



Regional Flyway Initiative · Site Study

January 2026

RFI Priority Site · Boeng Chhmar Ramsar Site

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General Site Information

Country	Cambodia		
RFI Site Name	Boueng Tonle Chhmar	ID013	
City/ Municipality, Province, Region	Peam Bang commune, Stoung district, Kampong Thong Province		
Geographical coordinates	12.83° N, 104.29° E	Area (has)	28,016
Key species	Spot-billed Pelican, Greater Adjutant, Painted Stork, Fishing Cat, and Hairy-nosed Otter		
Key habitats (biomes)	Seasonally flooded grassland, and swamp forest		
Key ecosystem services	Provisioning services (fisheries and various NTFPs), regulating services (flood hazard regulation)		
Key drivers of change	Wastewater pollution, invasive species, siltation		
Conservation status (mark all that applies)	<input checked="" type="checkbox"/>	Protected Area	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	Ramsar Site	<input checked="" type="checkbox"/>
IBA/ KBA name (and number) and other designations	Boeung Chhmar/Moat Khla		
Management Stakeholders	Ministry of Environment, Provincial Department of Environment, Kampong Thom and Siem Reap, Ministry of Agriculture, Forestry and Fisheries, Boeng Tonle Chhmar Committee		
With management plan?	Yes		
Project concept themes	Strengthen fisheries management and alternative livelihoods, site protection		
Length of project	8 years		
Sector/s	Fisheries and aquaculture		
No. of potential beneficiaries	Peam Bang Commune - over 3,000 people in about 700 households		
Indigenous Peoples	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
Anticipated Implementation Risks	Interventions to improve the quality of fish habitat may cause short-term disturbance to wetlands.		
Estimated Project Budget (US\$)	11,600,000		
Potential Source/s of Financing	<input checked="" type="checkbox"/>	Loan (to be identified)	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	Grant (to be identified)	<input checked="" type="checkbox"/>

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Acronyms

ADB	Asian Development Bank
AWC	Asian Waterbird Census
BTC	Boeng Tonle Chhmar
CFi	Community fishery
CPA	Community-protected areas
CSR	Conservation Status Review
DoFWC	Department of Freshwater Wetlands Conservation
DoF	Department of Fisheries
DMC	Developing Member Country
EAAFP	East Asian-Australasian Flyway Partnership
FiA	Fisheries Administration
IBA	Important Bird and Biodiversity Area
IUCN	International Union for the Conservation of Nature
LCG	Local conservation group
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOE	Ministry of Environment
NLC	NatureLife Cambodia
NGO	Non-governmental Organisation
PDoE	Provincial Department of Environment
RFI	Regional Flyway Initiative
TPA	Takeo Provincial Administration
TESSA	Toolkit for Ecosystem Services Assessment
USD	United States Dollars
WCS	Wildlife Conservation Society
WWT	Wetlands and Wildfowl Trust

Executive summary

Cambodia's Tonle Sap Great Lake and its diverse wetland habitats, such as seasonally flooded grasslands and swamp forests, support Southeast Asia's largest congregations of waterbirds, including several large breeding colonies of storks, egrets, cormorants, and pelicans. The very same habitats also host large congregations of migratory waterbirds in the EAAF, including several ducks and shorebird species. Spanning an area of over 28,000 ha, Boeng Tonle Chhmar wetlands is recognised as a Ramsar Site, and one of three core areas in the Tonle Sap Biosphere Reserve, together with Prek Toal and Stoeng Sen. At least three species of waterbirds occur in the site at significant congregations (>1% of EAAF thresholds), notably the Spot-billed Pelican (NT) and the Greater Adjutant (NT), of which the vast majority of the breeding population in Southeast Asia occurs within the Tonle Sap. The largest part of BTC lies in Kampong Thom Province, with a small area of about 5,000 ha in Siem Reap. Peam Bang Commune, which falls entirely within Boeng Tonle Chhmar, contains five small floating villages (Peam Bang, Pov Veuy, Daun Sdeung, Balot, and Pichakrei) with a population of over 3,000 people in about 700 households.

Local communities in and around BTC are almost entirely dependent on small-scale fishing and the processing of fish-based products, such as smoked and dried fish as a major source of livelihood. Not surprisingly, the key ecosystem service identified for BTC is its provisioning services. Nature-based tourism here is limited due to the site's remoteness, unlike other Tonle Sap sites such as Prek Toal, which is near major tourist centres. Major threats to BTC include land encroachment and illegal fishing, and, to some extent, water pollution from household waste. Dry-season fires have degraded parts of BTC, especially cleared areas of formerly swampy forest. Invasive plants such as the water hyacinth affect the site's wetland ecosystem.

To strengthen management and conservation of Boeng Tonle Chhmar, there is a clear need to continue integrating an ecosystem approach to fishery management (EAFM) into current and future interventions. Therefore, there is a need to strengthen management and legal protection of the BTC wetlands through zonation, establish new community protected areas (CPAs), and address dry-season fires and invasive species such as water hyacinth, which is now established across much of Tonle Sap. In addition, interventions proposed under this project aim to improve and scale up the sustainable management of community fisheries in BTC, building upon existing fisheries and conservation projects, while expanding on alternative sources of livelihoods for local people through tourism, fish product processing, and improving market access.

1. Background of the Regional Flyway Initiative

In July 2021, the Asian Development Bank made a commitment to develop a long-term Regional Flyway Initiative (RFI) in the East-Asian Australasian Flyway (EAAF) (Sovereign Project 55056-001) to protect and restore priority wetland ecosystems and the associated ecosystem services they provide in the EAAF, the most threatened migratory bird flyway globally. The Initiative is slated for implementation in nine ADB developing member countries (DMCs) in East, South and Southeast Asia: Mongolia, People's Republic of China (PRC), Bangladesh, Viet Nam, Cambodia, Philippines, Thailand, Malaysia and Indonesia. In 2023, the geographic scope of the RFI was further extended to two DMCs in Southeast Asia and the Pacific respectively, Lao PDR and Papua New Guinea.

The primary aim of the RFI is to enhance and expand the existing efforts in conserving and managing wetlands of the highest priority for migratory birds within the EAAF through innovative loan and grant financing, and at scale. Consultations and analyses over the development period help identify key interventions to strengthen the management of wetlands, enabling the implementation of nature-based solutions while strengthening biodiversity protection. Over time, the RFI seeks to leverage collaborative opportunities by developing partnerships among important stakeholders including national governments, civil society organizations, communities, regional organizations like the East Asian-Australasian Flyway Partnership (EAAFP), development agencies, the private sector, and other relevant entities.

Through the RFI Technical Assistance (TA) implemented over the RFI's development phase from 2021 to 2024, BirdLife International takes the lead in providing and coordinating technical support for development of the RFI. This is carried out in collaboration with the EAAFP and a consortium of international non-governmental organizations including Wetlands International and the Paulson Institute, as well as two universities, namely the University of Southampton, UK and the National University of Singapore. Over the development phase, the TA team undertook a site selection analysis to identify priority wetland sites in all 10 countries based on recent bird data benchmarked against internationally accepted criteria under the Convention on Wetlands of International Importance (or Ramsar Convention), EAAFP Flyway Network Sites and Important Bird and Biodiversity Areas (IBAs). The team further developed ecosystem services profiles for prioritised wetlands using a multi-pronged approach used the TESSA ecosystem services assessment tool, and data-driven modelling of water-based ecosystem services and stored carbon.

In Cambodia, a total of 15 wetland sites, including several Asian Waterbird Census (AWC) count sites, were initially assessed through data analysis and expert consultation, of which 12 were short-listed for assessment based on the available (recent) data. Of this pool of sites, nine (9) were defined and identified to be RFI priority sites on the basis that they support more than 1% the flyway population of at least one EAAF migratory waterbird species. Eight (8) of the RFI sites identified are inland wetlands, most notably a cluster of sites around the Tonle Sap Great Lake, such as Prek Toal, Ang Tropeang Thmar and Boeng Tonle Chhmar. A single coastal site was identified, i.e. Koh Kapik Ramsar Site where there have been extensive surveys of its biodiversity to date, including surveys led by NatureLife Cambodia. 11 EAAF species exceeded the 1% threshold at the site level in Cambodia, with species such as the Masked Finfoot, Greater

Adjutant and Sarus Crane (*ssp. sharpii*) at their highest congregations in Southeast Asia. Other species with important populations and/or congregations in Cambodia includes Spotted Greenshank, Black-headed Ibis and Painted Stork.

2. Site profile of Boeng Chhmar Ramsar Site

Location: The Boeng Chhmar Ramsar site is situated in the northeast of the Tonle Sap Lake floodplain, just northeast of the constriction in the lake. It is bordered to the east and northeast by the floodplain forests which surround Boeng Chhmar Lake, and to the south and southwest by the Tonle Sap River. It is located in Kampong Thom and Siem Reap provinces, and the nearest towns are Kampong Luang commune, south of Tonle Sap, and Krakor district town, which are approximately 20 km and 45 km distant respectively.

Area: The Boeung Tonle Chhmar RFI site has an area of 28,016 ha (including about 23,000 ha in Kampong Thom Province and about 5,000 ha in Siem Reap Province)

Altitude: 10 metres asl.

Geographical coordinates: 12.83° N, 104.29° E

Description of site: Boeng Tonle Chhmar is part of the Tonle Sap floodplain, and it represents a fine example of a relatively undisturbed wetland in the (Lower) Mekong River Ecoregion. The site consists of a permanent lake (4,000 ha) surrounded by a creek system and swamp forests in the northeast fringe of Tonle Sap Lake. During the dry season between March and April, the water becomes shallower (0.5 meters) and is only available in the lake and creeks. During the wet season, the entire Tonle Sap Lake floodplain becomes inundated, with the lake swelling four to five times its dry season size and its average depth increasing to approximately 4 meters. The whole character of the Tonle Sap Lake is influenced by the Mekong River and the surrounding catchment areas, including the Cardamom Mountains to the southwest and the northern river tributaries. The Tonle Sap River reverses its flow twice each year, draining the lake into the Mekong River during the dry season, when water levels are low, and filling the lake from the Mekong River during the wet season, when water levels are high. Boeng Tonle Chhmar supports a complex range of wetland habitats, including seasonally inundated forest and grassland, and the nutrient dynamics of the site create an area rich in biodiversity.

Site administration, management, and land tenure: Boeung Chhmar is part of three Core Areas of the Tonle Sap Biosphere Reserve designated to protect fisheries and biodiversity, the other two being Stoeng Sen and Prek Toal. It was designated as a Ramsar site in 1999 and as an IBA in 2003. The Kampong Thom and Siem Reap provincial authorities have territorial jurisdiction over the Boeng Chhmar Ramsar site, and the Ministry of Environment (MOE) has functional jurisdiction in supervising resource management activities in the area. The Boeung Chhma Ramsar site is state-owned, and the Management Authority is the Environmental Department of Kampong Thom Province. The flooded forests that surround the

Boeung Chhma Ramsar site are the property and under the jurisdiction of the Fisheries Administration, and the rice fields in the north of the site are privately owned.

Social and economic values: Fish products and other aquatic resources are integral to the livelihoods of the Cambodian people, and are a vital food source, commonly eaten with rice. Tonle Sap Lake and Boeng Chhmar Lake are important for the regional economy as the wetlands supply fish products to millions of people in Cambodia. In the past, the lakes were divided into fishing lots (four in total), with the fishing managed by individuals holding fishing licences, but in 2012, the fishing lots were cancelled and replaced by fish sanctuaries established by the government. Some floating village communities are permitted to fish for their livelihoods, raise fish, and grow rice in small open areas near the villages.

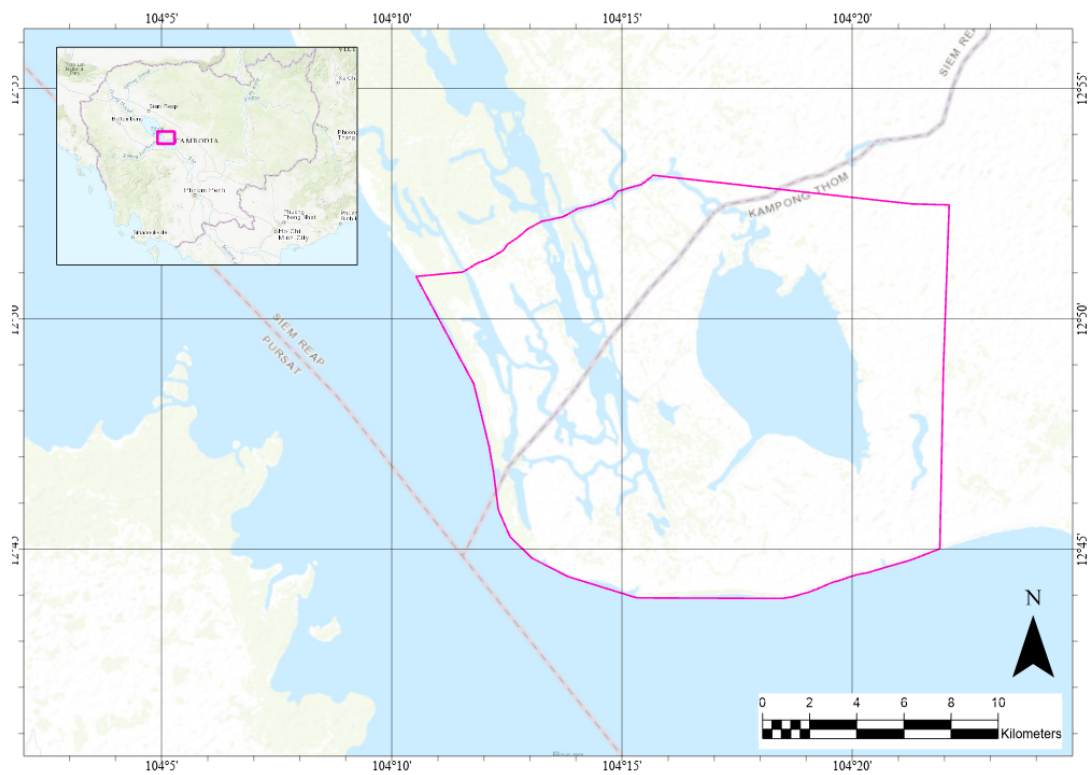


Figure 1. Map of the Boeung Chhmar Ramsar Site, showing its location in the Tonle Sap Great Lake and Cambodia (Map: Evelyn Pina Covarrubias)

3. Biodiversity value of Boeng Chhmar Ramsar Site

3.1. Key habitats

Boeng Tonle Chhmar is part of the Tonle Sap floodplain, and it represents a fine example of a relatively undisturbed wetland in the (Lower) Mekong River Ecoregion. The site consists of a permanent lake (4,000 ha) surrounded by a creek system and swamp forests in the northeast fringe of Tonle Sap Lake. During the dry season between March and April, the water becomes shallower (0.5 meters) and is only available in the lake and creeks. During the wet season, the entire Tonle Sap Lake floodplain becomes inundated, with the lake swelling four to five times its dry season size and its average depth increasing to approximately 4 meters.

3.2. Importance of the Boeng Chhmar Ramsar Site for migratory waterbirds

Count data from the 2011 and 2017 Asian Waterbird Census (AWC) were used in the RFI analysis for Boeng Chhmar Ramsar Site, together with SMART Patrol Report monitoring of the site conducted in January-May 2022. Monthly count data were available for 2022, which were averaged for that year, and then averaged with the single AWC counts available for 2011 and 2017. The averaged count results were compared to the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. Three migratory waterbird species were found to regularly exceed the 1% population estimates during these three years (Table 1), and the CSR1 scores for these species were summed to produce the overall site score.

Table 1. List of migratory species (based on the EAAFP list of species) with globally significant congregations in Bueng Tonle Chhmar wetlands.

Species name	IUCN	Average count	CSR1	CSR1 score
Painted Stork <i>Mycteria leucocephala</i>	LC	1,100	70	15.7
Greater Adjutant <i>Leptoptilos dubius</i>	NT	18.875	8	2.4
Spot-billed Pelican <i>Pelecanus philippensis</i>	NT	75.1	55	1.4

During the breeding season, many of the large waterbirds that nest at Prek Toal (another of the RFI priority sites) forage at Beoung Chhmar Ramsar site, which is a key feeding site for these birds. In addition to the two species in the table, the site supports several near-threatened waterbird species, including Lesser Adjutant *Leptoptilos javanicus*, Black-necked Stork *Ephippiorhynchus asiaticus*, Black-headed Ibis *Threskiornis melanocephalus*, Spot-billed Pelican *Pelecanus philippensis*, and Oriental Darter *Anhinga melanogaster*. There were three or four sightings of the rapidly declining Masked Finfoot *Heliopais*

personatus (CR) in Beoung Chhmar Ramsar site between 1998-2002, but there are no recent records, suggesting that the species may now be extirpated. A survey in March 2006 located a substantial non-breeding population of the threatened Manchurian Reed-warbler *Acrocephalus tangorum* (VU), but none has been detected since.

3.3. Other notable biodiversity

Several globally threatened mammal, reptile, and fish species occur at Beoung Chhmar Ramsar site, most prominently Fishing cat *Prionailurus viverrinus* (VU) and Hairy-nosed Otter *Lutra sumatrana* (EN), both of which have been documented in recent surveys and camera trap data (NatureLife Cambodia in litt.) The site is also known to support an important population of the Indochinese Silvered Langur (EN), a species largely restricted to Cambodia and southern Vietnam. Other species of conservation concern that has been recorded are Grey-headed Fish Eagle *Ichthyophaga ichthyaetus* (NT), Long-tailed Macaque *Macaca fascicularis* (EN), Burmese Python *Python bivittatus* (VU), Siamese Crocodile *Crocodylus siamensis* (CR), Asiatic Softshell Turtle *Amyda cartilaginea* (VU), Yellow-headed Temple Turtle *Heosemys annandalii* (CR), Mekong Giant Catfish *Pangasianodon gigas* (CR), Flying Minnow *Laubuka caeruleostigmata* (EN), Jullien's Golden Carp *Probarbus jullieni* (CR), Mekong herring *Tenualosa thibaudeaui* (VU), Bala Shark *Balantiocheilos melanopterus* (VU) and *Scleropages formosus* (EN).

4. Ecosystem services

4.1. Ecosystem services provided by Boeng Chhmar Ramsar Site

Boeng Chhmar Ramsar Site overlaps with various wetland habitats, providing valuable provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop¹ highlight the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services for fresh water and food benefit communities within, adjacent to, and distant from the site. Regulating services, including air quality regulation, global climate regulation, and water purification and waste treatment, are crucial, benefiting communities at all distances.

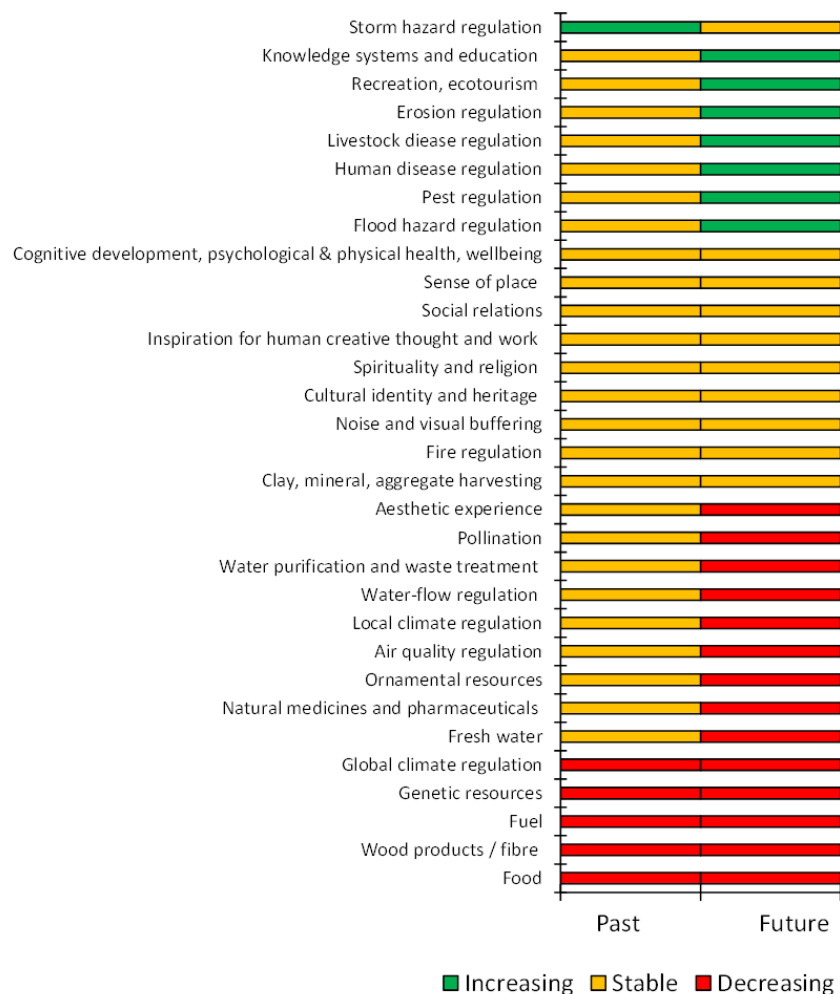


Figure 2. List of ecosystem services provided by Boeng Chhmar Ramsar Site, as identified through stakeholder consultation at the Regional Flyway Initiative workshop. Phnom Pehn, Cambodia

¹ Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. <https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop>

Table 2. List of top ecosystem services provided by the Boeng Chhmar Ramsar Site.

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
<i>Provisioning services</i>						
Fresh water	Yes	✓	✓	✓	No change	Decrease
Food	Yes	✓	✓	✓	Decrease	Decrease
<i>Regulating services</i>						
Air quality regulation	Yes	✓	✓	✓	No change	Decrease
Global climate regulation	Yes	✓	✓	✓	Decrease	Decrease
Water purification and waste treatment	Yes	✓	✓	✓	No change	Decrease

4.2. Global climate regulating services

Based on the lookup values from a FAO report (Dondini et al. 2023) and the IPCC (2006), the amount of carbon stored in the Boeng Chhmar Ramsar Site is estimated to range from 372,000 to 538,000 tonnes, while the annual carbon sequestration rate is estimated at 26,100 tonnes per year.

4.3. Flood mitigating services

The flood mitigation services provided by Boeng Chhmar were assessed using biophysical values only (see Table A1 and Annex 1 for details). When compared to both the average of the eight RFI inland sites and the average of all other inland wetlands in Cambodia (Table A2 in Annex 1), Boeng Chhmar shows some mixed results in terms of benefits and beneficiaries:

(1) for the average green storage capacity per sq. km of wetland, Boeng Chhmar is above average when compared to RFI inland sites (406 Giga Litres or GL of water per km² vs. 384 GL/km²) but below average when compared to all other inland wetlands (399 vs. 458 GL/km²);

(2) for the average population uniquely benefitting from influential green storage upstream per sq. km of wetland, Boeng Chhmar is above average when compared to RFI inland sites (102 vs. 81 people/km²) but slightly below average when compared to all other inland wetlands (102 vs. 110 people/km²); and

(3) for the average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland, Boeng Chhmar is more consistently well above average (6.57 ha/km² vs. 4.89 ha/km² for RFI inland sites and 3.92 ha/km² for all other inland wetlands).

5. Drivers of change and their potential impacts on Boeng Chhmar Ramsar Site

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop² identified 48 drivers of change impacting Boeng Chhmar, and their corresponding levels of impact on the wetland site (Table 3). High-impact drivers include droughts, which significantly affect water availability and ecosystem health. Erosion and siltation/deposition alter the natural habitat, while fire and fire suppression further contribute to habitat loss. Biological resource use, such as fishing, killing, and harvesting of aquatic resources, poses substantial threats to biodiversity. Garbage and solid waste, household sewage, invasive animal and plant species, and water extraction or diversion within the wetland site are all high-impact drivers disrupting the ecological balance.

Medium-impact drivers include agricultural and forestry effluents, which degrade water quality and harm aquatic life. Air-borne pollutants, dams upstream or within the wetland site, and energy generation projects (such as hydropower) have moderately modified the site. Additional medium-impact factors include habitat shifting, increased fragmentation, loss of hydrological connectivity, loss of keystone species, marine and freshwater aquaculture, pathogens, and natural deterioration of cultural wetland values. Other activities like research, restoration for conservation, shipping lanes and canals, and storm and flooding events contribute to the moderate impact on the wetland.

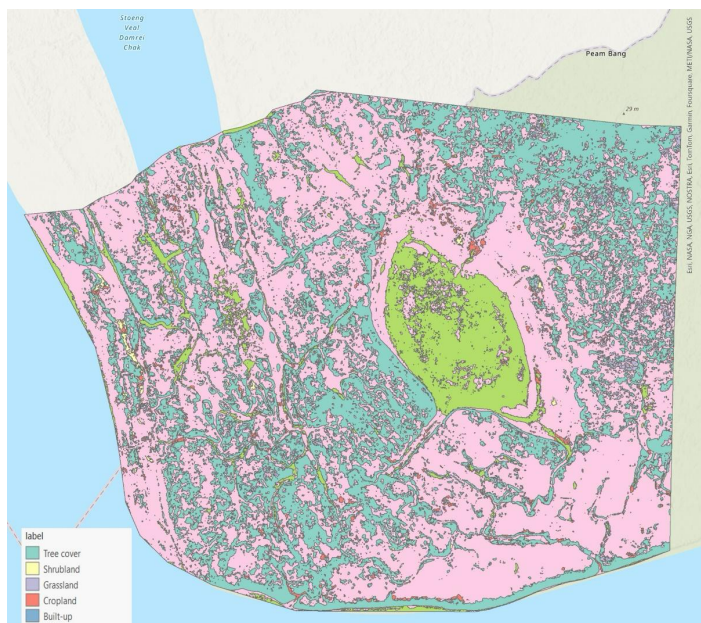


Figure 3. Major land cover types in Boeng Tonle Chhmar Ramsar Site based on remotely sensed data (Map: Radhika Bhargava)

² Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. <https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop>

Table 3. Drivers of change and their potential impact on the integrity of Boeng Chhmar Ramsar Site based on consultations with stakeholders.

Driver of change	Impact
Droughts	High
Erosion and siltation/deposition	
Fire and fire suppression	
Fishing, killing and harvesting of aquatic resources	
Garbage and solid waste	
Household sewage and urban wastewater from outside the wetland site	
Invasive animal species	
Invasive plant species	
Sewage and wastewater from wetland site facilities	
Temperature extremes	
Water extraction/diversion within the wetland site or catchment	
Agricultural and forestry effluents	Medium
Air-borne pollutants	
Dams within or upstream of the wetland site, which alter the hydrological regime	
Drought conditions	
Energy generation, including from hydropower dams, wind farms and solar panels	
Habitat shifting and alteration	
Hunting, killing and collecting of terrestrial animals	
Increased fragmentation within the wetland site	
Loss of hydrological connectivity	
Loss of keystone species	
Marine and freshwater aquaculture	
Natural deterioration of important cultural wetland site values	
Pathogens	
Research, education and other work-related activities	
Restoration for conservation	
Shipping lanes and canals	
Storm and flooding	
Activities of site managers	Low
Annual and perennial non-timber crop production	
Collecting terrestrial plants or plant products (non-timber)	
Desertification	
Destruction of cultural heritage buildings, gardens, sites, etc.	
Drug cultivation	
Excess energy	
Excess ponding of water onsite	
Habitat clearing	
Housing and settlement	
Industrial, mining and military effluents	
Introduced genetic material	
Livestock farming and grazing	
Loss of cultural links, traditional knowledge and/or management practices	
Other 'edge effects' that degrade the wetland site values	
Recreational activities and tourism	
Roads and railroads	
Tourism and recreation infrastructure	
Utility and service lines	
Vandalism, destructive activities or threats to staff and visitors	

5.2. Potential alternative state of Boeng Chhmar Ramsar Site under current drivers of change

Stakeholders at the RFI workshop³ defined the most plausible future alternative state (to 2035), and how this will translate to a net change in the cover of different types of wetland habitat types within this site (current habitat cover vs future alternative cover; Figure 3). The alternative state of the site assumes there will be no changes in the current drivers of change impacting the site, and the current management regime.

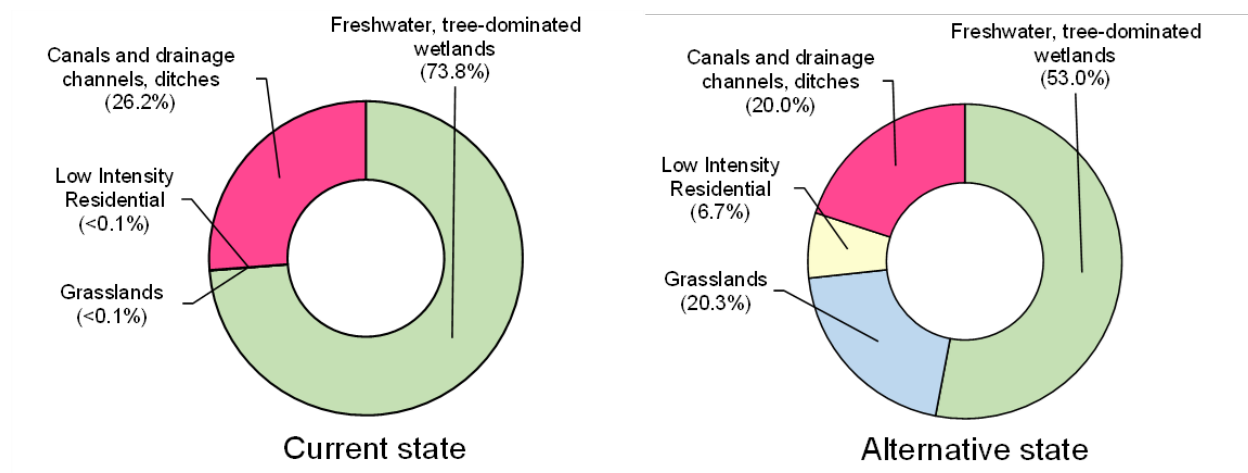


Figure 4. The proportional change in the extent of different habitat types between the current and alternative states of Boeng Chhmar Ramsar Site.

5.3. Expected changes in the ecosystem services of Boeng Chhmar Ramsar Site

Stakeholders at the RFI workshop⁴ documented the future trends in the provision of ecosystem services in Boeng Chhmar Ramsar Site, indicating if the ecosystem services provided by this site (to 2035) will increase, decrease, or remain stable if the current drivers of change impacting this site continue in their present condition, with the intervention remaining unchanged.

Figure 4 and Table 2 highlight that while freshwater has remained unchanged in the past, a decrease is expected in the future. Food provision has already seen a decline and is anticipated to decrease further. Air quality regulation and water purification have remained stable in the past but are projected to

³ Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. <https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop>

⁴ Asian Development Bank. (2023, September 13-14). Cambodia: Wetland Ecosystem Services Workshop [Workshop]. Phnom Pehn, Cambodia. <https://events.development.asia/learning-events/cambodia-wetland-ecosystem-services-workshop>

decrease in the future. Global climate regulation has already experienced a decline and is expected to continue decreasing.

In the alternative state, the 631-fold increase of grassland and the loss of 28% of wetland will result in a gain of stored carbon estimated to be between 47,600 and 94,100 tonnes, and a decrease in carbon sequestration rate (carbon accumulation) by approximately 5,480 tonnes per year.

As presented in Table A5, a loss of 135 hectares of green water habitats, including freshwater tree-dominated wetlands and grasslands, is expected to result in an effective reduction of 0.65% or 2.6 Giga Litres of green storage capacity per km². This may amount to nearly 0.7 people and 0.04 hectares of built-up areas losing flood mitigation benefits per km² of wetland.

6. Capacity gaps and needs in Boeng Chhmar Ramsar Site

The stakeholder consultation and analyses with government and civil society stakeholders identified at least 10 stakeholder groups with clear roles in the long-term sustainable management of the wetlands in the Boeng Chhmar Ramsar Site. Table 4 summarizes the current and potential roles of these stakeholder groups in relation to the management of the Boeng Chhmar Ramsar Site. There are opportunities to strengthen patrolling and law enforcement, ecotourism, biodiversity monitoring, and livelihood development.

Table 4. Capacity needs for key stakeholders involved in the management of Boeng Chhmar wetlands.

Stakeholder Group	Current role in the wetland management	Possible Future role in wetland management (in 10 years)	Current capacity for sustainable wetland management	Capacity Development support needed to improve wetland management	Form of capacity development
Cambodian National Mekong Committee (CNMC)	International cooperation and coordination Site management and conservation Development of water policy and other related legal frameworks in the Mekong River Basin	Remain the same	N/A	N/A	N/A

Stakeholder Group	Current role in the wetland management	Possible Future role in wetland management (in 10 years)	Current capacity for sustainable wetland management	Capacity Development support needed to improve wetland management	Form of capacity development
Tonle Sap Authorities (MoWRAM)	Coordinating ministries' interventions on the lake, research, assessment, and recommendations to agencies	Remain the same	N/A	N/A	N/A
Tonle Sap BR authorities (MoE)	Coordinating ministries' interventions on the lake, Management & Research	Remain the same	N/A	N/A	N/A
MoE & PDoE	Guidelines, legal and institutional frameworks Technical support Promoting cooperation across agencies Administration	Maintain the current role and might have more authority in decision-making for site management	GIS SMART Patrols Bird and wildlife monitoring Reporting Communication channels Coordinating skills Development and implementation legal framework Management & action plan development and implementation Site assessment tools on the site (R-METT)	GIS mapping Bird monitoring Apply wetland Assessment Tools Ecosystem services assessment SMART Patrols Coordination skills	Funding support Training on key skill sets Site visit (local & overseas) Coaching & demonstration of assessment tools
Ministry of Agriculture (MoA)& FiA	Law and guidelines Legal and institutional frameworks	Remain the same	GIS mapping Bird monitoring Reporting	N/A	N/A

Stakeholder Group	Current role in the wetland management	Possible Future role in wetland management (in 10 years)	Current capacity for sustainable wetland management	Capacity Development support needed to improve wetland management	Form of capacity development
	Technical support, cooperation Administration		Communication channels Coordinating skills Development and implementation legal framework Management & action plan development and implementation Fish Inventories		
CPA (MoE)	Participation in conservation, monitoring, restoration, awareness raising, livelihood, tourism	Maintain the current role and will have better engagement in decision-making processes	GPS skills Use SMART devices Reporting and coordination skills Ecotourism operation Geographic knowledge Bird monitoring	Ecotourism, site management and monitoring, action plan and management plan development, livelihood, fishery products and value chain, fire forest control	Financial and technical support Training Feasibility study on alternative livelihood Network building Equipment and tool for forest fires control
Cfi (MoA)	Participation in conservation, monitoring, restoration, awareness raising, livelihood, tourism	Remain the same	Kubo device Reporting & monitoring Ecotourism Operation Forest fire control Coordination skills	Ecotourism Site management & monitoring, restoration Biodiversity monitoring Livelihood improvement opportunities	<ul style="list-style-type: none"> ● Training ● Financial and technical support ● Site visit

Stakeholder Group	Current role in the wetland management	Possible Future role in wetland management (in 10 years)	Current capacity for sustainable wetland management	Capacity Development support needed to improve wetland management	Form of capacity development
				Fisheries products Forest fire management	
Agricultural Cooperatives (AC)	Water management Crop and livestock Poultry production Chemical Inputs Land expansion	Remain the same	N/A	N/A	N/A
Local authorities	Administration Coordination, cooperation Community Investment Plan	Maintain the current role and will have active participation in conservation & PA Management	Coordination and reporting CIP Administration	Understanding the negative impact on ecosystem services and biodiversity CIP allocation for conservation and site management	Training Financial and technical support Awareness raising on ecosystem services and biodiversity, value and Impacts
Private sectors (Rice millers, fish processors, handicrafts)	Price regulation Collector & buyer Market access networking & processing products	Maintain current role and have more investment & contribution in conservation & PA management)	N/A	N/A	N/A
Tour Operators	Promote tourism (for domestic and international tourists) Capacity Building Tourism regulation	Maintain the current role and have more investment & network for conservation & PA management	N/A	N/A	N/A

Stakeholder Group	Current role in the wetland management	Possible Future role in wetland management (in 10 years)	Current capacity for sustainable wetland management	Capacity Development support needed to improve wetland management	Form of capacity development
Local communities	Access to natural resources and ecosystem services	Maintain the current role and have better understanding and knowledge to less harm in exploitation and accessibility	Bird monitoring Geography Fishing	Fish production Alternative livelihood Marketing & communication	Awareness raising Campaign Site exchange visits Forming local groups and clubs
Conservation NGOs	Funding projects in conservation and management Technical support Capacity building Awareness raising Livelihood and tourism development	Remain the same	SMART patrol GIS skills Bird monitoring Coordinating and implementing projects	N/A	N/A

7. Opportunities for RFI interventions

7.1 Recommended Interventions

Boeng Tonle Chhmar (BTC) is one of three core areas of the Tonle Sap Biosphere Reserve designated for biodiversity conservation and fishery management, and it protects some of the largest remaining areas of floodplain wetland, including seasonally inundated grassland and swamp forest (flooded forest) on the Tonle Sap Great Lake. There are at least six villages (mostly floating villages) across several communes (most notably Peam Bang) in Stoung district, and local communities here are entirely dependant on small-scale fishing and fish processing as the main source of livelihood. Unlike Prek Toal in the north-western part of Tonle Sap, there are limited tourism activities in this part of the lake due to accessibility issues.

To strengthen the management and conservation of BTC there is a clear need for improving the management of the site's fisheries through engaging the local communities active in at least four

community fisheries (Cfi) operating within BTC, especially at Pov Veuy, Doun Sdeung, and Peam Bang (see Tiaye & Lieng 2024). Herein, there is a need to strengthen management and legal protection of the BTC wetlands through zonation, establish new community protected areas (CPAs) while addressing dry-season fires and invasive species such as water hyacinth, which is now established across much of Tonle Sap. In addition, interventions proposed under this project aim to improve and scale-up the sustainable management of community fisheries in BTC, building upon existing fisheries and conservation projects, while expanding on alternative sources of livelihoods for local people through tourism, fish product processing and improving market access.

Table 5. Summary of key RFI interventions proposed for the Boeng Tonle Chhmar

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
<i>Component 1: Strengthening site management and protection of Boeng Tonle Chhmar</i>					
Conduct a scoping study of existing interventions and threats and disturbance at Boeng Chhmar, including targeted work on long-term threats (from climate change, damming, sedimentation, and invasive species).	Best practices, guidelines, and standards for proposed RFI interventions	Assessment report with key threats identified and recommendations for improved management published, and disseminated to key stakeholders	50,000	1 year	MOE and the provincial department of environment (Kampong Thom) MAFF; fisheries administration BTC committee Consultancy companies
Strengthen and expand the site management plan in BTC	Strengthened stakeholder collaboration in conserving the BTC wetlands Increased patrol and enforcement efforts for wildlife protection and encroachment activities.	Site management plan and zonation plan agreed by key stakeholders and endorsed by MOE Number of stakeholder consultation meetings organized	100,000	5 years	MOE and provincial department of environment BTC management board Kampong Thom provincial government

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	Reduced forest fire risks during the dry season	<p>Number of enforcement patrols against baselines, focusing on illegal bird hunting and land clearance</p> <p>Risk mitigation plan for fire in flooded forests during the dry season.</p> <p>Number of identified and implemented measures in the risk mitigation plan.</p>			<p>Stoung district government</p> <p>Conservation organisations</p> <p>Community groups (including LCGs)</p>
Designate more community-protected areas (CPAs) with the local communities in Peam Bang	Strengthened stakeholder collaboration in conserving the BTC wetlands	<p>Number of designated CPAs (target of up to three) with local communities in Peam Bang, with well-defined boundaries.</p> <p>Number of meetings and workshops conducted to engage local stakeholders</p>	150,000	2 years	
Improve water management infrastructure to ensure water supply to BTC in vulnerable areas during	Reduced forest fire risks during the dry season	Number of rainage canals for water management repaired, dug and/or maintained	500,000	2-3 years	<p>MOE</p> <p>MAFF</p> <p>BTC committee</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
the dry season, minimising the risk of fires.		(including clearance of vegetation). Number of localized dredging works to address siltation and vegetation. Number of forest and scrub fire incidents against baselines.			
Strengthen legal protection of BTC	Increased patrol and enforcement efforts for wildlife protection and encroachment activities. Increased enforcement capacity of rangers (and management board)	Number of boundary markers placed around the edges of BTC to minimize management and signage against illegal activities. Number of patrol activities, using SMART approach Number of training activities for enforcement and patrols Number of trained personnel in law enforcement Number of patrolling equipment provided	100,000	5 years	MOE and provincial department of environment BTC committee Stoung district government Conservation and academic organisations (including bird and community-focused NGOs)

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Number of illegal cases (of fishing and encroachment) reported against baselines.			
Manage water hyacinth in key fishing areas.	Sustained management of areas impacted by water hyacinth growth.	Up to 50 ha cleared and/or managed of water hyacinth and other invasive plants, with participation from local community groups.	100,000	5 years	MOE and provincial department of environment BTC committee Community groups
Restore degraded areas of swamp (flooded) forest during the dry season	Degraded areas of flooded forests, including areas damaged by fires and encroachment restored.	Nurseries with native swamp forest species established. At least 200 ha of degraded (flooded) forest restored over a five-year period.	200,000	5 years	Conservation organisations
<i>Component 2. Wildlife protection and monitoring, with a focus on breeding waterbirds and other flagship species of the Tonle Sap</i>					
Strengthen biodiversity monitoring, with a focus on breeding waterbirds such as storks and raptors.	Biodiversity monitoring and management cycle strengthened. Increased awareness of waterbirds amongst local communities.	Number of awareness-raising activities on the importance of protecting waterbirds and wetlands. Number of trained local community members on biodiversity monitoring	100,000	3 years	MOE BTC committee (and rangers) Conservation organisations Research institutions

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		<p>Biodiversity monitoring system and guidelines developed</p> <p>Number of biodiversity monitoring activities conducted with local communities</p> <p>A local biodiversity monitoring group created.</p>			
<i>Component 3: Strengthen the management of fisheries in Boeng Tonle Chhmar</i>					
Strengthen the management of site fisheries, with a focus on small-scale artisanal fishers.	<p>Fishing activities in BPL are better regulated and enforced.</p> <p>The management system is strengthened, and fishery resources are better managed and conserved.</p> <p>Stronger management and protection of fish breeding areas.</p>	<p>Number of meetings and workshops conducted to engage local stakeholders for participatory processes</p> <p>Licensing framework for fishers established and in place.</p> <p>Number of patrol activities, using SMART approach against illegal fishing implemented</p> <p>Fishery monitoring</p>	500,000	5 years	<p>MAFF</p> <p>Fisheries Administration (FiA)</p> <p>BTC committee</p> <p>Siem Reap and Kampong Thom provincial government</p> <p>Stoung district governments, and selected communes.</p> <p>Community fisheries (Cfi)</p> <p>Conservation organisations (including rural</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		framework in place. Number of supported community-led agreements on sustainable fishing practices			development NGOs) Fishing operators
Improve the conditions and quality of key fish-breeding areas (i.e. fish sanctuaries) in BTC through deepening the key water pools used by breeding fish during the dry season.	The management system is strengthened, and fishery resources are better managed and conserved. Stronger management and protection of fish breeding areas.	Number of (target of at least 5) inundated areas dredged and deepened. Volume of fishing output at deepened areas of pools in BTC.	500,000 (for dredging in the first 2 years)	5-8 years	Provincial department of fisheries for Kampong Thom Fisheries Administration (FIA) BTC committee Community fisheries
Strengthen the capacity and resilience of small-scale fishers in floating villages	Fishing activities in BPL are better regulated and enforced. The management system is strengthened, and fishery resources are better managed and conserved. Improved access to micro-finance	Awareness program on fishery management developed Number of trained fisherfolk (target of at least 100 across BTC, with % of women participants) from local communities of 5-6 villages, including Peam Bang, on good fishing practices	200,000	5 years	Fisheries Administration Stoung district governments Fishing operators Community groups (and Community fisheries) Conservation organisations

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
	for small scale fishing communities based around sustainable practices.	<p>Number of organized and supported local fishing cooperatives</p> <p>Number of supported local community livelihoods</p> <p>Small-scale financing scheme in place for small-scale fishers.</p> <p>Number of loans benefiting at least 100 households with grants and microloans</p>			
<i>Component 4. Strengthen alternative livelihoods for local communities (in selected villages) for value-added products</i>					
Develop capacity for alternative livelihoods, including value-added activities, such as aquaculture product development	Improved livelihoods for local communities, through alternative income streams.	<p>Training programmes for local communities on the development and production of selected aquaculture products (e.g., processing of dried and smoked fish, fish sauce), and business planning developed</p> <p>Number of people trained on livelihood activities</p>	200,000	8 years	<p>Fisheries administration</p> <p>Stoung district government, commune authorities, and village community groups</p> <p>Conservation organisations and rural development NGOs</p> <p>Community groups of key</p>

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
		Number of co-developed, launched, and supported aquaculture products in the local communities			communes and villages
Establish market access for local products in major cities, including Siem Reap.		Number of local products reaching the major cities Number of market partnerships closed for the local products.			
<i>Component 5. Upscaling tourism infrastructure and strengthening sustainable ecotourism</i>					
Improve and expand tourism infrastructure at BTC, including signage, jetties, and viewing structures.	Strengthened local, nature-based tourism, co-managed with local communities. Access structures and shelters in the wetlands improved through signage, jetties, and viewing structures	Number of people benefitting from livelihood activities (target of at least 100 households), with up to 30% beneficiaries from women, youth, elderly, indigenous people, and other vulnerable groups Number of organized	250,000	2 years	MOE and provincial department of environment (Kampong Thom) Provincial department of tourism BTC committee Stoung district government; commune offices of Peam Bang
Strengthen the capacity of local communities and businesses for nature-based tourism. Establish a development	Improved local capacity for nature-based tourism, with stronger capacity for the administration of nature facilities.	exchange visits between Prek Toal and Siem Reap. Ecotourism strategy and business plans and packages	200,000	3 years	Conservation and academic organisations (including bird and

Intervention	Outcome	Indicators	Cost (USD)	Timeframe	Potential Stakeholders
plan for nature-based tourism in BTC		<p>with a focus on migratory waterbirds and flooded forests developed and tested with tourism operators.</p> <p>Number of stakeholder consultation meetings conducted, and the number of groups represented in these meetings</p> <p>Number of people trained on livelihood activities</p> <p>Number of tourism-related infrastructure established</p>			<p>community-focused NGOs)</p> <p>Community groups of key villages</p> <p>Tourism operators</p>
Total investment for 8 years			11,600,000		

7.2 Potential Financing

The estimated project cost is USD 11,600,000 over eight years. This budget supports strengthening local stakeholder collaboration to conserve the BTC wetlands, reducing risk from forest fires during the dry season, improving local capacity for sustainable fishing practices, establishing microfinance mechanisms for local communities, and building tourism infrastructure and local livelihoods. Table 5 summarizes the projected budget distribution across the proposed project components.

There is potential for co-financing from a planned IUCN freshwater adaptation project, supported by AFD and the Green Climate Fund, as well as from ongoing capacity-building projects by several NGOs.

7.3 Proposed Institutional Arrangements

The proposed project is expected to be implemented over a period of at up to eight (8) years, with main project components focusing on improved site management for BTC (led by the Ministry of Environment, and Provincial Department of Environment for Kampong Thom) and scaling up sustainable fisheries and the development of alternative livelihoods for local communities (with the Ministry of Agriculture, Forestry and Fisheries, and its Fisheries Administration). Conservation organisations and rural development NGOs are expected to play a major supporting and technical role in the project by supporting project activities focused on biodiversity monitoring, driving community engagement and capacity building for alternative livelihoods.

7.4 Project Beneficiaries

The largest part of BTC lies in Kampong Thom Province, with a small area of about 5,000 ha in Siem Reap. Peam Bang Commune, which falls entirely within Boeng Tonle Chhmar, contains five small floating villages (Peam Bang, Pov Veuy, Daun Sdeung, Balot, and Pichakrei) with a population of over 3,000 people in about 700 households.

This proposed project is expected to undertake activities to promote gender inclusion and participation in livelihood activities, through capacity building activities for alternative livelihoods (e.g. fish processing and development of fish-based products), small-scale fisheries, and nature-based tourism.

There are no indigenous communities in the project landscape. Most households are ethnically Khmer, but there are a few Vietnamese and Cham households, mostly in the floating villages.

7.5 Anticipated Implementation Risks

Environment: Establishing ecotourism can offer alternative livelihood opportunities for local communities in the BTC. The proposed interventions include new infrastructure, such as jetties and viewing structures, to enhance the tourism experience for visitors. Building these infrastructures and increasing tourism access, however, would generate noise that may disturb wildlife and reduce essential habitats in the area. Planning with the stakeholders is critical before any infrastructure development.

Stakeholders buy-in: Proposed interventions rely on support from local communities, particularly in adopting sustainable fishing practices, patrolling, and co-management. Establishing strong stakeholder buy-in from local leaders and engagement from local communities for the proposed interventions will facilitate better implementation of the proposed interventions.

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Annex 1. Supplementary information on flood mitigation services

To further validate the identification of the top ecosystem services by means of stakeholder consultation, an expectedly essential or non-substitutable regulating service across all RFI sites, namely coastal protection and flood mitigation (i.e., storm and flood hazard regulation), was assessed based on a combination of globally available datasets supplemented by web-based tool Co\$tingNature (Mulligan, 2022). Estimates for flood mitigation were spatially inferred in QGIS from a selection of metrics expressing different biophysical values modelled online by the Water World component of this tool. Equivalent data to assess monetary values similarly to coastal protection were not available for the RFI region.

The key metrics selected for biophysical values (Table A1) were the average green storage capacity, which is the volume of water stored by each square kilometre of wetland itself as well as its soil and vegetation, and the direct influence of this storage capacity on beneficiaries found downstream of the wetland, both as the average number of people and the average built-up area that are uniquely benefitting from the resulting flood mitigation (and not from other green storage found upstream).

Table A1. Contribution of the wetland habitats to flood mitigation in Boeng Chhmar based on site-level (biophysical) values inferred from Mulligan (2022) and expressed as ranges to represent the resulting uncertainty.

Influence of the wetland on flood mitigation (metrics)	Benefit/Beneficiaries
Average green storage capacity per sq. km of wetland in million cubic metres (GigaLitres/km ²)	379 – 433
Average population uniquely benefitting from influential green storage upstream per sq. km of wetland (n/km ²)	95 – 109
Average built-up area uniquely benefitting from influential green storage upstream per sq. km of wetland (ha/km ²)	6.15 – 7.00

Table A2. Biophysical benefits from and beneficiaries of RFI inland wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	Green storage capacity (GigaLitres/km ²)	Downstream population (n /km ²)	Downstream built-up area (ha /km ²)
Prek Toal Core Area	486 (±29)	112 (±7)	7.19 (±0.42)
Ang Tropeang Thmor	411 (±38)	73 (±7)	3.84 (±0.36)
Boeung Prek Lapouv	448 (±37)	139 (±12)	8.40 (±0.71)
Anlung Pring	264 (±63)	0 (±0)	1.22 (±0.29)

Site name	Green storage capacity (GigaLitres/km ²)	Downstream population (n /km ²)	Downstream built-up area (ha /km ²)
Boeng Tonle Chhmar	406 (±27)	102 (±7)	6.57 (±0.43)
Chikraeng / Stoung	206 (±23)	45 (±5)	2.84 (±0.32)
Kulen Promtep WS	456 (±6)	87 (±1)	4.20 (±0.05)
Cambodia RFI average	384	81	4.89
Cambodia national average	458	110	3.92

Table A5. Key habitat types in Boeng Chhmar Ramsar Site based on stakeholder-based assessment at the Regional Flyway Initiative workshop in September 2023.

Habitat type	Current state		Alternative state (2035)	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Freshwater, tree-dominated wetlands	20661.8	73.8	14848.5	53.0
Grasslands	9.0	0.0	5687.2	20.3
Low Intensity Residential	2.0	0.0	1877.1	6.7
Canals and drainage channels, ditches	7343.2	26.2	5603.2	20.0
Total	28016.0	100.0	28016.0	100.0