUPPORT OF NATURAL CAPITAL

OUTPUT 1.2.9

UPDATE THE WATER RESOURCES AND TOURISM-RELATED POLICIES, PLANS AND REGULATIONS TO IMPROVE THE CONSERVATION AND SUSTAINABLE USE OF NATURAL CAPITAL

Author

Adis Israngkura, Thailand Development Research Institute (TDRI)

Prinyarat Leangcharoen, Thailand Development Research Institute (TDRI)

Ramida Hansaward, Thailand Development Research Institute (TDRI)

THE INTEGRATION OF NATURAL CAPITAL ACCOUNTING IN PUBLIC AND PRIVATE SECTOR POLICY AND DECISION-MAKING FOR SUSTAINABLE LANDSCAPES

NATURAL CAPITAL

Funded by gef UN environment programme

Executing Agencies TDRI THAILAND DEVELOPMENT RESEARCH INSTITUTE

Acknowledgment

This output involves a comprehensive review of plans, policies, and strategies related to the tourism and water resource sectors. The review encompasses both national-level and Krabi provincial-level plans and strategies, aiming to identify key management issues as well as the specific tools utilized for tourism and water resource management in Krabi Province.

We would like to express our gratitude to the Office of the National Water Resources (ONWR), the Krabi Provincial Office, and the Krabi Provincial Office of Natural Resources and Environmental Policy and Planning for their invaluable support in providing plans, policies, strategies, and constructive feedback that greatly contributed to this data analysis.

Executive Summary

Urbanization and the growth of the tourism industry in Krabi Province have led to increased resource consumption and subsequent environmental impacts. Water resources constitute one of the critical environmental issues affected by tourism, which can be categorized into two main aspects:

1) Wastewater Issues: The majority of wastewater generated from tourism activities is not adequately treated prior to being discharged into natural water bodies and the sea. Currently, only a fraction of this wastewater enters the existing centralized wastewater treatment systems operated by local authorities, which are insufficient to accommodate the total volume of wastewater generated in the area.

2) Water Scarcity Issues: Over the past decade, Krabi Province has continuously faced water shortages during the dry season (February to April). This severity intensifies during years of high climate volatility, particularly affecting small-scale water sources in key tourist areas such as Ko Lanta and Ao Luek districts. This scarcity directly clashes with the high water demand during the peak tourism season.

This report is prepared to study the management measures and mechanisms regarding tourism and water resources in Krabi Province by reviewing the linkages between national and provincial-level plans, policies, and strategies. The 20-Year Krabi Provincial Development Goals (2023-2042/B.E. 2566-2585) and the Krabi Provincial Development Plan (2023-2027/B.E. 2566-2570) are firmly aligned with Thailand's three-tier planning hierarchy and connected to the Sustainable Development Goals (SDGs). These frameworks emphasize eco-friendly growth ("Krabi Goes Green") alongside upgrading creative tourism to meet international standards. Furthermore, they drive the Krabi Smart City prototype project, utilizing digital technologies to enhance safety, environmental management, and the overall quality of life.

In addition, digital technology plays a vital role in managing the carrying capacity of tourist destinations to maintain an equilibrium between the economic and environmental dimensions of the area. This is particularly crucial in major attractions such as Maya Bay, Pileh Lagoon, and the Ko Lanta archipelago. Implementation includes the use of an electronic ticketing (E-Ticket) reservation system to limit the number of tourists and vessels to alleviate congestion, as well as clearly demarcating zones for marine tourism activities to prevent potential ecological damage.

Regarding water resources, Krabi Province employs a highly integrated water management approach. This includes formulating a comprehensive water management plan that combines the expansion of water storage infrastructure, the restoration of upstream forests, and the management of water demands such as through water conservation campaigns and water reuse initiatives. It also involves planning the construction of additional centralized wastewater treatment systems to comprehensively accommodate effluent volumes, coupled with the continuous monitoring and inspection of wastewater quality from commercial establishments, particularly those related to the tourism sector.

Based on the context, to enhance the efficiency of the current measures and mechanisms for tourism and water resource management in Krabi Province, the research team has formulated policy recommendations categorized into the following areas:

1. Innovation and Technology Application: The application of digital technologies should be promoted for data collection and analysis to accurately and appropriately plan for Krabi's tourism management. This initiative will elevate Krabi Province into a high-quality and sustainable tourism destination (Smart & Sustainable City of Tourism).

2. Education and Resource Management: Research studies aimed at determining the tourism carrying capacity across terrestrial, marine, and coastal areas should be heavily supported. This requires establishing clear and evaluable indicators—such as water quality and coral reef status—to serve as benchmarks for environmental stewardship.

3. Wastewater Infrastructure Development: The establishment of centralized wastewater treatment facilities in densely active island and coastal areas should be accelerated. Special emphasis should be placed on the wastewater management project in Ko Lanta District and the wastewater management project in Ko Si Boya Sub-district. These should focus on adopting decentralized systems to prevent adverse impacts on the local ecosystems and community economies.

4. Wastewater Surveillance: Continuous education and the monitoring of wastewater quality discharged by business operators should be implemented in primary areas, such as Ao Nang and Phi Phi Island. This must be coupled with the utilization of incentive measures, such as awarding certification emblems to establishments that meet standardized criteria, offering fee reductions, or providing low-interest subsidies for the installation of wastewater treatment systems.

Contents

Tables

Page

Update the water resources and tourism-related policies, plans and regulations

This section of the study focuses on reviewing plans, policies, and strategies related to the tourism and water resources sectors. The objective is to improve relevant policies, plans, and governance within both sectors, thereby promoting and incentivizing the sustainable management of natural capital. The review encompasses both the national level and the provincial level of Krabi, along with recommendations for improving tourism and water resource plans, policies, and strategies, detailed as follows:

1. National-Level Plans, Policies, and Strategies Related to the Tourism and Water Resources Sectors

National plans, policies, and strategies concerning the tourism and water resources sectors are categorized into three levels. Level 1 consists of the 20-Year National Strategy (2018 - 2037). Level 2 comprises the Master Plans under the National Strategy and the 13th National Economic and Social Development Plan. Level 3 includes the 3rd National Tourism Development Plan, the Thai Tourism Service Development Plan, the 20-Year Water Resources Management Master Plan, and the National Climate Change Adaptation Plan for the tourism and water resource management sectors. These plans collectively aim towards environmentally friendly growth and sustainable management (Table 1).

Table 1 Interlinkages between Tourism and Water Resource Management and the Three Levels of National Plans

Plan Level	Tourism	Water Resources Management
Level 1	**20-Year National Strategy (2018 - 2037)** Competitiveness Enhancement Eco-Friendly Growth for Quality of Life	**20-Year National Strategy (2018 - 2037)** National Security Competitiveness Enhancement Eco-Friendly Growth for Quality of Life
Level 2	**Master Plans under the National Strategy** • Sustainable Tourism **The 13th National Economic and Social Development Plan** Quality and Sustainable Tourism	**Master Plans under the National Strategy** Total Water Resources Management System **The 13th National Economic and Social Development Plan** Conservation and Restoration of Natural Resources and Ecosystems to Prevent and Mitigate Impacts from Natural Disasters and Climate Change
Level 3	**The 3rd National Tourism Development Plan (2023-2027)**	**The 20-Year Water Resources Management Master Plan (2018 – 2037)** • This plan serves as the development framework for resolving the country's water resource issues over a

Plan Level	Tourism	Water Resources Management
	The development framework for the country's tourism sector consists of 4 main goals: 1) Resilience & Re-balancing Tourism, 2) Connectivity, 3) Entrusted Experience, and 4) Sustainable Development. The development approach is driven by 4 strategies: Strategy 1: Resilient Tourism Strategy 2: Quality Tourism Strategy 3: Tourism Experience, which focuses on high-value tourism development, quality and standardized transportation systems, as well as a diverse range of tourist destinations and tourism formats. Strategy 4: Sustainable Tourism, which aims to develop tourist destinations and tourism communities by considering visitor carrying capacity, managing tourist numbers, and mitigating potential impacts arising from tourism activities. **The Thai Tourism Service Development Plan (2023 - 2027)** The objective is to develop the tourism service industry to achieve high quality, and to strengthen the readiness of tourism entrepreneurs and communities to develop products and services that meet certified quality standards. It comprises 4 strategies as follows: • Strategy 1: Innovative & Smart Tourism, to transform Thai tourism products and services into high-value offerings. • Strategy 2: Global Standardization, to enhance competitive advantages. • Strategy 3: Human Resource Development and Upskilling/Reskilling in the Tourism Service Sector, for the continuous development of tourism services. Strategy 4: Tourism Networking, to collaboratively support and promote the development of the entire tourism service ecosystem. **National Climate Change Adaptation Plan (NAP) – Tourism Sector** The objective is to enhance the capacity of the tourism sector to achieve sustainable growth and to build resilience against risks associated with climate change.	20-year period, covering droughts, floods, and water quality. "Thailand achieves sustainable water resources management through the participation of all sectors under balanced and dynamic development, ensuring water security across all dimensions." The plan outlines 5 dimensions of water resources management: • Dimension 1: Management of Domestic and Drinking Water Supply, ensuring adequate quantity and standard quality. • Dimension 2: Water Security for the Production Sector • Dimension 3: Flood and Inundation Management • Dimension 4: Conservation and Restoration of Water Resource Ecosystems Dimension 5: Management and Governance, by updating and reviewing water resource regulations and bylaws, promoting organizational capacity and participation, and developing management tools. **National Climate Change Adaptation Plan (NAP) - Water Resources Management Sector** This plan provides a framework for climate change adaptation in water resources management, utilizing watershed management principles to guide the formulation of consistent and appropriate area-based measures. The goal is to build immunity, reduce risks, and enhance adaptive capacity in alignment with sustainable development. The management approaches are categorized as follows: • (1) Upstream Area Management: Focuses on the conservation and preservation of ecological abundance to maintain vital headwater sources. • (2) Midstream Area Management: Addresses areas with diverse multi-sectoral water utilization activities, as well as flood and drought management that impacts all relevant sectors. • (3) Downstream Area Management: Focuses on water quality management, water source restoration, and ecological preservation. (4) Supporting Mechanisms for Water Resources Management

Source: The research team

National plans, policies, and strategies related to the tourism and water resources management sectors encompass a diverse range of development approaches, detailed as follows:

1.1 Plans, Policies, and Strategies Related to the Tourism Sector

The tourism industry in Thailand still faces significant challenges. These include the high vulnerability of the tourism sector to external factors, such as global economic volatility, climate change, and pandemic crises. Another major challenge is the degradation of tourism resource bases, where both natural and historical-cultural destinations have begun to deteriorate due to a past emphasis on tourism volume over quality. Furthermore, the Thai tourism service sector has not yet fully integrated technology and innovation to maximize efficiency. There are also disparities in service quality standards across different areas, alongside an increasing global emphasis on sustainable tourism standards, and ongoing concerns regarding the safety of tourists' lives and property.

The core essence of national plans, policies, and strategies related to the tourism sector is to drive tourism development toward "High-Value Tourism" that is both balanced and sustainable. The key guidelines for tourism development and promotion are as follows:

1. Implementation of the BCG Economy Model: Applying the concepts of Bio-Circular-Green (BCG) Economy to develop and transform the tourism sector.
2. Focus on Quality Tourists: Shifting the paradigm toward becoming a "Global Destination" by prioritizing high-spending and long-stay tourist segments rather than relying solely on the sheer volume of arrivals.
3. Value Creation for Tourism Products and Services through Thai Identity: Promoting ecotourism, agritourism, and community-based tourism. This involves utilizing cultural capital, local wisdom, creativity, and innovation to add value while preserving authentic Thai identity and culture to attract high-quality tourists.
4. Income Distribution to Communities and Secondary Cities: Utilizing tourism as a strategic tool to generate economic opportunities for local populations. This is achieved by developing infrastructure and building an ecosystem that facilitates the sustainable distribution of opportunities to grassroots communities.
5. The promotion of tourism based on the country's potential is categorized into 6 formats, as follows: **Creative and Cultural Tourism:** Promoting community-based, agricultural, eco-tourism, and Buddhist way-of-life tourism by utilizing creativity and technology to manage historical landmarks. **Business Tourism (MICE):** Driving Thailand to become a global hub for international meetings, incentives, conventions, and exhibitions (MICE) by developing public utilities and digital systems to facilitate business travelers. **Health, Wellness, and Thai Traditional Medicine Tourism:** Elevating service standards by blending traditional Thai wisdom with modern medical science, and developing a workforce with strong language skills and professional standards. **Maritime and Waterway Cruise Tourism:** Developing ports and marinas to meet international standards, and promoting Thailand as a hub for both cruise line and riverine tourism. **Regional Connectivity Tourism:** Leveraging Thailand’s

strategic geographical location to connect tourism routes with neighboring countries in ASEAN and the Mekong Subregion via land, water, and air, and the last one is **Development of the Tourism Ecosystem.**

Under the goal of fostering "Eco-Friendly Growth for Quality of Life," key guidelines, measures, and instruments have been established to drive Thailand toward sustainable tourism, low-carbon tourism, and disaster management in high-risk tourist destinations. These include: **Development of Tourist Destinations and the Tourism Ecosystem:** Focusing on the preservation of existing destinations and the creation of unique new attractions based on area potential, while distributing income to secondary cities and local communities. Development strategies are tailored to the specific potential of each area and season. Adherence to Ecological Carrying Capacity: Promoting tourism activities in strict alignment with the carrying capacity of local ecosystems to prevent environmental degradation. The primary focus is on **balancing economic growth, natural resource conservation, and equitable income distribution. Water and Coastal Resource Management:** Developing maritime and waterway cruise tourism in tandem with natural resource and environmental conservation, placing the ultimate priority on the long-term sustainability of tourist areas. **Building a Green Economy:** Driving environmentally friendly consumption and production patterns, reducing environmental risks and impacts, and enhancing the value of the bio-based economy.

Guidelines for transitioning **toward a low-carbon society** emphasize developing management models for tourist destinations and cities to become "Low-Carbon Cities." This involves expanding all forms of green spaces to serve as greenhouse gas sinks, supporting investments in infrastructure and services that reduce greenhouse gas emissions, and managing waste and pollution. The latter is achieved by promoting the "Zero Waste" concept within production and service sectors and managing pollution at its source to meet international standards—particularly in major tourist destinations. For natural disaster response and adaptation, the focus is placed on the following initiatives: Risk Mapping: Developing area-specific risk and impact data to assess the vulnerability of tourist destinations. Early Warning Systems: Developing integrated and interconnected disaster warning systems to ensure the safety of tourists. Tourism Calendar Adjustment: Updating tourism plans to align with shifting seasonal patterns. Business Continuity Plans (BCP): Encouraging entrepreneurs to adopt BCPs to handle climate crises. Adaptive Design for Buildings and Infrastructure: Developing structures that withstand weather volatility, such as flood protection systems or heat shelters. Climate Insurance: Developing climate-related insurance businesses. Instruments and mechanisms for tourism management include:

1. **Economic Measures and Incentives:** Applying the "Beneficiaries Pay Principle (BPP)" through the collection of Ecosystem Service Fees to reinvest revenues into the management of tourist destinations and natural resources. Implementing Green Procurement to stimulate tourism entrepreneurs to transition toward eco-friendly growth. This also includes utilizing tax measures, various privileges, and carbon credit mechanisms to incentivize the private sector and the public to collaboratively conserve and sustainably utilize natural resources and biodiversity.

2. **Technological and Data Instruments:** Utilizing Big Data and standardized centralized database systems to monitor the status of natural resources, plan tourism activities, and oversee tourism impacts and safety. Implementing electronic ticketing (E-ticket) systems and GPS tracking to regulate tourist numbers in real time.
3. **Participatory Mechanisms:** Promoting the "Pracharath" (Public-Private-People Partnership) model to foster collaboration among the government, private sector, and local communities in managing protected areas and marine resources through various awareness-raising activities. This involves enhancing the role of communities in local resource management decision-making, developing community enterprises to serve as primary mechanisms for developing tourism products and services according to international standards, and cultivating awareness among locals and tourists regarding ecosystem vulnerability and adaptation options.
4. **Administrative and Legal Instruments:** Implementing Strategic Environmental Assessment (SEA) as a vital tool to prevent environmental, economic, and social impacts in major tourist destinations before development projects commence. Promoting and expanding the role of the public and local communities in decision-making and accessing resource management data within their own tourist areas. This also includes establishing traceability for the origins of raw materials and products within the tourism supply chain to mitigate deforestation and environmental destruction.

1.2 Plans, Policies, and Strategies Related to Water Resources

Thailand possesses a total surface water volume of approximately 285,221 million cubic meters across the country. When compared to the average water demand (2015 - 2020), the surface water volume remains sufficient to meet overall demand. The agricultural sector exhibits the highest water demand, accounting for 83% of total water consumption. Significant challenges include rainfall variability, which leads to flash flood risks in certain areas. Concurrently, the number of rainy days may decrease, resulting in more severe droughts. Additional challenges encompass wastewater issues in community areas and major tourist destinations. The core essence of national plans, policies, and strategies related to water resources includes:

Water Resources Management and Water Source Procurement

Water Resources Management Approaches: The water management guidelines focus on watershed-based management, dividing operations into three main components: upstream area management (forest conservation and restoration), midstream and downstream area management (flood and drought management for economic activities), and water quality management (wastewater treatment and coastal ecosystem preservation). These components aim to balance water demand with the available raw water supply in each basin. This is achieved by implementing Integrated Water Resources Management (IWRM) principles to harmonize demand and supply across individual watersheds. Additionally, it includes developing water diversion and inter-basin connection systems to distribute water to scarcity-prone areas.

Water Source Procurement: Procurement strategies focus on developing raw water sources by upgrading and enhancing the efficiency of existing reservoirs alongside sediment management. This also includes exploring new

surface and groundwater sources to address water scarcity. The plan aims to ensure an adequate water supply to meet consumption demands and support economic growth in special economic zones, major tourist destinations, and smart farming areas. To facilitate this growth, infrastructure for rainwater harvesting and inter-basin water diversion systems will be developed to distribute water to chronically drought-prone areas. For areas outside irrigation zones, the focus is on developing small-scale water sources in chronically drought-prone and non-irrigated agricultural sectors, with a target of establishing community water management systems in no less than 4,000 sub-districts (Tambons). Furthermore, the integration of surface and groundwater will be pursued to maximize joint management efficiency, alongside promoting artificial recharge in high-potential areas to store water for the dry season.

Climate Change Adaptation Approaches in Water Management: Adaptation strategies involve developing climate-resilient infrastructure and promoting Climate-Smart Agriculture to minimize losses. This encompasses applying digital technology and innovation for water situation forecasting and disaster warnings to mitigate losses driven by climate variability. Additionally, it involves adjusting crop calendars and promoting drought-tolerant or flood-resistant crop varieties to reduce climate risks, alongside establishing local surveillance networks and community-level early warning systems.

Water Management Tailored to Tourism: The guidelines emphasize developing and securing additional backup water sources in natural tourist destinations vulnerable to drought. Key measures include updating tourism calendars to realign with changing seasonal patterns, establishing carrying capacity limits to prevent ecological degradation, and closely monitoring sea-level rise and beach erosion at critical coastal tourist destinations.

Water Supply Services

The primary goal of **domestic and drinking water** management is to ensure that rural households have access to clean water in appropriate quantities and standards. It also aims to enhance water security in urban areas by utilizing modern technologies in water system design to improve efficiency and developing database systems for planning and policy formulation.

Key actions include developing water mapping and water supply distribution systems, as well as promoting water conservation and efficient water usage. The objective is to increase overall water productivity to meet international standards, using the domestic and drinking water security index as a key performance indicator. The ultimate focus is to continuously increase the proportion of households with access to standardized water supply systems.

Conservation and Restoration of Water Resource Ecosystems

This involves **conserving and restoring headwater forests, wetlands, and natural water sources** to maintain the balance of natural aquatic ecosystems. Significant emphasis is placed on Ecosystem-based Adaptation (EbA) and Nature-based Solutions (NbS) to preserve ecological balance. Examples include restoring upstream forests to optimize water retention balance, rehabilitating wetlands to serve as natural water retention areas, and restoring coastal ecosystems to act as natural barriers against erosion.

Furthermore, operational guidelines prioritize improving water quality in surface and groundwater sources to prevent and mitigate pollution directly at its origin or source. Urgent actions are required to demarcate boundaries and officially register rivers and canals, alongside strictly addressing waterfront encroachment issues. The plan also mandates monitoring watershed integrity using the River Health Index and biological indicators across vulnerable areas nationwide. This is coupled with promoting the participation of the public and local communities in defining measures to restore and safeguard local water resources.

Wastewater Management

Wastewater Management focuses on enhancing treatment processes and regulating wastewater discharges into the environment to meet international standards. This is driven by managing pollution directly at its source and considering the pollution carrying capacity of water bodies. Key initiatives include developing urban wastewater collection and management systems by supporting adequate and standardized water mapping and wastewater collection networks in urban areas, alongside installing high-efficiency wastewater treatment systems in industrial zones.

Furthermore, **Water Reuse** is prioritized by promoting the development and deployment of wastewater treatment technologies to recycle water in household and industrial sectors. This is particularly targeted at critical or drought-prone areas to reduce demand on natural water resources, which also includes promoting water reuse in non-irrigated agricultural zones.

Instruments and Mechanisms for Sustainable Water Management include:

1. Economic Measures and Incentives: Applying the "Polluter Pays Principle (PPP)" to collect wastewater treatment fees as a tool for water quality control, and the Payment for Ecosystem Services (PES) principle to incentivize reforestation and forest conservation—particularly in headwater forests, wetlands, or natural water sources. This also encompasses developing climate insurance systems, establishing disaster funds, and creating incentives for the private sector and local communities to invest in water recycling systems.
2. Database Systems and Technology: Integrating digital technologies and innovations, such as the Internet of Things (IoT) and smart systems, to maximize water management and distribution efficiency. Key systems include:
    - Thai Water Plan (TWP): A project management and database system implemented to integrate national water plans and budget allocations. This works alongside the Thai Water Assessment (TWA) system to monitor and evaluate water security achievements.
    - Water Security Index: A strategic decision-making tool used to assess national water security across multiple dimensions. The target is to maintain the water quality of surface water, groundwater, and marine water at levels suitable for utilization in no less than 90% of monitored sites. This utilizes instruments like the River Health Index to track watershed ecosystem integrity, alongside biological indicators to monitor ecosystem health in vulnerable areas.

- One Map: A unified mapping system developed to integrate risk maps and climate change impact forecasts in collaboration with relevant agencies.

3. Participatory Mechanisms: Promoting Community-Based Flood Management (CBFM) to strengthen management capacities at the local level. This involves encouraging communities and Local Administrative Organizations (LAOs) to participate in land-use planning and empowering them to manage initial risks independently.
4. Administrative and Legal Instruments: Implementing water usage permit systems categorized by priority levels, and applying pollution discharge permit systems to control waste releases into water bodies in compliance with standard values. This is coupled with encouraging private sector co-investment in waste and wastewater management, establishing provincial/city-level water and drainage charts, utilizing the Building Control Act to enforce climate-resilient construction standards, and enacting fair water allocation laws. Furthermore, conducting Water Footprint assessments provides critical data to plan a balanced water allocation strategy for all sectors.

In addition, the National Economic and Social Development Plan supports the study and development of the System of Environmental-Economic Accounting (SEEA). This system links economic dimensions with environmental data, ultimately leading to the calculation of Green GDP—a key index reflecting economic growth that truly accounts for the sustainability of the country's resource base.

2. Plans, Policies, and Strategies Related to the Tourism and Water Resources Sectors of Krabi Province

The review of plans, policies, and strategies concerning tourism and water resources in Krabi Province encompasses the 20-Year Krabi Provincial Development Plan (2023 - 2042), the Krabi Provincial Development Plan (2023 - 2027), the Local Development Plan of the Provincial Administrative Organization (2023 - 2027), and the Local Development Plan (2023 - 2027) of the Ao Nang Subdistrict Administrative Organization (SAO), with details as follows:

2.1 Plans, Policies, and Strategies Related to the Tourism Sector

The core tourism management approaches under the Krabi Provincial Development Plan focus on rehabilitating the tourism business sector, which experienced a decline following the COVID-19 pandemic. This rehabilitation continues to align with the province's strategic positioning as an eco-tourism and environmentally friendly green tourism destination under the "Krabi Go Green" initiative. High priority is placed on environmental preservation, such as expanding pollution mitigation at tourist destinations and promoting green establishments. Other key focuses include ensuring the safety of citizens and tourists, developing international-standard infrastructure, and executing proactive marketing and public relations to attract diverse tourist segments and generate higher tourism revenue.

Developing Tourism into Green Tourism and Enhancing Potential to Meet International Standards

Under this development agenda, Krabi Province has enhanced its tourist destinations and upgraded facilities to accommodate a growing number of visitors while ensuring safety. Through the fiscal year 2025 (B.E. 2568) budget allocation, road improvements have been implemented in accident-prone risk areas to mitigate the severity of loss to life and property. Furthermore, the province emphasizes local cultural dimensions by providing designated spaces for local artisans, cultural product creators, and folk performing arts groups to showcase, present, and sell their work, thereby generating local employment and income.

Regarding tourist demographics, Chinese tourists remain the largest group, followed by visitors from Malaysia, Russia, Sweden, Singapore, and India. However, the volume of Chinese tourists has decreased compared to 2018 (B.E. 2661) due to the boat capsizing incident in Phuket, highlighting the need to strictly prioritize safety and emergency readiness.

Concurrently, it is essential to maintain tourism quality for Krabi's primary high-quality tourist segment: European travelers. This requires preserving natural resources and the environment to ensure they remain abundant, beautiful, and clean, while minimizing pollution and maintaining the atmosphere of a peaceful holiday destination—factors that European tourists heavily prioritize when deciding to travel to Krabi.

Nevertheless, to significantly boost the province's tourism revenue, Krabi needs to establish new revenue bases by expanding into other tourist markets, including Asia, South America, and the Middle East, with the ASEAN and Middle Eastern markets presenting the highest potential opportunities.

Tourism Development Guidelines

The guidelines for tourism development consist of 6 key approaches:

(1) Developing the province into a high-value, diverse, outstanding, and internationally sustainable tourism city; establishing it as a MICE City hub linked with art, culture, sports, and community ways of life, while maintaining a unique identity and eco-friendliness.

(2) Developing creative and diverse tourism products and services to ensure stable economic expansion, job creation, income generation, and equitable distribution into the local economy.

(3) Enhancing the potential of tourism personnel to deliver international-standard services across diverse tourism pathways, fostering adaptability to withstand all forms of change.

(4) Developing interconnected, safe infrastructure and transportation systems, along with universal design facilities to accommodate all individuals according to international standards and in alignment with the carrying capacity of tourist destinations.

(5) Managing tourism sustainably and in balance with natural resources and the environment, driven by innovation and technology, while connecting provincial tourism to regional and international levels.

(6) Elevating safety standards for life and property, improving public health conditions, and ensuring readiness to prevent and mitigate all forms of risk factors to build confidence and enhance a positive image among tourists.

2.2 Water Resource Policies, Plans, and Strategies

Key water resource management guidelines under the Krabi Provincial Development Plan focus on integrated water management to enhance efficiency. This includes procuring water sources to meet demand, establishing reserves for periods of scarcity, conserving and restoring water bodies, and developing a comprehensive water resource database system. Preparations are underway to draft ready-to-implement plans for submission through the Thai Water Plan system, enabling the allocation of budget for water management and drought mitigation. Furthermore, wastewater management is emphasized to promote environmentally friendly and sustainable development.

Crucial operations planned for the 2025–2026 period (B.E. 2568–2569) include the formulation of the "Comprehensive Water Management Plan (2027–2032)" (B.E. 2570–2575). This plan aims to integrate data and operations across relevant public and private sectors to ensure the sustainability of Krabi's water resources, provide sustainable solutions for droughts and floods, and prepare for the growing water demand from the tourism and agricultural sectors.

In this regard, the Royal Irrigation Department has outlined major water management initiatives divided into three phases:

- **Short-term (2027 / B.E. 2570):** Dredging canals, repairing weirs, and improving drainage efficiency.
- **Medium-term (2028–2029 / B.E. 2571–2572):** Constructing floodgates, upgrading weirs, and conducting continuous dredging.
- **Long-term (2032 / B.E. 2575):** Constructing reservoirs and ensuring comprehensive water security under the 2027–2032 (B.E. 2570–2575) framework to execute canal dredging, weir construction, and enhance water storage capacity for the dry season, while developing water sources based on river basin potential and preventing potential damages.

Concurrently, the Provincial Waterworks Authority (Krabi Branch) has planned water quality control, water reserve systems, and the provision of free water to affected areas during droughts. Their drought response strategies include:

- **Short-term guidelines:** Increasing raw water supply from the Krabi Noi Canal and diversifying production distribution points.
- **Long-term guidelines:** Connecting pipelines and constructing new production stations to supply sufficient consumption of water for tourism and local communities.

Additionally, this encompasses collaborative frameworks with the private sector for waterworks management on Phi Phi Island, demand-side management guidelines through the promotion of water conservation, and measures to address the discharge of untreated wastewater into public water bodies.

For water resource management guidelines under the Krabi Provincial Development Plan, the guidelines are categorized into 4 main pillars, with details as follows:

Management and Procurement of Water Sources

Krabi Province focuses on enhancing water management efficiency both within and outside irrigation zones, encompassing surface water sources (such as medium-sized reservoirs) and groundwater sources to satisfy increasing demands. The province aims to systematically mitigate water-related disasters, including both floods and droughts, while fostering multi-stakeholder participation in integrated water management from upstream to midstream and downstream areas. Key approaches include:

The development of diverse water resource infrastructures, such as developing water sources to expand storage capacity and improve water flow; dredging major canals and reservoirs; developing "Monkey Cheek" (Kaem Ling) areas and retention basins to retard water and store it for the dry season; and developing water regulatory structures to control flow directions and constructing or repairing check dams. Furthermore, water management is aligned with the BCG (Bio-Circular-Green) Economic Model. This includes developing and procuring groundwater sources, particularly in areas facing water scarcity or saltwater intrusion, by utilizing solar-powered groundwater pumping systems to minimize costs and reduce greenhouse gas emissions.

In agricultural sectors, emphasis is placed on improving water system efficiency and promoting water reuse in agricultural zones outside irrigation areas, alongside developing community water management systems to mitigate flood and drought risks at the sub-district (Tambon) level. Additionally, Krabi Province has submitted water resource management efficiency improvement projects to mitigate droughts and dry spells during 2024 and 2025 (B.E. 2567 and 2568). These projects were proposed by water management agencies and local administrative organizations through the Thai Water Plan system via the dry-season operational plan submission channel.

For localized development, the Ao Nang Sub-district Administrative Organization manages water resources and wastewater treatment to support the growth of tourism cities and enhance the population's quality of life. The primary focus is resolving consumption water shortages, particularly during the dry season when water supply is insufficient. This is addressed by expanding networks and dredging canals and drainage channels to enhance drainage efficiency and prevent localized flooding. It also includes upgrading village waterworks systems to ensure comprehensive coverage and acquiring additional water sources by drilling groundwater wells in water-scarce areas.

Nevertheless, groundwater management must strictly account for the issues of illegal groundwater drilling and over-pumping beyond recharge capacities in certain areas, which could disrupt water table equilibrium, leading to saltwater intrusion and contamination of underground aquifers.

Waterworks Services

Development plans focus on expanding the coverage of waterworks services to ensure both residents and tourists have widespread access to clean water. This is achieved through procuring raw water, expanding

waterworks networks to accommodate growth and resolve shortages, and laying pipelines to extend distribution zones. These measures aim to comprehensively increase the raw water supply of the Provincial Waterworks Authority (PWA) across various areas, particularly in major tourist destinations—with the exception of certain localities that must rely on community-based waterworks systems. Additionally, innovation is integrated through the installation of Reverse Osmosis (RO) drinking water production systems in schools and child development centers.

For localized development, the Ao Nang Sub-district Administrative Organization emphasizes expanding the PWA service areas to reach more citizens. It also features development guidelines for seawater desalination to sustainably address water scarcity on Phi Phi Island.

Conservation and Restoration of Water Resource Ecosystems

Efforts focus on conserving and restoring crucial upstream forest areas, particularly the forest terrain around the Phanom Bencha Mountain Range, which is the origin of the Krabi Yai Canal. This involves reforestation and ecosystem management to enhance soil water absorption capability, mitigate the severity of flash floods and mudslides, and preserve natural water sources through local innovations, such as constructing check dams to trap sediment, reduce flash floods, and maintain moisture in upstream areas.

Wastewater Management

The province prioritizes pollution control and continuous water quality monitoring by relevant agencies to maintain its tourism image, covering surface water, seawater, and coastal water quality. Monitoring records from 2023 (B.E. 2566) indicated that the water quality was within the "Good" criteria; however, it is still necessary to monitor the water quality of natural water sources affected by community activities and tourism establishments. This is also vital for maintaining the standards of the green tourism image (Krabi Go Green). Furthermore, guidelines include developing centralized wastewater treatment systems to comprehensively cover urban areas and major tourist zones, such as Krabi Town Municipality, Phi Phi Island, and Ao Nang, to prevent untreated wastewater from flowing into natural water bodies.

Regarding development in the Ao Nang Sub-district Administrative Organization area, which faces challenges from untreated wastewater discharged into the sea and public water bodies, guidelines have been established to develop and construct a centralized wastewater collection and treatment system in the Ao Nang and Khlong Chak areas to resolve wastewater issues comprehensively. Wastewater management on Phi Phi Island includes outsourcing the operation and maintenance of the centralized wastewater treatment system to ensure its continuous and efficient operation. Additionally, the plan promotes the installation of prefabricated septic tanks to reduce pollution from households and commercial establishments of all sizes before discharge into the environment. This is complemented by regular on-site inspections of wastewater treatment systems belonging to tourism-related businesses—such as hotels, resorts, homestays, restaurants, and laundromats—to monitor and inspect wastewater sources, alongside creating a database for continuous situational tracking.

Examples of projects related to water management under Krabi's development guidelines include: projects to improve and develop water sources for consumption and agriculture; reservoir construction projects; water distribution station construction and pipeline expansion projects; projects to upgrade and enhance the efficiency of water distribution pipe networks; and solar-powered groundwater development projects for agricultural purposes.

3. Synthesis and Policy Recommendations for Krabi Province

A review of plans, policies, and strategies related to the tourism sector and water resource management in Krabi Province, synthesizing the linkages between tourism and water resources, alongside project recommendations to be integrated into the provincial development plan, with details as follows:

3.1 Synthesis of Policy Implementation and Plans for Tourism and Water Resources

As a major tourist destination, Krabi Province welcomes a massive influx of visitors annually. This growth has triggered rapid urbanization, population growth, and an influx of migrant labor. The expanding population and workforce directly increase daily water consumption, solid waste generation, and wastewater production. Furthermore, tourist attractions—especially primary destinations experiencing dense visitor volumes—suffer from overloaded capacities, resulting in the degradation of terrestrial, marine, and coastal natural resources. Consequently, investing in utility infrastructure, such as centralized wastewater treatment, high-quality waterworks production, and waste management, constitutes a critical agenda in the Krabi Provincial Development Plan.

According to the provincial development plan, guidelines are in place to drive the "Krabi Smart City" blueprint through a city management platform designed to enhance efficiency in safety, environmental management, emergency assistance, public health, and essential information services, thereby elevating the quality of life for both residents and tourists. This initiative supports integrated cooperation among public, private, and technological sectors to tangibly utilize data and digital technologies for tourism development within the province.

In addition, development guidelines place strong emphasis on managing the carrying capacity of Krabi's tourist destinations. The strategy focuses on regulating tourist numbers to balance with the ecosystem's recovery capacity, particularly in highly popular island areas like Maya Bay and Pileh Lagoon, ensuring the ecosystem has adequate time to regenerate. This also serves to upgrade tourism quality. Examples include studying and establishing the ecological carrying capacity for destinations in the Ko Lanta area, implementing quota systems, and introducing advanced reservations for marine attractions—particularly within the Had Noppharat Thara-Mu Ko Phi Phi National Park. To prevent overcrowding, tourist and boat numbers are restricted through an advanced booking and digital payment platform via the National Park's Electronic Ticket (E-Ticket) system.

Maritime traffic and mooring management are also being organized; this includes banning boat-to-boat passenger transfers in ecologically fragile zones, restricting mooring strictly to designated mooring buoys, and enforcing vessel speed limits to prevent damage to coral reefs. Activity zoning has been established to clearly

demarcate swimming and snorkeling areas to minimize marine environmental impacts, complemented by continuous coral health assessments.

Regarding water resources, Krabi has faced dry-season water shortages over the past decade, typically spanning from February to April, with April marking the peak crisis period in certain years. For instance, during 2015–2016 (B.E. 2558–2559), a severe El Niño phenomenon caused rainfall to drop 20–30% below average, plunging multiple districts into drought as reservoir storage volumes fell significantly below historical averages. In 2020 (B.E. 2563), a consecutive drought extended from late 2019, combined with delayed monsoons, prolonged the critical shortage period until June 2020. More recently, in 2023 and 2024 (B.E. 2566 and 2567), the province experienced flooding during the monsoon season followed by water scarcity early in the year. This reflects an intensifying trend of climate volatility, characterized by higher fluctuations in annual rainfall, delayed onset of the rainy season—which stretches the duration of water shortages—and a rising frequency of official drought disaster declarations over the past decade. These situations indicate that average raw water supplies may become insufficient during years of extreme climate variability.

Furthermore, data shows that small-scale water sources possess a much higher vulnerability than medium-sized reservoirs, particularly in major tourism areas like Ko Lanta and Ao Luek districts. This vulnerability directly clashes with the peak water demand during the tourism high season. The El Niño and La Niña phenomena heavily dictate Krabi's water situation, with El Niño years significantly exacerbating water crises.

Wastewater management remains a pivotal issue for tourism cities. The provincial development target is to treat wastewater to ensure that water quality in major water bodies and coastal waters ranges from "Good" to "Very Good." Currently, Krabi lacks adequate centralized wastewater treatment systems, and effluent quality issues persist in several areas. Although two centralized wastewater treatment plants are operational—one in Krabi Town Municipality and another on Phi Phi Island—they cannot accommodate the total volume of wastewater generated by rapid urban expansion. Consequently, plans are underway to construct additional centralized wastewater treatment systems. This deficit indicates that the majority of Krabi’s wastewater is currently discharged into natural canals and the sea without proper treatment.

While the law dictates that tourism operators must install standardized wastewater treatment systems prior to discharging water into natural environments, wastewater remains visible in natural canals. Operational guidelines exist to monitor and inspect operators—such as walking inspections to track wastewater discharges—but budget constraints prevent these from being executed continuously. Despite surveillance and quality tracking of surface and coastal waters, certain areas like Ao Nang still experience periods of severe water degradation. In 2025 (B.E. 2568), a study analyzing wastewater quality collected samples across 28 points in the Ao Nang Sub-district—covering Ying Suea Canal, Chak Canal, roadside drainage lines, and coastal discharge points. These areas are dense with tourism activities, including restaurants, hotels, homestays, markets, and laundromats.

The study revealed a clear degradation pattern along the water flow paths: upstream water in natural zones and source areas maintained better quality compared to downstream segments, which accumulated concentrated wastewater from various tourism-related activities. This aligns with reports from the Pollution Control Department stating that both tourist-zone canals exhibited Biochemical Oxygen Demand (BOD) and nutrient levels exceeding standard limits during the high season (Pollution Control Department, 2019 / B.E. 2562). The study concluded that water quality across most observed areas tends to degrade, particularly at multiple points where canals discharge into the sea at Ao Nang, reflecting the receipt of insufficiently treated wastewater. However, the distribution of pollutants indicates that water degradation does not stem from a single source; rather, it is the cumulative result of wastewater from multiple small-scale commercial activities. Areas with a high density of tourism operations consistently exhibited elevated pollution levels. Overall, water quality in the majority of the studied zones was classified as degraded, presenting limitations for environmental utilization and recreational activities unless treated beforehand. This study highlights the immense challenges of wastewater management in rapidly developing coastal tourism areas, where small-scale land-based and marine activities collectively drive overall water quality shifts (Detailed study results are documented in Output 2.3.5, Section 3).

In response to these challenges, Krabi Province has established the 20-Year Krabi Provincial Development Goals (2023–2042 / B.E. 2566–2585) and the Krabi Provincial Development Plan (2023–2027 / B.E. 2566–2570). These plans are fully aligned with Thailand's three-tier planning hierarchy and connect with the Sustainable Development Goals (SDGs), steering toward eco-friendly growth, sustainable management, balanced utilization within the ecosystem's carrying capacity, and climate resilience.

Tourism operational guidelines focus on developing high-quality tourism that meets international standards, anchored on diverse, balanced, and sustainable tourism modalities. Key targets include upgrading capacities to international benchmarks, advancing the green tourism city agenda ("Krabi Goes Green"), fostering value-added creative tourism rooted in local wisdom and culture, and sustainably conserving and restoring natural resources and the environment. This ensures a high-quality, continuous response to the area's primary economic engine while building resilience against climate volatility.

Water management in Krabi Province demands an integrated execution that fuses the expansion of water storage infrastructure, the restoration of upstream ecosystems, and community participation in localized water management, utilizing raw water volume data as a baseline for proactive planning. Crucially, the Krabi Provincial Development Plan prioritizes expanding water storage and distribution capacities to meet escalating demands. This includes formulating the "Comprehensive Water Management Plan (2027–2032 / B.E. 2570–2575)," which emphasizes data and operational integration across relevant public and private sectors to build water sustainability, resolve drought and flood issues permanently, and prepare for the expanding water needs of the tourism and agricultural sectors. It also includes executing projects to improve water resource management efficiency to handle droughts and dry spells.

Furthermore, under Krabi's 20-Year Irrigation Development Plan (2018–2037 / B.E. 2561–2580), there are guidelines to increase irrigated areas across a total of 31 projects. The majority of these focus on medium and small-scale projects, with the primary objective of serving strategies for production-sector water security and flood management. However, beyond expanding storage sources, substantial weight should be given to demand-side water management guidelines. This includes water conservation campaigns, promoting low-water-use crops in agriculture, and fostering water recycling or reuse initiatives.

Lastly, Krabi Province has integrated waste and refuse management plans that aim to upgrade the management of waste and pollution originating from the tourism sector. By encouraging operators and communities to adopt efficient, standardized management systems, the province targets an increased ratio of properly disposed waste relative to total waste generated. This forms a pathway toward Carbon Neutral Tourism, Zero Waste initiatives, and the tangible conservation and restoration of water sources and upstream forests to expand forest cover.

3.2 Policy Recommendations

The research team outlines strategic recommendations to promote and develop the tourism sector and sustainable water management, while advocating for increased budget allocation toward environmental conservation and management in high-economic value zones of Krabi Province, detailed as follows:

1. Promotion and Development of Innovation and Digital Technology in Tourism

This involves introducing digital technology and innovation to drive tourism development in Krabi Province, facilitating the aggregation and multi-dimensional analysis of tourism-related data. This approach will enhance planning, management, and executive decision-making efficiency, while preparing Krabi Province to adapt to changes and capitalize on critical tourism opportunities. Ultimately, this will elevate Krabi's tourism industry toward secure and sustainable growth. Key initiatives include implementing E-Ticket systems and transitioning the province into a "Smart & Sustainable City of Tourism."

2. Promotion and Development of Tourism Carrying Capacity Assessments

This directive aims to establish management standards for local tourist destinations, raising tourism management benchmarks toward sustainability. This aligns with Krabi Province's development goals of becoming a green tourism hub that prioritizes quality tourism and eco-friendly environments. Comprehensive research should be conducted across major terrestrial, marine, and coastal attractions throughout Krabi Province. This requires compiling critical ecological and environmental carrying capacity indicator data, such as water quality, coral reef status, differentiated waste management systems, and diving activity management protocols.

3. Support for Centralized Wastewater Treatment in Crucial Areas

Wastewater management requires continuous support in Krabi's primary areas, especially on islands, coastlines, and tourist destinations with highly dense economic activities and massive influxes of non-registered tourist populations. Because water quality directly influences public health, destination quality, marine ecosystems, and provincial competitiveness, sustained wastewater management projects are vital. These initiatives must

comprehensively cover problem assessments, infrastructure development, environmental surveillance, regulatory enforcement, and multi-stakeholder cooperation involving both communities and business operators. This consists of 2 targeted projects:

1) Wastewater Management Project in Ko Lanta District: As a primary tourism zone in Krabi Province, this area undergoes intensive land and resource utilization for accommodations, restaurants, maritime transportation, and tourist services. The growth of these operations exerts massive pressure on local wastewater treatment and environmental management systems, particularly during the high season when tourist volumes and non-registered populations surge significantly. Consequently, efforts should focus on surveying wastewater sources, evaluating the capacities of existing treatment systems, developing wastewater management approaches tailored to island contexts, and establishing collaborative mechanisms between local administrative organizations, business operators, and communities.

2) Wastewater Management Project in Ko Si Boya Sub-district: This area holds critical ecological and socioeconomic value regarding coastal communities, fishery resources, and community-based and eco-tourism potential. Wastewater management in this locality is essential to prevent adverse impacts on coastal water quality, community livelihoods, and nearshore marine ecosystems, such as seagrass beds. The project focuses on designing solutions suitable for islands and small-scale communities—such as decentralized wastewater treatment systems, managing household and tourism-generated wastewater, enhancing community knowledge and participation, and establishing water quality monitoring systems in critical areas. This will safeguard community economic security, artisanal fisheries, and sustainable tourism development.

4. Sustained Monitoring and Inspection of Wastewater from Tourism-Related Businesses

Continuous surveillance and inspections of effluent discharged by tourism operators must be supported, particularly in the Ao Nang and Phi Phi Island areas. As Krabi's core tourist destinations that generate substantial revenue and shape the province's tourism image, these zones are environmentally vulnerable due to the intensive utilization of land and marine spaces for tourism activities, accommodations, restaurants, vessel operations, and various services. Regular wastewater surveillance and auditing are therefore vital measures to prevent degradation of seawater quality, protect coastal ecosystems, and preserve tourist confidence.

Operational priorities include establishing an inspection system for wastewater sources, conducting walking audits in high-risk zones, gathering water quality data, coordinating with local administrative organizations and regulatory authorities, and developing a database for continuous situational tracking. The data generated through this project can be leveraged to formulate location-specific mitigation measures and inform future investment planning for wastewater treatment infrastructure. Furthermore, support should incorporate incentive structures—such as granting awards and certifications to establishments that meet standardized effluent quality guidelines to be used in tourism marketing, offering wastewater treatment fee reductions for properties utilizing highly efficient systems, and providing low-interest subsidies for investments in small-scale on-site wastewater treatment systems.

Furthermore, development guidelines aimed at upgrading destination quality, enhancing safety and accessibility, promoting ecological learning, and conserving natural resources can effectively distribute income to local communities, generate high-quality tourism activities, and satisfy the diverse preferences of visitors, such as hiking enthusiasts. Consequently, nature trail development projects should be implemented to distribute community income and cultivate high-quality tourism activities, consisting of the following 2 projects:

1) Nature Trail Development Project at the Urban Forest Project, Plant Genetic and Local History Learning Center of Ban Nai Nang: This project aims to establish a learning center for plant genetics, local ecosystems, and the community history of Ban Nai Nang. It connects forest conservation, youth education, and supplementary income generation for the community. Operational activities include upgrading nature trails, installing interpretive signage regarding plant species, ecosystems, and local history, and improving landscapes to appropriately accommodate visitors. These actions will strictly account for ecosystem carrying capacities and the mitigation of impacts on natural resources.

2) Nature Trail Development Project at the Wang Tewada Sacred Water Source, Huai To Waterfall Commemorative Project: This area possesses significant value in terms of water resources, ecosystems, and ecotourism. The project focuses on developing wooden walkways and riverside rest areas, covering a total distance of approximately 70 meters, alongside constructing 2 suspension bridges. These installations will facilitate travel, enhance safety, and enable visitors to access natural attractions appropriately. The development of small-scale infrastructure will harmonize with the surrounding environment, minimize disturbances to natural spaces, and support ecotourism management.

References

Ao Nang Sub-district Administrative Organization. (2024). Action Plan for Fiscal Year 2025. Ao Nang Sub-district Administrative Organization, Mueang District, Krabi Province. Strategy and Planning Section, Office of the Permanent Secretary. (Digital file)

Department of Climate Change and Environment. (2024). Thailand's National Adaptation Plan (NAP). Ministry of Natural Resources and Environment. (Digital file)

Department of Tourism. (2022). Tourism Services Development Plan 2023–2027. Action Plan of the Tourism Services Development Division. February. (Digital file)

Krabi Provincial Administrative Organization. (2025). Annual Action Plan for Fiscal Year 2026, Krabi Provincial Administrative Organization (1st Amendment, 2025). Strategy and Budget Division, Strategy and Planning Section. October. (Digital file)

Krabi Provincial Office. (2022). The 20-Year Krabi Provincial Development Goals (2023–2042).

Krabi Provincial Office. (2024). Annual Official Action Plan of Krabi Province for Fiscal Year 2025. Strategy and Information for Provincial Development Group. (Digital file)

Krabi Provincial Office. (2025). Krabi Provincial Development Plan Fiscal Year 2023–2027 (Revised Edition 2026). Strategy and Information for Provincial Development Group. (Digital file)

Ministry of Tourism and Sports. (2022). The 3rd National Tourism Development Plan (2023–2027): Resilience, Sustainability, Inclusive Growth. (Digital file)

Office of the National Economic and Social Development Council. (2018). The 20-Year National Strategy (2018–2037). (Digital file)

Office of the National Economic and Social Development Council. (2022). The 13th National Economic and Social Development Plan (2023–2027). Office of the Prime Minister. (Digital file)

Office of the National Economic and Social Development Council. (2023). Master Plans under the National Strategy (2023–2037) (Revised Edition). Office of the Prime Minister. (Digital file)

Office of the National Water Resources. (2024). The 20-Year Water Resources Management Master Plan (1st Revision, 2023–2037). August. (Digital file)

Pollution Control Department. (2019). Report on Water Quality Monitoring and Inspection in the Ao Nang Area, Krabi Province. Water Quality Analysis Group, Pollution Control Department. (B.E. 2562)

Royal Irrigation Department. (2018). Master Plan Report on River Basin Development at the Provincial Level: Krabi Province. Project Management Bureau, Royal Irrigation Department. December.

Suchanya Wongrod, et al. (2025). Analysis of wastewater sampling points in Ao Nang Subdistrict, Krabi Province. Environmental Technology Program, School of Environment and Materials, King Mongkut's University of Technology.

THE INTEGRATION OF NATURAL CAPITAL ACCOUNTING IN PUBLIC AND PRIVATE SECTOR POLICY AND DECISION-MAKING FOR SUSTAINABLE LANDSCAPES