

Environmental Due Diligence Report

PUBLIC

December 2025

Thailand: Lower East Chao Phraya Irrigation
System Improvement – Climate Adaptive
Strengthening Investment Project

Output 2: Modernization of Hydrometeorological Observation
Network

Prepared by the Royal Irrigation Department (RID), Government of Thailand for the Asian
Development Bank (ADB).

This environmental due diligence report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or Staff, and may be preliminary in nature. Your attention is directed to the "[terms of use](#)" section of ADB's website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

I. INTRODUCTION

A. Background

1. The Lower East Chao Phraya Irrigation System Improvement Project (hereinafter referred to as “project” or “overall project”) is one of the nine large-scale plans under the comprehensive investment program prepared by the Government of Thailand to alleviate the flood issues in the Lower Chao Phraya River Basin. The project will be supported by ADB under a Multitranche Financing Facility (MFF), which will be implemented in three tranches over eight-year period.

2. The project includes modernization of irrigation and drainage infrastructure and other supporting outputs in the Lower East Chao Phraya area. The project is aligned with the following impact: Economic impacts from climate-induced floods and droughts reduced.¹ The project will have the following outcome: Resilience and preparedness to climate-induced risk in the Lower East Chao Phraya strengthened. The project will comprise the following three outputs:

- (i) Output 1: Modernized climate-resilient irrigation and drainage infrastructure established. Output 1 will upgrade existing irrigation canals, regulation structures, and pumping stations to function as dual-purpose irrigation and flood-conveyance systems, creating climate-resilient assets that mitigate both flood and drought risks. Physical modernization will include re-sectioning and stabilizing canal cross-sections, and constructing or upgrading flow-control structures, pumping stations, and operations buildings to enhance structural resilience and hydraulic performance. These improvements will increase the system’s flood-conveyance capacity from 210 m³/s to 400 m³/s, reducing downstream flood levels in the Lower Chao Phraya River and Bangkok.² Enlarged waterways will also expand storage capacity, improving water availability for irrigation and other uses during dry periods. The project will (i) upgrade approximately 473 km canals (both banks), 311 km under the loan funds and 162 km under domestic financing and (ii) construct or upgrade 16 structures, 11 under loan funds and 5 under domestic financing;
- (ii) Output 2: Climate smart and efficient water management capacity strengthened. Output 2 will establish and upgrade digital systems to improve operational efficiency, strengthen climate-risk management, and modernize irrigation network operations. A comprehensive decision-support system (DSS) will be developed for real-time flow monitoring, flood forecasting, early warning, and optimized irrigation and drainage operations. The output will also modernize the hydrometeorological observation network, strengthen institutional frameworks, and build RID’s capacity for digital O&M and asset management. Activities include: (i) upgrading flow-forecasting and early-warning systems; (ii) establishing a functional asset management system and institutionalizing O&M planning and execution processes; (iii) enhancing staff competencies in digitized water management; and (iv) adopting a strategy to advance women’s participation and leadership within RID; and
- (iii) Output 3: Community resilience and livelihood supported. Output 3 will build on ongoing government initiatives to empower communities and strengthen resilience

¹ Government of Thailand. 2022. Thailand 2nd Updated Nationally Determined Contributions. Bangkok.

² United Nation Development Programme/Green Climate Fund are implementing *the Enhancing climate resilience in Thailand through effective water management and sustainable agriculture project* in the upstream Chao Phraya watershed, which include soil improvement and erosion control.

at the local level. Effective gender-responsive CBDRM³ and early warning system (EWS) will be established in communities at risk to reduce losses caused by disasters triggered by natural hazards and contribute to livelihood development, and indirectly food security. Extensive training on livelihood development and diversification will be provided, specifically for the most vulnerable groups in the communities. In close cooperation with the DDPM of the Ministry of Interior, CBDRM groups will be established in the communities and provided with the necessary equipment to effectively operate, including community EWS linked to RID's DSS. Technical training on DSS, O&M, and EWS operations will be provided by RID and local governments. Training will also be provided to benefit communities by developing opportunities for livelihood diversification and improving existing agricultural activities to reduce flood risks. Cultural and gender aspects, the roles of women's community organizations, and local employment opportunities will be assessed and integrated. Specifically, this output will: (i) make CBDRM programs operational in communities around irrigation canals, (ii) allow affected households in RID right-of-way become legal land users, (iii) increase women in leadership/decision-making positions in CBDRM groups, and (iv) increase knowledge on livelihood enhancement and business development among farmers and Micro, Small, and Medium Enterprises (MSMEs), including female farmers and women-owned MSMEs.

3. **Implementation Arrangements.** The Royal Irrigation Department (RID) is the Executing Agency of the MFF. A project management unit (PMU) will be established under the Medium Scale Water Resources Development Division of RID with close cooperation with the Treasury Department, the Ministry of Interior, and other relevant agencies. The PMU will have the overall responsibility for project management and implementation, including safeguards compliance. Project implementation units (PIUs) will be established to manage day-to-day implementation at the project site level. The project will engage a project management consultant (PMC) to support the PMU and several construction supervision consultants (CSCs) to support the PIUs.

4. **Project Components.** The project will have civil works components consisting of the following:

- (i) Upgrading of about aggregate 311 kilometers of existing canals by dredging and increasing the cross-sectional area of these canals, and by construction of wall protection on either or both sides of these canals;
- (ii) Construction and/or upgrading of 11 flow regulator structures; and
- (iii) Upgrading or modernization of existing hydromet observation networks.

5. The procurement packages will include civil works, goods, consulting services, and non-consulting services. The civil works packages include combination of retaining wall construction, regulator construction and dredging. And initial environmental examination (IEE) report has been

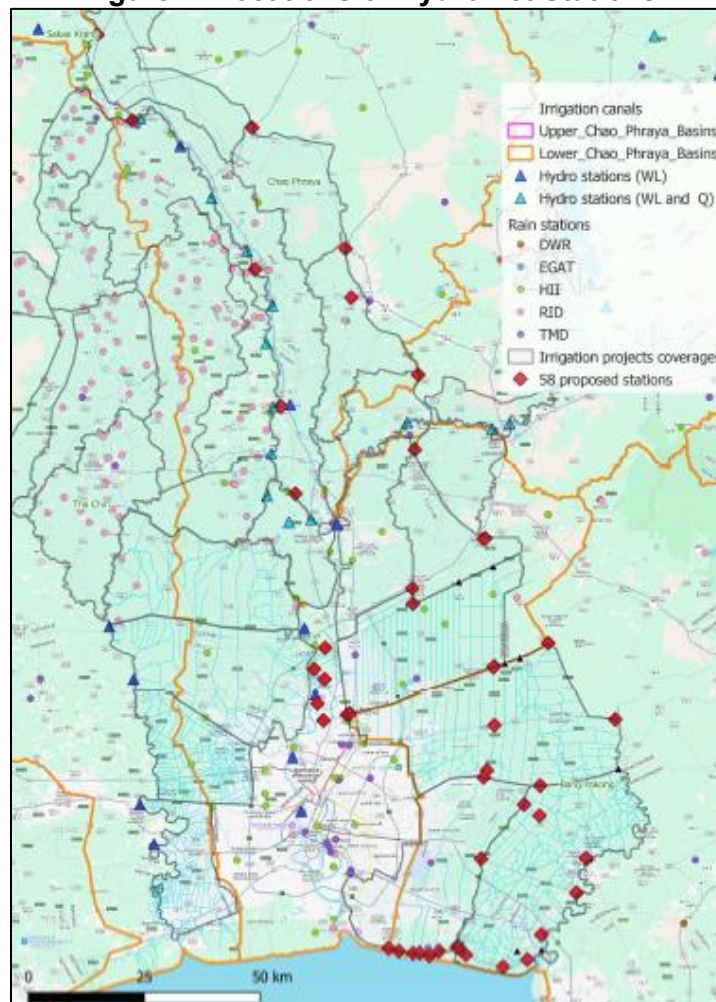
³ Gender-responsive CBDRM considers and addresses differentiated needs and vulnerabilities of women and girls particularly those from vulnerable groups, during disaster prevention and response. It includes mechanisms for women's participation in consultation and decision-making. The program will ensure: (i) participation of women in planning, training, and implementation of pilot activities; (ii) women's participation and leadership in the CBDRM committees; (iii) actions that enhance women's safety, agency, and capacity to lead preparedness, response, and recovery; (iv) incorporation of gender considerations into early warning, maintenance, and community flood- and drought – response planning; and (v) GBV prevention measures within community preparedness and response systems.

prepared for this set of civil works. Separately, one goods package includes hydromet network modernization. The installation of hydromet stations involves small works which are deemed to have minimal environmental impacts.

B. Purpose of Environmental Due Diligence

6. The installation of hydromet stations is regarded as an activity with minimal environmental impacts. Despite this envisaged minimum level of impacts, the environmental implications will need to be evaluated to comply with the ADB SPS. This evaluation ensures that even small-scale infrastructure improvements meet international standards for environmental protection and risk management. Therefore, an environmental due diligence process has been undertaken to assess potential impacts, identify any necessary mitigation measures, and confirm regulatory compliance. This environmental due diligence report (EDDR) has been prepared to document the assessment process, findings, and recommended actions, ensuring transparency and accountability throughout the project implementation. The EDDR serves as a critical tool for guiding decision-making related to the environmentally sustainable modernization of hydromet network stations.

Figure 1: Locations of Hydromet Stations



II. RELEVANT LEGAL PROVISIONS

7. ADB will not finance any project if it does not comply with ADB SPS nor will it finance any project if it does not comply with Government of Thailand environmental laws, rules and regulations. Where discrepancy between ADB and Government of Thailand policies exist, ADB's policy will prevail.

A. ADB Safeguard Policy Statement

8. ADB SPS requires borrowers to meet a set of requirements when delivering environmental safeguards for projects supported by ADB.⁴ The objectives are to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process. The project is required to comply with the policy principles, as summarized below.

9. **Screening and Categorization.** A project is to be screened for its potential environmental impacts and is assigned to a specific category as follows:

- (i) **Category A.** The project is likely to have significant adverse environmental impacts that are diverse, irreversible, and unprecedented. Impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA) has to be undertaken, which includes an environmental management plan (EMP) that has to be prepared by the borrower/client.
- (ii) **Category B.** The project's potential environmental impacts are less adverse and fewer in number than those in category A. Impacts are site-specific, and only few of which, if any, are irreversible. Impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE) has to be undertaken, which includes an EMP that has to be prepared, by the borrower/client.
- (iii) **Category C.** The project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, but a desk review of the project's environmental implications will need to be conducted.
- (iv) **Category FI.** The project involves the investment of ADB funds to or through a financial intermediary. An environmental and social management system is required.

10. Categorization is to be based on the most environmentally sensitive component of the project. However, in the case of the project that will be funded under an MFF, all components need to be assessed and confirmed that none of these components can trigger Category A. If a particular project component is assessed to trigger Category A, the implementing agency shall examine alternatives to the component's location/s, designs, technologies, and subcomponents that would avoid, and, if avoidance is not possible, minimize adverse environmental impacts and risks, and to meet Category B categorization. For the Output 2 component on the modernization of hydromet network, screening reveals that the activity is classified as Category C, wherein

⁴ ADB SPS Safeguard Requirements 1 is a set of requirement aimed to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. This set of requirements is triggered if a project is likely to have potential environmental risks and impacts. There are 11 key policy principles that need to be considered to ensure the requirements of addressing these impacts and risks are met.

minimal or no adverse impact is envisaged. Thus, the conduct of an environmental due diligence is sufficient to comply with ADB SPS requirements.

11. **Environmental Assessment.** Environmental assessment shall include description of environmental baseline to provide an understanding of current conditions forming the benchmark against which project impacts are assessed. Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including design and planning stage, construction, operations, decommissioning, and post-closure activities such as rehabilitation or restoration. The "no action" or "without project" alternative will also be considered.

12. This environmental due diligence follows the suggested outline in the EARF of the overall project.

13. **Environmental Audit.** When the project involves existing activities or facilities, PMU is responsible to ensure that relevant external experts will perform environmental audits to determine the existence of any areas where the project may cause or is causing environmental risks or impacts. If the project does not foresee any new major expansion, the audit constitutes the environmental assessment for the project. As the project aims to rehabilitate the existing water conveyance system (i.e. existing regulators and canals), the IEE prepared for Output 1 constitutes environmental assessment covering these existing facilities.

14. **Physical Cultural Resources.** The PMU will identify all physical cultural resources (PCRs) in the project area. If the project is likely to affect the PCRs, the PMU will engage qualified and experienced experts to assess the project's potential impacts using field-based surveys. If there is high likelihood that PCRs are expected to be found as determined during the environmental assessment process, chance finds procedures shall be included in the environmental management plan (EMP).

15. **Environmental Planning and Management.** The EMP will describe and address the potential impacts and risks identified by the environmental assessment. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks. The EMP shall include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. The EMP as part of the IEE shall be updated in every subsequent tranche.

16. **Pollution Prevention and Control Technologies.** During the design, construction, and operation of the project the PMU will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines.⁵ These standards contain performance levels and measures that are normally acceptable and applicable to the project. When the national regulations differ from these levels and measures, the project shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, PMU will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

⁵ World Bank Group. 2007. *Environmental, Health, and Safety General Guidelines*. Washington, D.C.

17. **Occupational Health and Safety.** The PMU⁶ will ensure that workers⁷ are provided with a safe and healthy working environment, considering risks and specific classes of hazards in the project work areas, such as but not limited to physical, chemical, biological, and radiological hazards. PMU will ensure that the contractors shall take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

18. The PMU will ensure to apply preventive and protective measures consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines⁸ and International Labor Organization (ILO).⁹

19. **Community Health and Safety.** The PMU will ensure to identify and assess the risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the project, and will establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts.

20. **Consultation and Participation.** PMU will carry out meaningful consultation¹⁰ with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. The consultation process and its results are to be documented and reflected in the environmental assessment report.

⁶ In case where responsibility is delegated to project contractors during construction phase, PMU shall ensure that the responsibilities on occupational health and safety as described herein are included in the contract documents.

⁷ Including nonemployee workers engaged by PMU through contractors or other intermediaries to work on project sites or perform work directly related to the project's core functions.

⁸ <https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-occupational-health-and-safety-en.pdf>

⁹ <https://www.ilo.org/dyn/normlex/en/f?p=1000%3A12000%3A%3A%3A%3A%3A%3A>

¹⁰ Per ADB SPS, 2009, meaningful consultation means a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

21. **Grievance Redress Mechanism.** PMU will establish a grievance redress mechanism (GRM) to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. The GRM will be scaled to the risks and adverse impacts of the project. As of the ADB loan processing for the project, a GRM meeting both environmental and social safeguard requirements of ADB SPS has been prepared and discussed in detail in the EARF. PMU will officially issue the GRM establishment before loan effectiveness.

22. **Monitoring and Reporting.** The PMU will monitor and measure the effectiveness of mitigation measures and document the implementation of the EMP. If necessary, PMU will identify the necessary corrective actions, and reflect them in a corrective action plan. PMU will prepare and submit to ADB semi-annual environmental monitoring reports that describe progress with implementation of the EMP and compliance issues and corrective actions, if any. Reporting on semi-annual basis will continue until ADB issues a project completion report.

23. The PMU shall ensure that relevant information (whether positive or negative) about environmental safeguard issues is made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation.

24. ADB will post the following safeguard documents on its website:

- (i) EARF before ADB project appraisal;
- (ii) draft IEE upon receipt during the MFF processing stage;
- (iii) updated IEE based on tranche-specific information;^{11, 12}
- (iv) environmental due diligence reports; and
- (v) environmental monitoring reports, including corrective action plan prepared, if any.

25. **Unanticipated Environmental Impacts.** Where unanticipated environmental impacts become apparent during project implementation, to meet ADB SPS requirement on unanticipated impacts, the PMU will update the IEE and EMP, or prepare a new environmental assessment report with EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

B. National Environmental Impact Assessment Regulation

26. **The Enhancement and Conservation of the National Environmental Quality Act (NEQA), B.E. 2535 (1992) [with amendments in The Enhancement and Conservation of the NEQA, B.E. 2561 (2018)].** This Act is the primary law that provides the specific regulations on environmental impact assessment of projects or undertaking in the country. It provides the general guidelines and processes on screening projects based on industry- or activity-specific classifications, preparation of required environmental assessment reports, review and approval process, timelines, etc. The Act also provides the process of public participation of the stakeholders related to a project.

¹¹ The draft IEE will include detailed plan on required updating due to ongoing studies that will not be completed by the time ADB approves the MFF and future studies that will be conducted during implementation.

¹² For each subsequent tranche, if the entire scope of the MFF remains unchanged since the approval of the previous tranche, the safeguard documents covering the entire scope of the MFF are assessed for validity. If valid, the same documents are used; otherwise, the documents are updated.

27. It is important to note that the hydromet component of the project does not fall under the categories of projects or activities specified by the Enhancement and Conservation of the National Environmental Quality Act (NEQA), B.E. 2535 (1992) and its subsequent amendments, nor does it meet the thresholds outlined in the supporting Notifications that would require the preparation of an Environmental Impact Assessment (EIA) or related reports. As such, compliance with NEQA's EIA provisions is not mandatory for this particular component, given its nature and scope that do not trigger the regulatory requirements stipulated for environmental assessment under Thai law.

C. Other National Environmental Laws, Rules and Regulations

28. The legal framework on environmental protection, management of natural resources and public consultation is summarized in Table 1.

Table 1: Other Relevant Laws, Regulations and Standards

Legislations	Description and Relevance to the Project
Environmental Quality	
Constitution of The Kingdom of Thailand 2017(B.E.2560)	The Constitution contains provisions related to the conservation of natural resources. The acquisition of rights and access to natural resources and the environment are important factors in the livelihood of the people. Article 43 stipulates that "individuals and communities have the right to preserve, restore or promote wisdom, art, culture, traditions and fine traditions both locally and nationally. manage, maintain and utilize natural resources, the environment and biodiversity in a balanced and sustainable manner in accordance with the law. In terms of the duties, a person has the duty to cooperate and support the conservation and protection of the environment, natural resource, biodiversity and cultural heritage (Section 4 and Section 50 (8)) while the State has the duty to conserve, protect, maintain, restore, manage, and use or arrange the utilization of natural resources, the environment and biodiversity in a balanced and sustainable manner with the participation of the people and relevant local communities in the implementation and benefit from such activities as prescribed by law (Article 57 (2)). Applicability to the Project. The installation of hydromet monitoring stations will enhance the efficiency of flood water monitoring, providing significant benefits to the people of Thailand. These works aim to improve the collection and management of hydrological and meteorological data, supporting early warning systems and more effective flood response. The implementation of the hydromet installation must align with the conservation and protection of natural resources as mandated by the Constitution.
National Environmental Quality Promotion and Conservation Act B.E.2535 (1992) and its amendments Also referred to as the National Environmental Quality Act (NEQA)	The Act has the objective of encouraging the public and private organizations to participate in promoting and maintaining environmental quality by determining the authority and duties of government departments, state enterprises and local governments to coordinate and participate in environmental protection as well as to formulate pollution control measures, wastewater treatment system, exhaust air treatment system, and clearly define the responsibilities of the polluters.

Legislations	Description and Relevance to the Project
	Environmental Quality Standards. National Environment Board has the power to publish notification prescribing air, noise, vibration and water quality standards (clause 32). For the benefit of environmental quality conservation, the Ministry is authorized to prescribe list of projects which require to prepare environmental impact assessment (clause 48). Environmental Quality Management Planning. The Minister has the power to publish notification prescribing environmental quality management plan and announce in the Government Gazette. Relevant government departments shall carry out their powers and duties to implement the plan. The environmental quality management plan can be classified as a short-term medium-term and long-term plan. The environmental quality management plan consists of work plans for - management of air, water and other environmental quality – pollution control from sources – conservation of natural environment, natural resources - management of the national budget and funds necessary for the implementation of the plan and enactment and issuance of regulations, local ordinances, regulations, orders and notices necessary for the implementation of the plan (Section 36). Conservation and Environmental Protection Areas. Any watershed area or has a natural ecosystem that is different from other areas or has a natural ecosystem that may be destroyed or affected by various activities. or an area of natural or artistic value that deserves to be conserved and the area has not yet been declared as a conservation area. The Minister shall have the power to issue Ministerial Regulation designating the area as an Environmental Protection Area (clause 43). Environmental Impact Assessment. The Minister shall have the power to issue notification specifying any project, undertaking, or operation of the State or which the State will give any person permission to operate, requires preparation of environmental impact assessment report. Rules, procedures, and conditions to prepare environmental impact assessment report shall be prescribed in the Minister's notification. Preparation of environmental impact assessment report for a project, undertaking or operation of the State or which the State will give any person permission to operate, that may seriously impact natural resources, environmental quality, health, sanitary, quality of life or other important interests of people, communities, or environment, an operator or person asking for permission shall assess health impact and hold a public participation in accordance with the rules, procedure, and conditions prescribed in the Minister's notification (clause 48). Effluent Standards from Pollution Sources. The Minister shall have the power to publish notification prescribing emission or effluent standards to control wastewater discharge, air emission or discharge of any wastes or pollutants from point sources to environment (clause 55) . Pollution Control Area. Any area affected by pollution with the tendency to deteriorate health of the public or environmental quality, the National Environment Board shall have the power to publish notification to designate such an area as Pollution Control Area which allows any actions to be taken to reduce, minimize or control pollution (clause 59).

Legislations	Description and Relevance to the Project
	Air, Noise and Water Pollution. The Minister has the power to publish notification to specify point sources subject to emission control in conformity with prescribed emission/effluent standards(clause 68 and 69). Applicability to the Project. The installation of hydromet equipment as part of the project to enhance drainage and improve the flood water conveyance system—by upgrading canal networks from Rama 6 headwork down to the Gulf of Thailand—may result in some impacts to ambient air quality, noise, vibration, waste management, and agricultural activities, including fisheries. However, these impacts are expected to be minimal. Nevertheless, it remains essential that all project activities strictly adhere to the relevant environmental quality standards and requirements established by the National Environmental Quality Promotion and Conservation Act and related policies to ensure proper management and protection of the environment.
Natural Resources	
Water Resources	
Water Resources Act B.E. 2561(2018)	This Act provides allocation, use, development, management, maintenance, restoration and conservation of water resources. Water rights, water use permits, water storage, and management in drought and flood conditions to achieve unity. shall be as prescribed in the Act, except in the case of any law prescribed in relation to the allocation. The use, development, management, maintenance, restoration and conservation of water resources and water rights in particular shall be carried out in accordance with that specific law, as long as it does not contradict or contradict this Act. (clause 3). Water Resources. The state has the power and duty to manage water resources for the benefit of the public in a balanced and sustainable manner. For the benefit of the management of public water resources other than irrigation and groundwater, The Prime Minister may announce in the Government Gazette that any government agency or local government organization is responsible for supervising and maintaining any public water resource. The government agency or the responsible local government organization has the authority to determine the criteria for access to public water resources according to the framework of guidelines set by the National Water Resources Board. However, it must not be rules on water allocation and water use (Section 6). Water Right. Individuals have the right to use or store water as necessary for the benefit of their activities or on their land. without causing trouble or damage to other people who may use the water. This is except for this Act or a Ministerial Regulation, a regulation or a notification issued pursuant to this Act, or any other law as otherwise provided. (clause 7). Water allocation and use. Three types of water use are identified including use for livelihood, household consumption, agriculture or animal husbandry for subsistence household industry, ecosystem preservation, customs, disaster relief. Transportation and the use of a small amount of water, the use of public water resources for

Legislations	Description and Relevance to the Project
	industry, tourism industry, electricity generation, water supply and other businesses, the use of public water resources for large-scale undertakings that use large amounts of water or may cause impacts across river basins or cover a wide area. Criteria of usage shall be in line with the Ministerial Regulations. Drought Management. Prime Minister shall have the power to notify in Royal Gazettes the area with severe drought together with necessary requirements or measures to be undertaken to alleviate the situation (clause 58). Flood Management. The Watershed Committee shall prepare a flood prevention and remediation plan. The plan shall cover normal and emergency conditions and consider the environment, ecosystem and biodiversity in the target area. Applicability to the Project. The installation of hydromet stations will directly contribute to achieving the objectives of this Act. By providing timely and accurate data for monitoring and managing drought and flood conditions in the area, these stations support the effective implementation of Part 5, sections 2 and 3 of the Act.
State Irrigation Act B.E. 2485 (1942) and its amendments	The Act has the objective to control and enhance irrigation service to benefit the public. Maintenance of Irrigation System. The Ministry shall have the power to issue Ministerial regulation on fee collection from water users. The fees shall be collected from users in agricultural and non- agricultural sectors with the rate of 5 Baht/rai/year and 0.50 Baht/m3 respectively (clause 8). It is prohibited to encroach on irrigation waterways, connect or cause leaks in irrigation waterways, dump garbage, sewage, solid waste, or discharge wastewater into irrigation canals (clause 26). The irrigation technician shall be the officer with the authority and duty to control the violation of the said law. If a tree grown on a land of a person encroaches upon the irrigation waterway or cause damage to the irrigation waterway the competent official shall have the power to order the owner of the land to cut down or remove the tree (clause 24). Applicability to the Project. Project activities will be implemented along canals used for flood control and as sources of irrigation water. The improvement of these canals, together with the installation of hydromet stations, represents a positive initiative that directly contributes to the objectives of the Act. By providing timely and accurate data for monitoring and managing drought and flood conditions, hydromet stations enhance the effectiveness of canal improvements, supporting both flood control and irrigation needs. These efforts are aligned with the Act's goals to protect public water resources and ensure sustainable management for the benefit of the community.
Public Health Act B.E. 2535 (1992) and amendment	"Waste" means wastepaper, waste cloth, waste food, waste goods, waste materials, plastic bag, food container, soot, animal dung or carcasses, including any other thing swept away from road,

Legislations	Description and Relevance to the Project
	marketplace, animal farm, or other places, including infectious waste, toxic or hazardous waste from community (clause 4). Waste management under the Act shall not include waste of industrial origin. Sewage and Waste Management. Collecting, hauling or disposing of sewage or waste within the area of any local government shall be the authority of such local government. In carrying out the operations, the local government may do so in conjunction with other government agencies or other local governments under a joint agreement. However, for the benefit of the public, the Minister shall have the authority to issue ministerial regulations, on the advice of the Committee, prescribing criteria, methods, and conditions for the joint operation (clause 18). No person shall engage in the operation of collecting, hauling, or disposing of sewage or waste as a business or for reciprocal benefits, unless a license from the local official is granted (clause 19). The local official shall have authority to prohibit any person from causing a nuisance in a public place or way or private place and to abate nuisances, including watching over, improving, and maintaining roads, land routes, waterways, drainage, trenches, canals, and other places within his/her jurisdiction to be free from nuisances. In this regard, the local official shall have the authority to issue written orders to abate, eliminate, and control nuisances (clause 25,26) Applicability to the Project: During the installation of hydromet stations, contractors may establish temporary work areas or camps, which could generate waste. Contractors are required to comply with the Public Health Act and must coordinate with the local government agency to ensure proper waste collection and disposal.
Forest and Agricultural Land Management	
Health and Safety	
Occupational Safety, Health and Environment Act B.E. 2554 (2011)	The Act is under the jurisdiction of the Ministry of Labor. (i) General Provisions: Employer is obligated to provide and keep an establishment and an employee in safe and hygienic working conditions and environment including to support and promote an operation of the employee preventing the employee from any harm on life, physique, mentality and health (clause 6). (ii) Administration, Management and Operation on Occupational Safety, Health and the Environment: a. Employer is required to administer, manage and operate the occupational safety, health and environment in conformity with the standards prescribed in the ministerial regulation (clause 8). b. An Employer shall provide the Safety Officer, personnel, working unit, or group of persons to operate the safety in establishment according to criteria, methods and terms as prescribed in the ministerial regulation (clause 13). Whereas an employer assigns an employee to work in a working

Legislations	Description and Relevance to the Project
	condition or environment that may be harmful to life, physique, mentality and health of such employee, the employer shall inform the employee of danger which may arise out of work, and shall distribute the work manual to every employee before commencing work, changing work or changing workplace (clause 14), an employer shall provide for and control an employee to wear standard personal protective equipment as stipulated by the director-General (section22). (iii) Control, Supervision and administration: An employer shall (1) conduct hazard assessment; (2) conduct study on impacts of working conditions which have an effect on employee; (3) prepare operation plan on occupational safety, health and environment and supervisory plan for employee and the establishment; and (4) submit results on hazard assessment, impact study, operation plan and supervisory plan under (1), (2) and (3) to the Director-General or a person entrusted by the Director General. Applicability to the Project. The project will involve contractors whose workers and employees need to be protected by virtue of this Act. Contractors will need to comply with all provisions of the Act and ensure the health and safety of all workers and employees.
Ministerial Regulation Prescribing the Standards for Administration and Management of Occupational Safety Health Environment for Construction Work B.E. 2564 (2021)	Construction Work: Construction of all kinds of structures such as buildings, airport, railway, road ,tunnel, waterway, drainage including demolition of those structures (clause 2). Employer shall designate safety supervisor to conduct safety inspection before starting work and during working period (clause 5). Keep the construction area always clean, Nonhazardous waste shall be segregated from hazardous waste (clause 6). To transfer the excavated soil from the construction area, employers shall provide stockage area and implement mitigation measures to control hazard and dispersion of dust (clause 7). Provide suitable safety signs including enforce using PPE (clause 13). Specify danger construction zone together with fencing and signs. Only authorized people are allowed to enter the area(clause 16). Construction in Water: Employer requires employees to prepare work plan including safety management program and inform the employees(clause 59(1)). Prepare emergency response plan and provide rescue equipment as well as PPE to employees(clause 59(2,3)). Applicability to the Project: The project will have employees, workers who will be subject to occupation health and safety risks due to activities and construction works. Therefore, the project

Legislations	Description and Relevance to the Project
	through the contractors shall comply with this regulation to ensure the health and safety of all employees and workers.
Labor Protection Act B.E. 2541 (1998) and amendments	Prohibition of works to women: Mining, construction work carried out underwater, underground or in tunnel except when the working conditions are safe to the employees, working at heights (more than 10 meters), production or transportation of explosive or flammable materials except the working conditions are safe to the employees (clause 38). Prohibition of works to pregnant women: working with vibrating machine, lifting work more than 15 kg, working in vessel, work related to transportation, and work during 22.00 - 6.00 AM (clause 39). Child Labor: Prohibit child labor under 18 years. In case it is necessary to assign work to children under 18 years, employer requires to comply with the procedures (clause 44,45). Child labor under 18 years shall not work during 22.00- 6.00 AM (clause 47) Prohibit assigning works to child labor under 18 years: melting and stamping works, works related to significant level of heat, light, noise and vibration ,hazardous chemicals, toxic microbiological agents, crane controller. Work at height, radioactive work, underwater, underground or in tunnel, cleaning of machine while operating (clause 49) Applicability to the Project: Construction work of the project will require different groups of workers and therefore requires to comply with the Act.

D. Applicable Environmental Standards

29. The government provides the environmental standards applicable to the project. Table 2 below provides a list of the various Thailand national standards including international guidelines. Table 3 and

30. **Table 4** show the ambient air quality standards and noise level standards to be followed by the project. Following requirements of ADB SPS, the project shall apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in EHS Guidelines. When the government regulations differ from these levels and measures, the executing agency shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 2: Key National and International Environmental Standards and Guidelines

Environmental Issue	Thai National Standards	International Guidelines
Ambient air quality	Announcement of National Environment Board No.10 1995 (B.E.2538) "Ambient Air Quality Standards" April 17, 1995 (B.E.2538) Announcement of National Environment Board No.21 2001(B.E.2544) "Ambient Sulfur Dioxide-1	WHO Air Quality Guidelines, global update 2005

Environmental Issue	Thai National Standards	International Guidelines
	Hr Standards" April 9, 2001 (B.E.2544) Announcement of National Environment Board No.24 2004(B.E.2547) "Ambient Air Quality Standards" August 9, 2004 (B.E.2547) Announcement of National Environment Board No.28 2007(B.E.2550) "Ambient Air Quality Standards" April 10, 2007 (B.E.2550) Announcement of National Environment Board No.33 2009(B.E.2552) "Ambient Nitrogen Dioxide Standards" June 17, 2009 (B.E.2552) Announcement of National Environment Board "Particulate Matter with an Aerodynamic Diameter Less Than or Equal to Nominal 2.5 micrometers (PM_{2.5}) Standards" June 23, 2023 (B.E.2565) Announcement of National Environment Board "Ambient Carbon Disulfide Standards" August 21, 2017 (B.E.2560) -Announcement of National Environment Board No.30 2007(B.E.2550) "Ambient Volatile Organic Compounds; VOCs-1-year Standards" September 14, 2007 (B.E.2550)	
Noise	Announcement of National Environment Board No.5 1997 (2540) "Ambient Noise Standards" March 12, 1997 (B.E.2540) Announcement of National Environment Board No.29 2007 (2550) "Nuisance Noise Level" June 29, 2007 (B.E.2550)	WHO Guidelines for Community Noise, 1999
Surface water quality	Announcement of National Environment Board No.8 1994 (2537) "Surface Water Quality Standards" January 20, 1994 (B.E.2537) Announcement of Pollution Control Department "Classification of Water Quality: Bang Pakong River, Nakhon Nayok River and Prachinburi River June 7, 1994 (2537)	US EPA National Recommended Water Quality Criteria Mekong River Commission (MRC) Technical Guidelines for the Protection of Aquatic Life
Effluent quality (including leachate)	Announcement of Ministry of Natural Resources and Environment" Effluent Standards from Industry, Industrial Estate and Industrial Park March 29, 2016 (2559) Announcement of Ministry of Natural Resources and Environment" Effluent Standards from Aquaculture Farming in Coastal Area March 19, 2004(2547) Announcement of Ministry of Natural Resources and Environment" Effluent Standards from Amphidromous fish, shrimp, crab farming May 9, 2007(2550) Announcement of Ministry of Natural Resources and Environment" Effluent Standards from freshwater fish, shrimp, crab farming November 23, 2007(2550)	15F CEHS General Guidelines, April 2007 15F CEHS Guidelines for Water and Sanitation, December 2007 15F CEHS Guidelines for Waste Management Facilities, December 2007 USEPA Effluent Limitations
Soil quality standards	Notification of National Environment Board "Soils Quality Standards" January 6,2021 (2564)	

31. The government provides the environmental standards applicable to the project. Schedule 2 presents the national standards for ambient air quality and Schedule 4 presents the national standards for ambient noise. Following requirements of ADB SPS, the project shall apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the EHS Guidelines. When the government regulations differ from these levels and measures, the executing agency shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS. In view of this, Table 3 and Table 4 show the ambient air quality standards and noise level standards to be followed by the project.

Table 3: Ambient Air Quality Standards

Parameter	Thailand Ambient Air Quality Standard ($\mu\text{g}/\text{m}^3$)^a	WHO Air Quality Guidelines 2021^b ($\mu\text{g}/\text{m}^3$)
PM _{2.5}	37.5 (24-hr)	15
PM ₁₀	120 (24-hr)	45 (24-hr)
	50 (1-yr)	15 (1-yr)
SO ₂	780 (1-hr)	
	300 (24-hr)	40 (24-hr)
	100 (1-yr)	
NO ₂	320 (1-hr)	
		25 (24-hr)
	57 (1-yr)	10 (1-yr)
CO	34.2 (1-hr)	
		4 (24-hr)
Ozone	0.14 mg/m ³	100 (8-hr)
		60 (peak season)

^a National Air Quality Assessment and Management Regulation

^b These are not standards, but are guidance values only. Per WHO, the government may use these guideline values depending on its technical capabilities, economic capacity, air quality management policies and other political and social factors. Although these guidelines are neither standards nor legally binding criteria, they are designed to offer guidance in reducing the health impacts of air pollution based on expert evaluation of current scientific evidence.

Table 4: Ambient Noise Quality Standards

Receptor/ Noise Source	National Noise Standard Guidelines^a [dB (A)]	WHO Guidelines Value For Noise Levels Measured Out of Doors^b (One Hour LAeq in dBA)	
		07:00 – 22:00	22:00 – 07:00
Industrial area	70	70	70
Residential; institutional; educational (as receptor)	70	55	45

^a Notification of National Environment Board No.15 1997 " Ambient Noise Standards" March 12, 1997 (General standard is prescribed on the 24-hour average of 70 dB(A), but maximum noise level at 115 dB(A) at any time.

^b These are not standards, but are guideline values only. WHO. 1999. Guidelines for Community Noise; World Bank Group. 2007. Environmental, Health and Safety General Guidelines. Washington, D.C.

E. International Environmental Agreements

32. Thailand is party to the following international environmental agreements relevant to the project.

Table 5: International Environmental Agreements Relevant to the Project

Convention / Agreement	Key Provisions
United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol	Signed in 1992 as a Non-Annex I party, Thailand ratified it and the Paris Agreement (2016), committing to reduce greenhouse gas emissions by 30–40% by 2030. Recent policy shifts (e.g., 2022 NDC update) show ambition, but vulnerability to climate impacts (e.g., Bangkok's 1.5m elevation) questions adaptation capacity
United Nations Convention to Combat Desertification (UNCCD)	Established in 1994, Thailand is a party, focusing on land degradation. Its involvement in UNCCD COP15 (2025) indicates active participation, though desertification is less critical than flooding or deforestation in its context
International Labour Organization (ILO) Conventions and protocols	Thailand has ratified several ILO conventions and protocols, including: • Forced Labour Convention, 1930 (No. 29): Ratified in 1969, prohibits forced or compulsory labour, with the 2014 Protocol ratified in 2018 to enhance victim protection. • Abolition of Forced Labour Convention, 1957 (No. 105): Ratified in 1969, targets forced labour for economic or political purposes. • Minimum Age Convention, 1973 (No. 138): Ratified in 2004, sets a minimum age for work (15 years, with 13 for light work), addressing child labour. • Worst Forms of Child Labour Convention, 1999 (No. 182): Ratified in 2001, requires action against hazardous child labour, including trafficking and slavery. • Workmen's Compensation (Occupational Diseases) Convention, 1925 (No. 18): Ratified in 1961, covers compensation for work-related diseases. • Workmen's Compensation (Accidents) Convention, 1925 (No. 17): Ratified in 1961, addresses accident compensation. • Hours of Work (Industry) Convention, 1919 (No. 1): Ratified in 1939, limits work hours (48-hour week). • Right of Association (Agriculture) Convention, 1921 (No. 11): Ratified in 1969, protects agricultural workers' association rights. • Medical Examination of Young Persons (Industry) Convention, 1946 (No. 77): Ratified in 1968, mandates health checks for young workers. • Medical Examination of Young Persons (Non-Industrial Occupations) Convention, 1946 (No. 78): Ratified in 1968, extends health checks to non-industrial youth. • Labour Inspection (Commerce and Offices) Convention, 1947 (No. 86): Ratified in 1969, covers commercial inspections. • Social Security (Minimum Standards) Convention, 1952 (No. 102): Ratified in 1996, sets social security baselines. • Employment Injury Benefits Convention, 1964 (No. 121): Ratified in 1996, enhances injury compensation. • Occupational Safety and Health Convention, 1981 (No. 155): Ratified in 2001, promotes workplace safety. • Promotional Framework for Occupational Safety and Health

Convention / Agreement	Key Provisions
	Convention, 2006 (No. 187): Ratified in 2016, strengthens safety frameworks. • Protocol of 2014 to the Forced Labour Convention, 1930: Ratified in 2018, enhances forced labour prevention
The Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, 1995	The Mekong Agreement was established in 1995 by Laos, Thailand, Cambodia, and Vietnam to manage and coordinate the use of the Mekong River's resources. It aims to promote sustainable development, ensure equitable water use, and facilitate cooperation among the member countries. Under the Mekong Agreement, the parties have established five procedures including the Procedures for Notification, Prior Consultation and Agreement, or PNPCA. In accordance with the PNPCA, notification to the Mekong River Commission Secretariat is required for: • Intra-basin use and inter-basin diversion on the tributaries, including Tonle Sap (N/A) • Intra-basin use during the wet season on the mainstream Consultation with the Mekong River Commission Secretariat is required for: • Inter-basin diversion from mainstream during wet season • Intra-basin use on the mainstream during the dry season (relevant) • Inter-basin diversion of the surplus quantity of water during the dry season
Montreal Protocol on Substances that Deplete the Ozone Layer	Acceded to in 1989, Thailand meets obligations to phase out ozone-depleting substances, benefiting from Multilateral Fund support
Stockholm Convention on Persistent Organic Pollutants (POPs) of 17 May 2004	Relevant key provisions of the Convention require each party to: • Prohibit and/or eliminate the production and use, as well as the import and export, of the intentionally produced POPs that are listed annexes to the Convention. • Reduce or eliminate releases from unintentionally produced POPs that are listed in the Convention • Ensure that stockpiles and wastes containing POPs are managed safely.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	To control transboundary movement of hazardous waste before import, export and transshipment to other countries. It is required to provide necessary information in advance. Transshipment cannot be done till having the permit from target government. Key documents that shall be provided include documents relating to Transboundary Movements, Packaging, Labelling, Mode of transport, Financial Guarantee.
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	The objective of this Convention is to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm and to contribute to their environmentally sound use, by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export and by disseminating these decisions to Parties.
Minamata Convention on Mercury	The primary objective of the Minamata Convention is to protect human health and the environment from mercury pollution. Key provisions of the convention include: • Control and Reduction: The convention requires parties to control and reduce mercury emissions and releases across various

Convention / Agreement	Key Provisions
	sectors, including artisanal and small-scale gold mining, industrial processes, and the use of mercury in products. • Life-Cycle Approach: It takes a comprehensive life-cycle approach to mercury management, addressing its entire life cycle from production to disposal. • Prohibition of Certain Products: The convention prohibits the manufacture, import, and export of specific mercury-containing products, such as certain batteries, thermometers, and dental amalgams, with a phase-out timeline. Health and Safety Measures: It emphasizes the need for improved medical care and training for healthcare professionals to identify and treat mercury-related health effects.
International Covenant on Economic, Social and Cultural Rights (ICESCR)	Ratified in 1999, it includes provisions for safe working conditions • All people have the right of self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development. • The States shall recognize the right to work, which includes the right of everyone to the opportunity to gain his living by work which he freely chooses or accepts, and will take appropriate steps to safeguard this right. nomic, social and cultural development. The State shall recognize the right of everyone to the enjoyment of just and favorable conditions of work including fair wages, decent living for themselves and their families, safe and healthy working conditions, equal opportunity for everyone to be promoted in his employment, rest, leisure and reasonable limitation of working hours and periodic holidays with pay, as well as remuneration for public holidays.
ASEAN Agreement on Disaster Management and Emergency Response, 2009	The objective of this Agreement is to provide effective mechanisms to achieve substantial reduction of disaster losses in lives and in the social, economic and environmental assets of the Parties, and to jointly respond to disaster emergencies through concerted national efforts and intensified regional and international co-operation. The Parties shall • co-operate in developing and implementing measures to reduce disaster losses including identification of disaster risk, development of monitoring, assessment and early warning systems, standby arrangements for disaster relief and emergency response, exchange of information and technology, and the provision of mutual assistance; • immediately respond to a disaster occurring within their territory. When the said disaster is likely to cause possible impacts on other Member States, respond promptly to a request for relevant information sought by a Member State or States that are or may be affected by such disasters, with a view to minimizing the consequences; • promptly respond to a request for assistance from an affected Party; and d. take legislative, administrative and other measures as necessary to implement their obligations under this Agreement.

Source: TRTA Consultant, July 2025

III. APPROACH AND METHODOLOGY

33. The approach to environmental due diligence for the installation of hydromet stations focused on conducting targeted site visits to sample stations that had already been installed. This methodology was designed to assess the physical structure, installation techniques, and the immediate environment surrounding each station. By visiting sample stations, including one installed on a bridge parapet and another constructed on the side of a canal with a dedicated bridgeway, the team was able to directly observe the integration of these stations with local infrastructure and evaluate any potential environmental impacts. These site visits enabled the collection of firsthand data on construction quality, accessibility, and the preservation of ecological features in the vicinity.

34. During the site visits, detailed inspections were carried out to confirm the suitability of each location, the safety and stability of the installations, and their compatibility with the surrounding land use. Special attention was given to the structural integrity of the bridge parapet-mounted station and the environmental considerations involved in constructing a bridgeway for canal-side installation. The team also assessed potential risks such as erosion, waterway obstruction, and disturbance to local flora and fauna. This methodological approach ensured that the environmental due diligence process was comprehensive, balancing technical feasibility with ecological stewardship and community concerns.

35. Among the 6 hydromet stations proposed by RID as shown in Table 6, stations 1, 2 and 4 have been visited on 18 November 2025 to confirm their physical structure, size, function and surrounding environment. Detailed information of each station is as follows:

Table 6: Locations of Sample Hydromet Stations Assessed

No.	Code	River	Village	District	Province	Latitude	Longitude	Function	Photos
1	C.35	Chao Phraya	Ban Ban Pom	Phra Nakhon Si Ayutthaya	Phra Nakhon Si Ayutthaya	14.369104	100.528735	• Water Level	
2	C.7A	Chao Phraya	Ban Bang Kaeo	Mueang	Ang Thong	14.590444	100.453289	• Water Level	
3	S.9	Pasak	Ban Pa	Kaeng Khoi	Saraburi	14.629184	101.014437	• Water Level • Flow • Rainfall	

4	S.26	Pasak	Rama VI Barrage	Tha Ruea	Phra Nakhon Si Ayutthaya	14.560117	100.719943	• Water Level • Flow	
5	S.28	Pasak	Pasak Jolasit Dam	Phatthana Nikhom	Lopburi	14.834639	101.084302	• Water Level • Flow • Rainfall	
6	S.43	Pasak	Ban Poonsup	Chai Badan	Lopburi	15.327433	101.212404	• Water Level • Flow	

IV. SITE OBSERVATIONS AND FINDINGS

36. There are two primary methods for installing hydromet stations: mounting them on bridge parapets or rails, or installing them along the canal bank with an adjacent walkway. The preferred approach is to affix the stations directly onto the bridge parapet or rail. In this configuration, the hydromet unit is supported by metallic components, powered by a solar cell system, and protected by a lockable metallic screen. These units are compact, measuring approximately 0.8 x 0.8 meters, and require only on-site assembly since their components are pre-fabricated. Typically, these installations are located away from residential communities to minimize disturbance. Their functions may include monitoring river flow, water level, and rainfall. No pollutant or nuisance is generated during operation.

37. In certain situations where bridge installation is not feasible or where there is no bridge in the area, the hydromet stations are instead positioned on the side of the canal, through a walkway for access. This alternative requires the construction of additional supporting structures to secure the station in place.

38. Both installation types are designed to ensure accurate hydrological monitoring while minimizing environmental and community impacts. See Figure 3.

Figure 2: Locations of Six (6) Sample Existing Hydromet Stations

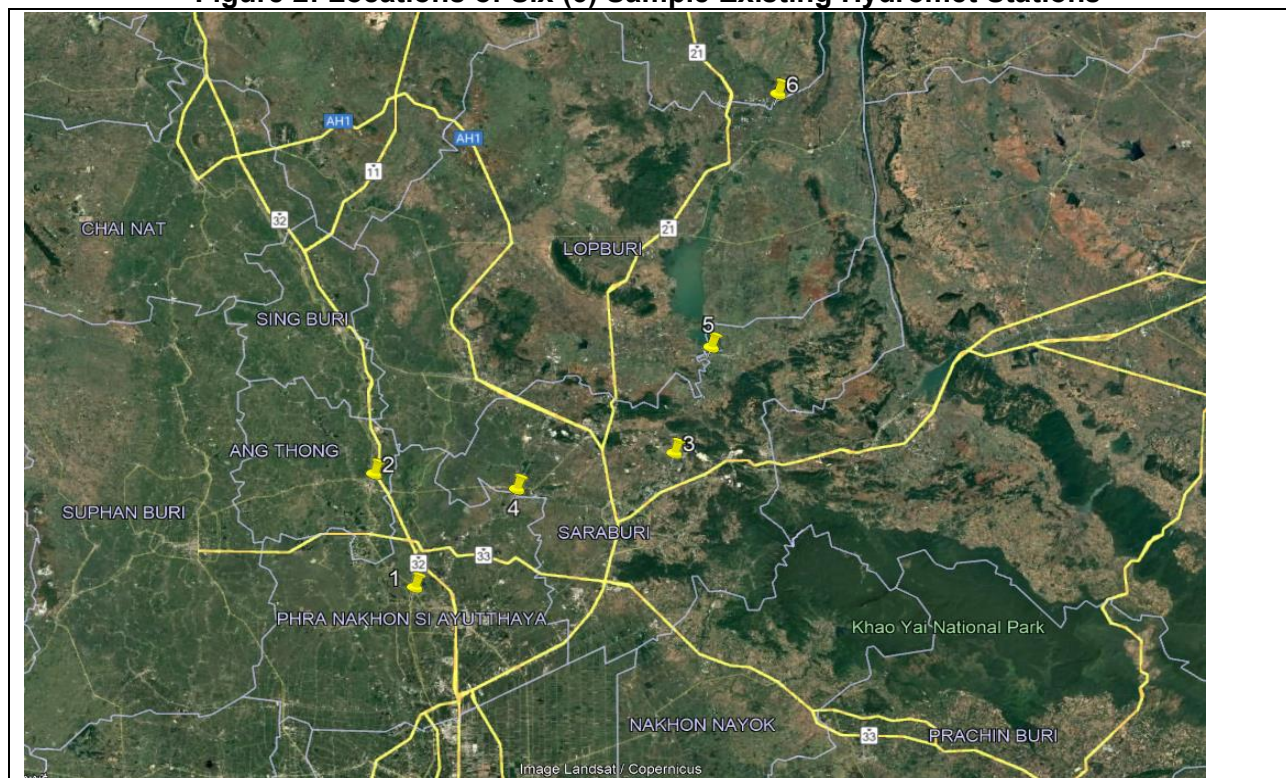


Figure 3: Alternative Type of Installation

V. ANTICIPATED ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

39. Although there are 100 potential installations for hydromet stations in various places in the Chao Phraya river basin, the nature and scale of installation works will be similar. Thus, potential environmental impacts were identified on the basis of the field visits to sample sites. In order to sketch out the potential impacts posed by this project intervention, it was necessary to single out every activity towards the installation of hydromet stations. The significance of potential impacts was assessed using the criteria and methodology given below.

40. **Impact Magnitude.** The potential impacts of any given project can be categorized as major, moderate, minor or negligible based on consideration of the parameters such as: (i) duration of the impact; (ii) spatial extent of the impact; (iii) reversibility; (iv) likelihood; and (v) legal standards and established professional criteria. These magnitude categories are defined in the below table.

Table 7: Parameters for Determining Magnitude

Parameter	Major	Medium/Moderate	Minor	Negligible
Duration of potential impact	Long term (more than 15 years)	Medium Term Lifespan of the project (5 to 15 years)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant

Parameter	Major	Medium/Moderate	Minor	Negligible
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

Source: ADB training module on prediction of impacts and development of site specific EMPs. 2018.

41. **Sensitivity of Receptor.** The sensitivity of a receptor has been determined based on review of the population (including proximity/numbers/vulnerability) and presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity in relation to the topic. Criteria for determining receptor sensitivity on a project's potential impacts are outlined in the following Table.

Table 8: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very Severe	Vulnerable receptor with little or no capacity to absorb proposed changes
Severe	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Mild	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good capacity to absorb proposed changes or/and good opportunities for mitigation

Source: ADB training module on prediction of impacts and development of site specific EMPs. 2018.

42. **Assigning Significance.** Following the determination of impact, magnitude and sensitivity of the receiving environment or potential receptors, the significance of each potential impact has been established using the impact significance matrix shown below in the table.

Table 9: Significance of Impact Criteria

Magnitude of Potential Impact	Sensitivity of Receptors			
	Very Severe	Severe	Mild	Low
Major	Critical	High	Moderate	Negligible
Medium	High	High	Moderate	Negligible
Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Source: ADB training module on prediction of impacts and development of site specific EMPs. 2018.

A. Summary of Impacts

The potential impacts of installing hydromet stations on the key environmental parameters have been assessed and their significance determined using the methodology described above. A summary of the potential impacts of the project on the key environmental parameters and significance of these impacts are presented in the following table.

Table 10: Summary of the Potential Impacts of the Project

Potential Impacts	Duration of Impact	Spatial Extent	Reversible or not	Likelihood	Magnitude	Sensitivity	Significance
Installation Phase							
Siltation and Water Pollution	Short term	Local	Yes	Unlikely	Negligible	Low	Negligible
Waste Disposal	Short term	Local	Yes	Occasional	Minor	Low	Negligible
Community Health and Safety	Short term	Local	Yes	Occasional	Minor	Low	Negligible
Occupational Health and Safety	Short term	Local	Yes	Occasional	Minor	Low	Negligible

B. Discussions of Potential Impacts Identified

43. The assessment of potential impacts associated with the installation of hydromet stations was conducted utilizing the sample Environmental Code of Construction Practice (ECOCP) outlined in the EARF. This evaluation was further substantiated through on-site inspections of existing hydromet stations within the project area. Furthermore, the general mitigation measures proposed in the aforementioned sample ECOCP were examined for their practicality and suitability in the areas of sample hydromet stations visited. Additional mitigation strategies identified during field surveys were incorporated into the existing measures as appropriate. The following sections provide a detailed discussion of these impacts and the corresponding mitigation measures, all of which remain consistent with the provisions of the sample ECOCP in the EARF.

1. Siltation and Water Pollution.

44. **Impact.** The installation of hydromet stations on bridge parapet is unlikely to cause siltation or water pollution because no contact with the surface water will happen at any stage of implementation. However, installation of hydromet stations on riverbanks with the construction of walkway is expected to have impacts, although minor, on soil erosion and vegetation clearing.

45. **Mitigation Measures.** Site preparation involves only minor excavation for foundations, which is localized and shallow, reducing the likelihood of significant soil disturbance. Any potential erosion is temporary and can be effectively managed through simple measures such as the following:

- (i) Stabilize exposed soil and applying erosion control practices;
- (ii) Implement sediment barriers such as silt fences or straw wattles around excavation areas to prevent runoff into the canal;
- (iii) Schedule construction activities during dry weather conditions to minimize the risk of sediment transport into the canals; and
- (iv) Ensure that equipment and materials are stored away from the canals, and promptly cleaning up any accidental spills.

2. Waste Generation and Disposal

46. **Impact.** The installation of hydromet stations is expected to generate impacts related to waste disposal, although considered minor. Construction activities are minimal, involving only small-scale excavation and assembly, which produce limited amounts of non-hazardous waste such as packaging materials, concrete debris, or surplus soil.

47. **Mitigation Measures.** Waste materials can be managed easily through standard disposal practices, including the following:

- (i) Reuse of excavated soil;
- (ii) Segregate wastes upon generation, including recycling of packaging;
- (iii) Properly collect construction residues and dispose following local waste management guidelines;
- (iv) Maintain documentation of waste handling and disposal to demonstrate compliance with local regulations; and
- (v) Implement a “leave no trace” policy at hydromet construction/installation sites.

48. During operation, hydromet stations do not generate ongoing waste streams, as they are passive monitoring structures with no significant consumables or by-products. Consequently, any waste generated is short-term, small in volume, and readily mitigated through routine disposal measures, ensuring that the overall impact on waste management systems remains insignificant.

3. Community Health and Safety

49. **Impact.** The installation of hydromet stations is anticipated to have impacts on community health and safety, although considered minor. Construction activities are small in scale, involving limited excavation and assembly, which pose minimal risks to nearby residents. The stations themselves are passive monitoring structures that do not emit pollutants, noise, or radiation, and therefore do not create hazards for public health.

50. **Mitigation Measures.** Despite the minimal risks, safety considerations during installation shall be observed, such as proper handling of equipment and adherence to standard construction practices, ensure that any risks to the community are effectively managed. Other mitigation measures include:

- (i) Inform local communities in advance about scheduled construction activities to minimize concerns and promote awareness;
- (ii) Implement clear signage and temporary barriers around installation sites to restrict unauthorized access and enhance public safety;
- (iii) Schedule construction work during daylight hours to reduce potential hazards and disturbances to residents;
- (iv) Ensure all equipment and materials are securely stored when not in use to prevent accidents or tampering; and

- (v) Establish an emergency response plan to address any unforeseen incidents promptly and effectively.

51. By incorporating these measures, the project can minimize any risks to community health and safety, ensuring a safe and well-managed construction of installation process for the hydromet stations.

52. The hydromet stations are not connected to grid electricity since they are solar-powered. Once operational, hydromet stations function discreetly, with no ongoing safety concerns, making their presence compatible with maintaining a safe and healthy environment for surrounding communities.

4. Occupational Health and Safety

53. **Impact.** Although there is limited scope and straightforward/simple nature of the required construction activities, the installation of hydromet stations may still pose minimal risks to occupational health and safety. Workers will primarily be subject to minor injuries resulting to mishandling of materials or carelessness at the installation sites.

54. **Mitigation Measures.** Despite the minimal risks, safety considerations shall be observed as well. Workers will be engaged in light excavation, equipment assembly, and minor electrical work, tasks that can be safely managed by following standard safety protocols and using appropriate personal protective equipment (PPE). The implementation of routine training, close site supervision, and adherence to established safe work practices further reduces the likelihood of accidents or injuries, such as slips, trips, or equipment handling incidents. In summary, the contractor shall implement the following:

- (i) Provide comprehensive safety training for all workers prior to commencement of activities, ensuring that personal protective equipment (PPE) such as helmets, gloves, and safety boots are worn at all times;
- (ii) Conducting regular safety briefings to reinforce hazard awareness;
- (iii) Maintain clear communication channels for reporting unsafe conditions or incidents;
- (iv) Provide mandatory water safety training to all workers involved in tasks near water, covering the risks of drowning and safe rescue procedures;
- (v) Ensure that all personnel working within proximity to water are equipped with appropriate personal flotation devices (PFDs) and that these are worn at all times during such activities;
- (vi) Establish clear site boundaries and signage to alert workers to the presence of water hazards;
- (vii) Assign a trained spotter or safety supervisor to monitor water-related work and respond promptly in case of emergencies;
- (viii) Maintain rescue equipment, such as lifebuoys and throw ropes, at accessible locations near the work area;
- (ix) Appoint a dedicated safety officer to oversee compliance with safety protocols and monitor working conditions ensures prompt intervention if risks arise; and
- (x) Develop and communicate emergency response procedures for water-related incidents, including immediate rescue and first-aid protocols.

55. These measures, combined with the previously listed precautions on community health and safety, strengthen the overall safety framework and reduce the likelihood of occupational injuries or health concerns among workers throughout the construction and installation phases.

56. Once the stations are operational, they require little to no ongoing maintenance, which virtually eliminates any long-term occupational hazards, ensuring a safe working environment throughout the project lifecycle.

VI. CONCLUSION

57. The installation of hydromet stations is expected to have negligible environmental impacts due to the small scale and limited nature of the works involved. Site preparation typically requires only minor excavation for foundations and minimal vegetation clearing to ensure sensor exposure, resulting in highly localized and temporary disturbances. Transport and equipment assembly activities are short-term and generate only minor emissions, while the operational phase relies on renewable energy sources such as solar or wind, further reducing any long-term environmental footprint. Waste generation is minimal and confined to packaging materials or end-of-life components, which can be managed through standard disposal and recycling practices.

58. Given the very small physical footprint of each station and the absence of significant or lasting environmental effects, large-scale mitigation measures are not necessary. Basic precautions—such as careful site selection, erosion control during installation, and proper waste handling—are sufficient to address the limited impacts. Overall, the project is environmentally sustainable, with negligible adverse consequences and substantial long-term benefits for climate monitoring, water resource management, and disaster preparedness. This assessment concludes that the installation of hydromet stations can proceed with confidence, requiring only routine environmental safeguards rather than extensive mitigation programs.

59. Summary of significance of impacts before and after minor mitigation measures are applied is in the following table.

Table 11: Summary of Significance of Impacts Before and After Mitigation Measures

Impact Area	During Installation Phase	During Operational Phase	Significance After Mitigation
Siltation and Water Pollution	Low, localized and temporary	None	Negligible
Waste Disposal	Low, localized and temporary	None	Negligible
Community Health and Safety	Low, localized and temporary	None	Negligible
Occupational Health and Safety	Low, localized and temporary	None	Negligible

VII. RECOMMENDATIONS

60. Although the anticipated impacts from the installation of hydromet stations are considered minor, it remains essential to proactively address any potential risks. It is recommended that the mitigation measures discussed above be included in contractors' contracts to ensure the installation works adhere to best practices. By including these requirements in the contracts, RID can better monitor compliance and hold contractors accountable for implementing the specified safeguards. This approach helps to minimize disruptions, maintain a safe working environment, and protect surrounding communities, even in instances where risks are low and temporary.

61. Consistent with the ECOCP in the EARF, the following mitigation measures should be included in the contract of contractor (hydromet stations):

Table 12: Mitigation Measures for Hydromet Installation Activities

Project Activity / Field	Impacts	Avoidance/Mitigation Measures	Responsibility	
			Implementation	Monitoring
Siltation and water pollution	The installation of hydromet stations on riverbanks is expected to have impacts, although minor, on soil erosion and vegetation clearing.	• Stabilize exposed soil and applying erosion control practices; • Implement sediment barriers such as silt fences or straw wattles around excavation areas to prevent runoff into the canal; • Schedule construction activities during dry weather conditions to minimize the risk of sediment transport into the canals; and • Ensure that equipment and materials are stored away from the canals, and promptly cleaning up any accidental spills.	Contractor	PIU
Waste Generation and Disposal	The installation of hydromet stations is expected to generate impacts related to waste disposal, although considered minor. Construction activities are minimal, involving only small-scale excavation and assembly, which produce limited amounts of non-hazardous waste such as packaging materials, concrete debris, or surplus	• Reuse of excavated soil; • Segregate wastes upon generation, including recycling of packaging; • Properly collect construction residues and dispose following local waste management guidelines; • Maintain documentation of waste handling and disposal to demonstrate compliance with local regulations; and • Implement a "leave no trace" policy at hydromet construction/installation sites. •	Contractor	PIU

Project Activity / Field	Impacts	Avoidance/Mitigation Measures	Responsibility	
			Implementation	Monitoring
	soil.			
Community health and safety	Construction activities are small in scale, involving limited excavation and assembly, but may still have risks to nearby residents.	• Proper handling of equipment and adherence to standard construction practices; • Inform local communities in advance about scheduled construction activities to minimize concerns and promote awareness; • Implement clear signage and temporary barriers around installation sites to restrict unauthorized access and enhance public safety; • Schedule construction work during daylight hours to reduce potential hazards and disturbances to residents; • Ensure all equipment and materials are securely stored when not in use to prevent accidents or tampering; and • Establish an emergency response plan to address any unforeseen incidents promptly and effectively.	Contractor	PIU
Occupational Health and Safety	Although minor, the construction will have risks to occupational health and safety due to construction activities.	• Provide comprehensive safety training for all workers prior to commencement of activities, ensuring that personal protective equipment (PPE) such as helmets, gloves, and safety boots are worn at all times; • Conducting regular safety briefings to reinforce hazard awareness; • Maintain clear communication channels for reporting unsafe conditions or incidents; • Provide mandatory water safety training to all workers involved in tasks near water, covering the risks of drowning and safe rescue procedures; • Ensure that all personnel working within proximity to water are equipped with appropriate personal flotation	Contractor	PIU

Project Activity / Field	Impacts	Avoidance/Mitigation Measures	Responsibility	
			Implementation	Monitoring
		devices (PFDs) and that these are worn at all times during such activities; • Establish clear site boundaries and signage to alert workers to the presence of water hazards; • Assign a trained spotter or safety supervisor to monitor water-related work and respond promptly in case of emergencies; • Maintain rescue equipment, such as lifebuoys and throw ropes, at accessible locations near the work area; • Appoint a dedicated safety officer to oversee compliance with safety protocols and monitor working conditions ensures prompt intervention if risks arise; and • Develop and communicate emergency response procedures for water-related incidents, including immediate rescue and first-aid protocols.		