HA TINH PROVINCIAL PEOPLE'S COMMITTEE
HA TINH PROJECT MANAGEMENT UNIT OF CONSTRUCTION INVESTMENT WORKS FOR AGRICULTURE AND RURAL DEVELOPMENT
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ENVIRONMENTAL AND SOCIAL IMPACT ASESSMENT (ESIA)

Subproject 1: Dam Rehabilitation and Safety Improvement Project - Ha Tinh province
Dam Rehabilitation and Safety Improvement Project (WB8)

Ha Tinh, September 2018

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ENVIRONMENTAL AND SOCIAL IMPACT ASESSMENT (ESIA)

Subproject 1: Dam Rehabilitation and Safety Improvement Project - Ha Tinh province
Dam Rehabilitation and Safety Improvement Project (WB8)

PROJECT OWNER	CONSULTANT AGENCY
Ha Tinh Agriculture and Rural Development Investment and Construction Project Management Unit	**Joint-venture of Institute for Water and Environment and Ha Tinh Center for Environmental Monitoring and Engineering**

Ha Tinh, September 2018

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ABBREVIATIONS

AH	Affected Household
CPC	People's committee of Commune
CPO	Central Project Office (MARD)
CSC	Construction Supervision Consultant
DARD	Department of Agriculture and Rural Development (province level)
DoNRE	Department Of Natural Resources and Environment (province level)
DPC	District People's Committees
DRSIP	Dam rehabilitation and safety improvement project
DSR	Dam Safety Report
ECOP	Environmental codes of practice
EPP	Emergency Preparedness Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMF	Environmental and Social Management Framework
IMC	Irrigation Management Company
IPM	Integrated Pest management
LEP	Law on Environmental Protection of Vietnam
LURCs	Land User right committe
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
ODA	Official Development Assistance
OP/BP	Operational Policy/Bank Procedures
PMU	Project management Unit
PPMU	Provincial Project Management Unit
RAP	Resettlement Action Plan
SA	Social assessment
SS	Suspended solid
UXO	Unexploded Ordnance
VND	Vietnam currency (dong)
WB	World Bank

EXECUTIVE SUMMARY

1. Background: The Subproject 1 "Dam Rehabilitation and Safety Improvement Project - Ha Tinh province" is one of the proposed subprojects under the World Bank's DRSIP Project. The objectives of the subproject: (i) rehabilitating and improving safety of 08 reservoirs in the Subproject 1 including: Loi Dong, Da Den, Nuoc Xanh, Khe De, Khe Co, Khe Nhay, Ba Khe and Dap Buom; (ii) ensuring the safety and stability of headworks to protect the downstream population areas as well as their properties (iii) in accordance with objectives of the National dam safety program. The Environmental and Social Impact Assessment (ESIA) was prepared for the subproject in compliance with the World Bank's Environmental Safeguard Policy (OP/BP4.01) requirements and the Law on Environmental Protection of Vietnam (LEP-2014) and relevant provisions, legal frameworks. Total estimated cost of the Subproject 1 is **VND 227,011,822,000**.

2. Location of Subproject 1- Repair and improvement for safety of dams in Ha Tinh province has 8 works which are distributed in following communes and districts: Ky Trinh, Ky Phong, Ky Bac commune in Ky Anh district (3 works); Son Le, Son Tien, Son Mai commune in Huong Son district (3 works), Huong Tho commune in Vu Quang district (1 work) and Ngoc Son commune in Thach Ha district (1 work).

3. Current status of the subproject: All reservoirs had been built for long time ago, i.e. during 1966 - 1978. Over many years of use, these earthen dams have been severely degraded: dam seepage flows through the dam body and foundation, upstream slopes eroded, downstream slope is covered by bushes and permeated causing swamps; valves of the outlet works have been damaged with many leaks; the spillways became narrower and are significantly eroded. These works are not safe anymore and cannot ensure flood drainage capacity.

4. Description of the subproject activities: The proposed activities in the subproject: (i) Reinforcing dam crest (main and auxiliary dams) with concrete; expanding dam surface, upgrading upstream and downstream slopes and lining dam surface; building downstream drain trench; installing permeability monitoring equipment system; (ii) Constructing 7 new outlet works, excepting for the outlet of Khe Co reservoir, to ensure irrigation water supply for the downstream areas; (iii) Repairing/building new spillways and expanding spillway surface; (iv) Repairing and upgrading 4 construction routes and management roads with the total length of 4,220.36 m; (v) building ancillary works: a diversion canal after the new outlet of Dap Buom reservoir.

5. Environmental and social screening: Based on the social and environmental screening results, the subproject is classified as Category B as per OP 4.01 policy (Environmental Assessment). The subproject includes both large and small dams and therefore as per OP 4.37 (Dams Safety) the subproject has prepared a Dam Safety Report (DSR) and which have been submitted to the PoE for review and monitoring. In addition, safeguard instruments such as Resettlement Action Plan, Social Impact Assessment, Environmental and Social Impact Assessment/ Environmental and Social Management Plan have been prepared.

6. Policy, legal and administrative framework

National laws and regulations applied in the subproject: Environmental Protection Law No. 55/2014/QH13 dated June 23, 2014, Decree No. 18/2015/ND-CP issued on Feb 14, 2015 on Environmental Protection Planning, SEA, EIA and Environmental Protection Plans (EPP), Circular No. 27/2015/TT-BTNMT dated May 29, 2015 on SEA, EIA and EPP, and other relevant laws, regulations and standards.

The following World Bank's safeguard policies have been followed: Environmental Assessment (OP/BP 4.01), Pest management (OP 4.09), Physical Cultural Resources (OP/BP 4.11), Involuntary Resettlement (OP/BP 4.12), and Safety of Dams (OP/BP 4.37).

7. Potential Environmental and Social Impacts:

Positive impacts: Generally, the project will bring in significant long-term benefits to the community, particularly a stable irrigation supply to cultivation areas. Dam and reservoir safety will be improved as a result of dam and spillway rehabilitation and safety of downstream population will be ensured. Dam management will be more convenient since management roads are upgraded.

Negative impacts:

Pre-construction phase: Loss of lands and crops - The subproject implementation will directly affect 71,917m^2 of all kinds of lands of 67 households and 9 CPCs, including 2 housess in Ky Thinh ward who are affected and relocated in the sub-project of Loi Dong reservoir. Besides, subproject implementation process will also affect plants of 21 households who are growing crops on land of CPCs; temporarily affects are also found on 18,500m^2 of public land managed by the 9 CPCs.

Construction phase: General impacts due to construction activities such as dust, noise, vibration, waste, waste water, increased traffic and social impacts due to the influx of labours, impacts relating to risks and accidents may affect health of local population, workers and environment. Besides, site-specific impacts can be disruption of irrigation water supply due to lowering of water level in reservoirs for construction activities (low level impacts), risks of incidents as construction activities take place under the corridor of 500KV transmission line (moderate level), dust, noise can affect Ky Bac primary school and Huu Lac pagoda.

The subproject is expected not to cause significant adverse impacts given its location, type and scale. Negative impacts are considered as low to moderate levels.

Negative impacts during the operation phase of the subproject will be long-term ones such as risk of emergency flood discharge in flood season without timely prior-notice to the downstream area; disruption of irrigation water supply due to lowering water level for repair and maintenance (low level). Environmental pollution due to production development – the stably irrigated agricultural production area will increase by 69 ha of winter-spring crop (from 1,115 ha to 1,184 ha) and 109 ha of summer-autumn crop (from 1,055 ha to 1,164 ha). As the irrigation area is expanded, the amount of agricultural chemicals will increase and risks of soil and water pollution in the area will rise accordingly;

8. Mitigation measures: *Pre-construction phase and construction phase:* Land acquisition impacts will be mitigated through RAP while construction-related impacts will be mitigated through application of ECOP, ESMP and site-specific mitigation measures. The total

compensation and resettlement support cost is **VND 2,275,354,800** (equivalent to **$100,235.89**). *Operation phase:* Emergency preparedness plan (EPP) has been prepared for emergency flood discharge risks. Monitoring and supervision should be regularly carried out by the management unit to ensure that all of structural damages will be timely detected and repaired. Integrated pest management program will be prepared to provide mitigation tools for pesticide management;

9. Institutional arrangements: Ha Tinh PPMU under the Ha Tinh DARD will be responsible for implementation and monitoring of the ESIA. The PPMU shall ensure that bidding documents and contracts duly include environmental covenants for contractors' compliance. The contractors shall undertake construction activities and comply with agreed environmental covenants in the contract. Particularly, the contractor will prepare contractor's ESMP for review and approval by PPMU before commencing construction. The PPMU and its consultants will closely supervise contractor's compliance with agreed mitigation measures. In addition, contractor's compliance will be closely supervised by Ha Tinh DONRE, local authorities and people.

Capacity building: During implementation process, PPMU will receive support from CPMU on environmental safeguard policy compliance of the WB. PPMU safeguard staffs participated in training courses held by CPMU in coordination with WB experts to provide guidance on compliance with environmental safeguard requirements of the project, including OP4.01 (Environmental Assessment), Environmental, Health, and Safety Guidelines (EHS) of IFC, OP4.04 (Natural Habitats), OP4.10 (Indigenous peoples) and OP4.12 (Involuntary Resettlement), etc. During the project implementation, training and capacity building on environmental safeguard policy for Construction supervision consultant (CSC) and EHS staff of the contractor will be regularly carried out to update the latest requirements on compliance of environmental safeguard policy. During the subproject implementation process, the PPMU will be regularly supported by independent consultants and technical assistance consultant of CPMU on the Bank's policies on dam safety risks management and ESMP monitoring. Various stakeholders of the Subproject, including environmental safeguard staff of PPMU, construction supervision consultant, safeguard staff of contractors, local community shall take part in short training courses (1-2 days) to improve their capacity for the implementation of environmental and social management plan and dam safety skills. Estimated cost for training program is of VND 480,000,000.

10. Cost estimates for ESMP implementation: The total implementation cost of Environmental and Social Management Plan is **VND 1,870,279,200**.

11. Grievance Redress Mechanism (GRM): Complaints relating to any subproject's problems will be solved through negotiations to achieve the consensus. A complaint will go through three stages before being transferred to the court. The enforcement unit will pay all administrative and legal fees relating to the acceptance of complaints. This cost is included in the subproject budget.

12. Public consultation: The Consultant and subproject owner organized two community consultation rounds; the 1st round was conducted during 4-8 September 2017 in CPCs in the subproject area. Participants are representatives of local authorities, social unions and mass organizations and representatives of affected households in the sub-project area. The

consultations were to share information on the subproject and potential environmental and social impacts. Total number of participants was 218 people, including 20% as female. The second consultation round relating to the mitigation measures took place during 18-20 September 2017 at the headquarters of CPCs and total participants were 214 (21% of participants are female). Participants are CPCs staff, village party secretary, village heads/vice heads and all affected households. Consultation meetings were held to get consensus on the implementation of the Sub-project and to inform negative impacts of the subproject and mitigation measures to communities.

13. Information Disclosure: In compliance with OP/BP 4.01 and the Bank policy on access to information, for the meaningful consultation, the subproject owner sent the subproject description, objectives, and potential impacts and draft ESIA to the affected groups and social organizations prior to public consultations. The final ESIA will be disclosed on the project's website and subproject sites accessible to locally-affected people and local NGOs in Vietnamese language and on the Bank's external website in English before subproject appraisal.

CHAPTER I. INTRODUCTION

1.1. Background of the project

The Vietnam Dam Rehabilitation and Safety Improvement Project (DRSIP) is a World Bank assisted project which aims to support implementation of Vietnam's National Dam Safety Program. The project development objective is to improve the safety of targeted irrigation dams under the Government's Dam Safety Program to protect downstream communities and economic activities through priority investments and capacity building. The project provides an optimal mix of structural and non-structural measures designed to improve safety of dams and auxiliary works**.** Structural measures include repair and improvement of safety of existing dams and appurtenant structures, including safety monitoring equipment. Non-structural interventions have been proposed to support a range of institutional and regulatory measures, as well as pilot specific basin level measures.

The preliminary list of 450 irrigation dams of 34 provinces have been identified through an iterative and consultative prioritization process with national and provincial authorities.

The project consists of 3 components, as follows:

Component 1- Dam safety rehabilitation:

This component will be implemented through MARD and the Provinces with the aim of improving the safety of irrigation dams through physical rehabilitation of existing infrastructure. The implementation includes two different approaches required for the rehabilitation of small community-managed and large dams. The difference between the two approaches relates not only to the types of works and the regulatory framework involved, but also the institutional and implementation arrangements required to undertake such works and ensure their sustainable operations and maintenance. The activities would include: (i) detailed engineering design, safeguards policies documents, supervision and quality control of rehabilitation works and associated safeguards compliance for prioritized dams and associated infrastructure; (ii) rehabilitation works, including civil works, hydro-mechanical works and installation of hydrological and safety monitoring equipment and devices; (iii) preparation of Operation and Maintenance Plans, Instrumentation Plans and Emergency Preparedness Plans; (iv) flood discharge assessments for large dams to confirm the adequacy of spillway discharge capacity; and (v) monitoring and evaluation. Financing under this component would be used for consulting services, works, goods and non-consulting services.

Component 2 - Dam safety management and planning

This component will be implemented through MARD, MOIT and MONRE with the aim of improving the planning and operational framework for dam management to safeguard the downstream communities and socio-economic infrastructure. Three common and mutually reinforcing sub-components are envisaged, involving all three participating Ministries including: (i) technical services and strategic studies; (ii) institutional, legal and regulatory improvements; and (iii) capacity enhancement and professional development. Financing under this component will support consultant services, works and goods, equipment and non-consulting services.

Activities under MOIT: (i) hydropower dam and reservoir database for safety operations; (ii) the development and piloting of hydropower dam safety methodology with internationally-accepted safety indicators; (iii) the development of legal and institutional standards norms and regulations for hydropower dams; (iv) the provision of technical assistance to support the Project activities carried out by MOIT; and, (v) improvement of the monitoring capacity of MOIT's safety management department.

MONRE's activities : (i) the installation and rehabilitation of hydromet stations the Vu Gia-Thu Bon river and Ca river basins; (ii) the provision of equipment for the operation of cascade dams in, and disaster forecasting and early warning for, the Vu Gia-Thu Bon and Ca river basins; (iii) the development of an information database for monitoring dam operations; and, (iv) the provision of technical assistance to support the Project activities carried out by MONRE; and, (v) improvement of MONREs capacity to monitor implementation of the joint operating rules for cascade dams.

MARD's activities: (i) the provision of monitoring and support equipment for disaster risk management by the Department of Water Resources Directorate; (ii) the development of a dam/reservoir database; (iii) the preparation of provincial disaster risk management plans for selected provinces; (iv) the development of legal, institutional and financial models for sustainable dam safety management; (v) the adoption of a standardized operational procedures for small community-managed dams; (vi) the provision of technical assistance to support the Project activities carried out by MARD; (vii) training, capacity building and information dissemination and awareness activities on dam safety; (viii) the study of new dam rehabilitation and safety management technologies; and, (ix) improvement of the monitoring capacity within MARD; and, monitoring and evaluation.

Component 3- Project management support

This component will provide the necessary enabling environment to support project implementation. This will include support for the following: (i)High Level Working Group(HLWG) composed of MARD, MoIT and MoNRE, along with other relevant Government agencies, to coordinate and oversee all project interventions; (ii) Project Management Units (PMU) within MARDand the Provinces to provide the necessary supporting services for timely and effective project implementation, including monitoring and evaluation, procurement, financial management, safeguard monitoring, etc.; (iii)a Project Implementation Consultant to provide Technical Assistance for Engineering and Quality Assurance; (iv) a Project Implementation Consultant to provide Environmental and Social support; (v) an independent international Panel of Experts (POE); (vi)establishment and operations of a National Dam Safety Review Panel; (vii) Technical Assistance for beneficiary departments within MARD, MoIT and MoNRE to provide supporting services for timely and effective project implementation; and (viii) an Independent Supervision Consultant, or Third Party Monitor, for monitoring and quality control. Financing under this component willbe used for consulting services, goods, equipment, non-consulting services, and incremental operating costs associated with project implementation, management and monitoring.

1.2. Background of the Sub-project

The “Dam Rehabilitation and Safety Improvement Subproject - Ha Tinh province” is one of the subprojects of the Dam Rehabilitation and Safety Improvement Project financed by the World Bank in phase 2. The six-year DRSIP project aims to support the National Dam Safety Program. There are 8 reservoirs under Sub-project 1 "Dam Rehabilitation and Safety Improvement Project - Ha Tinh province" which will be built from the WB loan and a part from the Vietnam Government's counterpart fund. Environmental and Social Impact Assessment is a part of the World Bank's request for approval of project supports, including Subproject 1.

Eight (8) reservoirs to be repaired and upgraded to improve dam's safety in Sub-project 1 are: Loi Dong Reservoir (Ky Trinh ward, Ky Anh district), Nuoc Xanh Reservoir (Ky Phong commune, Ky Anh district), Ba Khe Reservoir (Ky Bac commune, Ky Anh district), Dap Buom Reservoir (Huong Tho commune, Vu Quang district), Khe Co Reservoir (Son Le commune, Huong Son district), Khe Nhay Reservoir Son district, Son Mai commune, Huong Son district, Khe De Reservoir (Son Mai commune, Huong Son district) and Da Den Reservoir (Ngoc Son commune, Thach Ha district).

The Environmental and Social Impact Assessment was prepared in accordance with the guidelines and requirements of the World Bank's Policy on Environmental Assessment (OP/BP 4.01) and complied with provisions of the current Law on Environmental Protection of Vietnam (LEP).

1.3. Objectives and evaluation methods for environmental and social impact assessment

Objectives

- As prescribed in approved ESMF, ESIA is a safety instrument required for the subproject. The ESIA for the subproject 01 has been prepared based on guidelines from approved ESMF for the whole project. The overall objective is to carry out the Environmental and Social assessments of a specific subproject, including the preparation of necessary tools for improving dam safety to meet requirements of the GoV and the World Bank.
- The specific objectives of the Environmental and Social Impact Assessment Report include: (i) assess Environmental and Social Impacts caused by rehabilitation of headworks of 8 reservoirs in the Subproject; (ii) Develop an Environmental and Social Management Plan (ESMP) including compliance monitoring and reporting mechanism; (iii) Create communication channels that allow local communities to participate in decision-making process.

Scope of environmental and social impact assessment: The area affected by the Sub-project consists of 2 sub-areas:

(i) Construction and repairs of headwork including upgrading of dams, spillway, outlet works, management road, borrow pits, stockpiles, machineries, dumpsites, tents and camps, including the borders affected by water level of reservoirs and downstream canals.

(ii) Beneficiary and/or affected areas by the subproject, including Ky Trinh, Ky Phong, Ky Bac communes (Ky Anh district) and Huong Tho commune (Vu Quang district), Son Le, Son Tien and Son Mai communes (Huong Son district and Ngoc Son (Thach Ha district).

Environmental and Social Impact Assessment Method: Data and information were collected by combining secondary data and data from field surveys, including field surveys, data collection and analysis of environmental samples.

- *Field surveying method:* Prepare questionnaire forms; organize survey groups and carry out surveys of current natural and socio-economic development conditions of the Sub-project area, locations of major works, auxiliary works; environmental status, affected targets, the scope of impacts for the environmental and social impact assessment
- *Sociological survey Method:* The household socio-economic survey was conducted in 9 communes in the sub-project area with a total of 195 households or 817 people (who are directly, indirectly affected and beneficiaries in the Sub-project area) in Ky Trinh, Ky Phong, Ky Bac (Ky Anh district) and Huong Tho commune (Vu Quang district), Son Le, Son Tien, Son Mai, (Huong Son district), Ngoc Son commune (Thach Ha) district.
- *Statistical methods:* collecting, processing and analyzing: (i) meteorological, hydrological and environmental data in many years in the project area; (ii) Socio-economic and gender data and reports in 3 consecutive years in Ky Trinh, Ky Phong, Ky Bac communes (Ky Anh district) and Huong Tho commune (Vu Quang district), Son Le, Son communes Tien, Son Mai (Huong Son district), Ngoc Son (Thach Ha district).
- *Reference method:* Use the results of relevant projects/researches
- *Expert Method:* The Consultant held meetings and participatied in meetings and consultations to get feedbacks on proposed measures for mitigating negative environmental impacts among such experts as Agriculture, Water Resources, Irrigation, Sociology, Resettlement, Dam Safety and Gender Development.
- *Synthesizing, analyzing data and formulating reports:* Analyzing and synthesizing the project impacts on components of natural and socio-economic environment in the project area.
- *Rapid assessment method:* Use pollution coefficients of World Health Organization (WHO) in the estimation of emissions and prediction of pollution.
- *Comparison method:* Assess impacts by comparing against land, air, noise, environmental and water quality criteria and standards.

During the preparation of the Environmental and Social Impact Assessment Report (ESIA), community and stakeholder consultations were conducted. Consultations provided additional contents which will be addressed in the Environmental and Social Impact Assessment Report.

1.4. The subproject owner and investment capital

The subproject owner: Ha Tinh Agriculture and Rural Development Investment and Construction Project Management Unit (PMU)

Address: Floor 5, Building of DARD, No. 04 Xo Viet Nghe Tinh street, Ha Tinh city, Ha Tinh province

Tel: 0239.3891859 Fax: 0239.3891859

Email: banqldadtxdctnnptntht@gmail.com

Director: Nguyen Ba Duc.

Total investment capital:

Total investment capital for the implementation of Sub-project 1: VND **227,011,822,000** including Environmental and Social Management Plan: VND 1,870,270,200 and mentioned in other cost as per Table 1.1

The implementation budget of the Subproject 1 is shown in **Table 1.1 and Table 1.2**:

Table 1 - 1: **Total investment capital of the subproject**

Unit: VND

No.	*Items*	*Capital*
1	Construction cost	167,990,934,000
2	Project mangement cost	2,682,955,000
3	Construction Consulting cost	24,798,758,000
4	Site clearance and compensation cost	2,000,000,000
5	Other costs	18,901,736,000
6	contingency cost	20,637,439,000
	Total investment capital	**227,011,822,000**

Table 1 - 2: Construction cost of each work in the Sub-project 1

Unit: VND

No.	*Reservoir*	*Location*	*Construction cost*
1	Loi Dong	Ky Trinh Ward, Ky Anh District	19,777,814,000
2	Nuoc Xanh	Ky Phong commune, Ky Anh District	34,108,213,000
3	Ba Khe	Ky Bac commune, Ky Anh District	23,969,247,000
4	Dap Buom	Huong Tho commune, Vu Quang District	20,847,570,000
5	Khe Co	Son Le commune, Huong Son District	29,416,291,000
6	Khe Nhay	Son Tien commune, Huong Son District	9,706,825,250
7	Khe De	Son Mai commune, Huong Son District	18,467,893,105
8	Da Den	Ngoc Son commune, Thach Ha District	11,697,080,353
Total :			**167,990,934,000**

1.5. Consultant firm

Name of Consultant firm: Joint-venture of Institute of Water and Environment and Ha Tinh Center for Environmental Monitoring and Engineering.

- Joint-venture Lead Firm: Institute of Water and Environment

- Address: No. 2, Alley 165 - Chua Boc District
- Representative: Assoc.Prof.Dr. Nguyen Tung Phong
- Title: Director
- Tel: 043.5634809; Fax: 043.5634809
- Email: iwe.vietnam@gmail.com

● Joint-venture Firm: Ha Tinh Center for Environmental Monitoring and Engineering

- Address: No. 01, Vo Liem Son, Ha Tinh city, Ha Tinh Province
- Representative: Le Anh Duc
- Title: Director
- Tel: 0239.3690809-3690677 Fax: 0239.3690677
- Email: ttqtktmt.stnmt@hatinh.gov.vn

List of Consultant members involving in the preparation of Environmental and Social Impact Assessment reports is presented in **Appendix 6.**

CHAPTER II. SUB-PROJECT DESCRIPTION

2.1. Overview of the sub-project

Name of the Sub-project 01: Repair and improvement for safety of dams in Ha Tinh province

Subproject 1- Repair and improvement for safety of dams in Ha Tinh province consist of 8 works and distributed in following districts: Ky Anh, 03 works; Huong Son 03 works; Vu Quang: 01 work and Thach Ha 01 work.

According to its investment report, the objectives of rehabilitation and improvement of the safety of 8 reservoirs in the Subproject 1 are as follows: (1) Ensure reservoir safety and protect residential areas and infrastructure in downstream; (2) Ensure irrigation water supply for cultivated lands; (3) Ensure flood safety in the downstream and contribute to forest fire prevention and control; and (4) Restore ecological landscape in the subproject area.

Sub-project location:

Locations of hydraulic works in the Sub-project 1 are listed in **Table 2.1 and Fig. 2.1**.

Table 2 – 1: **Locations and Technical parameters of works under Sub-project 1**

No.	*Reservoir*	*Locations*	*Type of dam*	*Technical parameter*				
				F catchment (km^2)	*W (million m^3)*	*F irrigation (ha)*	*Main dam*	
							H_{max} (m)	*L (m)*
1	Loi Dong Reservoir	Ky Trinh Ward, Ky Anh District	Earthen dam	1.15	0.421	49	12	793
2	Nuoc Xanh Reservoir	Ky Phong Commune, Ky Anh District	Earthen dam	1.9	1.61	144	11	1800
3	Ba Khe Reservoir	Ky Bac commune, Ky Anh District	Earthen dam	4.17	1.017	131	12	805
4	Dap Buom Reservoir	Huong Tho Commune, Vu Quang District	Earthen dam	4.25	0.301	60	9	88
5	Khe Co Reservoir	Son Le commune, Huong Son District	Earthen dam	8.04	4.605	560	22	90.7
6	Khe Nhay Reservoir	Son Tien commune, Huong Son district	Earthen dam	0.6	0.408	59	8	222
7	Khe De Reservoir	Son Mai commune, Huong Son	Earthen dam	2.5	2.158	180	12.5	237
8	Da Den Reservoir	Ngoc Son commune, Thach Ha district	Earthen dam	0.75	0.64	54	11.0	153

i) Geographical location of Loi Dong Reservoir

The Loi Dong Reservoir is located in Ky Trinh Ward, Ky Anh Town, Ha Tinh Province. Loi Dong reservoir is located on the road to thermal power plant, 2.5 km to the south from Hoa

Loc Bridge. The catchment of the reservoir is located in the following geographic coordinates: $18^0$05'23 "to $18^0$06'38" North latitude; $105^0$44'48" to $105^0$45'53" East Longitude.

The entire reservoir catchment is located in the South of Cao Vong Mountain at the elevation of 344m. The area lowers from North to South. The reservoir has a relatively round shape. There are two streams flowing into the reservoir and the streams cutting across the reservoir contours are often short and steep. The irrigation area is located to the west of the reservoir and between Quyen River and Cao Vong mountain foot.

ii) Geographical location of Nuoc Xanh Reservoir

Nuoc Xanh Reservoir is located in Ky Phong commune, Ky Anh district, Ha Tinh province. The reservoir catchment is located in following geographic coordinates: $18^0$05'23 "to $18^0$06'38" North latitude; $105^0$10 'to $105^0$20' East Longitude.

The reservoir is located in the middle of the area where there are some springs collecting water of the whole catchment area. The reservoir is stretched widely and the dam route covers three sides of the reservoir with a total length of 1,800m. The irrigation area is located to the south of the reservoir downstream of the dam and mainly irrigates the elevated lands near the National Highway 1A.

iii) Geographical location of Ba Khe reservoir

Ba Khe reservoir is located in Ky Bac commune, Ky Anh district, Ha Tinh province. The catchment of the reservoir is located in following geographic coordinates: $18^0$12'58 "to $18^0$13'34" north latitude; $105^0$08'35 "to $105^0$09'14" East longitude.

Around the reservoir are high and continuous hills; the catchment of the reservoir is located in the Northwest – Southeast direction, the length along the reservoir centerline from the dam to the upstream is approximately 1,500m and the maximum width of the reservoir is 750m. The irrigated area is located in the downstream of the dam and stretches along the old stream.

iv) Geographical location of Dap Buom reservoir

Dap Buom Dam is located in Huong Tho commune, Vu Quang district, Ha Tinh province. Dap Buom reservoir is 300m - 500m away from Dap Buom bridge and Ho Chi Minh Road to the East. The reservoir is located in following geographical coordinates: $18^0$19'41 "to $18^0$19'42" north latitude; $105^0$34'58"to $105^0$35'00" East longitude.

The entire catchment is located in the south of the Dong Chua mountain range within the Ngan Sau river basin. The catchment is shaped like a fan which is lowered from South to North and is located in southwest – northeast direction. The reservoir is surrounded by high hills. The irrigated area extends along the East of Ho Chi Minh Road acrossing Huong Tho Commune

v) Geographical location of Khe Co Reservoir

Khe Co reservoir is located in Son Le commune, Huong Son district, Ha Tinh province with following geographical coordinates: $18^0$34'77 "to $18^0$35'05" North Latitude; $105^0$28'04 "to $105^0$28'43" East longitude. Khe Co reservoir is 1 km far from Ho Chi Minh Road to the east and 1 km from Thanh Nhan Brick Co., Ltd to the west. Ho Chi Minh road has 5.6 km

crossing Son Le commune which means convenient travelling and materials transport;

The reservoir is surrounded by high mountains and hills. The direction of the reservoir catchment is Southwest – Northeast direction. This is also the hilly area adjacent to Thanh Chuong district, Nghe An province. The irrigated area of the reservoir extends over the administration area of Son Le, Son Tien and Son An communes to the east of Ho Chi Minh road.

vi) Geographical location of Khe Nhay Reservoir

Khe Nhay reservoir is located in Son Tien Commune, Huong Son District, Ha Tinh Province with geographic coordinates: $18^0$34'77 "to $18^0$35'05" north latitude; $105^0$28'04 "to $105^0$28'43" East longitude. Ho Chi Minh road runs through Son Tien Commune about 1.6 km and about 6 km far from Khe Nhay reservoir to the west, i.e. convenient for travellong and material transport.

The reservoir tends to be inclined from North to South and is surrounded by low hills at the elevation of 30-40m. The reservoir receives water from two small streams in the area. The irrigated area is located right behind the downstream of the dam and along old stream.

vii) Geographical location of Khe De reservoir

Khe De reservoir is located in Son Mai commune, Huong Son district, Ha Tinh province with following geographical coordinates: $18^0$27'40 "to $18^0$29'47" North latitude; $105^0$22'20 "to $105^0$23'25" East longitude. Khe De reservoir is 8 km far from Nation road 8A to the South and 2.5 km to Son Mai commune center.

The reservoir area is located between Con Chua and Lam Mountains at the height of 30-50m and the basin slope is rather steep. The reservoir is located in the middle of the area where some rivutlets form all flows of the reservoir catchment. The reservoir area stretches to three directions compared to the dam site. The irrigated area lies between hills and stretches over 3 communes of Son Phuc; Son Thuy and Son Mai for 3.2 km and the average width is 0.5 km.

viii) Geographical location of Da Den Reservoir

Da Den reservoir is located in Ngoc Son commune, Thach Ha district, Ha Tinh province with following geographic coordinates: $18^0$19'07'' to $18^0$19'40''N latitude; $105^0$46'06 "to $105^0$46'55" East longitude. The project area is 300m away from Provincial Road 21 Northeastbound and 800m away from Provincial Road 3 and 12km away from National Highway 1A.

The reservoir basin has a kame-and-kettle topography, sloping from Southwest to Northeast. The reservoir is surrounded by low hills at the height of 50-200m. The basin has quite steep rivulets and slope. The irrigated area is located between Provincial Roads 3 and 21.

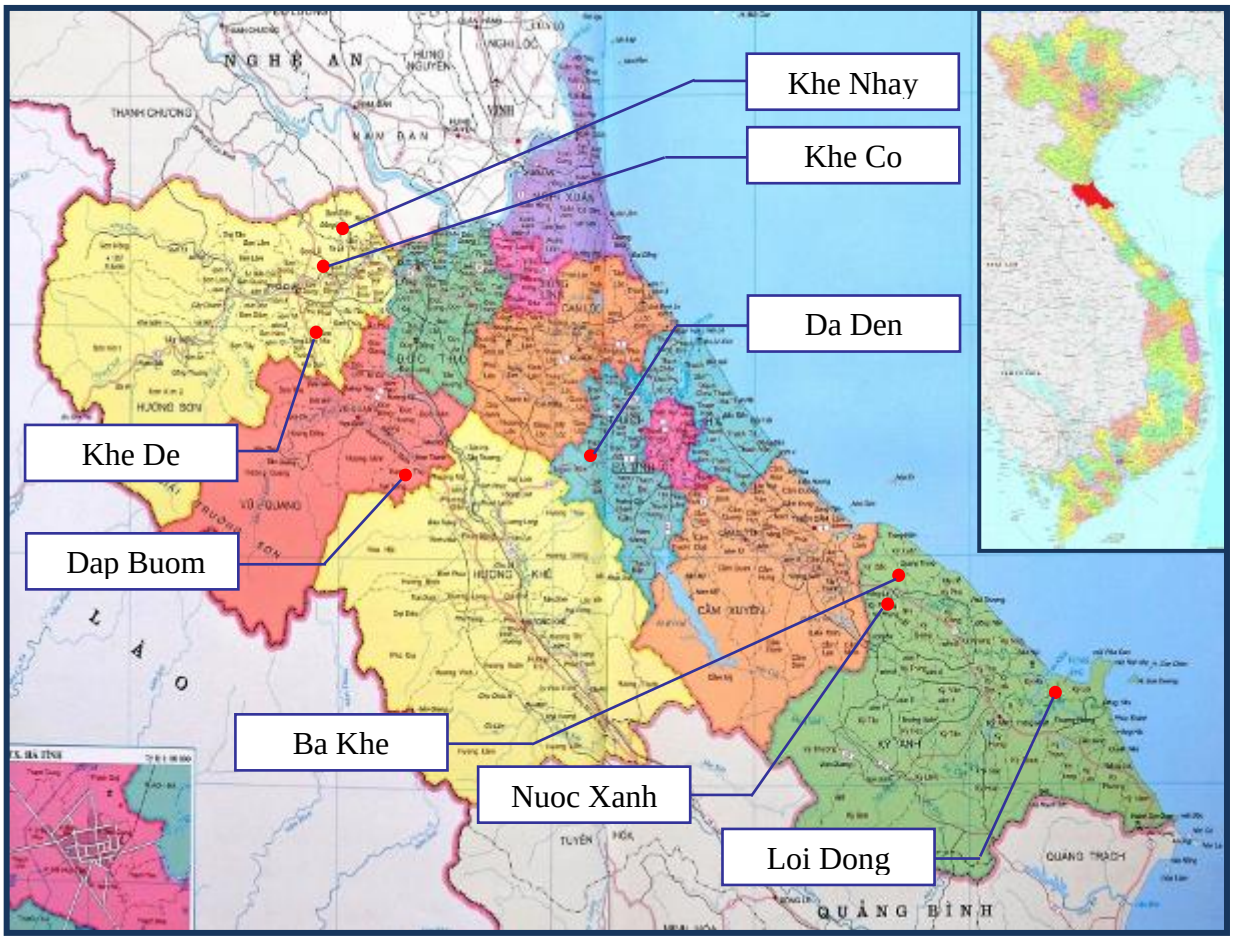

Figure 2 – 1: Diagram of Reservoirs in Sub-project 1

2.2. Status of the work and key items of the Sub-project

Summary of the subproject activities:

Dam safety is presenting quite urgent problems. In the context of climate change, abnormal floods and rains, given low safety level of dams, dam failure risk is quite high. 8 reservoirs of the subproject 01 had been built for a long time and have not been upgraded due to limited funding to meet specifications per Vietnam Standard QCVN 04-05: 2012/BNNPTNT and the Dam Safety Manual of the World bank. Spillways of all 8 reservoirs have been degraded and are not able to drain flood and is presenting high risk of dam failure. Downstream area of the reservoirs is populated areas, production areas and infrastructure etc. In case of dam failure, the consequences are quite serious. To ensure the safety of works, safety of residential areas as well as economic infrastructure, flood prevention and reduced flooding for downstream areas, adequate multi-purposes water supply and to limit possible damages caused by the reservoirs, components of these 8 reservoirs of Subproject 1 should be urgently upgraded to ensure safety. Repairing and rehabilitating activities of 8 reservoirs do not change their storage capacity, instead the design irrigation area will be restored.

The proposed activities of the subproject:

Earthen dam:

(i) Increase dam crest of 8 reservoirs to a stable elevation to enhance flood prevention and absorption capacity;

(ii) Lining dam surface of 8 main dams and 6 auxiliary dams of 8 works with total length of 5,345.7m;

(iii) Expanding dam surface of 8 reservoirs for enhanced stability of dam body structure;

(iv) Repairing and lining upstream and downstream slopes to enhance safety of slope system;

(v) Planting grass on the downstream slope to protect dams and as an environmental friendly measure;

(vi) Building downstream drain trenches to reduce impact of runoff and flood water on dam structure;

(vii) Installing permeability, water level and transposition monitoring equipment system;

(viii) Building retaining wall for reservoirs: Loi Dong, Khe Co and Khe Nhay to limit wave run-up and storm surge;

Outlet works: Constructing 7 new sluices for reservoirs, except for Khe Co reservoir, to ensure stable irrigation water for the downstream areas;

Spillway: Repair and rehabilitate spillways of reservoirs: Nuoc Xanh, Khe Nhay, Khe De and Khe Co and build new spillway and expand spillway surface of reservoirs: Loi Dong, Ba Khe and Da Den in order to ensure flood drainage capacity and avoid flooding impact on downstream areas;

Auxiliary works

(i) Repair and upgrade 4 construction routes and management roads with the total length of 4,220.36 m;

(ii) Build a diversion canal after the new intake with total length of 224.2m for Dap Buom reservoir.

Table 2 - 2: Information summary of reservoir status and construction items of the Subproject

Works, location	*Current condition*	*Construction categories*	*Photo on status*
Loi Dong reservoir, Ky Trinh ward, Ky Anh Town, ha Tinh province	The Loi Dong Reservoir was built in 1970, and heightened for 0.5-0.6m in 2005. The reservoir is to irrigate 49ha. The reservoir has a catchment area of 1.15 km^2 and a total capacity of 0.66 million m^3. Over many years of exploitation, the dam has been severely degraded; earthen dam is penetrated in the downstream slope; upstream and downstream slopes is eroded; control equipment system of the intake is damaged; the concrete of the sluice is eroded; spillway is not reinforced with leaked shoulder; the stilling pool is eroded and subsided; flood drainage canal is silt up. The work cannot ensure safety of the reservoir during flood season.	<u>1. Earthen dam:</u> Heighten dam crest to +13.3 m from +13.8 m and widen dam's surface to b=5.0 wide from 2.6-3m; line the dam surface using mixture of macadam and earth; the dam length is L=825m; reinforce the upstream slope using rip-rap in concrete frame and grow grass on downstream slope. The downstream slope drainage trench will be built of concrete. The downstream slope drain is of prism shape and attic style; install monitoring system for transposition, water level and penetration. <u>2) Culvert:</u> build new culvert which is 6m away from the centerline of the old one on the right side of dam shoulder; this is a pressurized, submerged sluice made of reinforced concrete coated steel pipe and downstream opening and closing valve; sluice aperture D=0.8 m, 38.2 m long. <u>3) Spillway:</u> New spillway will be built on the old site; the dimension is (BxH)=(20x1.04)m	 

Nuoc Xanh reservoir, Ky Phong commune, Ky Anh district, Ha Tinh province	Nuoc Xanh Reservoir was built in 1967 and was repaired in 2012, and the reservoir is to provide irrigation water to 120 ha. Over many years of operation, the earthen dam has been severely degraded; earthen dam is leaked and upstream slope is collapsed; the lined layer is damaged; downstream slope drain is buried. Control valve of the intake is damaged; stilling pool after the intake is degraded with cracked bottom and side wall; spillway made of earth with narrow width and strongly eroded downstream slope. These works do not ensure safety for the reservoir.	1) Earthen dam: Heighten dam crest from + (24.25-25.3) to + 25.6 m; expand dam's surface from b= (2.85-3.5) m to b=5.0m, length of dam L=1.800m. Reinforcing the upstream slope above the full supply level with reinforced concrete slabs, and reinforcing below the full supply level with rip-rap; downstream slope grown with grass; downstream drain has attic style. 2) Intake: Build new culvert which is 4m away from the centerline of the old one on the right side of dam shoulder. 3) Spillway: Reinforcing the beginning section of flood discharging canal for a length of 6m; the canal section after the spillway is kept unchanged (made of natural earth). Spillway dimension (BxH) = (70x0.747). Design spillway flow Q_{tk} = 64.06m^3 $Q_{check\ p=0.5\%}$ = 116.23m^3/s 4) Management road: upgrading and expanding the management road in accordance with road grade IV, length of L=700m and width 3.5m; the road is made of concrete. 5) Service road: building a new	 

		construction road in accordance with road grade IV, road length is 604.66m and width 4.0m wide. The road is made of earthfill.	
Ba Khe reservoir, Ky bac commune, Ky Anh district, Ha Tinh province	Ba Khe reservoir was built before 1970 with an irrigation capacity of 119 ha. Flood spillway was recently repaired in 2013. Over many years of exploitation, the earthen dam has been seriously degraded; the dam was strongly penetrated in dam body and foundation; upstream slope is eroded and downstream slope is deformed; the spillway is narrow in width; spillway drop is subsided (the bottom slab) and bottom is eroded; This work cannot ensure safety of the reservoir.	1) Earthen dam: Heighten dam crest; expand dam's surface from (b=2.8-3.5) m to b=5.0m; main dam length L=805m; auxiliary dam L=508.8m. Reinforcing upstream slope of the main dam and auxiliary dam. Installing downstream water collection device and manual water level measurement device. 2) Intake: Build 2 new intakes to replace the 2 old ones. 3) Spillway: Build new spillway on the old spillway site; the spillway is Expanded from 25m to 35m; the spillway and side gutter are made of reinforced concrete M250; spillway dimension (BxH)=(35.0x1.38)m. design flow Q_{TK} = 110.78m^3/s.	 

Dap Buom reservoir, Huong Tho commune, Vu Quang district, Ha Tinh province	The Dap Buom reservoir was built in 1978 with an irrigation capacity of 60 ha. Over many years of exploitation, the earthen dam has been seriously degraded; earthen dam is strongly penetrated through its body and foundation; upstream slope is eroded and collapsed; downstream slope is eroded and deformed; intake is damaged; the spillway cannot ensure flood drainage and is significantly eroded; This dam cannot ensure safety for the reservoir.	1) Earthen dam: Heighten dam crest from +(18.9)m to +20m; Expand dam's surface from (width =3.8-4.0)m to width =5.0m; lining the dam surface with concrete; dam length of L=88m; Reinforcing upstream dam slope; installing downstream drain; 2) Intake: Build new sluice which is 3m away from the centerline of the old one on the right side of the dam. 3) Diversion canal after the intake: build a new canal with rectangular shape, made of reinforced concrete and 224.2 m long. 4) Spillway: build a new spillway on the old location; Expand the spillway surface to B=35m from B=25m (width). 5) Service cum management road: the road is built of concrete for both construction and management activities; road width b=3.5m and length L = 332.9m;	 

Khe Co reservoir, Son Le commune, Huong Son district, Ha Tinh province	Khe Co reservoir was built in 1987 with an irrigation capacity of 560 ha... Over many years of exploitation, the dam has been severely degraded, height of the dam is not guaranteed for water storage in the reservoir; the dam is significantly permeable through its body and foundation with many eroded and collapsed parts. Earth-fill auxiliary spillway is eroded in the downstream part. This dam cannot ensure safety for the reservoir	1) Earthen dam: Heighten dam crest of 3 auxiliary dams from + (41.2) m to +41.7m. Expand dam surface b= (3-3.5) m to b=6.5m; Main dam L=90.7m; auxiliary dam 1: L=271m; auxiliary dam 2: L=95m, auxiliary dam 3: L=55m; reinforce upstream slope and downstream drain; 2) Intake: Keep the existing one 3) Auxiliary spillway: Upgrade auxiliary spillway based on the existing one. 4) Management road cum rescue road: Line the road pavement with concrete both management and rescue purposes: road width: 3.5m; road length 2,371.7m.	 

Khe Nhay reservoir, Son Tien commune, Huong Son district, Ha Tinh province	Khe Nhay Water Reservoir was built in 1966 and with an irrigation capacity of 50 ha. Over many years of exploitation, the earthen dam has been seriously degraded, the dam has been penetrated through its body and foundation and some parts of upstream slope have been collapsed. Valve gate of the intake is damaged. Deep discharge valve of the spillway is broken. The work cannot ensure safety and drainage capacity during flood season.	<u>1) Earthen dam:</u> Heighten dam crest from +(22.8-23.4)m to +23.5m, building retaining wall with a crest elevation of 24.6 m, expanding dam's surface towards the upstream from b=(3-3.5)m to b=5.0m; main dam L=222m. Reinforcing upstream slope; and downstream drain; <u>2) Intake:</u> Build new sluice which is 4.1m away from the old one on the left dam shoulder. <u>3) Spillway:</u> Repair and upgrade the existing spillway on the old spillway site;	 

Khe De reservoir, Son Mai commune, Huong Son district, Ha Tinh province	Khe De reservoir was built in 1977, with an irrigation capacity of 160 ha. Over many years of exploitation, the dam has been severely degraded, the dam is permeable, upstream slope is collapsed; intake is damaged, gate is rusted and stuck, closing and opening device is rusted; stilling pool is damaged; the spillway is narrow and cannot meet flood discharge demand; stilling pool is deeply eroded and bottom worn off. This dam cannot ensure safety for the reservoir.	1) Earthen dam: Increase dam height from + (29.08-29.26) m to + 29.60m and expand dam surface from b= (3.8-4.7) m to a width of b=5.0m, main dam L=240m, auxiliary dam: L=242m, reinforcing upstream slope and downstream slope drain. 2) Intake: Build a new sluice on the right shoulder of the main dam 3) Spillway: Lower spillway threshold from +26.70m to +26.44m; expand spillway threshold from B=8m to B=15m; reinforce the spillway. 4) Access, rescue and management road: Expand and line the road based on the existing foundation; road width B=3.5m and road length: 1,960m.	 

Da Den reservoir, Ngoc Son commune, Thach Ha district, Ha Tinh province	The Da Den reservoir was built in 1978 to irrigate a total area of 54 ha. Over many years of operation, the dam has been severely degraded; there is water leakage in dam body and foundation; upstream slope is eroded and partly collapsed; downstream slope is occupied with bushes and leaked into swamps; sluice valve gate and valve are damaged, with significant leakage; the spillway is narrow and is significantly eroded. The work cannot ensure safety and drainage capacity during flood season.	1) Earthen dam: Heighten dam crest from + (27.0-27.3) m to the elevation of + 27.7m, and expand dam's surface b= (2-3) m to the width of b= 5.0m, lining the dam surface with concrete and a dam length of L=153m. Reinforcing upstream slope and downstream slope drainage trench and downstream drain; 2) Intake: Build new sluice which is 2.35m away from the centerline of the old one on the left side. 3) Spillway: Remove the old earthfilled spillway, build a new spillway with wider surface (from B=20m to B=30m). 4) Management and rescue road: Upgrading the management and rescue road with a width of 3.5m and length of 544m.	 

2.3. Construction materials of the Sub-project and auxiliary works;

Table 2 - 3: **Summary of material quantity needed for civil works in the Sub-project**

No.	*Construction material*	*Unit*	*Quantity*
1	Excavation soil	m^3	397,040
2	Backfill soil	m^3	291,093
3	Waste soil	m^3	134,284
4	Sand	m3	20,120
5	Stone	m3	68,437
6	Brick	Brick	27,811
7	Wood	m^3	1,246
8	Steel	ton	1,000.5
9	Cement	ton	9,912.5

Transporting distance and material quantity for each work are described in the following table:

Table 2 - 4: Summary of material quantity and transporting distance

No.	*Reservoir/structure*	*Unit*	*Quantity*	*Mode of supply*	*Transport distance*
1	**Loi Dong Reservoir**				
	Excavation soil	m^3	29,537		
	Backfill soil	m^3	28,298	Purchased from other areas	
	Sand	m^3	1,795	Purchased from Ky Anh town	9.5km
	Stones	m^3	7,884	Purchased from Stone quarry Com Tria, Ky Tan Commune, Ky Anh District	19.2km
	Brick	piece	4,850	Purchased from Ky Anh town	9.5km
	Formwork	m^3	49		
	Steels	kg	155,457		
	Cement	kg	894,516		
2	**Nuoc Xanh Reservoir**				
	Excavation soil	m^3	103,793	In-situ	
	Backfill soil	m^3	65,305	Purchased from 666 Company, Ky Phong commune, Ky Anh district	2km
	Sand	m^3	4,742	Purchased in Ky Phuong commune, Ky Anh district	20km
	Stone	m^3	12,186	Purchased in Cam Thinh commune, cam Xuyen district	8km

No.	*Reservoir/structure*	*Unit*	*Quantity*	*Mode of supply*	*Transport distance*
	Brick	piece	3,300	Purchased from Ky Anh town	20km
	Formwork	m^3	484		
	Steel	kg	209,213		
	Cement	kg	2,528,053		
	Water	liter	1,656,192	In-situ	
3	**Ba Khe Reservoir**				
	Excavation soil	m^3	26,290		
	Backfill soil	m^3	44,995	Purchased from other areas	6 km
	Sand	m^3	2,404	Purchased from Ky Anh town	24km
	Stone	m^3	7,663	Purchased from Stone quarry in Chau Doai, Ky Bac commune, Ky Anh District	1,4km
	Brick	piece	4850	Purchased from Ky Anh town	24km
	Formwork	m^3	76,5		
	Water	liter	832,541	In-situ	
	Steel	kg	67,702	Purchased from Ky Anh town	24km
	Cement	kg	1,306,771		
4	**Dap Buom reservoir**				
	Excavation soil	m^3	12,238		
	Backfill soil	m^3	16,857	Purchased from other areas	
	Sand	m^3	1,887	Purchased from sand mine of Viet Ha company, Huong Minh commune, Vu Quang district	8,5km
	Stone	m^3	7,637	Purchased from Stone quarry Long Cao, Dai Long company, Son Thuy commune, Huong Son commune	20,5km
	Brick	piece	4,912	Purchased from Vu Quang town, Vu Quang District	11km
	Formwork	m^3	55		
	Water	liter	668,084	In-situ	
	Steel	kg	179,384	Purchased from Vu Quang town, Vu Quang District	11km
	Cement	kg	994,433		
5	**Khe Co Reservoir**				
	Excavation soil	m^3	112,280	In-situ	

No.	*Reservoir/structure*	*Unit*	*Quantity*	*Mode of supply*	*Transport distance*
	Backfill soil	m^3	72,367	In-situ	
	Sand	m^3	4,143	Purchased from Thanh Nhan company, Son Trung Commune, Huong Son District	20km
	Stone	m^3	14,529	Purchased from Stone quarry of 496 road management and repair company, Son Trung commune, Huong Son district	24km
	Formwork	m3	259	Purchased from Pho Chau Town, Huong Son District	12
	Water	liter	1,067,794	In-situ	
	Steel	kg	166,668	Purchased from Pho Chau Town, Huong Son District	12
	Cement	kg	1,840,421		
6	**Khe Nhay Reservoir**				
	Excavation soil	m^3	19,452	In-situ	
	Backfill soil	m^3	10,642	In-situ	
	Sand	m^3	1,019	Purchased from Thanh Nhan company, Son Trung Commune, Huong Son District	20km
	Stone	m^3	1,893	Purchased from Stone quarry of 496 road management and repair company, Son Trung commune, Huong Son district	12km
	Brick	piece	3,300	Purchased from Pho Chau Town, Huong Son District	20km
	Formwork	m^3	84,3		
	Water	liter	289,799	In-situ	
	Steel	kg	79,928	Purchased from Pho Chau Town, Huong Son District	20km
	Cement	kg	492,535		
7	**Khe De Reservoir**				
	Excavation soil	m^3	61,250	In-situ	
	Backfill soil	m^3	30,020	In-situ	
	Sand	m^3	2,781	Purchased from Thanh Nhan company, Son Trung commune, Huong Son commune	17,5km
	Stone	m^3	12,579	Purchased from stone quarry of	18km

No.	*Reservoir/structure*	*Unit*	*Quantity*	*Mode of supply*	*Transport distance*
				496 company, Son Trung commune, Huong Son commune	
	Brick	piece	3000	Purchased from Pho Chau Town, Huong Son District	12km
	Formwork	m^3	130		
	Water	liter	715,447	In-situ	
	Steel	kg	59,753	Purchased from Pho Chau Town, Huong Son District	12km
	Cement	kg	1,167,014		
8	**Da Den Reservoir**				
	Excavation soil	m^3	26,804	In-situ	
	Backfill soil	m^3	22,610	Purchased	
	Sand	m^3	1,358	Purchased from Huong Khe town	40km
	Stone	m^3	4,067	Purchased from Thach Hai stone exploiting and processing company	32km
	Brick	piece	3300	Purchased from Brick factory Thach Vinh	8 km
	Water	liter	408,379	In-situ	
	Formwork	m^3	109	Purchased from Ha Tinh city	12km
	Steel	ton	82,404		
	Cement	ton	688,796		

2.4. Auxiliary works

a) Electricity for construction and domestic uses:

As this is a reservoir project providing gravity irrigation, power demand is insignificant. Electricity is mainly used for lighting at night and domestic activities of workers at construction site or for the installing steel structures (cutting, welding, bending ...). At present, there are national power grid connections in the construction site based on the 35KV line. There are 110KV backup generators in case of power outages.

b) Water supply for construction and domestic uses

Water for domestic uses: It is expected that the construction of 8 reservoirs will mobilize 330 construction workers on site at the same time. According to Vietnamese construction criteria TCXDVN 33/2006 on water supply - pipe network and works - design standards, the average water consumption per person is 50 liters/day. Maximum water consumption per day is Q1 = 16.5 m^3/day.

Water used for such construction works as concrete mixing, washing equipment is estimated

at 18 m^3/day.

Total water volume expected to be used during the construction time is approx. 34.5 m^3/day.

Supply source: Water used during construction is taken from reservoirs; Water for daily uses of workers is from groundwater through drilled wells;

c) Staffing requirement and workers' camp

It is expected that the construction of 8 reservoirs will mobilize totally 330 construction workers on site at the same time in peak time. Most of the project sites are convenient to gather materials as well as arrange worker camps. Project works are widely distributed in many localities in Ha Tinh province whereas water supply and electricity infrastructure are limited yet the number of workers focusing during peak time is not large. Majority of workers are managers and skilled workers. Local workers are directly hired for simple works, which account for 40% of the workforce on a site. The construction period of each item does not last for long time so it is expected land or houses of local people will be hired as camps or tents for workers, ensuring environmental sanitation and daily living conditions of workers. Stockpiles are located near the residential area to make sure properties are protected; material shelters are arranged that meet Vietnam specifications of QCVN 01: 2011/BYT on sanitary latrines. Daily domestic activities of workers are carried out in the workers' camp area.

d) Dumping sites and borrow pits

Dumping sites are located in planned areas of the communes which are agreed by local authorities, households, PPMU and specialized agencies in the locality. The location should be proper and convenient for transport and impacts on environment and living activities of people are minimized.

Locations of borrow pits are approved and licensed by the People's Committee of Ha Tinh province. For the subproject, soil materials for construction works are exploited in the planned borrow pits of Ha Tinh which meet safety and environmental protection requirements.

Specific locations of dumping sites and borrow pits are in the following table:

Table 2 - 5: Locations of dumping sites, borrow pits

No.	*Reservoir/ structure*	*Unit*	*Quantity*	*Description*	*Transport distance*
1	**Loi Dong Reservoir**				
	Borrow pit	m^3	26,095	Purchasing in Mui Doi borrow pit, Hong Ha company, Ky Trinh ward, Ky Anh town	9.54 km
	Dumping site	m^3	21,569	Con Moc site, Ky Trinh ward, Ky Anh town	0.9 km
2	**Nuoc Xanh Reservoir**				
	Borrow pit	m^3	81,792	In-situ	2 km
	Dumping site	m^3	12,350	Dumpsite near Mr. Vo Van Tai	1,5 km

No.	*Reservoir/ structure*	*Unit*	*Quantity*	*Description*	*Transport distance*
				household, Lang Con village, Ky Phong commune, Ky Anh District	
3	**Ba Khe Reservoir**				
	Borrow pit	m^3	41,694	Purchase from Borrow pit Ngoc Thao, Cam Trung commune, Cam Xuyen District	6 km
	Dumping site	m^3	10,581	Vacant lowland Gieng Cho, Hop Tien village, Ky Bac commune, Ky Anh district	2.6 km
4	**Dap Buom Reservoir**				
	Borrow pit	m^3	24,456	Purchase from borrow pit of Minh Huong company, Duc An commune, Duc Tho district	32 km
	Dumping site	m^3	9,508	Vacant, low land in Huong Tho Commune	0.9 km
5	**Khe Co Reservoir**				
	Borrow pit	m^3	83,115	In-situ Purchasing clay in Son Binh commune	0.3km
	Dumping site	m^3	7,024.5	Vacant land A1, in Son Tien Commune, Huong Son District	6.5 km
6	**Khe Nhay Reservoir**				
	Borrow pit	m^3	12,451	Backfill soil exploited in Son Le commune, Huong Son District	0.3km
	Dumping site	m^3	4,228.5	Vacant land A1, in Son Tien Commune, Huong Son District	5.5km
7	**Khe De Reservoir**				
	Borrow pit	m^3	32,107	Borrow pit on left and right shoulder of the main dam in Son Mai commune, Huong Son district Purchasing clay in Son Binh commune	0.3km 11 km
	Dumping site	m^3	12,191.7	Vacant site in Son Mai commune	1.2km
8	**Da Den Reservoir**				
	Borrow pit	m^3	24,974	Purchasing from Vinaco company, in Ngoc Son commune, Thach Ha district	2 km

No.	*Reservoir/ structure*	*Unit*	*Quantity*	*Description*	*Transport distance*
	Dumping site	m^3	3,491	Dumpsite in Ngoc Ha village, Ngoc Son commune	4.3km

e) Construction roads

Construction conditions are relatively good with convenient transportation; Accesses to all reservoirs have been made available. These access roads serve the transport of construction materials.

Construction road of Khe Nhay reservoir

Construction road of Ba Khe reservoir

Figure 2 - 2: Status of some transportation routes

The status of roads for transporting materials during construction of subproject works is presented in the following table

Table 2 - 6: Status of transportation roads

Works	*Material*	*Description of the road*	*Distance*
Loi Dong Reservoir	Filling soil	Crossing following roads: Highway IA for 1.6 km, asphalt road of 6.0 m wide and 2.8 km long, asphalt road of 4.0 to 5.0 m wide and 2.3 km long; concrete road of 4.0 m wide and 0.4 km long and the remaining road is the aggregate road width of 3.0 to 5.0 m.	9.54 km
	Stones	Crossing National Highway I of 3.2 km, National road 12C of 3.9 km, 5.1 km of asphalt road of 4-6.0 m wide	19.2 km
	Sand	Crossing following roads: National Highway I of 3.6 km and 5.1km of an asphalt road of 4 - 6.0 m wide	9.5 km
	Other materials	Crossing following roads: a Highway I of 3.6 km long, an Asphalt road of 4 - 6.0 m wide and 5.1 km long	9.5 km
Nuoc Xanh Reservoir	Filling soil	Concrete road and 3.5-5m wide gravel road in Ky Phong commune	2 km
	Stones	Crossing following roads: 15 km of highway 1A, asphalt road and internal concrete road with 5-6m wide of road pavement from stone quarry to highway 1A, length of 5.4km; 4-5m wide asphalt road with length of 2.7 km and 4m wide gravel road with length of 0.9km. The transport	24 km

Works	*Material*	*Description of the road*	*Distance*
		road goes through communes of Cam Thinh, Cam Lac, Cam Trung communes in Cam Xuyen district and Ky Bac, Ky Phong communes of Ky Anh district	
	Sand	Crossing National Highway 1A (38.2km); 0.61 km of asphalt road with 4-5m wide surface and 0.53 km of gravel road (4-5m wide road)	43 km
	Other material	Crossing following roads: a Highway I of 17 km long, an Asphalt road of 4 - 5.0 m wide and 2km	20 km
Ba Khe reservoir	Filling soil	Crossing following roads: Highway IA: 3.2 km, an asphalt road of 4.0 - 5.0 m is 2.0 km, the remaining road is the aggregate road 3.0 to 5.0 m	6 km
	Stones	Crossing following roads: an Asphalt road of 4.0-5.0 m wide and 1.1 km long; the remaining is an aggregate road of 4.0 – 5.0 m wide	1.4 km
	Sand	Crossing following roads: National Highway I: 22 km, an asphalt road (4 - 6.0 m wide and 1.8 km long) and an aggregate road of 0,4 km	24 km
	Other material	Crossing following roads: 22km along Ho Chi Minh road, 1.8km along 4-6m wide asphalt road, 0.4km along 4-5m wide gravel road	24 km
Dap Buom Reservoir	Filling soil	Crossing following roads: Crossing following roads: National Highway IA, 4 - 5 m wide asphalt road and 3 -5 m wide gravel road	32 km
	Stones	Along Ho Chi Minh road for 20.5km, along 2.5km of asphalt road from Ho Chi Minh road to Son Truong, Son Mai; 4.97km of 4-6m wide gravel road to Son Mai, Son Thuy, and the rest are internal road in the quarry and path to Dap Buom Dam	20.5 km
	Sand	Along Ho Chi Minh road for 5km and service road in the mine and entrance into Dap Buom	8.5 km
	Other material	Along Ho Chi Minh road, crossing Vu Quang township, Huong Minh commune	11 km
Khe Co Reservoir	Stones	Transportation road includes national highway 8A, Ho Chi Minh road and 1km of pathway to the work	12 km
	Sand	Transportation road includes national highway 8A, Ho Chi Minh road and 1km of pathway to the work	20 km
	Other material	Transportation road includes national highway 8A, Ho Chi Minh road	12 km
Khe Nhay Reservoir	Filling soil	Inter-village road	1.5 km
	Stones	Transportation road includes national highway 8A, Ho Chi Minh road and 1km of pathway to the work	17.5 km
	Sand	Transportation road includes national highway 8A, Ho Chi Minh road and 1km of pathway to the work	17.5 km

Works	*Material*	*Description of the road*	*Distance*
	Other material	Transportation road includes national highway 8A, Ho Chi Minh road and inter-commune road	20 km
Khe De Reservoir	Stones	Transportation road includes national highway 8A, Ho Chi Minh road and 1km of pathway to the work	18 km
	Sand	Transportation road includes national highway 8A, Ho Chi Minh road and 1km of pathway to the work	17,5 km
	Other material	Transportation road includes national highway 8A, Ho Chi Minh road and inter-commune road	12 km
Da Den Reservoir	Filling soil	Transportation road includes: 1 km of provincial road 21; 0.5km of provincial road and 0.5km of gravel rural transportation road with width of 3-5m	2 km
	Stones	Crossing following roads: 4-6m wide asphalt road to National highway 1A: 18.5 km, provincial road 21: 5 km; concrete road to the stone quarry: 2km; 4 - 6m wide concrete road to the dam heel: 0.5km long	32 km
	Sand	Crossing following roads: National highway 15, provincial road 550 and 1km of gravel road	40 km
	Other material	Crossing following roads: Provincial road 21, Provincial road 3 and rural road in Nam Son village	12 km

2.5. Construction organization measures

2.5.1. Pre-construction phase

The subproject design proposed alternatives taking into account different scenarios and climate change impact risks on functions of construction items. The design also studied climate factors in recent years as presented in the subproject status section to select optimal design option. Climate change impacts in the subproject area in recent years mainly related to changing rainfalls which caused flooding, erosion and drought.

Site clearance in pre-construction phase will relate to the demolition of existing structures, tree cutting down and removal of weathered layers:

- Demolishing existing structures: 10 households with their houses and properties on lands will be affected, including 2 households with affected houses and 8 households with archictecture on land affected. In particular, a total of 234 m^2 of fence, 185m^2 of yard and 476 m^2 of breeding facilities will be affected. However these affected properties are within the dam protection corridor which have been encroached by households. No household is relocated.
- Cutting down plants: A total of 1,259 fruit trees, 8,016 trees for timber, and 2,702m^2 of subdidary crops will be cut down for construction activities. Households may collect cut down trees for firewood. Other parts of plants, vegetable will be collected and moved to dumping site by the subproject owner.
- Removing weathered layer will be carried out at selected stockpiles, workers' camps area and existing dam foundation.

Activities during pre-construction phase are summarized in the table below:

Table 2 - 7: Summary of pre-construction activities

Activities	*Schedule*	*Technology/method*	*Environmental factors likely to arise*
- Site clearance: cutting down trees, levelling ground for workers' camps, stock piles; removing top soil; - Prepare auxiliary works for construction activities, such as: borrow pits, dumping sites, workers' camps, stockpiles. - Gather construction machines, equipment and materials	30 days	- Site clearance will use manual methods (cutting down trees, collecting wood) and mechanical methods (use bulldozers, excavators to level camp areas, stockpiles, remove top layers of borrow pits, etc.); - Prepare auxiliary works: primarily by manual methods; - Gather construction machines, equipment and materials: mechanical methods	- Generate solid waste due to cutting down trees, demolishing existing structures, removing top soil layer, debris after levelling, debris from preparing camps, domestic waste from workers; - Generate domestic wastewater of workers, wastewater from cleaning machine activities; - Generate dust, emissions due to levelling ground, transporting materials and waste. - Increase noise, vibration due to operation of construction devices

Management of debris and wastes during pre-construction phase is summarized in the table below:

Table 2 - 8: Summary of debris and wastes management during pre-construction phase

Works (reservoir)	*Estimated volume of wastes* (m^3)	*Number of transportations*	*Transportation distance (km)*
Loi Dong	2,350	470	0.9
Nuoc Xanh	2,585	517	3
Ba Khe	3,582	716	2.6
Dap Buom	1,000	200	0.9
Khe Co	4,205	841	6.5
Khe Nhay	1233	247	5.5
Khe De	905	181	1.2
Da Den	1,521	304	4.3
Total	***17,381***	***3,476***	***24.9***

2.5.2. Construction phase

Construction methods and activities during construction phase are described in table below:

Table 2 - 9: Summary of activities during construction phase

Activities	*Schedule*	*Technology/ Methods*	*Environmental factors likely to arise*
- Repairing dam: Heightening and expanding dam crest, reinforcing dam crest with concrete; reinforcing upstream slope with concrete slabs; Repairing and reinforcing downstream slope; build downstream drain. - Repairing spillways: Removing existing spillway on natural ground; Building new spillway using reinforced concrete on the old location; Expand spillway width to ensure drainage capacity. - Repairing intakes: removing old intakes, constructing the new one near the location of the old one. - Repairing construction cum management road: Upgrading existing earth road to a	Total construction time of 2 years: - 1st year: focusing on the repair and construction of headworks such as earthen dam, spillway and backfilling construction road and completing and repairing intakes. - 2nd year: Completing the repair of earthen dam and spillway, reinforcing construction road pavement	- Repairing dam: + Soil excavating and backfilling: remove soil at the dam heel and transport waste soil to dumping sites. Transport backfilling material to construction site for filling. + Use bulldozers to remove top soil at dumping sits; use shovels to transport soil to the vehicles. + Use reedle vibrator to complete the repair of dam revetment; + Reinforce the stone layer of dam upstream slope using stone and concrete (mechanical and manual methods) - Repairing spillway: + Soil excavating and backfilling: Removing top layer of spillway and transport to dumping sites; transport construction materials and stones to construction site. + Use mixers (500-700 liters) to pour concrete into designated areas. + Apply mechanical and manual methods. - Repair water intakes: + Excavate soil both mechanically and manually, compact both sides of the intakes with jumping compactor + Paving works manually. - Repair and upgrade construction cum management	- More dust, emission gases, noise and vibration: + Dust generated from earth works, ground leveling, loading materials, transporting soil and stone, improving roads; + Emissions arising from construction activities, mainly from transporting of excessive soil and construction materials; - Increased noise and vibration: given a total of 53 types of equipment and machineries working on site, noise generated mainly from excavation by equipment and means of transport; - Waste and domestic wastewater from worker camps: - Hazardous waste generation: 17 types of machineries and equipment of which there are 14 kinds of diesel oil equipment and vehicles to ensure project progress.

Activities	*Schedule*	*Technology/ Methods*	*Environmental factors likely to arise*
concrete road of 3.5 m wide.		road: + Backfilling soil and sand using compactor to level road pavement + Concreting the road pavement	

Materials transportation plan

Construction materials will be gathered at site one week prior to the construction commencement. Construction materials will be transported to the site using local routes during low peak time to minimize negative impacts on agricultural production and living activities of local people. Quantity of workers, machines and materials are shown in above mentioned sections.

Flow diversion and cofferdam embankment for construction:

During the construction and repair of earthen dam and construction of new intakes, it is necessary to divert flow to ensure water demand of the downstream area. Flow diversion for construction is through the existing intake. Suitable time to lower water level in reservoirs for construction is at the end of summer-autumn crop, i.e. July – August which is also dry season and water demand for irrigation is the lowest. The embankment of cofferdam for water pumping is only necessary for the construction of dam heel at low position and new intakes.

Once the pre-casting and construction of new intakes is finished, the existing intakes will be removed, creating a diversion canal at the location of the old intake to continue diverting water to downstream area. As soon as the new intakes ensure water drainage, flow will diverted through the new intake and cofferdam of the drainage canal gate will be built to block the dam section of the diversion canal (where the old intake exists) and the dam section on the new intake in accordance with design cross section.

The construction time of the dam heel and intake is short, i.e. 2-3 months. At the same time, there is a plan to find other water sources to support the downstream area. Moreover, duration of July - August is the end of summer-autumn crop and irrigation demand of the downstream area is quite low. Thus impact of construction on downstream water supply is minimal.

Among 8 works under the subproject 01, 7 works (Loi Dong, Nuoc Xanh, Ba Khe, Dap Buom, Khe Nhay, Khe De, Da Den) required the construction of new intakes and needed dam slope to be improved including the dam heels at the downstream side and downstream drains. Therefore cofferdam embankment is necessary for the construction of above mentioned items in all 8 works.

2.6. Construction progress

a) Site clearance progress: expected 1 month (30 days) in the 1st year and in rainy season

b) Construction progress:

Construction will take place during dry season (from January to August). It is estimated that

construction time of all items including earthen dam, spillway, intake, management and rescue roads is 11 months for each of the reservoirs. Water cut for construction of intake and dams will take place in the most convenient time so not to interrupt irrigation supply to cultivation areas in the downstream of reservoirs.

(i) 1st Year:

- Construction period is during dry season (from January to August)
- Construction of auxiliary works for construction: dumpsites, houses of construction management board, tents for workers, stockpiles, site for machineries, equipment and construction materials
- Filling soil on construction cum management roads;
- Scrubbing, demolishing existing works, transporting disposal soil and stones;
- Repairing dams: removing the rip-rap at the dam heel and old dam slope; reinforcing the upstream slope to the full supply level; heightening and expanding dam crest; reinforcing downstream slope and constructing downstream drains;
- Building new/upgrading spillways: removing old spillways and building new ones on the location of the old ones.
- The construction of intakes and repairing dam body under the full water level will be undertaken during 20/6 to 30/8 which is the end of summer-autumn crop when water level in reservoirs is lowered and water demand is the lowest.
- Especially, due to water shortage, summer-autumn crop of in Loi Dong reservoir has ceased since 2000. Thus the construction of intake can take place as late as May (after the harvest of winter-spring crop) until August.

2nd year:

- Continue to complete spillway and earthen dam above the full supply level;
- Continue to build concrete road pavement of the management cum rescue roads;

2.7. Operation and maintenance activities

Periodic monitoring of dam safety: Once reservoirs complete their storage and dams are operated, dam owners will carry out dam monitoring activities which are executed by a qualified independent expert who have not involved in the investigation, design, construction or operation of dams. After normal operation, regular inspections of dams will take place, including pre- and after flood season inspections in accordance with Government Decree (No. 72/2007/ND-CP) on Dam Safety Management.

After completion of works, the dam owner will be responsible for dam operation and PMU' role will then be terminated.

Reservoir and valve gate operation: The dam owners must set up water regulation procedure of the reservoir, regulations on water storage and discharge under normal conditions and in emergency situations, then submit them to the competent State management bodies for approval and organize the implementation thereof. The dam owners must formulate and submit to competent authorities for promulgation or promulgate according to their competence documents on the operation and procedures of the valve of each project

(hereinafter referred to as operation of the works). Other issues should be addressed under the Decree 72/2007/ND-CP of Government on dam safety management.

2.8. Dam safety plan

A dam safety report (DSR) will be prepared for the subproject. The objective of the Dam Safety Report (DSR) is to present, analyze and make recommendations on: a) All conditions can affect the safety of dams and auxiliary structures; b) Damages caused by the failure or non-operation of dams or other structures due to harsh natural conditions or human faults or structural faults; and c) institutional framework (at the present time and) in the future which is needed to be in place to avoid or to minimize adverse conditions for dam safety.

After completion of the review at the subproject screening stage, the CPMU under MARD should provide a DSR for each subproject which was identified during the project implementation phase and send to the PoE (international dam safety consultant team) and the World Bank for review. Reports must include findings and recommendations for any related safety issues, necessary actions to be taken. Dam safety measures should be integrated into the design, construction and operation of the reservoir.

Review and analysis of dam structure safety: The review and evaluation of dams and related works will include, but is not limited to, the following:

- Review survey documents on foundation geology and materials. Pay attention to potential adverse effects that may occur by known geological features. Assessment of unforeseen conditions and handling measures to address dam safety and operation issues of the dam and related works.
- Assess the suitability of type of dams and spillways, response of the dam design, including proposed measures for foundation treatment, embankment, load parameters of selected foundation, permeability and floating head pressure control. Pay attention to any abnormalities or faults and propose measures to be taken.
- Evaluate the stability, analyse strength and safety factors in normal, abnormal and extreme load conditions for earthen dams and concrete dams, spillway structure and discharge works, including the determination of geological impact criteria.
- Evaluate factors impacting reservoir stability, causes to landslide, wave and their effects on dam stability;
- Evaluate the hydrological calculation methods to determine design flood of the project, reservoir site and spillway dimension. Review designs of spillway structures including flow conditions, and stilling basins. Assess the spillway discharge capacity for all design floods without damaging dams.
- Assess water intake and discharge facilities, including hydraulic designs, emergency water discharge capacity of reservoirs, and sedimentation processes.
- Assess design of spillways and intake control facilities, including the selection of the number and type of main gates and valves, lifting equipment and other control mechanisms. Pay particular attention to the back-up system for operating gated spillways and water discharge facilities in case of operational and power failure.

- Assess designs of flow diversion structures, construction progress, hydrological and risks aspects related to flow diversion during construction and flow blocking at the beginning stage of reservoir impounding;
- Assess the suitability of measurement instruments, especially marking instruments or markers which are required for the forecast of serious risks or dam failure.
- Assess O&M procedures and emergency response plan of dam owners, including the assessment of sub-project operation and maintenance factors related to dam safety and assessment of the operator capacity relating to how they cay perform regular maintenance and inspections of dam safety.

Assess dam safety risks: In addition to ensuring dam safety, the project should assess the potential risks of the dam to population and environment in the downstream area, including related structures. Dam failure may not occur but once happens, it will result in serious damages. Dam safety risks to downstream residential areas should be carried out by the Client. For large and high-risk dams, comprehensive data should be collected during preparation phase, including topographic document and land uses in downstream, to simulate dam failure and flood in downstream under different conditions/scenarios serving the formulation of the Emergency Preparedness Plan. Data collection from upstream dams and/or activities relating to watershed can be necessary for some dams. Planning and implementation of capacity building programs for subprojects through pilot activities to promote active participation of local communities should be considered. Communities around the dam site can participate in daily dam monitoring activities to protect dams from external destructive activities, and take part in simple maintenance tasks. A participatory and community based model for dam safety protection should also be considered. Sedimentation and contamination of upstream water can be a serious problem to some river basins. The dam owner must commit to the allocation of funds to appropriate dam operation and management activities and to periodical dam safety checks.

CHAPTER III. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORKS

This chapter provides the briefing of relevant environmental and social policies of the GoV and the World Bank.

3.1. Government Regulations

The following national laws and regulations are applied for the subproject:

- Environmental Protection Law No. 55/2014/QH13 of the National Assembly of Vietnam dated June 23, 2014. This law stipulates environmental protection activities; policies, measures and resources for environmental protection; right and obligations of organizations, households and individuals in environmental protection. Article 7 of Chapter 1 prescribes prohibited actions such as destroying and illegal exploiting natural resources; transportation and dumping of toxic product, radioactive substance, waste and hazardous waste not following technical regulations on environmental protection; disposal of untreated wastes, toxic product, radioactive substance, and other hazardous materials into land, water and air; generating noise and vibration that exceeds national technical regulation on noise and vibration; emitting dust, smoke and gases containing toxic chemicals and offensive smell into air; emitting radiation and radioactivity and ionization substances that exceeds national technical regulations. Article 18 of Chapter 2 stipulates Environmental Impacts Assessment (EIA) for investment projects.

- Land Law No. 45/2013/QH13 of the National Assembly of Vietnam dated November 29, 2013 prescribes the regime of land ownership, powers and responsibilities of the State in representing the entire-people owner of land and uniformly managing land, the regime of land management and use, the rights and obligations of land users involving land in the territory of the Socialist Republic of Vietnam. Article 12 of Chapter 1 prescribes prohibited actions such as encroaching and destroying of land; violating of land planning that was publicly disclosed; improper land use; not providing or providing incorrect land information as per legal regulation. Article 16 of Chapter 2 stipulates land acquisition. Chapter 5 stipulates land acquisition, compensation, support and resettlement.

- Law on Water Resources No. 17/2012/QH13 of the National Assembly of Vietnam dated June 21, 2012 provides on management, protection, exploitation and use of water resources, as well as the prevention of, combat against and overcoming of harmful effects caused by water in the territory of the Socialist Republic of Vietnam. Chapter 3 of this law stipulates Protection of Water Resources. Extraction and use of water resources must comply with the water resources planning. Article 9 of Chapter 1 describes prohibited actions, such as discharge of wastes and illegal exploitation of sand and gravel in stream, river, channel, and reservoir.

- Law on Biodiversity No. 20/2008/QH12 of the National Assembly of Vietnam dated November 13, 2008 provides for the conservation and sustainable development of biodiversity; rights and obligations of organizations, households and individuals in the conservation and sustainable development of biodiversity. Article 7 of Chapter 1

prescribes prohibited actions such as hunting, poaching and exploiting wildlife in strictly protected sub region of protected areas, except for scientific research purposes; encroaching land, destroying landscape, degrading natural ecological systems and raising and growing alien species in protected areas; constructing works and houses in in strictly protected sub region of protected areas, except for works for defense and security purposes; illegal construction of works and houses in ecological recovery sub region of protected areas.

- The Law on Construction No. 50/2014/QH13 approved on 18th June 2014 by 7th National Assembly of the Socialist Republic of Vietnam. Article 12 of Chapter 1 prescribes prohibited actions such as use of materials to cause harm to the public health and environment. Article 16 of Chapter 2 stipulates environmental protection in construction. During construction, contractors are responsible for (i) establishing and implementing environmental protection measures, including air and water environment, solid wastes, noise and other requirements in accordance with Law on Environmental Protection, and (ii) compensating for damages caused by contractors.

- The Law on Roadway Traffic No. 23/2008/QH12 dated on 13/11/2008. Articles 8 of Chapter 1 prescribes prohibited actions such as driving vehicles without licenses; driving vehicles with speed exceeding allowed speed; sounding horn between 10 p.m. and 5 a.m.; driving vehicles while the body is positive with drug. Article 55 of Chapter 4 stipulates ensuring technical safety quality and environmental protection for vehicles moving on roadways.

- The Law on Complaint No. 02/2011/QH13 dated 11 November 201.This law stipulates complaint and handling complaint; management and monitoring of complaint handling. Article 6 of Chapter 1 prescribes prohibited actions such as limited responsibility for handling complaint; creating wrong information and documents of compliant cases; intentionally handling complaint not following legal regulation; impeding and causing inconvenience for people who conduct complaint right; threatening, revenging, and victimizing complainant. Article 7 of Chapter 2 stipulates complaint procedures; Article 8 of Chapter 2 stipulates complaint form; Article 9 of Chapter 2 stipulates complaint prescription.

- Labor Law No.10/2012/QH13. This law stipulates labor standard; right and obligation of employee, employer, representative organization of employee, representative organization of employer in labor relations and other relations directly related to labor relations; state management of labor. Article 8 of Chapter 1 prescribes prohibited actions such as discrimination of gender, ethnicity, skin color, social status, belief, religion, disability; labor forcing; use of untrained employee; use of employee with age not following legal regulation.

- The Law on Culture Heritage No. 28/2001/QH10. This law aims to (i) reinforce the state management effectiveness and (ii) raise responsibility of people for participation, protection and promotion of the value of cultural heritages. Article 13 of Chapter 1 prescribes prohibited actions such as destroying and causing potential destruction of cultural heritage; illegal excavation of archaeological sites; illegal construction and encroaching land of historical relics and famous landscape; appropriating of cultural

heritage and making of untrue cultural heritage. Article 37 of Chapter 4 stipulates chance find procedures.

- The Law on Safety, Labor Sanitation No. 84/2015/QH13 dated June 25, 2015. This law stipulates ensuring safety and labor sanitation; policy and regulation for labor accident and occupational diseases; responsibility and right of organizations and individuals in safety and labor sanitation and state management of safety and labor sanitation. Article 12 of Chapter 1 prescribes prohibited actions such as cheating at verification, safety training, labor sanitation, monitoring labor environment; discrimination of gender in safety insurance, labor sanitation; hiding or reporting untrue labor accidents; not implementing requirements and measures for safety insurance, labor sanitation to cause harm or potential harm to human, assets and environment; use of equipment and machinery requiring strictly requirements on safety and labor sanitation but not verified or verified results not satisfying requirements. Article 14 of Chapter 2 stipulates training in safety and labor sanitation for employee. Article 16 of Chapter 2 stipulates employer's obligation in ensuring safety and labor safety at workplace.

- Law on Fire Prevention and Fighting No.27/2001/QH10 dated June 29, 2001. This law stipulates fire prevention and fighting; establishing human resources, equipment and machineries and policy on fire prevention and fighting. Article 13 of Chapter 1 prescribes prohibited actions such as construction of works which the design for fire prevention and fighting has not been reviewed and approved; approval and put into operation of works which have not yet satisfied conditions of fire prevention and fighting. Article 4 of Chapter 1 prescribes principles of fire prevention and fighting.

- Law on Electricity No.28/2004/QH11dated December 14, 2004. This law stipulates planning and investment in electricity; electricity saving; electricity market; right and obligation of organizations and individuals in electricity use; protection of electricity equipment and works; electricity safety. Article 7 of Chapter 1 prescribes prohibited actions such as destroying electricity equipment and works; violating safety regulations on electricity generation, transmission and distribution; violating regulations on protection of electricity network safety corridor, and safety distance between transmission line and substation.

- Decree no.72/ND-CP on date 07/05/2007 of the government of Vietnam regarding on dam safety management. According to the decree, a big dam is the dam with the height calculating from the floor face to the top of the dam equal to or greater than 15 meters or dam of water reservoirs with the scale of capacity equal to or greater than 3,000,000 m^3 (three million cubic meters). Small dam is the dam with the height calculating from the floor face to the top of the dam smaller than 15 meters. Dam owners are organizations and individuals owning dams to harness the benefits of water reservoirs or assigned to manage, operate and harness water reservoirs by the competent state agencies. Ministry of Agriculture and Rural Development takes responsibility before the Government for the implementation of state management of dam safety. The Ministry of Industry and Trade presides over and coordinates with ministries, branches and relative localities to appraise, approve or submit to the Prime Minister for approval of the process of operating hydropower reservoirs. The provincial-level People's Committees implement its state management on dam safety in the areas.

- Decree No.14/2014/ND-CP on Electricity Safety dated 26 February 2014.

- Decree No.59/2007/ND-CP dated 9 April 2008 on solid waste management.

- Decree 174/2007/ND-CP dated 29 November 2007 of GOV on environmental protection charges for solid wastes.

- Decree 155/2016/ND-CP dated 18 November 2016 on punishment on administrative violation in environmental protection.

- Decree No.98/2010/ND-CP of the Government dated 21 September 2010 on detailing the implementation of some articles of the Law on Cultural Heritage and the Law amending and supplementing some articles of Law on cultural heritage.

- Decree No. 59/2015/ND-CP of Vietnam Government issued on 18 June 2015 on Construction Investment Project Management.

- Decree No. 46/2015/ND-CP of Vietnam Government issued on 12 May 2015 on Construction Work Maintenance and Quality Management.

- Decree No. 18/2015/ND-CP of Vietnam Government issued on 14 Feb 2015 on Environmental Protection Planning, SEA, EIA and Environmental Protection Plans.

- Decree No. 19/2015/ND-CP of Vietnam Government issued on 14 Feb 2015 on detailing some articles of Law of Environmental Protection.

- Circular No. 27/2015/TT-BTNMT dated 29 May 2015 on SEA, EIA and EPP.

- Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on Hazardous Waste Management.

The applicable National Technical Regulations and Standards include:

- QCVN 14:2008/BTNMT- National technical regulation on domestic wastewater.

- QCVN 01:2009/BYT- National technical regulation on drinking water quality.

- QCVN 02:2009/BYT- National technical regulation on domestic water quality.

- QCVN 06:2009/BTNMT-Air quality -specified maximum allowable concentrations of certain hazardous substances in ambient air.

- QCVN 07:2009/BTNMT - National Technical Regulation on Hazardous Waste Thresholds.

- QCVN26:2010/BTNMT- National technical regulation on maximum noise limit in public and residential areas.

- QCVN 27:2010/BTNMT- National technical regulation on vibration.

- QCVN 40:2011/BTNMT- National technical regulations on industrial wastewater.

- QCVN 05:2013/BTNMT- National technical regulation on ambient air quality.

- QCVN 08-MT: 2015/BTNMT - National technical regulation on surface water.

- QCVN 09-MT: 2015/BTNMT - National technical regulation on groundwater.

- QCVN 03-MT: 2015/BTNMT - National technical regulation on the allowable limits of

heavy metals in the soils.

- QCVN 43:2012/BTNMT - National technical regulation on sediment quality.

- QCVN 18:2014/BXD - National technical regulation on Safety in Construction.

- TCVN 9902:2016: Irrigation Works – Specifications for Design of River Dikes.

- TCVN 4118:2012: Irrigation Works – Specifications for Design of Irrigation Canal Systems.

- Decision No. 3733/2002/QD-BYT dated Oct 10, 2002 of Ministry of Health on publishing 21 occupational sanitation standards, 05 principles and 07 parameters of occupational sanitation.

- Other relevant sector technical regulations and standards.

Compliance with environmental and social impacts assessment implementation

The subproject environmental and social impacts assessment will be carried out in line with environmental and social impacts assessment procedure of the WB and GoV. In particular, environmental and social impacts assessment of the subproject will comply with project environmental and social management framework which have been reviewd and approved by the WB. Environmental and social screening shall be carried out for each subproject to identify scope and proper type of environmental and social impacts assessment. Based on that, the TOR will be prepared for environmental and social impact assessments in accordance with subproject scale and potential forecasted impacts from subproject implementation. Environmental and social screening will be conducted by World Bank safety policy experts. The Environmental and Social Impact Assessment TOR will also be reviewed and approved by the World Bank Safety Policy Specialists prior to the implementation of the Environmental and Social Impact Assessment. In the process of environmental and social impact assessment, consultations with affected people and local NGOs should be conducted. The environmental and social impact assessment report will be disclosed at the sub-project site in Vietnamese so that affected people and local NGOs can access and the English version will be published on the World Bank's website prior to the appraisal of the subproject.

3.2. World Bank Safeguard Policies

3.2.1. Project level

An environmental and social screening of the Project was undertaken in line with the OP 4.01 and it showed that the following World Bank's safeguard policies have been triggered: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Pest management (OP 4.09), Indigenous peoples (OP/BP 4.10), Physical Cultural Resources (OP/BP 4.11), Involuntary Resettlement (OP/BP 4.12), Safety of Dams (OP/BP 4.37) and Projects on International Waterways (OP/BP 7.50). The Project has been classified as Category A. In addition, the Bank’s requirements for public consultation and information disclosure will be met.

3.2.2. Subproject level

This ESIA is based on the approved ESMF for the whole project, thus the following policies triggered respectively:

Environmental Assessment (OP/BP 4.01) Environmental Assessment (EA) is an umbrella policy for the Bank's safeguard policies. The overarching objective is to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. The EA process is intended to identify, avoid and mitigate potential impacts of Bank operations. EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. EA considers natural and social aspects in an integrated way.

This subproject triggers OP 4.01 because it involves the repair of dams, intakes, spillways, etc. which would likely cause potentially negative environmental and social impacts. Based on the social and environmental screening activities undertaken, the subproject is classified as Category B as per OP 4.01 (Environmental Assessment). As required by OP 4.01, the subproject has prepared an ESIA that meet the GoV's regulations and the World Bank's safeguard policy requirements. The subproject draft ESIA will be disclosed locally at the subproject areas and through the Bank's Portal as required by OP 4.01 and the Bank's policy on access to information. The final subproject ESIA will be disclosed locally at the subproject sites and through the Bank's information system.

Pest management (OP 4.09): Rehabilitation of the dam will result in stabilized agricultural land which is irrigated by the upgraded works, i.e. irrigated agriculture land will increase. Thus more amount of fertilizer can also be applied. The OP/ BP 4.09 – Pest management policy has been triggered to manage and promote the application of Integrated Pest Management (IPM) and guidance to this issue will be incorporated into the ESIA.

Physical Cultural Resources (OP/BP 4.11): This policy is triggered because the subproject construction activities may affect the pagoda, belief and religious utilities by construction traffic. In addition, since the subproject involves excavation that may encounter PCRs under the ground. Mitigation measures for impacts on the pagoda have been proposed in the section of site-specific mitigation measures while ESMP included measures to address chance finds.

Involuntary Resettlement (OP/BP 4.12): The Involuntary Resettlement policy seeks to prevent severe long-term hardship, impoverishment, and environmental damage to the affected peoples during involuntary resettlement. OP 4.12 applies whether or not affected persons must move to another location. The Bank describes all these processes and outcomes as "involuntary resettlement," or simply resettlement, even when people are not forced to move. Resettlement is involuntary when the government has the right to expropriate land or other assets and when affected people do not have the option to retain the livelihood situation that they have.

This policy is triggered because the subproject would have impacts involving the temporary and permanent involuntary taking of land and the loss of structures and assets associated with the land for the construction of project items. The Resettlement Policy Framework (RFP) was

prepared and included in the ESMF. It was assessed that the subproject has prepared Resettlement Action Plan (RAP) based on this RFP. Mitigation measures have been included in the RAP to ensure that displaced people are: (i) informed of options relating to their resettlement; (ii) consulted and offered alternative resettlement options; and (iii) compensated effectively and their livelihood is restored.

Safety of Dams (OP/BP 4.37): The project will not finance construction of any new dam or significant change to dam structure. This policy is triggered as the project will finance rehabilitation and improvement of existing dams including large dams (15 meters or more in height). Thus, it requires to arrange for one or more independent dam specialists to (a) inspect and evaluate the safety status of existing dams, its appurtenances, and performance history; (b) review and evaluate the owner's procedures for operations and maintenance; and (c) provide written report of findings and recommendations for any repair work or safety-related measures necessary to upgrade existing dams to an acceptable standard of safety. Policy and practice relating to dam safety need to meet international benchmarks, such as World Bank regulatory frameworks for dam safety. These measures are designed into the project, which includes the establishment of a national dam safety review panel (DSRP). Also the project will establish an independent Panel of dam safety Experts (PoE) who will carry out independent review of dam safety reports and proposed mitigation measures. This PoE will be working closely with the established DSRP to ensure the technical integrity of investment interventions. Each subproject will have separate Dam Safety Plan (DSP) in addition to the ESMPs.

World Bank Group Environmental, Health, and Safety Guidelines

World Bank-financed projects should also take into account the World Bank Group Environmental, Health, and Safety Guidelines[1] (known as the "EHS Guidelines"). The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice. The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group and are generally considered to be achievable in new facilities at reasonable costs by existing technology. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to the World Bank, become project-or site-specific requirements. This subproject should conform to the General EHS Guidelines.

Table 3 - 1: A summary of the WB and GOV regulations on environmental assessment

Environmental assessment stages	*WB (Regulation on OP/BP 4.01 on environmental assessment)*	*Vietnam (Decree 18/2015/ND-CP, Circular 27/2015/TT-BTNMT)*
Screening	- Category (A, B, C, FI) - Not required for each specific case in order to classify, apply safeguard policies and identify	- Category: I, II, III and IV of Decree 18/2015/ND-CP. - Rules, fixed in Annexes I, II and III - List of projects requiring

[1] [1]The EHS Guidelines can be consulted at IFC website www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

Environmental assessment stages	*WB* *(Regulation on OP/BP 4.01 on environmental assessment)*	*Vietnam* *(Decree 18/2015/ND-CP, Circular 27/2015/TT-BTNMT)*
	environmental assessment tool (EA). - The World Bank will classify a proposed project into one of four categories including A, B, C, or FI depending on the type, location, sensitivity and scale of the project and the nature, the importance of its potential environmental impacts. - Category A: Request for full Environmental Impact Assessment. In some cases, ESMF is also required. - Category B: ESIA, ESMF or ESMP is required. In most cases, it requires ESMF and/or ESMP. - Category C: without EA. - Category FI: ESMF is the most popular used tool. In the case of a number of subprojects that have been identified before the appraisal, the FI will prepare specific tools based on the framework, e.g. ESIA or ESMP.	SEA and EIA reports submitted and approved. - All of the projects which are not listed. - Generally, the project owner examines the project based on the classification as stated in Decree 18/2015/ND-CP and consults with the Department of Natural Resources and Environment (DONRE) or Vietnam Environment Administration (DONRE - VEA) to categorize and required EA report of the project, such as: • The project is in list of Annex I, II, III: SEA or EIA is required • The project is in list of Annex IV: EIA and Environmental protection plan is not required • The project is not in list of Annex I, II, III and IV: EPP is required
Environmental assessment tool	- Depending on project impacts, a range of tools will be used to meet the World Bank's requirements, including: ESMF; specific environmental assessment; ESMP, Regional and sectoral EA; Risk or hazard assessment; Environmental audit. The World Bank provides general guidelines for implementing each tool.	- EA tools such as SEA, EIA or EPP are identified based on Annexes I, II, III and IV of Decree 18/2015/ND-CP.
Scope of environmental assessment	- The World Bank supports borrower in the drafting TOR for the EA and determines the EA	- TOR for EA is not required. - Normally, after consultation with the local DoNRE or VEA about

Environmental assessment stages	*WB* *(Regulation on OP/BP 4.01 on environmental assessment)*	*Vietnam* *(Decree 18/2015/ND-CP, Circular 27/2015/TT-BTNMT)*
	scope, procedures, timeline and draft EA report... - For Category A projects, an ESIA TOR is required, identification of scope and consultations will take place in preparation for EIA TORs.	the type of EA, the project owner will prepare an EA report.
Community consultation	- During the EA process, the borrower must consult with affected groups and local NGOs on the environmental aspects of the project, focusing on their views. - For Category A projects, the Borrower shall consult these groups at least twice: (a) immediately after the environmental inspection and before the EA TOR is completed; and (b) when a draft EA report has been prepared. In addition, borrowers consult with these groups throughout the project implementation process as needed to address issues relating to EA that affect them... - For Category B projects, there should be at least one public consultation. - For meaningful consultations, the borrower provided relevant project documents in a timely manner prior to consultation in a form and language that the group could understand and be accessible to by them. - The minutes of the public meeting are included in the report.	- The project owner is responsible for consulting with the People's Committee of the commune, ward or township (hereinafter referred to as the commune) where the project is being implemented, with organizations or communities under direct impact of the project; Research and receive objective opinions and reasonable requests from relevant agencies to minimize the negative impacts of the project on the natural environment, biodiversity and public health. - Commune People's Committees where the project is implemented and organized under the direct impact of the project will be consulted. The project owner is responsible for submitting the EIA report to the people's committee of the commune where the project was implemented and have direct impacts on the locality, enclosing a written request for comments. Within 15 working days from the date on which the EIA reports are received, CPCs and organizations subject to

Environmental assessment stages	*WB* *(Regulation on OP/BP 4.01 on environmental assessment)*	*Vietnam* *(Decree 18/2015/ND-CP, Circular 27/2015/TT-BTNMT)*
		project direct impacts are obliged to submit their feedbacks if they do not approve the project. - The community consultation on direct impacts of the project is carried out in the form of community meetings co-chaired by the Clients and CPCs where the project is implemented and with the participation of Vietnam Fatherland Front, Socio-Political organizations, Socio-Professional organizations, relevant residential quarters, villages/hamlets. All opinions of participants in the meeting must be fully and truthfully presented in the minutes of meeting.
Disclosure of information	- Before the World Bank appraise the project, the EA report must be disclosed in public in a way that is easily accessible by project-affected groups and local NGOs. Once the World Bank has officially received the report, the World Bank will publish the report in English to the public via its website.	- After the EIA report is approved, the project owner is responsible for preparing, approving and publicly disclosing their EMP at the local CPC headquarter and consulting local communities so that local people can be informed and carry out their inspection and monitoring rights (Article 16 of Decree 18/2015/ND-CP).
Independent environmental expert	- For Category A projects, the independent EA experts who have no relation with the project will be hired by the Borrower for the implementation of the EA. - For category A projects with high risks or multi-dimensional environmental concerns, the Borrower will also hire a consultation team of independent	- Not regulated in Vietnam policy. - The Project owner shall implement or hire a consulting unit which satisfies conditions specified in Clause 1, Article 13 of Decree No.18/2015 for the preparation of the EIA report. Project owners or consultancy service providers must fully meet the following conditions:

Environmental assessment stages	*WB* *(Regulation on OP/BP 4.01 on environmental assessment)*	*Vietnam* *(Decree 18/2015/ND-CP, Circular 27/2015/TT-BTNMT)*
	qualified environmental experts of international experience for Consultancy on project aspects relating to the EA - Experts/consultation firms will be selected through a bidding process under the close supervision of the World Bank.	(i) The staff responsible for EIA must have at least BA degree and EIA consultancy certificate; (ii) There are staff with relevant specializations with a university degree or above involving in the project; (iii) Having certified and qualified laboratories and testing equipment for measurement, sampling, sample processing and analysis of environmental samples for environmental impact assessment of the project; In the absence of a certified and qualified laboratory and calibrating equipment, a qualified laboratory must be contracted for testing items.
EA review/Approval Process	- The Bank reviews findings and recommendations of EA to determine whether they provide sufficient grounds to process the funding to the project by the Bank. In case the Borrower has fully completed or completed part of the environmental assessment before the Bank participates in a project, the Bank will review this environmental assessment to ensure its consistency with this policy. The Bank may, where appropriate, request additional environmental assessments, including public consultation and disclosure.	- The MONRE shall appraise and approve EIA reports of projects as specified in Appendix III to this Decree, except for projects relating to defense and security activities and locations. - Ministries and ministerial-level agencies shall appraise and approve EIA reports of projects under their competence for investment approval, except for projects included in Appendix III to this Decree; - PPC shall carry out appraisal and approval of EIA reports of projects in the province, except for projects as mentioned above. - The appraisal will take place at least 45 working days at MONRE level and 30 working days at DoNRE level and 5

Environmental assessment stages	*WB* *(Regulation on OP/BP 4.01 on environmental assessment)*	*Vietnam* *(Decree 18/2015/ND-CP, Circular 27/2015/TT-BTNMT)*
		working days at district level after EIA or full EPP is received.
The number and language of the EA/EIA needed to be evaluated	- Number of copies is not specified. - Language requirements: English and Vietnamese. EA reports in Vietnamese are required for the information disclosure in the country and must be in English for publication on the World Bank website.	- The project owner must submit at least seven copies of EIA reports (depending on the number of members of the appraisal council) and one feasibility study or a technical-economic report of the proposed project.
Content of the EA report	- For Category A projects, the contents of the EA report are in Appendix B of OP4.01. - The scope of EA for Category B projects may vary by project, but EA's scope is narrower than that of Category A projects. ESMP is an integral part of type A projects' EAs (regardless of other tools used). EA for Category B projects may also be an Environmental and Social Management Plan (EMP) with contents as set out in Annex C of OP 4.01.	- The contents of the EA report must be in line with Circular 27/2015/TT-BTNMT.
Monitoring EA	- During the implementation of the project, the World Bank supervises the implementation of the environmental aspects against environmental regulations and the project borrower prepare report as agreed in the loan agreement and as described in other project documents, to determine the satisfactory compliance of the borrower's to Environmental Procedures (mainly with EMP). If the	- The local DoNRE is entrusted with the supervision of environmental compliance of the project. - At the end of the project construction phase, the Environmental Management Agencies will coordinate with the Construction Management Agencies to monitor the compliance of environmental management activities as

Environmental assessment stages	*WB (Regulation on OP/BP 4.01 on environmental assessment)*	*Vietnam (Decree 18/2015/ND-CP, Circular 27/2015/TT-BTNMT)*
	compliance fails, the World Bank will discuss it with the Borrower to ensure its compliance.	identified in the EA.

ESIA is a 5-step process which is summarized in the following table:

Table 3 - 2: Summary of ESIA formulation method and process

Step	*Target for ESIA*	*Method*
Step 1: Screening	Screen to determine eligibility of subprojects and prepare safeguard instruments for a subproject, if eligible for funding	- Initial screening: Applying 3 criteria including: technical standard on emergency repairs and regulations in line with environmental and social protection conditions. This is conducted by local dam management units - Confirm and screen for the last time: safeguard policy requirements must be defined
Step 2: Scoping	Prepare TOR for Consultants who will prepare safeguard policies and tools: ESIA/ ESMP/ECOP	Following guidelines as described in ESMF
Step 3: Prepare draft ESIA/ESMP including community consultation and information disclosure	- Identify potential impacts, assess potential negative environmental and social impacts - Propose mitigation measures and management plans to address potential negative impacts - Create an information channel for participation of community in decision making	Following guideline as described in ESMF
Step 4: Submit the draft ESIA for review and approval by competent	- Consult stakeholders and get final approval from competent agencies	Follow Law on Environmental Protection 2015 and ESMF prepared for the DSRIP project.

agencies		
Step 5: Monitoring and supervising	- Ensure compliance with ESIA - Check effectiveness of mitigation measures; - Determine arising issues, if any, for timely remedial actions - Draw lessons for similar projects in the future	- Incorporate mitigation measures into technical design and cost estimates - Closely integrate environmental specifications in tender documents and contract (for both civil work contract and construction supervision contract) - Recruit Independent supervision contractors, capacity building and independent monitoring - Monitor and supervise works done by contractors and consultants

CHAPTER IV. ENVIRONMENTAL, NATURAL AND SOCIO-ECONOMIC CONDITIONS OF THE SUB-PROJECT AREA

4.1. Geological and geographical conditions

a) Geographical and geological conditions of Loi Dong Reservoir

i) Topographical conditions: Loi Dong Reservoir has a catchment area of 1.15 km2 and is shaped like a bamboo fan. The vegetation cover in the basin is mainly pines, eucalyptus and jungle. The surrounding areas are high hills, small, steep and short streams and rivulets. The Reservoir has North - South direction which is also the coastal mountain in the North of Ngang Pass.

ii) Geological features: The headwork of Loi Dong Reservoir is located on a good geological background. Upstream foundation and stilling pool are shallowly allocated. This explains for the water leakage at the foot of the spillway which should be fixed (including stilling pool). The survey of the sub-project area and collected data do not reflect any serious slides or erosion.

b) Geographical and geological conditions of Nuoc Xanh Reservoir

i) Topography conditions: The Nuoc Xanh Green Reservoir has a catchment area of 1.90 km^2. The area has some streams focusing their flows into the entire basin. The Reservoir is wide with low mountains in the South at the elevation ranges of 100-350m. The main slope of the catchment is South-North bound and the average gradient of the basin is 245 ‰.

ii) Geological features: The old dam is filled mainly with sandy clay, siltstone and unevenly weathered. The dam runs across the main channel where geological structure is complex, threatening stability of hydraulic works.

c) Geographical and geological conditions of Ba Khe Reservoir

i) Topography conditions: The Ba Khe Reservoir has a catchment area of 4.17 km^2 and is shaped like a bamboo fan. The Reservoir is surrounded by high and continuous mountains without saddles at the average elevations of 100-200m. The main slope of the catchment is Northwest – Southeast. The length from the centerline of the Reservoir to the upstream is 1,500m and the largest width of the Reservoir is 750m and average gradient of the basin is 128‰.

ii) Geological features: The backfill soil of the old dam foundation is relatively complicated. The dam foundation and body need to be treated. The geological feature of the spillway is half hard to hard. The sluice foundation on layer 1e is heavy sandy clay with good waterproofing capacity (K = 9.3-10-6cm/s).

d) Geographical and geological conditions of Dap Buom Reservoir

i) Topography conditions: The Dap Buom Reservoir Dam has a catchment area of 4.25 km2 and is shaped like a bamboo fan and is lowered from South to North. The main features of the basin are as follows: average gradient 309 ‰; mainstream length 2.3km; main slope 48 ‰; the impoundment is shallow and relatively flat. Reservoir bottom is at the elevations of 20.0 ÷

8.0m.

ii) Geological characteristics: The main dam consists of many layers with different weathered status.

e) Geographical and geological conditions of Khe Co Reservoir

i) Topography conditions:

Khe Co Reservoir has a catchment area of 8.04 km2. Surrounded by high mountains and hills, the reservoir basin is in southwest - Northeast. The characteristics of the basin: average gradient is 467 ‰, length of the mainstream is 4.76 km and slope of the mainstream is 78 ‰. The project area has relatively flat terrain with small difference in elevations and tends to lean southeast bound.

ii) Geological characteristics: The main dam and auxiliary dam 1 and 2 from top to toe has following layers: The clay and grit (filled soil), semi-solid to soft plastic; clay and grit layers, soft plastic to half solid; Strong weathered shale of grayish blue; strongly weathered and cracked stone of medium solid.

f) Geographical and geological conditions of Khe Nhay Reservoir

i) Topography conditions: Khe Nhay Reservoir has a catchment area of 0.6 km2. The reservoir basin tends to be inclined from North to South which is surrounded by low hills at the elevation of 30-40m. The general characteristics of the basin are: average gradient 188 ‰, length of the mainstream is 1.0 km, slope of the mainstream is 16 ‰, total length of the rivulet branches 0.65 km. The irrigation area has relatively flat terrain.

ii) Geological features: The dam and sluice site consist of 3 layers: dams is filled with clay and grit; gray clay, purple gray, vermilion brown which is not evenly weathered, the rock is cracked, loosened and mixed with hard rock seams.
The spillway consists of layers: strongly weathered shale, purple gray, and russet. The weather is uneven, rocky cracked cascade between hard rock and hard.

g) Geographical and geological conditions of Khe De Reservoir

i) Topography conditions:

Khe De Reservoir has a catchment of 2.5 km2. The reservoir is sandwiched between Con Chua and Lam Mountains at the elevations of 30-50m. The average gradient of the basin is 365 ‰, the height of the mountain slope varies greatly from 50 m high to 15- 16 m high in the reservoir; length of the mainstream: 1.5 km; average gradient of the stream: 67 ‰. The high mountain slope consists of mainly strongly weathered sedimentary rocks and relatively thin vegetation. The low hills has gentle slope, elevations ranging 20-30m and thicker vegetation of mainly forestry plantations.
ii) Geological characteristics: The main dam and culverts sites are composed of 5 layers: clay mixed with macadam; clay layer; clay mixed with gravel layer; shale mixed with silty sandstone and Granite rocks which all are strongly stable. The spillway site consists of: clayey soil and gravel; clay soil and gravel and shale and silty sandstone, which are all stable.

h) Geographical and geological conditions of Da Den Reservoir

i) Topography conditions: The Da Den Reservoir has a basin area of 0.75 km2. The basin is

hollow shaped with sloping direction from Southwest to Northeast and surrounded by low hills at the elevations of 50-200m. The basin has steep streams and slopes. The length of mainstream is 0.45 km; gradient of the mainstream 167 ‰; average basin slope 317 ‰; total length of mainstream 0.65 km. The dam shoulder leans on a hillside with an average slope of $10^0 \div 30^0$. The spillway is located at the saddle on the right shoulder of the dam. The downstream area is a delta with terrain lowering from West to East and from North to South.

ii) Geological features: Dams and intakes sites consist of 4 layers: loam; loam containing grits, yellowish-gray, solid; loam containing grits, dark brown, yellow gray, solid plastic to half-solid; layers of loam mixed with grits; silty sand layer. Spillway site has clay soils, remnants, brown gray loam, strongly weathered siltstone and claystone, strongly to medium weathered shale containing charcoal.

4.2. Climate and meteorology

Ky Anh is a relatively large precipitation center in the North Central region and this is explained by the influence of Hoanh Son, Truong Son mountain ranges and wind directions. The rainy season in the region starts in September and ends in December. Rainfall distribution is not even both spatial and temporal. Over the three months of September, October and November, the precipitation accounted for nearly 70% of the total rainfall. Only in September and October the precipitation accounted for almost 70% of the total rainfall in the three months. Rainfall tends to increase from North to South.

The subproject area is annually affected by the North East and Southwest monsoons and tropical cyclones. The average wind speed in many years is 2.3 m/s. The maximum wind speed in Ky Anh occurs in rainy months reaches over 45 m/s. The Northeast winds usually start from October to March. There are strong coastal winds of grade 5 and 6 bringing rainfall and cold winds. Southwest wind usually starts in late April and ends in July with wind speed grade 4 and 5 bringing dry and heat weather.

In Ha Tinh province, typhoons usually occur in late June and end in late October, also in August, September and October with heavy and concentrated rainfall of the year and maximum wind speed can reach above 45 m/s. On average, there are one or two storms hitting Ha Tinh province annually. Only in 2005 alone, there were 3 storms directly hitting the region (storms 6, 7, 8) causing great damages to people and properties in the area.

4.3. Hydrological conditions

The hydrological regime in the region is influenced by annual rainfall. The annual flow is observed in two major seasons: flood season and dry season: flood season from September to November and dry season from December to early August. The May flood often appears in annual April and May. Annual flows are not evenly distributed in a year, mainly in flood months with over 70% of the annual flow. The dry season lasts for 9 months yet only producing 30% of the annual flow. This is very unfavorable to the exploitation and utilization of water resources in the region.

- Loi Dong Reservoir: The Loi Dong Reservoir has Quyen river system and Cau Quen river system. As the Loi Dong sub-basin is located in the basin of these two rivers, the Quyen and Cau Quen rivers are to drain water from Loi Dong reservoir basin during

flood season. The survey of sub-project area and collected documents did not reflect any serious risk due to unfavorable weather or climate.

- Nuoc Xanh Reservoir: Nuoc Xanh Reservoir is located in Ky Phong Commune, Ky Anh District with a catchment area of 1.9 km2. The reservoir is adjacent to part of the Rac River reservoir basin. There are no big river and streams in the basin except for few small streams. The flow in the basin entirely depends on annual rainfall in Ky Anh district.
- Ba Khe Reservoir: Ba Khe Reservoir is located in Ky Bac commune, close to Nuoc Xanh reservoir (Ky Phong commune). The hydrological and flow characteristics of the two basins of Ba Khe reservoir are similar to those of Nuoc Xanh Reservoir. The flow of Ba Khe Reservoir entirely depends on the annual rainfall in the region.
- Dap Buom Reservoir: Dap Buom Reservoir is located in the Ngan Sau road basin with small streams that form the inflow of the Reservoir.
- Khe Co Reservoir: The Khe Co Reservoir is located in Son Le commune, Huong Son district, with a catchment area of 8.04km2 and is the largest reservoir in the Sub-project area. The mainstream of the reservoir is 4.76 km long and flow is available throughout the year.
- Khe Nhay Reservoir: Hydrological conditions of Khe Nhay Reservoir are similar to that of Khe Co reservoir. Khe Nhay Reservoir has a catchment area of 0.6 km2. The hydrological regime of Khe Nhay Reservoir basin is influenced by annual rainfall in the region.
- Khe De Reservoir: The Khe De Reservoir has a catchment area of 2.5 km2 and the hydrographic regime in the Khe Dien reservoir basin is also influenced by the annual rainfall in the region.
- Da Den Reservoir: Da Den Reservoir has a catchment area of 0.75 km2. There are only some small rivulets flowing from acacia forests in the West. The inflow in the area entirely depends on the rainfall regime in the year. In the rainy season, the water level in the reservoir will rise and overflow the spillway into to the drainage canal to fields in Nam Son village.

4.4. Status and quality of soil, water, air environments

4.4.1. Surface water environment

Pursuant to QCVN 08-MT: 2015/BTNMT and impacting factors on the surface water resource environment in the project area, suggesting analysis and evaluation criteria for surface water quality:

- Chemical and physical parameters: pH, DO, SS, COD, BOD_5, NO_2^-, NO_3^-, NH_4^+, PO_4^{3-}, Cl^-, Total Fe, total grease.
- Microbiological parameter: Coliform
- Parameters for heavy metals: As, Pb, Cd

Assessment of surface water quality in the subproject areas where can be affected by the

construction and repairs of dams, spillway, sluices and by water in canals after the spillway in the upstream and downstream area. Five (5) samples are taken from each reservoir as shown in **Appendix 1**:

Assessment results of surface water quality of the subproject area in **Table 1, Appendix 2.**

Comments:

i) Evaluation of water quality in Khe Co and Khe De Reservoirs (NM26, NM27, NM28, NM36, NM37, MN40 comparing at column A_2 - QCVN 08-MT: 2015/BTNMT) showed that: most of Chemical and physical criteria, and micro-organism are within the QCVN. Only 2 criteria exceed the QCVN at one sampling location, as follows:

- At Khe Co Reservoir: Sample NM27: Criterion COD exceeding by 1.07 times; BOD_5 exceeding by 1.25 times.

Based on survey data at reservoirs, farmer infrastructure, environmental factors, etc., it is predicted causes of COD, COD and BOD_5 exceeding the limit value due to grazing livestock activities in the sampling area.

ii) Assessment of water quality of remaining reservoirs compared to Column B1 - QCVN 08-MT: 2015/BTNMT: Most of the analysis criteria are within the permitted limits; surface water has not been impacted by hazardous criteria such are total fat, heavy metals and microorganisms. However, some indicators still exceed the limit values in some positions, as follows:

- At Loi Dong Reservoir:

• Sample NM3: TSS exceeding the allowable limit by 1,56 times; NH_4^+ exceeding the allowable limit by 1.2 times; NO_2^- exceeding the allowable limit by 2 times; PO_4^{3-} exceeding the allowable limit by 1.2

• Sample NM4: NH_4^+ exceeding the allowable limit by 1.35 times

- At Khe Nhay Reservoir:

• Sample NM34: Total Fe exceeding the allowable limit by 1.75 times

• Sample NM35: BOD_5 exceeding the allowable limit by 1.07 times; total Fe exceeding the allowable limit by 2.8 times.

- At Khe De Reservoir:

• Sample NM38: Total Fe exceeding the allowable limit by 1.2 times.

• Sample NM39: Total Fe exceeding the allowable limit by 2.27 times.

- At Da Den Reservoir: Sample NM49: NO_2^- exceeding the allowable limit by 10.4 times.

Based on survey data in the field, there are no industrial parks or craft villages in the surrounding area of the Reservoir. Some analysis indicators exceeded the limit value due to livestock grazing activities in the areas near the sampling sites.

4.4.2. Status of groundwater environment

Based on QCVN 09 -MT: 2015/BTNMT and factors impacting groundwater quality, the suggested groundwater quality analysis and assessment criteria are as follow:

- Chemical and physical parameters: pH, TDS, COD_{KMnO4}, total hardness ($CaCO_3$), NO_2^-, NO_3^-, NH_4^+, Mn, SO_4^{2-}, Cl^-, Total Fe.
- Microorganism: Coliform; E. Coli
- Heavy metals: As, Pb, Cd

Assess the groundwater quality of the project site at sites that may be affected by the construction of dams, spillways, sewers, and management road. Each reservoir takes three samples as in **Appendix 1**.

Assessment results of groundwater water quality in the sub-project area in **Table 2 in Appendix 2.**

Comment:

Groundwater in the subproject area is of good quality, most of the indicators are within the allowable limits. Only Coliform indicator at some sampling sites exceeds QCVN 09-MT: 2015/BTNMT - National Technical Regulation on groundwater water quality, as follows:

- Nuoc Xanh Reservoir: sample NN1 with Coliform exceeding as much as 1.33 times compared to the allowable limit.
- Nuoc Xanh Reservoir: sample NN5 with Coliform and NN6 exceeding as much as 1.67 times compared to the allowable limit.
- Ba Khe reservoir: sample NN7 with Coliform exceeding 1.67 times compared to the allowable limit.
- Dap Buom reservoir: sample NN11 with Coliform exceeding 2 times compared to the allowable limit.
- Khe Co reservoir: sample NN16 with Coliform exceeding more than 2 times; The NN17 is 3.67 times and the NN18 is 2.67 times compared to the allowable limit.
- Khe Nhay reservoir: sample NN19 with Coliform exceeding 4.33 times and the NN21 sample exceeding 1.67 times compared to the allowable limit.
- Khe Dien reservoir: The NN22 sample with Coliform exceeding 1.67 times, the NN23 sample exceeding 2.67 and the NN24 sample exceeding 3.67 times compared to the allowable limit.

The field survey result showed that in the Sub-project area not affected by waste from industries or craft villages. Coliform indicator in some samples exceed the allowable limit due of livestock and poultry grazing activities and domestic activities of people in the area.

4.4.3. Air environment

Based on QCVN 05:2013/BTNMT; QCVN 26:2010/BTNMT; QCVN 27:2010/BTNMT and factors affecting air environment, parameters for analysis and assessment of air quality: total dust, SO_2, NO_2, CO.

Assess air quality in the subproject area at locations that may be affected by the construction

of dam, spillway, intake, and management road. Three samples are taken from each work as shown in **Appendix 1.**

Assessment results of air quality in the subproject area in **table 3, Appendix 2.**

Based on the air quality assessment in the area, indicators are within the allowable limits under the current regulations. Air environment in the Sub-project has no signs of pollution.

4.4.4. Soil environment

Based on QCVN 03 -MT: 2015/BTNMT and factors affecting the growth of crops, following soil sample analysis criteria are suggested:

- Chemical and physical parameters: pH, total organism, density, specific weight, blistering, mechanical texture (sand, limon, clay)
- Heavy metal parameters: Cu, Zn, As, Pb, Cd,

Evaluate the soil environment quality in the Subproject area at locations that may be affected by such construction activities as dam, spillway, intake, management road and auxiliary facilities such as dumpsite, borrow pits. Three samples are taken from each work as shown in **Appendix 1**:

Assessment results of soil environment quality in the Subproject area in **Table 4, Appendix 2.**

Based on the analysis data of soil quality in the Sub-project, there are no signs of being contaminated by heavy metals. The analysis criteria are within the allowable limits i.e. QCVN 03-MT: 2015/BTNMT – for agricultural land.

4.4.5. Sedimentation quality

Based on QCVN 43 -MT: 2015/BTNMT and impacting factors on sedimentation quality, following sedimentation sample analysis criteria are suggested:

- Chemical and physical parameters: pH, total organic substances, mechanical texture (sand, limon, set)
- Heavy metal parameters: Cr, As, Pb, Cd, Cu, Zn,

Assessment results of sedimentation quality in the Sub-project area in **Table 5, Appendix 2.**

The sedimentation quality in Reservoir areas has no signs of being contaminated by heavy metals, analytical parameters are within the allowable limit of QCVN 43-MT: 2015/BTNMT on freshwater sediment.

4.5. Biological resources

a) Plant and animal resources of Loi Dong Reservoir

Ky Trinh Ward has 1,754.18 ha of secondary forests which are scattered in hills and in the Southwest and West of the irrigation area. The main vegetation here is vines and vegetation coverage is strongly degraded due to wood logging for firewood and other purposes for a long time. Plantation forests are mainly eucalyptus, acacia, pine, casuarinas. Most of them are newly planted so they are small and low (<4m) and of low economic value. The natural

vegetation only has grass coverage or herbaceous plants along roadside and shrubs. The vegetation is poor and do not have economic value.

Animals are mainly cattle and poultry which are raised or grazed by households such as buffaloes, cows and poultry. There are no rare and precious species of animals and plants which need to be preserved or protected.

b) Plant and animal resources of Nuoc Xanh Reservoir

Ky Phong commune, Ky Anh district has 814.46 ha (2016) of protection forests and production forests. The forest area is mainly concentrated in Song Rac Reservoir and Nuoc Xanh Reservoir basins to the South and Southwest of the commune. Part of the forest lands is located to the North and borders on Ky Bac commune. In addition, some forest lands are scattered and intermingled in irrigation and residential areas. Vegetation cover is mainly planted with eucalyptus, acacia, pine and these trees are of good economic value and at the same time can help cover the surface, keep moisture, prevent flood flow and control erosion. The remaining area is secondary forest with mixed trees and vines of almost no economic value. The surface cover is low grass cover, herbaceous and shrub species. Out of a total of 1,214.42 ha of cultivated land, paddy rice fields and some vegetable crops, fruit trees and short-term cash trees are predominant.

Animals in the area are mainly cattle and poultry which are raised or grazed by households such as buffaloes, cows, pigs, chickens and ducks. There are no rare species of animals and plants which need to be preserved or protected.

c) Plant and animal resources of Ba Khe

Ky Bac commune has a total forest area of 1,125.48 ha (2016), of which production forests account for the majority of about 830 ha and the remaining are protection forests. Forest area is concentrated in the north and west of the commune, covering the entire basin area of Ba Khe reservoir. The trees are grown mainly of eucalyptus, acacia and pine. Some areas of protection forest are secondary forests of mixed species and vines which are of little economic value but are still valuable in soil protection and erosion control. Natural surface cover is low grass cover, herbaceous and shrub species. On the total area of 537.63 ha of cultivated land, agricultural plantation covers mainly wet rice fields and some vegetable crops, fruit trees (oranges, lemons, guava, guavas ...), short-term cash crops (peanuts, beans), though not high yield but meaning the main income for farmers in the commune.

Animals in the area are mainly cattle and poultry which are raised or grazed by households such as buffaloes, cows, pigs, chickens and ducks. There are no rare species of animals and plants which need to be preserved or protected.

d) Plant and animal resources of Dap Buom Reservoir

Flora in the reservoir area is mainly Eucalyptus, Acacia, Pine and Casuarina. Most of them are newly planted so they are small and do not have much economic value. The natural vegetation covers are only low grass or herbaceous plants along roadside and shrubs. Poor vegetation cover does not have economic value.

e) Plant and animal resources of Khe Co

Son Le commune has a total forest area of 1,323.01 ha which is distributed over most of the commune. Its three sides are Northwest, West and South of the commune, including the majority of Khe Co reservoir (the rest of the basin is located in Son Tien commune). Forests in the commune also consist of two types of production forests and protection forests with plantation forests as the dominant forests and a small part of secondary forests with good coverage. Plantation forests grow acacia, eucalyptus and pine; secondary forests have mixed trees and vines. Natural surface cover consists of grass cover, herbaceous and shrub species. The total area of 965.02 ha of agricultural land is mainly rice fields and some vegetables and fruit trees (oranges, lemons, guava, custards etc.), short-term cash crops (peanuts, beans) with average yield.

Animals in the area are mainly cattle and poultry raised or grazed by households and some species of birds and small wild animals. There are no rare species of plants and animals that need to be preserved or protected.

f) Plant and animal resources of Khe Nhay Reservoir

Son Tien Commune has a total forest area of 1,360.23 ha which are widely distributed throughout the commune, including the entire Khe Nhay Reservoir Basin and part of Khe Co Reservoir Basin (Son Le Commune). Forests here are mainly plantation forests, with a small proportion of secondary forests of moderate coverage. Plantation forests are both production forests and protection forests with main trees as acacia, eucalyptus and pine. The natural surface coverage is low grass cover, herbaceous and shrub species. Out of a total of 1,613.45 ha of cultivated land, agricultural lands are mainly occupied by wet rice fields and some vegetables and fruit trees (oranges, lemons, guava, custards...), short-term cash crops (peanuts, beans). Yield of these crops is medium.

Animals in the area are mainly cattle and poultry raised or grazed by households and some species of birds and small wild animals. There are no rare species of plants and animals that need to be preserved or protected.

g) Plant and animal resources of Khe De Reservoir

Khe De reservoir is located in Son Mai commune, Huong Son district, Ha Tinh province. The Reservoir was built in 1977. The Khe De reservoir catchment area is 2.5 km2. Both sides are hills, thin grass coverage, pine forest and regenerated eucalyptus. The surrounding area has sparse and poor vegetation which mean the failure to keep surface water and low reserves for the reservoir. About 800 m downstream of Khe De Reservoir, the vegetation cover is covered with such trees as eucalyptus and pine close to being harvested.

Animals in the area are mainly cattle and poultry raised or grazed by households such as buffaloes, cows and chickens/ducks. There are no rare and precious species which need to be preserved or protected in the area.

h) Plant and animal resources of Da Den Reservoir

The vegetation coverage in Ngoc Son commune is mainly plantation forests. The agricultural plantation coverage is mainly rice fields and some vegetables (sweet potato, gourd, pumpkin, spinach, morning glory, wild onion), fruit trees (orange, lemons, tangerines, guavas, custard, etc.) for stable harvest but small quantity; short-term cash crops (peanut, bean) and long-term

cash crops (acacia, eucalyptus) for low yields.

The characteristics of the vertebrate fauna are monotonous and less abundant. They are mainly small animals such as rodents like rat and animals such as buffalo, cow, pig, etc. Among vertebrate territorial animals, there are no protected or precious animals in the region.

4.6. Socio-Economic Profile of the communes in the subproject Area

The total area of subproject communes is 28,863 ha. Of which, there are 9.4 thousand ha of forest land and 6.9 thousand ha of paddy field. The area of Ky Trinh Ward is the largest (over 4.7 thousand ha) and the areas of Son Mai Commune in Huong Son District and Ky Bac commune, Ky Anh District are the smallest (about 1.9 thousand ha). The paddy and forestry areas in Ky Trinh Ward are the largest out of the 9 communes in the commune area (1.6 thousand ha and 1.4 thousand ha respectively).

Total population of the communes is approximately 49 thousand people in equivalent of 14,345 households. In which, male makes up 50.7% of total population (25,349 people). Population in Ky Thinh ward is the largest with over 11 thousand people. Following are Ky Phong and Son Tien communes with over 7 thousand people. For other communes, this number ranges from 2 thousand to 6 thousand. Ky Thinh commune has 3,428 households (the highest out of all subproject communes), while Son Mai commune has only 652 households. The labor force of subproject communes is approximately 29,392 people (58.9% of total population). Population density in subproject communes is unevenly distributed, i.e. Ky Bac commune has the highest population density (283 persons/km2) and the lowest population density is found in Huong Tho commune (55 persons/km2).

Income per capita of subproject communes is approximately 30 million VND/person/year. In which, income per capita in Ky Trinh ward is the highest (about 42 million VND/person/year). The main occupations of households in subproject areas are agriculture (growing rice, maize), forestry (growing acacia, eucalyptus, melaleuca etc.); in some communes in Ky Anh district, households engaged in aquaculture activities. In addition, as Ha Tinh has many industrial parks and manufacturing factories, the number of local people worked in industrial zones is relatively high. In leisure time, people will work as hired laborers (women) and men will work as bricklayers and masons to increase household's income.

Total number of poor households in subproject communes is 2,396, accounting for 16.7% of total households in 9 communes. In which, Ky Thinh ward has the highest poverty rate i.e. 26.9% (924 households), Ngoc Son has the lowest poverty rate 3.6% (33 households). Other communes have poverty rates ragining from 8% to 20%. There are 1,492 near-poor households in 9 subproject communes. In particular, Ky Thinh ward has the largest number of near-poor houses, i.e. 484 households (14.1%) among 8 communes. Proportion of near-poor households is low in the following communes: Ngoc Son commune, Ky Trinh ward, Huong Tho commune (4-55).

Ethnic minority: 100% of the population in subproject area are Kinh people and there is no ethnic minority.

Rural infrastructure: In the subproject area, all communes and wards have commune health clinics. 100% of households use electricity in their daily activities.

Main water sources in these communes are from drilled wells and dug wells. Water quality is relatively good for domestic and production usage. However, in the dry season, the

groundwater level is low so some wells do not supply enough water for domestic use and livestock farming needs. Some localities have concentrated water supply works, i.e. Huong Tho commune and Ngoc Son commune have been invested in concentrated water supply facilities which only meet demands of 80-90% of the population and the rest use drilled or dug well water. Some areas have access tap water (some communes where industrial parks are located, like Ky Thinh ward, are using tap water supplied by the industrial parks), yet tap water using ratio is quite low. Some communes use reservoir water for domestic and production uses, i.e. Son Le commune with 10% of the population using water from Khe Co reservoir, Son Tien commune with 10% of the population using water from Khe Nhay reservoir. The percentage of households having hygienic toilets is over 67%. In which, Ngoc Son commune, Ky Phong commune have the highest percentage of hygienic toilets (100%) and the lowest rate is Quynh Trinh ward (67%).

Utility services in the area meet the domestic needs in the commune (market, network, internet ...). In 9 communes and wards, there are 14 markets under the management of Commune/Ward PC. The people in subproject communes do not have difficulty in buying and selling goods. For postal services, only Huong Tho commune does not have postal services. Specific information on subproject communes is in the below table.

Table 4 - 1: Socio-Economic conditions in the subproject communes

Indicator	*Thach Ha district*	*Ky Anh township*		*Ky Anh district*		*Huong Son district*			*Vu Quang district*	*Total*
	Ngoc Son	*Ky Trinh*	*Ky Thinh*	*Ky Phong*	*Ky Bac*	*Son Tien*	*Son Mai*	*Son Le*	*Huong Tho*	
Area (Ha)	1,964.87	4,795.02	4,084.26	3,005.99	1,994.46	3,757.56	1,915.90	2,935.97	*4,409.60*	*28,863.63*
Paddy land area	1,189.59	1,618.52	1,027.52	675.50	383.88	930.01	261.73	630.25	238.67	6,955.67
Land for perennial plant	315	272.74	341.86	538.92	153.67	683.44	417.55	327.1	517.21	3,567.49
Forest land	538.04	1,416.68	171.97	814.46	1,123.39	1,360.20	992.84	1,323.00	1,683.35	9,423.93
Aquacultural area	75.21	320.36	7.96	48.06	1.61	22.99	13.12	21.04	7.28	517.63
Residential land	68.58	59.97	141.53	267.63	28.73	40.19	18.53	32.76	40.00	697.92
Unused land	53.3	484.23	314.34	152.35	99.45	258.07	35.43	312.09	706.33	2,415.59
Population (people)	2,541	6,285	11,399	7,923	5,643	7,199	2,311	4,085	2,539	49,925
Number of households (HHs)	930	1770	3428	2163	1697	1801	652	1164	740	14,345
Household size (People/HH)	2.73	3.55	3.33	3.66	3.33	4.00	3.54	3.51	3.43	3.48
- Men	1045	3014	5701	3987	3349	3750	1145	2117	1241	25,349
- Women	1,496	3,271	5,698	3,936	2,294	3,449	1,166	1,968	1,298	24,576
Population density (people/km2)	126	131	269	257	283	157	110	141	55	
Number of people in working age	1,580	3,629	6700	4,593	2,427	4,800	1,019	3,175	1,469	29,392

Income per capita (million VND/year)	30.19	42.00	20.00	31.00	30.52	26.50	32.00	27.06	30.70	30.00
Poor households (HHs)	33	358	924	338	213	243	55	115	117	2,396
Rate of poor households (%)	3.55	20.23	26.95	15.63	12.55	13.49	8.44	9.88	15.81	16.70
Near poor households (HHs)	39	79	484	220	202	210	54	160	44	1,492
Rate of near poor households (%)	4.19	4.46	14.12	10.17	11.90	11.66	8.28	13.75	5.95	10.40
Economic structure										
- Agriculture-forestry-fishery (%)	82.5	64.07	60.00	70.04	65.30	93.50	78.83	84.45	65.00	
- Industry-handicraft and construction (%)	3.3	5.42	25.00	5.18	27.50	0.01	1.23	1.63	4.19	
- Trading-services (%)	14.2	30.51	35.00	24.78	7.20	6.49	19.94	13.92	30.81	
% households using hygienic toilets	100.00	67.00	90.00	100.00	73.07	70.00	75.00	93.47	89.00	

Source: Statistical Year Book, Collected information at commune level and interviews results with local officials.

4.7. Socio-economic data of the project area

4.7.1. Access to public services

National grid. 100% of surveyed households in the project area communes use electricity to light their daily activities.

Cooking fuels: Households use many sources of fuel for cooking. However, the main energy of households is used in daily cooking (55.4%). About 38.5% of households use gas for cooking. The remaining households use biogas (2.1%) va and (4.1%) for cooking.

Traffic roads. Roads in subproject communes are: concrete roads (57.6%), asphalt roads (12.3%), earth roads (19.8%) and aggregate road (10.4%). Specific road information in the subproject area communes are in table 4.2:

Table 4 - 2: **Types of road in project communes**

Types of road		*Asphalt road*	*Concrete road*	*Earth road*	*Aggregate road*	*Total*
Ky Phong	Km	7.5	36.3	17.9	16	77.7
	%	9.7	46.7	23.0	20.6	100.0
Ky Trinh	Km	5.2	18.01	25.33	5.44	53.98
	%	9.6	33.4	46.9	10.1	100.0
Ky Thinh	Km	12	30	8	11	61
	%	19.7	49.2	13.1	18.0	100.0
Ky Bac	Km	4.3	25.9	0.0	11.9	42.1
	%	10.2	61.5	0.0	28.3	100.0
Huong Tho	Km	12.7	25.8	5.1	0.0	43.6
	%	29.1	59.2	11.7	0.0	100.0
Son Le	Km	7	42.35	29.75	0	79.1
	%	8.8	53.5	37.6	0.0	100.0
Son Mai	Km	2	35	4	3	44
	%	4.5	79.5	9.1	6.8	100.0
Son Tien	Km	8	57	0	0	65
	%	12.3	87.7	0.0	0.0	100.0
Ngoc Son	Km	2.2	15.6	8.2	4.3	30.3
	%	7.3	51.5	27.1	14.2	100.0
Total	Km	**60.9**	**286.0**	**98.3**	**51.6**	**496.8**
	%	**12.3**	**57.6**	**19.8**	**10.4**	**100.0**

Source: Socio-economic survey, March 2018

Water source. Clean water is one of the criteria for assessing the development and civilization of people and also one of the important criteria of new rural development program. According to the socio-economic survey, surveyed households mainly use water from wells for daily activities. Specific information on domestic water use sources of households are in **Table 4.3**:

Table 4 - 3: **Current condition of water supply facilities**

Reservoir	*Commune*	*Water supply system*		*Surface water*		*Groundwater*	
		Capacity (m^3/day night)	*Percentage of users (%)*	*Water source*	*Percentage of users (%)*	*Water source*	*Percentage of users (%)*
Loi Dong	Ky Trinh					Dug wells and drilled wells	100
Nuoc Xanh	Ky Phong					Dug wells and drilled wells	100
Ba Khe	Ky Bac					Dug wells and drilled wells	100
Dap Buom	Huong Tho	3.000	80			Drilled wells	20
Khe Co	Son Le			Khe Co reservoir	10	Dug wells and drilled wells	90
Khe Nhay	Son Tien			Khe Nhay reservoir	10	Dug wells and drilled wells	90
Khe De	Son Mai			Khe De reservoir	15	Drilled wells	85
Da Den	Ngoc Son	300	98			Drilled wells	2

Source: Socio-economic survey, 3/2018

Inhabitants in the subproject area mainly use water from dug or drilled wells with relatively good water quality for domestic uses and production. However, in the dry season, water level is so low and these wells cannot supply enough water for domestic uses and livestock.

Some localities that have concentrated water supply facilities such as Huong Tho commune and Ngoc Son commune. However, only 80-90% of the population has access to the water whereas while the remaining use water from dug wells or drilled wells.

Some localities use water from reservoirs for living and production activities such as Son Le commune with 10% of the population using water from Khe Co reservoir, Son Tien commune with 10% of the population using water from Khe Nhay reservoir), Son Tien commune with 15% of the population using water from Khe De reservoir).

The survey also showed that there is no realted water disease. The current water supply infrastructure can meet project construction needs.

Water sources for Production activities: 54.5% of surveyed households used water from irrigation reservoirs and irrigation system to irrigate crops and raising. 34% use well water for production activities.

4.7.2. Culture – Society

a) Cultural works, historical relics (Table 4.4)

Table 4 - 4: Statistic of cultural works, historical relics in the subproject area

Works	*Commune*	*Number of villages*	*Number of community house*	*Pagodas, temples*	*Entertainment area*	*Historical relics*	
						National level	*Provincial level*
Loi Dong	Ky Trinh	13	13				
Nuoc Xanh	Ky Phong	10	10				Duc Dai Vuong temple in Trung Phong village
Ba Khe	Ky Bac	10	10	2		Phuong Giai temple	
Dap Buom	Huong Tho	7	7				Cua Rao temple
Khe Co	Son Le	11	11		1	Cao Thang church, Le hau Tao temple	
Khe Nhay	Son Tien	12	12	1	1		The Phan's temple
Khe De	Son Mai	3	3	1	1		Duc Dai Vuong temple
Da Den	Ngoc Son	6	6	2	1		
Total		***72***	***72***	***6***	***4***	***2***	***4***

In the subproject area there are 72 villages, each village has a cultural house serving the needs of community activities; 6 pagodas and 4 entertainment centers at the village level; 2 national historic sites and 4 provincial historical relics. However, according to survey results, construction activities and repair works will not affect cultural and religious works and historical relics.

b) Cultural activities

Communes in the sub-project area have a movement of all people united to build a cultural life in the residential area. Community activities have many new features. Cultural activities,

sports performances, flag-raising organizations, banners, slogans to celebrate the great holidays of the country were well organized.

c) Utility services

Utilities in the area are relatively adequate to meet the needs of residents in the region and the requirements for workers during construction. Specifically:

- Among 8 communes/wards of the sub-project area, there are 12 markets under the management of the communes/wards. Of which there are 4 markets meeting daily, the rest meeting in session (3-4 days/session). Nearly every commune has a market, Ky Trinh has 4 markets and Ngoc Son has 2 markets. Due to the distance between communes, people in the sub-project communes did not have difficulty in buying and selling goods.
- Regarding postal services: Except for Huong Tho commune without postal service, the remaining communes have post office located at the headquarters of the commune people's committee, so it is very convenient for transactions.
- All communes in the project area are covered with mobile phone networks and internet, thus ensuring the circulation through telephone and internet throughout the region.

4.7.3. Characteristics of works management

Ha Tinh Provincial People's Committee has issued the Decision No. 15/QD-UBND dated 28/6/2011 along with regulation on decentralized management of hydraulic work management, exploitation and protection in Ha Tinh province. Details are as follows:

- Canals within a commune and having irrigation area ≤ 100 ha will be managed by local authorities.
- Canals with irrigation area of more than 100 ha will be managed by IMC (Irrigation management Company) at provincial level.
- Irrigation Management Unit: South Ha Tinh IMC and North Ha Tinh IMC will hold training classes for beneficiaries on O&M activities.
- Direct beneficiaries are villages getting irrigation water from Reservoirs will be responsible for lower level canals located within villages. Villager will contribute to O&M activities by their own labor.
- Management Units of Reservoirs in the subproject are summarized in **table 4.5**.

Table 4 - 5: Management units of the Subproject's Reservoirs

Works	*Communes*	*Management Units*	*Responsibility*
Loi Dong Reservoir	Ky Trinh	Ky Trinh CPC	Management of both headwork and canals
Nuoc Xanh Reservoir	Ky Phong	Nam Ha Tinh Irrigation Management Limited Company	Management of headwork

Ba Khe Reservoir	Ky Bac	Bac Ky CPC	Management of both headwork and canals
Dap Buom Reservoir	Huong Tho	Huong Tho CPC	Management of both headwork and canals
Khe Co Reservoir	Son Le	Bac Ha Tinh Irrigation Management Limited Company	Management of headwork
Khe Nhay Reservoir	Son Tien	Son Tien CPC	Management of both headwork and canals
Khe De Reservoir	Son Mai	Son Mai CPC	Management of focal works
Da Den Reservoir	Ngoc Son	Ngoc Son CPC	Management of both headwork and canals

CHAPTER V. ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

5.1. Types and scope of impacts

Implementation of the sub-project will generate some impact during the construction period, however, the impact level is not large and can be minimized. Once completed, the beneficiary area of the 08 reservoirs in the subproject will benefit from the restored public services/infrastructure, thereby promoting economic growth and access to social services. Critical flood protection structures/works which will have been repaired, solidified, rehabilitated roads and dams will help improve safety of people and property in adverse weather conditions.

Potential negative impacts are identified and screened at each component of the subproject from preparation to construction phase and are classified according to the nature of the construction work. Most of the negative impacts are temporary, localized and reversible due to the small to medium-sized construction works. Impacts can be mitigated by applying appropriate technologies and specific mitigation measures, with close monitoring of Consultant, PMU and local communities.

The table below defines levels of negative impacts based on how wastes are generated in relation to construction activities[2].

Table 5 - 1. Criteria for classification of negative impacts

Impact/Level	*Low*	*Moderate*	*High*
Waste water discharge (domestic and industrial)	Exceeding technical regulations on waste by 1.1 times to less than 1.5 times and waste discharging volume less than 5 m^3/day	Exceeding technical standards on waste by 1.5 times to less than 3 times, waste discharging volume of 5 - 10 m^3/day	Exceeding technical regulations on waste by more than 3 times, waste discharging volume of more than 10 m^3/day
Dust and Emissions	Exceeding the standard by 1.1 times to under 1.5 times with the emission level of less than 500 m^3/hour	Exceeding the standard by 1.5 times to under 3 times with the emission level of 500 – 5,000m^3/hour	Exceeding the standard by over 3 times with the emission level of over 5,000m^3/hour
Noise	Exceeding standards 2 to 5 dB	Exceeding standards 5 to 10 dB	Exceeding standards over 10 dB
Vibration	Exceeding standards 2 to 5 dB	Exceeding standards 5 to 10 dB	Exceeding standards over 10 dB

[2] Reference: Decree 155/2016/ND-CP regulations on sanctioning administrative violations in the field of environmental protection.

Domestic solid waste	Generated less than 1,000 kg/day	Generated from 1,000 to 2,000 kg/day	Generated over 2,000 kg/day
Hazardous solid waste	Generated less than 100 kg/day	Generated from 100 – 600 kg/day	Generated over 600 kg/day
Fire incidents, oil spills	Less than 2,000 kg	2.000 to 10.000 kg	Over 10.000 kg

Potential negative environmental and social impacts are also broken down into specific impacts, such as direct, indirect, short-term, long-term and cumulative impacts.

Direct impacts: Direct impact occurs through the direct interaction of a subproject activity with environmental and social components or business.

Indirect impacts: The indirect impacts on the environment and society are impacts that are not a direct result of the subproject, which is often created later, or as a result of a complex, real action. Indirect effects are also known as secondary effects, or even tertiary effects.

Cumulative impact is an impact created as a result of a combination of the subproject together with other projects that cause the associated impact. These impacts occur when the incremental impact of the subproject is combined with the cumulative effects of past, present, or future projects that have the potential for predictability.

Temporary impacts: are impacts occurring during construction or within short time after construction.

Long-term impacts: are the effects that arise during the construction process but most of the results appear in the operational phase, and can last for decades.

5.2. Potential positive impacts of the sub-project

The subproject will improve the effectiveness of the 8 reservoirs and will bring about positive environmental and socio-economic impacts for the local community, as follows:

1. Dam safety improvement: the repair and expansion of dam surface, reinforcement of upstream dam slope and repair of spillway will improve dam safety, reduce the risk of dam failure and safety for 41,486 people of 8 communes (Ky Trinh, Ky Phong, Ky Bac, Ky Anh) and Huong Tho commune (Vu Quang district), Son Le, Son Mai, Son Mai, Huong Son, Ngoc Son (Thach Ha district).
2. The repairing and constructing of new intakes and upgrading of headworks will improve water supply capacity and increase irrigated winter-spring area from 1,115 ha to 1,184 ha (an addition of 69 ha) and irrigated summer-autumn crop area from 1,155 ha to 1,064 ha (an addition of 109 ha) after the sub-project is completed
3. The upgrading and repairing of management and public service roads will contribute to better access to reservoirs and improve overall landscape of the area.
4. The repair and upgrading of management roads also contribute to improved flood prevention and control efficiency, facilitating daily transport of people, especially those who travel on the roads to their workplaces to access social services i.e. schools, health centers and markets.

5. Improving flow regulation capacity during flood season and dry season; maintaining air humidity and soil humidity which will have an impact on the development of organisms. Reservoirs will continue to be habitats of aquatic life. These contribute to multiple effects on improved biodiversity.
6. Impacts on income: In the construction phase, the population density in the sub-project area would increase due to the present of project staff and workers at construction site. During the highest time, there are 330 workers in all of 8 construction sites with local workers accounting for about 40%. In addition to economic benefits due to increased demands for food and food service, and improved income from food and foodstuffs provision, job opportunities may be available because the Client has policies to encourage the use of local workers and some households can significant earn from their business.
7. Impacts on the ecological environment: repairing and improving dam safety will help regulate the flow during flood season and increase water supply during the dry season, increasing the humidity, and groundwater reserves, ensuring improved habitat of vegetation and other living species, balancing ecological system in the area. Moreover as the sub-project area always suffer prolonged drought and the sub-project will help improve ecological environment of area. At the same time, favorable environments for downstream production activities will be created. Environmental incidents or risks will be minimized as the reservoirs are safe. In the context of climate change with abnormal floods and other extreme weather phenomena, improvement works will enhance the resilience of hydraulic works to climate change impacts (i.e. flood drainage capacity is improved as spillway is upgraded; dam stability is improved when dam surface is expanded and dam crest is heightened and dam slopes reinforced and monitoring equipment system for early warning is installed etc.

5.3. Potential negative impacts of the sub-project (8 reservoirs)

5.3.1. Impacts during the pre-construction phase

Activities in the pre-construction phase: Land acquisition, tree cutting, preparation of dump site, stockpile, borrow pits, camp installing, removal of vegetations, transport of wastes soil, etc. Details of activities during pre-construction phase are described in Chapter 2.

Construction activities mainly relate to the repair of existing headworks so excavating work is in-significant. In addition, the construction sites do not have unexploded ordinance (UXO) left over after wars and without existing production activities. Thus, mine clearance will not be required prior to construction commencement.

During the pre-construction stage, the following negative environmental and social impacts will happen:

- ***Impacts due to land and crop acquisition:***

Existing hydraulic works are mainly repaired and upgraded so impacts due to land and crops acquisition are insignificant as follows:

- The number of households affected by land acquisition: 88 households or a total of 320

people. Among 67 households are affected by land acquisition, 10 AHs with residential land affected, 12 AHs with agricultural land affected, 10 AHs with aquaculture land affected and 35 AHs with production forest land affected. 9 offices are affected and 21 AHs with trees affected as they grow plants on land managed by CPCs **(Table 5.1)**.

- The implementation of the subproject items will permanently acquire 71,917m^2 of land of 67 households and 9 CPCs, in which: (i) residential land 1,587m^2; (ii) agricultural land 6,263m^2; (iii) public land 23,840m^2 managed by 6 CPCs, consisting of special use hydraulic lands, river, dyke protection corridor; (iv) 37,081 m^2 as production forest land and (v) 3,146m^2 as aquaculture land. The construction process will affect trees and crops of 21 households with farming activities on land of CPCs and will temporarily affect 18,500m^2 of public land managed by CPCs. The land acquisition in the sub-project area is presented in **Table 5.2**.
- There are 12 severely affected houses, including 7 households with more than 20% of total production land affected and 5 as vulnerable households with more than 10% of total production land affected. Two households are totally affected and need to be relocated in Ky Thinh Ward due to the repair of Loi Dong reservoir. Affected lands in the subproject are summarized in **Table 5.3.**
- There are 1,259 fruit trees, 8,016 timber trees, and 2,702m^2 of subsidiary crops will be affected (including peanut, vegetable and bean).

Thus, the ***land acquisition is considered to have a negligible effect*** on production and lives of local people, as the majority of the acquired lands are production forest land areas; 24.2% of the total acquired land is public land. This impact will be recovered through full implementation of compensation regulations in the Subproject Resettlement Action Plan.

Table 5 - 2: Summary of affected HH due to land acquisition and affected crops

Works	*No. of affected households*				*No. of HH affected with trees on land managed by PC*	*No. of affected CPCs*
	Residential land	*Productive forest land*	*Agricultural land*	*Aquaculture land*		
Loi Dong Reservoir	8	6	2	2	4	2
Nuoc Xanh Reservoir	-	2	-		1	1
Ba Khe Reservoir	-	3	5	3	1	1
Dap Buom Reservoir	1	3	-	-	2	1
Khe Co Reservoir	-	11	1	2	6	1
Khe Nhay Reservoir	-	2	3	2	2	1
Khe De Reservoir	1	5	1	-	3	1
Da Den Reservoir	-	3	0	1	2	1

Works	*No. of affected households*				*No. of HH affected with trees on land managed by PC*	*No. of affected CPCs*
	Residential land	*Productive forest land*	*Agricultural land*	*Aquaculture land*		
Total	***10***	***35***	***12***	***10***	***21***	***9***

Table 5 - 3: Summary of affected lands in the Sub-project

Location (commune)	*Affected land*									*Total affected land*		*Temporarily affected area (m^2)*
	Residential land (m^2)		*Production forest lands*		*Agricultural production land (annual crop land)*		*Public land (m^2)*	*Aquaculture land*		*(m^2)*	*HH*	
	(m^2)	*HH*	*(m^2)*	*HH*	*(m^2)*	*HH*		*(m^2)*	*HH*			
Ky Trinh	176	1	2.213	5	-	-	2.213	-	-	4.602	6	2.000
Ky Thịnh	782	7	2.527	1	781	2	4.632	991	2	9.713	12	2.000
Ky Phong	-	-	4.956	2	-	-	-	-		4.956	2	2.000
Ky Bac	-	-	3.614	3	3.438	5	237.9	678	3	7.730	11	2.000
Huong Tho	411	1	1.087	3	-	-	2.859	-	-	4.357	4	2.000
Son Le	-	-	12.461	11	344	1		767	2	13.572	14	2.000
Son Tien	-	-	1.890	2	1.189	3	7.185	235	2	10.499	7	2.500
Son Mai	218	1	4.699	5	511	1	5.877	-	-	11.305	7	2.000
Ngoc Son	-	-	3.634	3	0	0	1.074	475	1	5.183	4	2.000
	1.587	***10***	***37.081***	***35***	***6.263***	***12***	***23.840***	***3.146***	***10***	***71.917***	***67***	***18.500***

Source: RAP report, March 2018

Table 5 - 4: **Number of households with affected structures**

No.	*Works*	*No. of HHs with affected structures*	*Affected items*		
			Fence (m^2)	*Yard (m^2)*	*Breeding facilities (m^2)*
1	Loi Dong Reservoir	8	234	121	70
2	Nuoc Xanh Reservoir	-	-	-	-
3	Ba Khe Reservoir	-	-	-	-
4	Dap Buom Reservoir	1	-	43	157
5	Khe Co Reservoir	-	-	-	-
6	Khe Nhay Reservoir	-	-	-	-
7	Khe De Reservoir	1	-	21	89
8	Da Den Reservoir	-	-	-	-
	Total	**10**	**234**	**185**	**476**

Source: RAP report, June 2018

b) Environmental and Social Impacts related to site clearance

Impact on air environment: Source of pollution is dust generated by the handling of

construction materials, travel of vehicles, emissions from construction equipment.

- *Dust from vegetation and surface soil remov*al in the entire project according to WHO's rapid assessment technique is 869.1 kg **(Table 5.5)**.
- *Dust caused by the transport of vegetation and surface soil to dumping site*: According to WHO data, the amount of dust generated by transport is 0.4 kg/km/vehicle. The amount of dust generated by transporting the *vegetation and surface soil* to the dumping site is 9,891.8 kg **(Table 5.5)**.

Table 5 - 5: Amount of dust generated during pre-construction phase

Works (reservoir)	*Dust due to the removal of vegetation and surface soils*		*Dust generated due to the transport of wastes*				*Total dust volume generated (kg)*
	Volume of vegetation and surface soils removed (m^3)	*Dust volume (kg)*	*Transported volume* (m^3)	*Number of transportations*	*Transportation distance (km)*	*Dust volume (kg)*	
Loi Dong	2,350	117.5	2,350	470	0.9	338.4	455.9
Nuoc Xanh	2,585	129.3	2,585	517	3	1,240.8	1,370.1
Ba Khe	3,582	179.1	3,582	716	2.6	1,490.1	1,669.2
Dap Buom	1,000	50	1,000	200	0.9	144	194
Khe Co	4,205	210.3	4,205	841	6.5	4,373.2	4,583.5
Khe Nhay	1233	61.7	1233	247	5.5	1,085	1,146.7
Khe De	905	45.3	905	181	1.2	173.8	219
Da Den	1,521	76.1	1,521	304	4.3	1,046.4	1,122.5
Total	***17,381***	***869.1***	***17,381***	***3,476***	***24.9***	***9,891.8***	***10,760.8***

- *Smoke and emission* also affecting air environment which are generated from (i) the removal of vegetation and surface soil, (ii) waste soil transportation. Total volume of smoke and emission generated during pre-construction phase is calculated as in **Table 5.6** below:

Table 5 - 6: The volume of smoke and emission generated during pre-construction phase

No.	*Reservoir*	Volume of fuels consumed (kg)	*Smoke (kg)*	*Exhaust emitted (kg)*			
				C_xH_y	SO_2	NO_x	*CO*
1	Loi Dong Reservoir	0.744	3.599	4.547	6.641	11.417	0.744
2	Nuoc Xanh Reservoir	1.839	8.454	7.781	9.520	18.139	1.839
3	Ba Khe Reservoir	2.279	10.528	10.049	12.608	23.662	2.279
4	Dap Buom Reservoir	0.317	1.531	1.935	2.826	4.858	0.317
5	Khe Co	5.758	25.937	20.193	21.491	44.636	5.758

	Reservoir						
6	Khe Nhay Reservoir	1.457	6.585	5.290	5.799	11.821	1.457
7	Khe De Reservoir	0.338	1.611	1.890	2.668	4.676	0.338
8	Da Den Reservoir	1.454	6.611	5.591	6.408	12.706	1.454
	Total	***14.185***	***64.855***	***57.277***	***67.962***	***131.916***	***14.185***

However, as the location of construction works is far away from residential areas and surrounded by hills and mountains, the affect is only on 330 workers working on the site and some households living near the construction site. In addition, inspection of construction equipment is carried out regularly and the duration of the impact is short, thus ***the impacts are assessed at moderate***.

Impacts on soil environment:

During the pre-construction time, surface leveling, vegetation and surface soil tak place in all 8 construction sites. These activities can cause erosion, soil deposition, soil degradation, infertility and bad effects on the soil of dam's protection corridor.

Waste oil from machinery and equipment during site leveling is minimal yet without disposal it can pollute soil and water environment due to great volume of toxic substances. Waste oil is black, viscous, insoluble in water, stable and contains such heavy metal as lead, zinc, and other toxic chemicals produced by the carbonation process of engine operation. Although the volume of waste oil is minimal, yet without proper collection and processing and if it is poured into reservoirs and canals, soil environment will be polluted as oil prevents the respiration and destroy food environment of microorganisms in contaminated soil. This impact is assessed as low level as routine equipment maintenance is carried out in workshops and waste oil is collected by workshop owner for reuse.

Impact on soil environment is considered negligible as most of the acquired land area is within the dam protection corridor. Borrow pit and dumping site are abandon lands or are being used.

Impacts on water environment:

The concentration of workers in the camp site near the construction site will affect the water environment due to their daily domestic waste; especially domestic wastewater if not properly treated will penetrate into surface water together with rain water and increase pollutant load in water environment in the area. It is estimated that volume of domestic waste water generated during site clearance phase of the project is 10.64 m^3/day i.e. each work will generate 0.8 m^3 to 2.4 m^3 of waste water per day. Each work has only 10 -30 workers which mean insignificant waste and can be controlled;

Wastewater from cleaning equipment contains grease, soil, sand and has a high content of suspensions. Given 22 vehicles transporting waste soil during the preparation phase, the wastewater volume is estimated at 11 m^3/day according to Vietnam standard TCVN 4513:1988.

Run-off in the leveled area or where materials are gathered or from equipment cleaning will bring with it surface soil and increase turbidity of reservoir water and affect downstream's water sources. ***These impacts on water environment are assessed as moderate*** as the Client arranged site clearance activities in dry season with fewer workers and more local labors working in the construction site.

Impacts due to risks and incidents

Traffic accidents are caused by increased vehicles, machinery and equipment operating in the construction sites and access roads. Labor accidents are due to the appearance of holes or bumpy surfaces in the construction sites.

During the preconstruction process, electrical incidents may affect construction workers and local population. However, during the pre-construction phase, the volume of work using electricity is not large and only during a short time, thus this impact is ***assessed as low level***.

Impacts on biological environment

The removal of trees, weathered soil and dumping waste may affect ecosystems in the soil due to loss of eggs, larvae, and habitat of some insects and plants in the area.

A total of 1,259 fruit trees, 8,016 trees for timber, and 2,702m^2 of vegetable area (including peanut, bean, vegetables) will be affected. The project implementation will permanently acquire 37,081 m^2 of production forest land of 35 households. Cutting down trees will affect environmental landscape and coverage of reservoir area. Loss of coverage may result in erosion and landslides. However, most of affected production forest land area are newly planted acacia and eucalyptus of 2-3 years. The affected and acquired area is not large and flat so erosion and landslide risks are not high. Due to short preparation time (estimated for 1 month), and there is no rare and endangered flora and fauna species for protection in the subproject area, ***the impact is considered as low***.

5.3.2. Impacts during construction phase

This is the stage with most impacts on the subproject's environment. The construction phase involves the construction and repair of main items (dams, spillway, intake, construction roads, management houses etc.), exploitation and transport of materials from borrow pits to the construction sites and transport wastes to dumping sites. Details of activities during construction phase are described in Chapter 2.

- ***Impact on air environment:***

i) Dust generated from earth works:

During construction phase, amount of dust increases by 620,779 tons (in which dust generated from earth works and soil transportation is 293,621 tons and dust generated due to material transportation is 327,159 tons) which is shown in **Table 5.7 and 5.8 below:**

Table 5 - 7: Amount of dust generated by excavation, filling, soil transportation during construction period

Work (reservoir)	*Dust generated due to earthworks*		*Dust due to transporting backfilling soil*			*Dust due to transporting wastes soil*			*Total dust amount generated*
	Volume of	*Dust*	*Distance*	*Vehicle*	*Dust*	*Distance*	*Vehicle*	*Dust*	

	filling and excavating soil (m^3)	*amount generated (kg)*	*(km)*	*routes*	*amount generated (kg)*	*(km)*	*routes*	*amount generated (kg)*	*(ton)*
Loi Dong	33,927	1,696	9.5	4,661	35,422	0.9	1,564	1,126	38,245
Nuoc Xanh	66,693	3,335	2	9,001	14,401	3.0	2,912	6,990	24,725
Ba Khe	80,861	4,043	6	10,566	50,715	2.6	3,128	6,507	61,265
Dap Buom	37,985	1,899	32	4,357	111,544	0.9	2,476	1,782	115,226
Khe Co	142,086	7,104	0.3	11,952	2,869	6.5	2,182	11,347	21,320
Khe Nhay	39,263	1,963	0.3	2,951	708	5.5	911	4,010	6,682
Khe De	82,065	4,103	0.3	8,186	1,965	1.2	2,405	2,309	8,377
Da Den	39,555	1,978	2	3,292	5,268	4.3	3,063	10,536	17,781
Total	**522,435**	**26,122**	**52.4**	**54,966**	**222,891**	**24.9**	**18,642**	**44,608**	**293,621**

Table 5 - 8: Amount of smoke and exhausted emission generated due to earthworks

No	*Work (reservoir)*	*Amount of fuels consumed (kg)*	*Smoke (kg)*	*Exhausted emission (kg)*			
				C_xH_y	SO_2	NO_x	*CO*
1	Loi Dong	6,412	5.002	26.675	50.015	83.423	133.438
2	Nuoc Xanh	12,605	9.832	52.437	98.319	163.991	262.310
3	Ba Khe	15,283	11.921	63.576	119.205	198.828	318.034
4	Dap Buom	7,179	5.600	29.865	55.997	93.401	149.398
5	Khe Co	26,854	20.946	111.714	209.463	349.374	558.837
6	Khe Nhay	7,421	5.788	30.870	57.882	96.543	154.425
7	Khe De	15,510	12.098	64.523	120.980	201.789	322.769
8	Da Den	7,476	5.831	31.100	58.312	97.261	155.573
	Total	**98,740**	**77.017**	**410.759**	**770.174**	**1,284.610**	**2,054.784**

Effects of dust on air environment are as follows: Under normal weather conditions, dust generated from the transportation of soil and stones only dispersed within an area of 30 m from dust generating point. With the wind dust can be diffused to the height of more than 10m and travel with wind as far as 100m. Cement dust from wind will be released into the air at the site, storage facilities. Cement dust is dense at the loading area. Dust from the transporting of steel, cement, sand and rocks in construction area has wide range of dispersion and may impact on many objects i.e. trees, people living along roads and travelers. During construction, suspended dust concentrations in the construction site and in stockpiles and dumpsites are usually higher than the allowable value of QCVN 05:2013/BTNMT. The most affected are workers working in the construction site. However, given the large construction sites and far away from residential areas and with high density of trees and high dust dispersion ability, ***the impact is considered as moderate***.

ii) Impact on air environment due to the material transportation (soil, stone, cement, steel,

etc.):

Amounts of smoke and emissions generated from the transportation of construction materials are calculated in **table 5.9 and 5.10** below:

Table 5 - 9: Amount of dust generated due to material transport during construction-phase

Work (reservoir)	*Dust generated due to sand transport*			*Dust generated due to stone transport*			*Dust generated due to cement, steel transport*			*Total (tons)*
	Distance (km)	*Number of transportations*	*Amount of dust (kg)*	*Distance (km)*	*Number of transportations*	*Amount of dust (kg)*	*Distance (km)*	*Number of transportations*	*Amount of dust (kg)*	
Loi Dong	9.5	359	2,728	19.2	1,746	26,819	9.5	150	1,140	30,687
Nuoc Xanh	20	948	15,168	24	2,698	51,802	20	391	6,256	73,226
Ba Khe	24	481	9,235	1.4	1,697	1,901	24	196	3,770	14,906
Dap Buom	8.5	377	2,564	30	1,691	40,584	11	168	1,476	44,624
Khe Co	12	827	7,939	24	3,217	61,766	12	287	2,753	72,459
Khe Nhay	20	204	3,264	12	419	4,022	20	82	1,308	8,594
Khe De	17.5	556	7,784	18	2,785	40,104	12	175	1,682	49,570
Da Den	40	272	8,704	32	901	23,066	15	110	1,322	33,092
Total	**151.5**	**4,024**	**57,386**	**160.6**	**15,154**	**250,063**	**123.5**	**1,559**	**19,707**	**327,157**

Table 5 - 10: Amount of smoke and exhausted emission generated due to material transport during construction-phase

TT	*Work (reservoir)*	*Number of transportations*	*Distance (km)*	*Smoke (kg)*	*Exhausted emission (kg)*			
					C_xH_y	SO_2	NO_x	*CO*
1	Loi Dong	150	9.5	1.340	5.900	3.648	2.907	7.325
2	Nuoc Xanh	391	20	7.351	32.377	20.021	15.954	40.198
3	Ba Khe	196	24	4.430	19.510	12.064	9.614	24.223
4	Dap Buom	168	11	1.734	7.636	4.722	3.763	9.481
5	Khe Co	287	12	3.234	14.245	8.808	7.019	17.685
6	Khe Nhay	82	20	1.537	6.771	4.187	3.336	8.406
7	Khe De	175	12	1.977	8.706	5.383	4.290	10.809
8	Da Den	110	12	1.243	5.473	3.384	2.697	6.795
	Total	***1,559***	***120.5***	***22.846***	***100.618***	***62.218***	***49.580***	***124.922***

Smoke and emissions generated from the transportation of materials (sand, soil, cement, steel, etc.) may affect population living along roads. However, as most of transportation roads are national roads, the amount of dust is not high. Access roads to the construction site are earth

road and aggregate road, yet not many households are living along these roads, excepting for few i.e. Dap Buom (6 households), Khe De reservoir (6 households), Ba Khe reservoir (Huu Lac pagoda and Ky Bac primary school (2km away from the reservoir). ***This impact is assessed as moderate*** and can be minimized through mitigation measures.

iii) Dust and exhausted emsisson due to the transport of waste soil

Amount of dust and exhausted emission due to the transport of waste soil is calculated in **Table 5.7 and 5.11:**

Table 5 - 11: Amount of smoke and exhausted emission generated due to the transport of waste soil during construction-phase

TT	*Work (reservoir)*	*Waste soil (m^3)*	*Distance (km)*	*Smoke (kg)*	*Exhausted emission (kg)*			
					C_xH_y	SO_2	NO_x	CO
1	Loi Dong	7,820	0.9	1.323	5.827	3.603	2.872	7.235
2	Nuoc Xanh	14,562	3	8.213	36.172	22.367	17.824	44.909
3	Ba Khe	15,641	2.6	7.645	33.672	20.821	16.592	41.805
4	Dap Buom	12,378	0.9	2.094	9.224	5.704	4.545	11.452
5	Khe Co	10,911	6.5	13.333	58.723	36.312	28.936	72.907
6	Khe Nhay	4,557	5.5	4.712	20.753	12.833	10.226	25.765
7	Khe De	12,027	1.2	2.713	11.950	7.389	5.888	14.837
8	Da Den	15,314	4.3	12.380	54.524	33.715	26.867	67.694
	Total	**93,210**	**24.9**	**52.414**	**230.845**	**142.745**	**113.750**	**286.605**

All dump sites are allocated in the commune lands which are near construction site within a short distance. However, there are still roads for transporting waste soil passing through the residential areas. Thus, the affected objects are people living along these roads and near dumpsites. Details of the affected will be described in section on sub-project impact. ***This impact is assessed as moderate.***

- ***Impacts of noise and vibration on the environment***

Noise and vibration are generated from such machinery and devices as trucks, excavators, bulldozers, concrete mixers, generators, pumps, etc. Noise and vibration are not frequently generated during this stage. Among 123 mechinaries expected to operate full time in the construction site, only some vehicles can cause excessive noise of over 90 dBA (i.e. exceeding the Vietnam standard TCVN) including bulldozers, excavators and trucks. Noise and vibration caused by construction activities mainly relate to the operation of equipment and will have very little impacts on local people as the construction sites are far away from residential areas i.e. the nearest residential area is as far as 400-500m from the construction sites. ***The impact is considered as moderate*** and can be minimized if contractors fully perform all inspection and maintenance regulations.

General assessments of the level of air pollution: a large of amount of dust and exhausted emission is generated, mainly in the construction sites of headwork and in stockpiles, borrow

pits and dumpsites. The direct affected objects are workers working on site. However, given the wide and airy space and away from residential area, these impacts will not affect the surrounding residential areas. Dust and exhausted emission generated from the transport of materials will affect many objects, yet they can be minimized through strict compliance with mitigation measures by contractors.

- ***Impact on water environment:***

i) Impacts of domestic waste water of workers on water environment :

With the presence of 330 workers in the subproject, the estimated amount of domestic wastewater generated is 330 persons x 80 liters/person/day = 26.4 m^3/day. The amount of pollutants in a day in the construction site is as follows:

Table 5 - 12: Pollutant loads in daily domestic wastewater in the subproject area

No.	*Parameter*	*Load (g/day)*	*Concentration (mg/l)*	*QCVN 14:2008/BTNMT Column B, K = 1.2; C_{max}*
1	BOD_5	14,850 ÷ 17,820	562.5 - 675	60
2	COD	23,760 ÷33,660	900 – 1,275	-
3	Suspended solid	23,100 ÷47,850	875 - 1.812,5	120
4	Grease	3,300 ÷9,900	125 - 375	24
5	Total N	1,980 ÷3,960	75 - 150	-
6	Ammonium	792 ÷1,584	30 - 60	12
7	Total P	264 ÷1,320	10 - 50	12

The results in **Table 5.12** show that the concentration of pollutants in domestic effluent exceeds regulation (QCVN 14: 2008/BTNMT) for many times. Without proper measures the wastewater will contaminate surface water, ground water and soil environment. Domestic wastewater generated from camp site located in the reservoir area (70-300m away from dams). There are 41 workers in each work on average. The domestic wastewater generated on daily basis is 26.4 m^3/day, i.e. 3.3 m^3/day on average is generated from each work. The waste water has bad ordor and contains organic substances (BOD_5, COD), nutrients (N, P, NH_4^+, NO_2, PO_4^{3-}) and pathogenic microorganisms. Without proper collection and treatment methods, the wastewater may penetrate into the soil or flow into reservoirs and cause pollutions to surface and groundwater. ***This impact is assessed as moderate*** and can be controlled by appropriate collection and treatment measures

ii) Impacts of runoff on water environment

Rainwater runoff can be polluted as it passes through areas containing pollutants such as stockpile, open air construction areas etc. Rainwater runoff then can be mechanically contaminated (with soil, sand, rubbish), or polluted with organism and grease. Rainwater runoff at this stage has high turbididty as it bring with it mud and soil from site leveling, excavation, backfilling, construction of main dam, spillway, and management house and management road. The maximum rainwater runoff in the subproject area is calculated as follows:

Q_{max} = 0.278.K.I.A = 0.278 x 0.12 x 56.95 x 50 = 0.2797 (m^3/s),

In which:

+ Q: The maximum flow of rainwater runoff (m^3/s).

+ K: Runoff coefficient, depending on ground surface feature. For disturbed construction site, K = 0.12.

+ I: Average rainfall intensity during highest rainfall time (mm/h), I = 56.95 mm/h.

+ A: Average area of each construction site is 50 ha.

The concentration of pollutants in rainwater runoff is estimated as follows:

Table 5 - 13: Concentration of pollutants in runoff

No.	*Pollutants*	*Concentration, mg/l*
1	Total N	0.5 ÷ 1.5
2	Total P	0.004 ÷ 0.03
3	COD	10 ÷ 20
4	SS	10 ÷ 20

If no treatment measure is applied, the runoff will flow into the reservoirs and downstream streams and cause increased residue amount in the receiving water source and reduced dissolved oxygen. Rainwater will be polluted when it passes through the dam construction site and stockpiles in the reservoir and downstream areas. Rainwater runoff will carry such dirts as cattle manure, waste material, soil, sand, waste, domestic waste water when it flows through construction sites and pollute water soucre, cause reservoir sedimentation and water bodies (canals, ditches) around stockpiles and dump sites. However, as construction activities only take place during dry season (January to August), ***the impacts are evaluated as low*** and can be minimized by such measures as shedding stockpiles and regular collecting and cleaning excessive material, wastes and domestic wastewater from activities of workers or digging trenches to collect rainwater.

iii) Impact of construction wastewater on the water environment

Construction wastewater is mainly generated from concrete and mortar mixing, equipment washing and stone screeing. This type of wastewater has high concentration of SS, pH content, but low flow, impact on the surrounding environment is low. Wastewater from washing equipment contains high levels of grease and dirt. However, with revolving construction method, number of machines used for construction is not many and they are scattered in many locations, water volume need for washing vehicles is not frequent and negligible. Volume of construction wastewater and equipment washing water at each site is estimated at 3-5m^3/day. Total wastewater generated at 8 sites of the subproject is 5 x 8 = 40 m^3/day.

Wastewater from construction activities, concrete curing, repairing and cleaning machinaries and equipment containing hazardous substances such as cement, oil and grease will present toxicity to aquatic environment. However, quantity of these two types of wastewater is in-significant and thus minial impacts on water environment.

Construction of spillways and intakes will inundate part of concrete work and water will wash away some impurities in concrete and contaminate water in the reservoirs. If the water level in reservoirs is low, concentration of these impurities may affect aquatic species.

As construction activities are mainly carried out in dry season when water level in reservoirs is low and as the construction time is short, impacts of wastewater on hydrological regime and water quality in reservoirs are low. ***The impact is evaluated as low.***

iv) Impacts of solid waste on water environment in reservoirs and canals

Such construction solid wastes as soil and rocks in dumpsites, if not properly handled and managed and without proper fencing and management, can result in high turbidity in water when there is a rain causing soil and stone to fall into canals.

The excavation of foundations as part of dam and intake repairing activities or backfilling in reservoirs (e.g. Khe De, Khe Co, Khe Nhay) may cause increased turbidity in water as soil, rocks, mud and sand will flow downstream with water.

Dead plants in the reservoir area and in the construction site if not collected, will decompose and cause bad smell. They can be also swept away with rainwater into streams and cause water pollution. Water contaminated by decomposed vegetation has green color and bad odor. Dead plants decomposing in anaerobic environment will produce such toxic substances as NH_4^+, H_2S, PO_3^-, etc., which will result in turbidly in reservoir water and bad odor, affecting lives of aquatic organisms as fish, shrimp, snails, etc. The decomposition of organic compounds consuming oxygen in water will reduce dissolved oxygen amount in water. This will harm the natural organisms living in reservoirs, such as the respiratory effects of some local fish, shrimps, snails ... and reduce the photosynthetic capacity of aquatic plants. It is surveyed that local people in the project area do not use water in reservoirs for drinking. However, as many as 630 households are using water from Khe Co, Khe and Khe Nhay reservoirs for bathing, washing and livestock raising. The contaminated water from reservoir may increase skin diseases, gynecological diseases of women and diarrhea for cattle. However, as the amount of tree cutting is not large which is mainly for fuel by local people and the unused part is transported to dumpsites, ***so the impact is evaluated as low*** if the contractor will fully performs mitigation measures.

- ***Impacts on soil environment***

i) Impact on soil environment due to domestic wastes

During the construction stage, the number of workers working regularly at site is about 330 people, i.e. 41 people in each construction site. Khe Co Reservoir has the largest number of workers i.e. 60. The estimated amount of daily solid waste generated will be 330 people x 0.5 kg/day = 165 kg/day.

Domestic wastes of about 330 workers on sites are biodegradable waste, containing many organic substances and pathogenic microorganisms. Without proper treatment and collection, these wastes will pollute once discharged into environment. However, domestic waste generated from worker camp area is minimal and can be controlled. As a result, ***the impact is considered as low.***

ii) Impacts of excavating and backfilling activities at borrow pits and dumpsites on soil

environment

Soil excavation and backfilling (earthwork) and material exploitation at borrow pits (in Khe Co, Khe Nhay and Khe De reservoir) and dumpsites will disturb surface soil layer and affect soil physical properties i.e. soil texture and porosity. Some borrow pits and dumpsites are only temporarily acquired and if they are not returned to its original condition in accordance with regulations after the removal of surface soil layer, production activities and growth of crops will be affected once these sites are returned to local people. The dumping of wastes can cause landslide and erosion which pollute neighboring areas. The impacts may include:

- The dumping of waste may cause landslide and erosion which pollute the neighboring areas. However, as dumpsites are empty, depressed and abandoned and isolated from residential areas, erosion and landslides will not likely to happen and affect the production activities and lives of people. In addition, the contractor will carry out leveling and compacting sites by layer during the dumping and at the same time embank the surrounding of the dumpsites to avoid erosion and landslide. The allowed height of the dumps should be equal to the natural ground, thus ***this impact is assessed at low***.
- Backfilling soil of 03 reservoirs of Khe Co, Khe De and Khe Nhay will be exploited from low hills and vacant land in the impounding area which is far away from residential area. The exploitation depth is only 1- 2 m and will not cause landslide. The impact is evaluated as low and the contractor must comply with all regulations on soil exploitation and waste dumping to minimize soil erosion and landslides. The exploitation of borrow pits in the impounding area will not affect storage capacity of reservoirs as the pit is only as low as freeboard and the contractors will return the site using waste soil generated from the removal of coffer dam.

iii) Impacts of hazardous wastes on soil environment

During construction phase, equipment using DO oil such as excavators, bulldozers, compactors, drilling machines, trucks transporting excavating and backfilling soil etc. will operate in the site. The construction time will be 6 – 12 months. Given the amount of waste oil generated into the environment of each work as 18 liters of DO oil/month/equipment, the total amount of waste oil generated will be 21,600 liters. Waste oil is hazardous, black, unsaturated waste which is insoluble in water, stable and contains such heavy metals as lead, zinc and other toxic chemicals caused by carbonization during engine operation. If not collected, heavy metals and toxic substances in waste oil will pollute soil and penetrate into and pollute groundwater. Humans and living organisms contaminated with heavy metals or toxic waste in waste oils can suffer metabolic disorders or even cancer. ***This impact is assessed as low*** as routine equipment maintenance will be carried out in workshops and waste oil is collected by workshop for reuse. There will no no waste oil discharged into the environment.

Table 5 - 14: Estimated waste oil generated during construction phase

Work	*Number of equipment*	*Construction duration (Month)*	*Waste oil (liters)*
Loi Dong	14	12	3024

Nuoc Xanh	17	12	3672
Ba Khe	15	12	3240
Dap Buom	11	12	2376
Khe Co	20	12	4320
Khe Nhay	13	6	1404
Khe De	17	6	1836
Da Den	16	6	1728
Total	**123**		**21,600**

Solid wastes containing grease and oil are hazardous substances. Althought they exist in small quantity, they are non-degradable in soil environment. Wihout proper collection and treatment measures, solid wastes can seriously affect soil environment.

iii) Impacts of heavy construction equipment on soil compaction

Operation of heavy construction equipment may affect soil surface and break the granular structure and cause compression and sealing effects to holes on the ground. Compacted soil may reduce cultivation capacity or limit the growth of plants. However, heavy construction machinaries (bulldozers, shovels, compactors, trucks, etc.) only operate within a certain area where vegetation coverage does not exist. As construction time is short and environmental recovery measures will be carried out by the contractors, the impact will be mitigated or avoided. ***The impact is assessed as low.***

- ***Impacts on biological environment***

The excavation, filling and disposing wastes will cause to the loss of habitats and hatching ground of some species in the soil such as insects and cave-dwelling animals as snakes and frogs. However, there is no special species that need special protection in the sub-project area, and ***the impact is considered as moderate***.

Dust and exhausted emission from construction activities affect the growth of fauna and flora in the subproject area and surrounding areas as follows: Dust on tree leaves reduces photosynthesis process; SO2, CO, NOx both cause leaf diseases and affect the growth of trees. The scope of impact on the trees is 20m from the site and along 10m of transportation route. The impact is in-significant as rainwater will wash away dust on trees. The impact is visiable yet localized and short-term so ***impact on ecological environment is considered as low.***

Impacts on the upstream aquatic ecosystems: it is provided that it is not allowed to practice aquaculture in irrigation reservoirs so there are only natural species such as shrimp, fish, weed, etc. Impacts on aquatic plants may occur if water is turbid and when such hazardous wastes as waste oil, construction waste containing oil, grease, cement are released into the reservoirs which cause obstruction to respiration of aqutic species and reduce the photosynthetic capacity of aquatic plants. Hazardous substances and heavy metals can accumulate in fish and shrimp and affect humans when they are used as food.

There is 0.3 ha of aquaculture ponds of households in the downstream area. However, as

aquaculture ponds are located far away from the construction site, construction activities do not affect aquatic ecosystems of these ponds. ***Impact on the aquatic ecosystem is considered as low*** as the amount of wastewater generated by aquaculture aqc is quite small compared to water quantity in reservoirs and construction contractors will take measures to manage wastes during construction.

- ***Impact on landscape:***

The collection of a great volume of construction materials and equipment may cause changes to the ground surface, reducing vegetation cover and creating unevenness on the ground due to excavation and backfilling activities in borrow pits and dumpsites. These may affect natural landscape of the area. ***These impacts are not serious*** and will be restored after the subproject complete.

- ***Impacts on local infrastructure***

i) Damaging roads and rural infrastructure:

It is calculated that up to 54,966 transportations using 7 tons trucks will carry backfilling soil and 19,756 transportations of waste soil to dumpsites and 18,642 transportations of construction materials including sand, rocks, steel, cement, steel to all construction sites during construction phase.

In all 8 construction sites, materials transportation will use gravel road routes (road to the reservoirs) which are 3-5m wide road pavement without being reinforced. The transportation of construction materials and wastes using a large number of vehicles in short time may cause erosion, soil subsidence and damages to surface of roads, bridges, culverts, canals etc. ***The impacts are assessed as moderate.***

ii) Impacts on houses and structures

Construction activities in 3 reservoirs of Loi Dong, Dap Buom and Khe Co will affect (the demolish of structures) houses and structures including: 56m^2 of fences, 234m^2 of yard and 476 m^2 of breeding farms. Detail is in **Table 5.4.**

In additional, some livestock farms (Loi Dong, ba Khe, Nuoc Xanh and Da Den) and 2 forestry farms (Da Den), 1 primary school (Ba Khe) can be affected by the transportation of construction materials. However, due to the short transport distance through less traffic areas (mainly limited to the construction sites) so ***the impact is assessed as moderate.***

iii) Impacts on 500KV transmission line

Construction sites of Loi Dong, Nuoc Xanh and Da Den reservoirs are adjacent to 500KV transmission line. Construction site of Nuoc Xanh reservoir is nearest to the line i.e. about 3-8m and this does not meet safety requirements for freeboard (> 10m). Where the dam surface is expected to be heightened, the dam will intersect ultility poles of 830 – 831 500KV transmission line and the line will be inundated in the reservoir. The construction activities taking place in the national grid safety corridor will lead to such risks as accidents due to short circuit and explosion that damage propertyies and lives of local people. Impacts on the 500 KV high voltage power system of repair works in Nuoc Xanh reservoir are evaluated as high and with serious consequences. Thus consultation from Ha Tinh Electricity Transmission

Agency is required. At the same time, safety regulations for construction activities under 500 KV high voltage system should be strictly complied with.

The construction sites of Loi Dong and Da Den reservoirs are beyond the safety corridor of national grid. So ***the impacts on the 500 KV high voltage transmission line is evaluated as moderate***.

iv) Impacts on cultural, historic and belief relics

- There are some national and provincial level historic relics such as: Cao Thang temple and Le Huu Tao temple near Khe Co reservoir, temple of the Phan near Khe Nhay reservoir. However, the subproject activities will not affect these relics.

- Huu Lac pagoda located near material transport road to Ba Khe reservoir will be affected. During the first and 15th of lunar months, number of people visiting the pagoda increases and visitors will be affected not only by dust, smoke, noise but also safety when they visit the pagoda. ***This impact is assessed as moderate.***

- Excavation and construction of new intakes can detect valuable cultural properties in the ground. The subproject mainly involves the repair and upgrade works on the existing foundations and works which have been operated for a long-time. As the sub-project area is not archaeological site and the ***possibility of detecting valuable cultural properties is quite low***.

- ***Impact on traffic safety during the construction phase***

Transported materials and wastes can be spilt on the road on the transport way to 8 construction sites with transportation distances of 0.2-47 km along national, provincial, inter-commune roads and rural roads, as well along farmers and on-farm roads in the sub-project area.

If not being properly managed, transported materials and wastes spilt on the road will present a loss of aesthetics and dangers to people and vehicles on circularion on roads. There might be more traffic accidents to workers and local people. In addition, the increased number of transported vehicles along local roads may present a higher risk of traffic accidents, especially if drivers do not comply with safety regulations. Specific impacts will be discussed in site-specific impact section.

These impacts are assessed as moderate and there should be remedial or mitigation measures.

- ***Social impacts***

i) Impacts on health services, public health and construction workers:

Air pollution caused by increasing emissions, smoke, dust and noise from construction activities in the sub-project site is only temporary yet some effects can be found in workers at construction site. Effects of dust and exhausted emission may be one of causes to respiratory diseases. Sexually transmitted diseases may increase. In addition, infectious diseases can be triggered in the area to an outbreak if environmental sanitation condition is not ensured. As a result, health care services will increase. Thus, it is necessary to strengthen health care activities to prevent and control possible diasises.

Accidents can happen during the construction process due to the operation of excavation and backfilling equipment, concrete mixers and electric systems in the camp area and in the construction sites. Particularly the 500 KV high voltage system across still present potential accidients to workers in Loi Dong, Nuoc Xanh and Da Den reservoirs although these reservoirs are beyond the safety corridor. Labor accident can occur for any of worker during construction activities. Labor accident also causes damages to people and properties and psychological panics to local people and workers. In addition, if the transportation of materials does not follow traffic safety regulations or the travelers may be careless, traffic accidents are quite likely to happen. ***The impact is assessed as moderate*** as the construction area is far away from residential area and the contractor is required to fully implement labor safety measures during the construction processes and material transport.

ii) Impacts due to labor influx

According to the 2016 socio-economic reports of communes, some social evils in the subproject area such as drug, prostitution, theft etc. have been observed. The construction activities require a labor force about 330 workers in 8 construction sites. Among them local workers make up 40% and average number of laborer is 40 at each site (Khe Co reservoir has the largest number of workers i.e. 60 people). Thus, as many as 200 workers will come and and stay in the subproject area during the construction phase and this is a small number compared to local population. The main potential social problems associated with worker immigration could be: (i) potential spreading of infectious diseases from employees to local communities and vice versa; (ii) potential impact of prostitution, drugs and gambling; (iii) potential conflict between workers and local communities due to culture and custom differences; and (iv) sexual abuse and assault of girls due to the influx of workers employed by construction contractors. Given that the construction period only last for 11 months (in 2 years) in each construction site, ***the impact is considered as low and manageable***.

- ***Impacts on downstream area due to water level lowering for construction***

i) Impact on production and domestic water supply:

There are 2 rice seasons in the sub-project area: spring crop from January to May and summer-autumn crop from June to August. This time is also dry season and suitable for construction activities. Project interventions mainly involve dam surface expansion and dam crest heightening or upgrading spillway which are all carried out above the normal water level (NWL) and will do not affect water supply to the downstream. On the other hand, the reinforcement of upstream and downstream slopes, waterproofing for dam body and construction of new intakes in 7 works (Loi Dong, Nuoc Xanh, Dap Buom, Khe De, Khe Nhay, Da Den, Ba Khe) will required water level in reservoirs to be lowered to below the normal water level for construction.

Water level lowering for construction may affect the irrigation supply of 1,115 ha of spring rice and 1,055 ha of summer-autumn rice and 630 households for their daily-life purposes and livestock. Drinking water is from drilled and dug wells. Income of people in the subproject area mainly depends on agricultural production. Thus, without proper measure, impacts of lowered water level will significantly impact incomes and lives of local people. However, ***the impact is assessed as low level*** or is not like to occur due to following reasons:

- During construction and repair of earthen dam and construction of intakes, flow diversion for construction is required to ensure downstream water uses. Flow diversion is done through existing intakes. Once the pre-casting of the new culvert is finished, the entire existing intakes will be removed and flow will be diverted into the exisitng intakes for downstream water supply. Once the new intakes can operate to drain water, the flow will be diverted back to the new intakes. At the same time, coffer dam will be built at the gate of drainage canal to block the dam section of the diversion canal (where existing intakes are located) and the dam section above the new intake in accordance with design cross section.
- Among 8 works under the Subproject, 7 works need new intakes (Loi Dong, Nuoc Xanh, Ba Khe, Dap Buom, Khe Nhay, Khe De, Da Den). Upstream dam heels and downstream drains of all works need improvement. Therefore embankment of cofferdam for construction will be applied in all of 8 works. Draining water inside coffer dam will ensure dry ground for construction of intakes wihout draining all water in reservoirs. Thus, a certain amount of water is still maintained in reservoirs.
- During the construction of 7 new intakes (except for Khe Co reservoir), the subproject owner will use other water sources to supply downstream uses. Water from Bau Son and Hoi Lay reservoirs will be use to supply Loi Dong reservoir; water from Song Rac canal will be used instead of Ba Khe and Nuoc Xanh reservoirs; water from Cau Trang reservoir will be used instead of Da Den reservoir; water from Nuc Trong reservoir or after Linh Cam pump station will be used instead of Khe De reservoir; water from Vu Quang dam will replace water from Dap Buom reservoir; replacement water source for Khe Nhay reservoir is not available so cofferdam and existing intake will be used to supply water to the downstream.
- Time to construct dam heel and water intake is quite short, i.e. 2-3 months. At the same time, there is plan to supply water for downstream areas from other sources. As July - August is dry season and is the end of summer-autumn crop season, water demand for irrigation of downstream areas is very low. Thus impact on water supply for downstream areas due to construction activities almost will not happen.

ii) Impacts on aquaculture, tourism, navigation:

There are no aquaculture, tourism or navigation activities in all 8 reservoirs. Thus, decrease of water level in reservoirs will not affect tourism and navigation activities. The drainage of reservoirs during construction will affect a small area of aquaculture activities in Ba Khe reservoir hired by local housejolds for fish-caged farming. The aquaculture area of communes in the downstream of reservoir is quite small (Loi Dong, Ba Khe, Khe Co, Khe Nhay, Da Den) with total area of 3,146 m^2. ***The impact is assessed as low*** and can be mitigated by measures as early notification to farmers of construction schedule and cutting off plan so that farmers can actively store water in aquaculture ponds or water supply contract with fish farmers in Ba Khe reservoir can be terminated.

- ***Negative impact of demolition activities of auxiliary works after construction:***

After construction, contractors have to demolish temporary facilities such as workers' camps, stockpile, sanitary facility, dumpsites that may cause negative impacts on the environment i.e. generating wastes, obstructing traffic. However, as these works are simply assembled and can

be demolished or disassembled in a short time, they have negligible impact on the environment and people's daily activities.

Returning sites of dumpsites of 8 works and borrow pits of Khe Co, Khe De and Khe Nhay reservoirs require tight compaction and the top layer to be covered with surface soil. If not, there be water leakage and trees cannot grow.

Rubbish in camp sites, stockpiles, toilets, dumpsites etc., if not proper collected and cleaned will present pollution risks to water environment, landscape, traffic and production activities of households in the area.

The impacts are assessed as moderate and can be minimized through mitigation measures.

- ***Impacts due to risks and incidents***

Impacts due to incident and accident risks are assessed at moderate as it is difficult to control and may pose a danger to human health as well as to property and works.

- Accidents: Traffic accidents are caused by increased vehicles, machineries and equipment operating in the construction sites and on access roads. Labor accidents happen because of holes and bumpy surfaces in the construction sites.

- Fire explosion: This may result in severe human, economic and environmental damages and loss or environmental damage. There are some causes to fire and explosion as follows: Vehicles containing temporary materials for construction, machineries, technical supplies (petrol, oil …) are source of fire and explosion. Fuel explosion can happen in the fuel depot or due to carelessness of workers on site construction. Electricity overload can cause short circurt, electric shock and explosion.

- Landslide: Landslide may occur during construction phase including dam and spillway repairs, construction of intake, operation of borrow pits and dumpsites and stockpiles. Especially, rains and flood will worsen the situation by increasing soil erosion risks and waste water runoff in the construction area. These impacts can cause reservoir sedimentation and increase turbidity in rivers, streams and canals in the downstream areas.

- Natural disasters: When the works are not completed and their structures are not strong engouh to resist flood and storms, traffic activities can break these structures and cause landslides. Erosion risks may be realistic during the construction phase as well as in the future operation of the sub-project. Therefore, upgrading reservoirs will enhance the resilience to climate change.

- Electrical incident during construction: During the construction process, electrical change can affect construction workers and local people, including:

  - Temporary power system for construction machines and equipment can cause electric shock, short-circuit, fire and explosion which cause economic loss or labor accident to workers.
  - As the construction site is near reservoirs, intake and spillways, if electric equipment is not properly located and operated, serious consequences such as electric shock, current leakage can happen and affect construction workers and local people in the surrounding area.

- Loi Dong, Nuoc Xanh and Da Den reservoirs have some construction works such as dams and spillway under the 500KV transmission line. Utility poles may sink or crack due to the excavation, embankment or drilling/grouting activities. Although the construction sites area is beyond the electricity safety corridor, incidents are quite likely to occur. Equipment/vehicle transporting trees, waste soil with excessive height can touch electricity line. Especially during rain, such close contact can cause electric shock or explosion, affecting properties and lives of workers and local people.

- Negative impacts of heavy rain and flood:

- During the construction process if unfavorable weather conditions are encountered such as prolonged heavy, quality of works can be affected and pollutants will be dispersed into the surrounding environment and affect construction progress.
- Such disaster as cyclones, hurricanes, tropical low pressure can easily blow up roofs of camps and construction materials on sites and affect project progress.
- Heavy rain and rising flood level can increase the water level in foundation pits that exceed the allowable level. The temporary cofferdams around the foundation pit do not guarantee technical design requirements.

5.3.3. Specific impacts on sensitive objects in the construction site during the construction phase

Table 5 - 15: Specific impacts on sensitive objects during construction

No.	*Affected objects*	*Works*	*Potential impacts*	*Impact level*
1	Biological environment	Construction sites, stockpiles, dumpsite, transporting roads	The excavation, backfilling and waste disposal will cause the loss of habitat, nesting and hatching grounds of some species living in soil or even their death, including insects, cave-dwelling animals such as snakes and frogs. During pre-construction and construction phase, these impacts are unavoidable; It is surveyed that there is no rare or protected species in the subproject area. Affected objects are common plants and living organisms in the local natural environment. Once civil works are completed, the contractor will apply measures to restore the original environment. Regarding to position, nature and scale of works, the impact is assessed as moderate	M
2	Transmission line 500kV	Loi Dong reservoir: above the main dam, the nearest distance from the works to	Construction activities affect the overhead 500 KV transmission line and power cut can happen due to short-circuit as the cranes or concrete mixers may touch overhead transmission line or operate within the safety corridor of the transmission line	M

		the line is 23m.		
		Nuoc Xanh reservoir: the nearest distance from the works to the line (when transmission line operates at maximum sagging) is 8m.	Overhead line can be struck by metal devices, such as ladders, or metal crane, triggering an explosion. Vehicles or grounded metal objects operating near overhead lines can result in electricity discharge without direct contact. Workers working within electricity safety corridor may be affected by magnetic field or electric shock, i.e. at a distance of less than 7 m from the transmission line In addition, the construction of dam, spillway under the 500KV transmission line might cause the utility poles to sink and crack due to the excavating, embanking or drilling and grouting activities. Nuoc Xanh construction site: Construction site of Nuoc Xanh reservoir is nearest to the line i.e. about 3-8m and this does not meet safety requirements for freeboard (> 10m). Where the dam surface is expected to be heightened, the dam will intersect utility poles of 830 – 831 500KV transmission line and the line will be inundated in the reservoir. The construction activities taking place in the national grid safety corridor will lead to such risks as accidents due to short circuit and explosion that damage properties and lives of local people. Impacts on the 500 KV high voltage power system of repair works in Nuoc Xanh reservoir are evaluated as high and with serious consequences. Thus consultation from Ha Tinh Electricity Transmission Agency is required. At the same time, safety regulations for construction activities under 500 KV high voltage system should be strictly complied with. The impacts on the 500 KV high voltage system of Loi Dong and Da Den reservoirs are assessed as moderate as the construction site is located beyond the national grid safety corridor. Strictly observation of safety regulations for construction activities under high voltage system is required.	H
		Da Den reservoir: 100m from the foot of downstream roof of the main dam		M

3	The area of the corridor encroached for other purposes	Loi Dong reservoir	Production activities of 2 households in Ky Thinh ward and 2 households in Ky Trinh ward are affected as their encroached lands in the dam safety corridor will be acquired for construction. The households mainly plant short-term crops on this land so the impact is negligible 	M
4	Agricultural production	Rehabilitation of upstream and downstream slopes, dam body waterproofing and construction of new intakes in 7 works (Loi Dong, Nuoc Xanh, Khe De, Khe Nhay, Da Den, Ba Khe) will require water level drawdown below normal water supply for construction. Thus, 1,115 ha of spring rice, 1,055 ha of summer – autumn rice and 3-5 ha of specialty orange will be affected. Income of local people in subproject area depends mostly on agricultural production. Thus, without proper mitigation measures, water cut for construction activities may adversely impact livelihood of local people. However, the impact is assessed as low since the construction time can be properly adjusted and remedial measures will be optimally applied.		L
		Loi Dong reservoir	115 ha of spring rice	
		Nuoc Xanh reservoir	112 ha of spring rice and 112 ha of summer rice in Ky Phong commune	
		Ba Khe reservoir	120 ha of spring rice crop and 120 ha of summer rice in Ky Bac commune	
		Dap Buom reservoir	3-5 ha of specialty orange, some households renting water surface for fish farming, 55 ha of spring rice and 55 ha of summer-autumn rice of village 1 and village 3 using irrigation water from Dap Buom reservoir.	
		Khe Co reservoir	540 ha of spring rice and 540 ha of summer rice in Son Le commune	
		Khe Nhay reservoir	45 ha of spring rice and 45 ha of summer rice in Son Tien commune	
		Khe De reservoir	150 ha of spring rice and 130 ha of summer-autumn rice in Son Mai commune	
5	Water supply for domestic	Water level lowering for construction activities of Khe Co, Khe Nhay, Khe De reservoirs may affect domestic water supply of more than 630 households in downstream area, and mainly for		L

	use	bathing and livestock. Drinking water is from dug wells.		
		Khe Co reservoir	supply water to 30 households but mainly for bathing and livestock in Son Le commune	
		Khe Nhay reservoir	supply water to 200 households for domestic use in Son Tien commune	
		Khe De reservoir	supplying water to 400 households for domestic use in Son Mai commune	
6	Livestock farm	Nuoc Xanh reservoir	Works affected by material transportation: Pig farm of Mytraco company under Ha Tinh mineral company which is 40m away from the main dam to the the west will not be demolished, however, noise and vibration and emission due to construction activities will affect cattle and travelling of local people. Works affected by the construction of head-works: 3 livestock farms of households located 100m away from spillway and 2 farms located 30m away from the main dam to the north, will be demolished or stopped during the repair of head-works.	M
		Ba Khe reservoir	Works affected by the construction of head-works: 01 livestock farm which is 700m away from the reservoir to the Northeast and will be demolished or stopped during the repair of head-works. 	M
		Da Den reservoir	Works affected by material transportation: 03 farms, including 1 livestock farm of 500 pigs and 2 forestry farms will not be demolished; however, noise and vibration and emission due to construction activities will affect cattle and travelling of local people.	M
7	Ky Bac primary school	Ba Khe reservoir	Near the access road to the reservoir and 2km away from the reservoir: materials transport will generate smoke, dust, vibration to the building. Transported materials and wastes dropped on the route across Ky Bac Elementary School may increase the traffic accident risks for pupils and teachers in the school, especially during school starting and finishing time i.e. 7AM to 7.30 AM; 11AM to 11.30 AM; 13.30 PM to 14 PM and	M

			16.30 PM to 17PM. This impact is assessed as moderate and the contractor shall implement mitigation measures.	
8	Huu Lac pagoda	Ba Khe reservoir	Near the access road to the reservoir and 2km away from the reservoir: materials transport will generate smoke, dust, vibration to the building On the first and 15th of lunar months, the number of people going to the pagoda rises. Therefore, material transport will affect the silence forest the pagoda and traveling of visitors. This impact is assessed as moderate. 	M
9	Households living beside the transportation road	Dap Buom reservoir	Impacts by material transportation: 7 households living near the material transport road from Ho Chi Minh road to Dap Buom reservoir and 16 households of village 1, Huong Tho commune may be affected due to increased traffic. They can be also affected by increased dust and noise. 	M
		Khe Nhay reservoir	Transporting materials may affect traffic safety of 6 households living along inter-village road (Hoi Son, Minh Giang and Kim Loc villages) Transporting of waste soil may affect traffic safety and air environment of over 100 households in villages Ha Tien, Thinh Tien and Ngoc Son in Son Tien commune.	M
		Khe Co reservoir	Transporting of waste soil may affect traffic safety and air environment of over 100 households in Khe Co village of Son Le commune and villages Ha Tien, Thinh Tien and Ngoc Son of Son Tien commute.	M
10	Rural road used to	At 8 construction	In all 8 construction sites, materials transportation will be on aggregate roads (access	M

	transport materials	sites	to the reservoirs) of 3-5m wide and not yet reinforced. Transportation of materials and wastes and large amount of vehicles in circulation in a short time may cause damages to roads, bridges and culverts surface. During the transport, spilt materials, if not cleaned up, may affect the aesthetics and threaten safety of people and means of transportation, and result in more traffic accident risks to workers and local people 	

Note: Impact level: H- high, M-Moderate, L-Low

5.3.4. Impacts during the operational phase

Most of the potential impacts during operation are positive impacts. At the end of construction period, land use, landscape conservation, income of local people and local economy will be stabilized. Improved dam safety and irrigation water supply will promote economic development and improve the livelihoods of downstream communities. Some of the negative impacts during the operation phase are as follows:

- ***Environmental pollution due to production development***

As shown in **Table 5.16**, total irrigated area in the subproject area will increase by 69 ha of winter-spring and 109 ha of summer-autumn crops thanks to improved storage capacity following repair and upgrading activities. As the result, the use of pesticide and plant protection chemicals also increases. The improper use and treatment of agriculture wastes can damage the environment and harm human's health. ***This impact is assessed as moderate*** and management measures should be taken to minimize the risks associated with the overuse of agrochemicals by farmers.

Table 5 - 16: Irrigated areas before and after the works completion

Works (reservoir)	*Irrigated area before the project*			*Irrigated area after the project*		
	Winter-Spring crop	*Summer-Autumn crop*	*Winter crop*	*Winter-Spring crop*	*Summer-Autumn crop*	*Winter crop*
Loi Dong	40	0	0	49	49	0
Nuoc Xanh	112	112	0	120	120	0
Ba Khe	120	120	0	131	131	0
Dap Buom	55	55	0	60	60	0
Khe Co	540	540	0	560	560	0

Khe Nhay	45	45	0	50	50	0
Khe De	150	130	0	160	140	0
Da Den	53	53	0	54	54	0
Total	**1,115**	**1,055**	**0**	**1,184**	**1,164**	**0**

- ***Emergency flood discharge and impacts due to risks and incidents:***

Description

When the sub-project is finished, the construction will no longer generate wastewater, exhausted emissions and solid waste. Risks generated by environmental pollution will almost not exist. However, due to the specific characteristics of the irrigation projects and given the unpredictable nature of weather conditions, such risks as dam failure, landslide, seepage, dam body leakage still should be taken into account. Damages caused by these accidents mean serious not only to production activities but also to lives of local people in the downstream areas.

In case of heavy rain or flood and unusual increase of water level, the reservoirs management agency will carry out emergency flood discharge to ensure reservoir safety. Emergency flooding discharge may have such downstream impacts as inundation of infrastructure, crops or crop losses and damages or negative impacts on livelihoods and travelling. It is surveyed that the project localities have never experienced such emergency situation since the construction of reservoirs. The impact is assessed as moderate.

Evaluating potential accidents and risks

Given advanced equipment, technology and qualified and well trained technical staff and workers and effective design, above mentioned risks or incidents are not likely to happen.

The technical design stage should also take into account the drainage basin and flood marks for unusually large flood and rains. The repairs and upgrading works should ensure adequate capacity of new drainage facilities which should not be lower than the existing ones, taking into account the context of unusually large flood/rains to avoid prolonged flooding events.

Dams upgraded in the project are small dams as classified under provision of the GoV and WB. It is surveyed that, dam failure have never happened to this reservoir in the past. Once they are upgraded, these dams will be more secured. Dam Safety Reports have to be prepared for all reservoirs in the subprojects to ensure that all risks related to the dam and ancillary works are reviewed before the investment approval from the Client.

The reservoirs with small capacity and low dams are mainly for raising water level for irrigation purposes. They are not in charge of flood storage and its capacity is not engouh for flood storage. Therefore, flooding risks to the downstream area will not be present due to flood discharging. All drainage works are free overflowing and when water level is higher than the overflow level, the water will overflow to the downstream. Since spillways are free overflowing types, emergency flood discharge that affect property and lives of people in the downstream areas will not happen. The flood drainage channels are natural rivers with steep slopes and rapid flood drainage capacity. It is surveyed that local people have not been affected by flood flow from these reservoirs in recent years.

According to the Dam safety and Dam Inspection Reports, dams are located on bedrock

which is slightly weathered, black-gray and blue-gray. These solid rocks are widely distributed where head-works are located. Two dam shoulders have good geological conditions. Soil and stone in the study area have weak permeability. Reserve of groundwater is poor, almost exclusively found in fracture rock zones and gravel sediments on a limited distribution area and thin thickness. Groundwater is mainly recharged from surface water and annual rainfall. Lands where reservoirs are located are generally sloping and composed of alternating types of sand shale siltstone, solid clay lime and thin vegetation of Forth Period. The reservoir impoundment is small and erosion and landslide are not likely to happen. As a result, the possibility of erosion, subsidence and landslide of these works are minimal.

According to the Dam safety inspection reports, following activities are required for all dams: Upgrading solutions for head-works and ancillary works are properly implemented; close monitoring of construction activities and quality management; management and safety operation of dams; competent and qualified agency will be assigned with the management and safety operation of reservoirs who will prepare and carry out annual O&M plans, report on regular basis and monitor and record all operations of the work; monitoring system is fully installed; emergency response plan is prepared for each reservoir. By so doing, dam failure risks of these reservoirs will be minimal and can be predicted and mitigated.

In summary, risks due to objective reasons are difficult to avoid. The management and operation process should follow O&M safety guidelines and regulation or unexpected and undesired incidents may occur. However, regarding the position, nature and scale of the works intervened in the sub-project, the possibility of such incidents is not high. ***The impacts thus are evaluated as low.***

5.4. Analysis of impact types

5.4.1. Cumulative impacts

Although there are many dams in the sub-project areas, they are scattered and independently located. Moreover, as scale and nature of subproject activities are small and simple, the implementation of subproject activities is not likely to cause cumulative effects. According to surveys and consultations with relevant agencies, there is no other large scale project of similar nature taking place at the same time and in the same location where Ha Tinh subprojects WB8 are located. Thus cumulative effects created together with other projects are none.

5.4.2. Direct impacts

The implementation of the subproject will generate direct impacts on the environmental and social conditions of the subproject area. Subproject activities will result in temporary or permanent loss of production lands. Construction activities will cause direct impacts on the quality of the surrounding environment such as air, land and water due to the generation of wastes and exhausted emissions and the removal of vegetation.

5.4.3. Indirect impacts

Temporary or permanent loss of land will result in impacts on livelihoods of affected people i.e. reduced or lost income, shifting occupations or possible social conflicts. Indirect impacts

are also identified as deteriorated water quality due to soil erosion caused by vegetation clearance during the construction process. Water pollution due to waste generated from the construction activities can result in a decline in composition and number of individuals of aquatic species. Or compacted soil due to the use of heavy equipment on farmland can lead to a reduction of the number of useful soil microorganisms as soil structures change. Loss of vegetation will also lead to the loss of habitat of many animal species in the subproject area and to the increased erosion, landslide and flooding risks. Restoration of the design irrigated area may lead to an increase of pesticides amount applied to fields and negative affects on the environment and public health can be observed.

5.4.4. Temporary impacts

In general, most of the impacts associated with construction activities within the subproject are short-term such as noise, vibration, dust, exhausted emission, solid waste and wastewater. These impacts will no longer exist when construction activities are completed.

5.4.5. Long-term impacts

Permanent loss of production land will have a lasting impact on the affected people as some households will lose part of their production inputs and they are forced to change their occupations. Such environmental incidents as oil spills or hazardous chemicals will also have long-term effects on the environment and human health as these chemicals have a long semi-decomposition time. They can penetrate into soil, water and enter the food chain. Risks relating to occupational accidents will also cause long-term effects once workers' health is reduced or lost.

5.5. Summary of potential negative impacts caused by the subproject

Table 5 - 17: Matrix of potential negative impacts caused by the subproject

Phase	Activities	Issues/Impacts	Time of the impact	Location	Impact magnitude
Pre-construction	Land acquisition	Total area to be acquired for 8 works is 71,917 m^2, including 6,263m^2 of agricultural land, 23,840 m^2 of public land, 37,081 m^2 of forest production land, 3,146m^2 of aquaculture land and 1,587m^2 of residential land. 67 households affected by land acquisition, including 10 households with affected residential land.	Permanently	Land acquisition area for construction of 8 works in 8 communes	M
	Tree cutting, land leveling, waste transportation, demolishing activities, building workers' camps, stockpiles, operation of construction machineries Land leveling, compacting soil,	Impacts on the air environment due to dust, gas emission	30 days	Construction site requiring site clearance, along the transportation road	L
		Impacts due to noise and vibration	30 days	Construction site requiring site clearance, along the transportation road	L
		Impacts on soil environment due to soil compacting; leaking waste oil into environment may lead to soil erosion, sedimentation and soil degradation risks	30 days	Construction sites with the operation of construction machineries , borrow pits and dumping sites	L
		Impacts on water environment due to domestic wastewater of workers, wastewater from washing machines,	30 days	8 construction sites	M

Phase	Activities	Issues/Impacts	Time of the impact	Location	Impact magnitude
	operation of construction machineries	rainwater runoff			
		Impacts due to risks, incidents	30 days	8 construction sites	L
		Impacts on biological environment	30 days		L
Construction phase	Soil digging and backfilling; Operation of heavy equipment such as bulldozers, shovels, compactors, trucks, etc.; Material loading and uploading; Waste and material transportation; Washing machine such as truck cabins, concrete mixers, etc.; Activities of workers on construction sites and in workers' camps; waste	Impact on air environment due to earth works, materials transport (soil, stone, cement, steel, etc.), waste soil transport	11 months during construction phase	8 construction sites, stockpiles, dumping sites, along the transporting roads	M
		Impacts on the environment caused by noise, vibration	11 months during construction phase	8 construction sites, stockpiles, dumping sites; Ky Bac primary school, Huu Lac pagoda and households living along the transporting roads	M
		Impacts on water environment due to wastes water from workers	11 months during construction phase	8 construction sites, workers' camps, reservoirs and canals in downstream	M
		Impacts on the water environment due to runoff	11 months during construction phase	8 construction sites, reservoirs and canals in downstream	L
		Impact on water environment due to construction wastewater	11 months during construction phase	8 construction sites, workers' camps, stockpiles, reservoirs and canals in downstream	L
		Impacts on the water environment of the reservoirs and canals due to solid waste from construction activities	11 months during construction phase	8 construction sites, workers' camps, stockpiles	L
		Impact on soil environment due to domestic wastes	11 months during construction phase	8 construction sites, workers' camps, stockpiles	L
		Impacts on soil environment due to waste disposal and soil excavating and	11 months during construction phase	8 construction sites, workers' camps, stockpiles, dumping site, borrow pits, area	L

Phase	Activities	Issues/Impacts	Time of the impact	Location	Impact magnitude
	disposal; Construction activities on construction sites;	filling at the borrow pits		executing soil excavating	
		Impacts on the soil environment due to hazardous wastes	11 months during construction phase	8 construction sites, area for construction machines gathering	L
		Impacts on soil compaction due to use of heavy construction equipment	11 months during construction phase	Area where repair and constructed works take place, along the transportation road	L
		Impacts on the biological environment caused by construction activities	11 months during construction phase	Site clearance area, areas where repair and construction works take place, along the transportation road, workers' camp, stockpiles, dumping sites, borrow pits	L
		Impact on landscape	11 months during construction phase	Land acquisition area, along the transportation road	L
		Damaging roads and rural infrastructure	11 months during construction phase	Roads used for transportation to 8 construction sites, Ky Bac primary school (Ba Khe) , forestry farms (Da Den), livestock farms (Loi Dong, Ba Khe, Nuoc Xanh and Da Den)	L
		Affecting on houses and structures	11 months during construction phase	Houses and structures to be acquired as discussed in RAP	L
		Impacts on 500KV transmission line	11 months during construction phase	Construction sites of Loi Dong, Nuoc Xanh and Da Den reservoirs	M-H
		Impacts on cultural, historic and belief relics	11 months during construction phase	Huu Lac pagoda located near transport road to Ba Khe reservoir	L
		Impact on traffic safety	11 months during construction phase	Roads used for transportation to 8 construction sites; road conjunction with Ky Bac primary school, residential areas	M
		Impacts on health services, public	11 months during	8 construction sites, workers' camps and	M

Phase	Activities	Issues/Impacts	Time of the impact	Location	Impact magnitude
		health and construction workers	construction phase	subproject communes	
		Impacts due to influx of workers in the subproject area	11 months during construction phase	8 construction sites, workers' camps and subproject communes	L
		Impacts on utility services	11 months during construction phase	8 construction sites, workers' camps and subproject communes	L
		Impact on production and domestic water supply	11 months during construction phase	8 subproject communes	L
		Impacts on aquaculture, tourism, navigation	11 months during construction phase	8 subproject communes	L
		Negative impact of demolition activities of auxiliary works after construction	11 months during construction phase	8 construction sites where prepared auxiliary works such as workers' camps, stockpile, etc.	M
		Impacts due to risks, incidents: Accident, fire explosion, landslide, natural disasters, electrical incidents, impacts of rainfall and flood	11 months during construction phase	8 construction sites	M
Operation phase	Restore the irrigation area as originally designed	Environmental pollution due to production development	Long – term	8 subproject communes	M
	Emergency flood discharge	Emergency flood discharge and impacts due to risks, incidents	Flood season, Long – term	8 subproject communes	M

CHAPTER VI. ANALYSIS OF ALTERNATIVES

6.1. Without the Sub-project

The reservoirs under Sub-project 1 were built during from the 60s - 70s of the 20th century. So far, they have been operating for about 30-50 years and significantly contributed to effective production, safety for people and infrastructure in the sub-project area. However, as they have been built for so long time ago by farmers themselves and that they are earthen dams, they cannot meet dam safety standards. Head-works have been degraded and damaged, affecting safety of reservoirs and water supply capacity to downstream areas. If the Sub-project cannot be implemented, dam failure risks will happen and 1,129 ha of cultivated land, 2,488 households, 4 utility poles of 500 KV, National Highway 1A, Ho Chi Minh Road passing sub-project communes and other infrastructure will be affected. Detailed impacts caused by dam failure (without the project) for each reservoir are summarized in **Table 6.1**

Table 6 - 1: Impacts in case of dam incidents (without the project)

No.	*Reservoir*	*Location*	*Year of construction*	*Impacted objects in case of dam incidents (without the subproject)*
1	Loi Dong Reservoir	Ky Trinh Ward, Ky Anh District	1970	Affecting lives and property of 28 households in Ky Trinh Ward, 46 ha of cultivated land, 4 utility poles of 500KV, entrance to thermoelectric plant and Tay Yen Bara.
2	Nuoc Xanh Reservoir	Ky Phong Commune, Ky Anh District	1967	Affecting 120 ha of cultivated land in Ky Phong Commune, lives and property of 35 households with more than 130 people, National Highway 1A, Irrigation Canal of Song Rac irrigation system and an 18 ha of a ranch of Ha Tinh Mitraco Company.
3	Ba Khe Reservoir	Ky Bac commune, Ky Anh District	1970	Affecting 110 ha of cultivated land of Ky Bac commune, lives and property of 125 households with more than 500 people, inter-communal roads and other infrastructure.
4	Dap Buom Reservoir	Huong Tho Commune, Vu Quang District	1978	Affecting lives and property of 25 households in Huong Tho commune, 48 ha of cultivated land, Ho Chi Minh highway and other infrastructure
5	Khe Co Reservoir	Son Le commune, Huong Son District	1987	Affecting 560 ha of cultivated land of Son Le and Son Tien Communes, lives and property of 1,125 households with more than 4,500 people, Ho Chi Minh Road and other infrastructure of Son La and Son Tien Communes.
6	Khe Nhay Reservoir	Son Tien commune,	1966	Affecting 50 ha of cultivated land of Son Tien commune, lives and property of 50

		Huong Son district		households, inter-communal roads and other infrastructure.
7	Khe De Reservoir	Son Mai commune, Huong Son	1977	Affecting 140 ha of cultivated land in Son Mai, Son Thuy and Son Phuc communes, lives and property of 600 households with more than 1,600 people, inter-commune roads and other infrastructure.
8	Da Den Reservoir	Ngoc Son commune, Thach Ha district	1978	Affecting 55 ha of cultivated land of Ngoc Son Commune, lives and property of 500 households with more than 2,000 people, provincial road 21, provincial road 3 and other infrastructure.

6.2. With the Sub-project

The implementation of the subproject will improve dam safety, limit risks due to dam failure, and stabilize production activities and livelihoods of local farmers in the area. However, the sub-project preparation phase and the construction/repairs of sub-project items will produce negative impacts on the environment. Impacts can be limited or reversed if the subproject owner selects appropriate intervention options and implements mitigation measures. A number of measures have been selected for minimal environmental impacts:

6.2.1. Alternations during the construction of works under the full water supply

Repairs of the dam mainly relate to the expansion of dam surface, heightening of dam crest, downstream slope reinforcing, repairing or building spillway which are all carried out above the normal water level (NWL) and will not affect water supply to the downstream. On the other hand, rehabilitation activities of the upstream and downstream slopes, waterproofing and construction of new intakes in 7 works (Loi Dong, Nuoc Xanh, Da Buom, Khe De, Khe Nhay, Da Den, Ba Khe) will need the drawndown of water level in reservoirs to below the normal water level for construction.

The lowering of the water level for construction may affect the production of 1,115 ha of spring rice and 1,055 ha of summer-autumn rice and domestic water supply for more than 600 households for washing and livestock. Local people use drinking water from dug wells. As income of local people in subproject area depends mostly on agricultural production, wihout any remedial measure, impacts of lowered water level in reservoirs for construction may cause serious consequence, especially to income and daily lives of local people. In stead of cutting water and compensating for production losses due to water cut, the subproject owner has selected following alternatives so as not to affect production activities and to save costs:

a) Arranging suitable construction time so as not to affect downstream production activities

According to the survey results, there is no winter crop in the sub-project area due to the lack of water resources. The subproject owner planned the construction of dam heel and water intakes which are works under normal water level during July - August. This is the dry season and at the end of the summer-autumn crop season when irrigation demand is quite low. At the same time, the Sub- project Client planned alternative water sources for the region.

Thus impact on water supply for downstream areas due to construction activities will not be likely to happen.

b) Flow diversion measure and cofferdam solutions during the construction of intake will ensure no impact on downstream production activities

During construction and repair of earthen dam and building new water intakes, flow diversion is applied to ensure water demands of the downstream users. Flow diversion for construction is carried out using existing water intakes. Once the pre-casting and construction of new intakes is finished, the existng intakes will be removed, creating a diversion canal at the location of the old intake to continue diverting water to downstream area. As soon as the new intakes ensure water drainage, flow will diverted through the new inake and cofferdam of the drainage canal gate will be built to block the dam section of the diversion canal (where the old intake exists) and the dam section on the new intake in accordance with design cross section.

Among 8 works under the subproject 01, construction of new water intakes will be carried out for 7 works (Loi Dong, Nuoc Xanh, Ba Khe, Dap Buom, Khe Nhay, Khe De, Da Den). All of 8 works will repair dam heel on upstream slope and water drainage system in downstream slope. Embankment of cofferdam for construction will be applied in all of 8 works and old intakes can be used for downstream irrigation during this time. Once the new intakes are put into use, the old ones will be demolished and production activities will not be affected.

c) Using other water sources to supply to downstream users during the water cut for construction activities

During the construction of 7 new intakes (except for Khe Co reservoir), the subproject owner will use other water sources to supply downstream uses. Water from Bau Son and Hoi Lay reservoirs will be use to supply Loi Dong reservoir; water from Song Rac canal will be used instead of Ba Khe and Nuoc Xanh reservoirs; water from Cau Trang reservoir will be used instead of Da Den reservoir; water from Nuc Trong reservoir or after Linh Cam pump station will be used instead of Khe De reservoir; water from Vu Quang dam will replace water from Dap Buom reservoir; replacement water source for Khe Nhay reservoir is not available so cofferdam and existing intake will be used to supply water to the downstream.

6.2.2. Alternative measures for selected auxiliary works (borrow pits, dumpsites)

a) Selection of borrow pit

The construction of the earthen dams involves the use of filling soil materials from different borrow pits. Exploitation of soil will affect production areas and involve the compensation for land acquisition and recovery, impacts on environment and necessary licenses for exploitation as required by Vietnam laws. In order to limit mentioned above impacts, the subproject owner selected following alternatives:

- Loi Dong, Ba Khe and Dap Buom reservoirs: soil will be purchased from licensed borrow pits beyond the sub-project area. These are borrow pits at the shortest distance to the dam to avoid compensation costs and do not lead to loss of production lands.

- Nuoc Xanh, Khe Co, Khe Nhay, Khe De and Da Den Reservoir: soil will be exploited from hills or high grounds within the dam protection corridors or inside the reservoirs. This option has such advantage of saving transportation costs (average distance

from the pits to dams ranging from 140m to 500m), saving compensation cost for lost land and crops. This option can increase the risk of erosion and sedimentation in the Reservoirs. However, as the construction will take place during the dry season and these impacts will be limited.

b) Selection of dumpsites

The rehabilitation and upgrading of earthen dams, intakes, and flood spillway will generate an amount of non-reusable organic soil which cannot be recycled for the construction of above items. Therefore, they should be transported to suitable locations for disposal. This will affect production areas and crops of farmers near the dumping area, landscape and environment which will result in increased compensation costs for affected land and crops. In order to minimize the above impacts, following alternatives have been selected:

- Nuoc Xanh, Ba Khe, Khe Co, Khe Nhay, Khe De and Da Den Reservoirs: the subproject owner coordinated with local authorities to select the dumpsite location which are vacant and weedy areas or depressed lands at the foot of mountains, along roads, suitable for waste dumping, far away from water bodies and residential areas (0.5÷1.5 km) and 0.3 - 0.3 km from the construction site and no compensation is needed for land and crops.

- There are 2 available dumpsites: Loi Dong Reservoir will have its dumpsite as Con Moc dumpsite, Dap Buom Reservoir as Khe Gieng dumpsite in Huong Tho commune. All these dumpsites are public lands under the management of local governments and no compensation is needed for land and crops.

6.2.3. Alternation of roads for construction material and waste transport

The transport of wastes and materials will affect people living on both sides of roads and increase traffic as well as damage roads. In order to minimize these impacts, the Consultant surveyed and selected the shortest and least traffic routes to save money and limit impacts as follows:

- Loi Dong, Ba Khe, Dap Buom, Da Den Reservoirs: make the most of material transportation along National Highway 1A, Ho Chi Minh road, provincial road 21, and provincial road 3 to minimize transporting accross residential areas.

- For the remaining works, materials to be transported accross inter-village or inter-commune roads will be in 7 ton - trucks or less load trucks to limit damages to roads. The transport activities should take place during low peak time to limit impacts on the travelling of local people.

Table 6 - 2: Options for borrow pits, dumpsites and material and waste transport routes

No.	*Reservoir*	*Location*	*Type of material and waste soil*	*Location of borrow pits and dumpsites*	*Preferred transport routes*
1	Loi Dong Reservoir	Ky Trinh Ward, Ky Anh	Backfill soil	Borrow pit of Việt Gia-Song Hui Jsc. Ky Trinh Ward – licensed until	National Highway IA 1.6 km, asphalt road 6.0 m wide and 2.8 km long, asphalt

		District		2030	road 4.0 to 5.0 m wide and 2.3 km long, concrete road of 4.0 m wide and 0.4 km long, the remaining is the aggregate road of 3.0 to 5.0 m wide
			Waste soil	Con Moc, Ky Trinh Ward managed by Ky Trinh Ward	Inter-commune asphalt road across Ky Trinh Ward 0,91km
2	Nuoc Xanh Reservoir	Ky Phong Commune, Ky Anh District	Backfill soil	Backfill soil from borrow pit of 666 Commerce and Service Co., in Ky Phong Commune, Ky Anh district	Concrete and aggregate road width 3.5-5m and length 2km
			Waste soil	Dumpsite near Mr. Vo Van Tai household, Lang Con village, Ky Phong commune, Ky Anh District	Inter-village concrete road of Ky Phong commune of 3 km long
3	Ba Khe Reservoir	Ky Bac commune, Ky Anh District	Backfill soil	Ngoc Thao Borrow pit, Cam Trung commune, Cam Xuyen district; managed by Ngoc Thao Construction material Co.Ltd.	National Highway IA of 3.2km, asphalt road 4.0 to 5.0 m wide and 2.0 km long, the remaining is the aggregate road of 3.0 to 5.0 m wide
			Waste soil	Depressed lands of Gieng Cho, Hop Tien village, Ky Bac commune which is vacant land with weeds	Inter-village concrete road of Ky Bac commune of 2.6 km long
4	Dap Buom Reservoir	Huong Tho commune, Vu Quang district	Backfill soil	Purchase from borrow pit of Minh Huong Company, Duc An commune, Duc Tho district	Transport distance: 32km, crossing Ho Chi Minh road, asphalt road of 4.0 -5.0 m wide and aggregate road 3.0 - 5.0 m.
			Waste soil	Vacant and depressed land in Huong Tho commune managed by Huong Tho CPC	Inter- commune road of Huong Tho commune of 0.9 km long
5	Khe Co Reservoir	Son Le Commune, Huong Son	Backfill soil	03 borrow pits wihint the project site	Construction and management road to dam sites 0.2-0.3 km
			Waste	Vacant site A1 in Son Le	Inter- commune concrete

		District	soil	and managed by Son Le CPC	road in Son Le commune of 6.5km long
6	Khe Nhay Reservoir	Son Tien, Huong Son District	Backfill soil	Borrow pit in the reservoir impoundmemts	Reservoir construction and management Road of 1.5 km long
			Waste soil	Vacant site A1 in Son Le and managed by Son Le CPC	Inter- commune concrete road in Son Tien commune of 5.5km
7	Khe De Reservoir	Son Mai, Huong Son District	Backfill soil	Borrow pit in the reservoir impoundmemts	Reservoir construction and management Road of 0.1 km long
			Waste soil	Vacant site, managed by Son Mai CPC	Inter- commune concrete road in Son Mai commune of 2.0 km long
8	Da Den Reservoir	Ngoc Son. H. Thach Ha	Backfill soil	Purchasing from Vinaco company, in Ngoc Son commune, Thach Ha district	Inter-village aggregate road of 2km
			Waste soil	Dumpsite in 19-5 field in Ngoc Ha village, Ngoc Son commune	Asphalt roads including Provincial Highway 21 of 0.8 km, Provincial Road 3 of 3.1 km and on-farm road of 0.4km

CHAPTER VII. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The Environmental and Social Management Plan (ESMP) aims to deal with potential environmental and social impacts by feasible mitigation measures which have been discussed and agreed by the sub-project owner, identify requirements, including a reference to other safeguard instruments, specify a monitoring plan or strategy, and determine responsibilities for implementing mitigation and monitoring measures. The ESMMP will be considered as a general reference for all stakeholders in the sub-project implementation.

7.1. Mitigation measures

7.1.1. Measures for pre-construction phase

- ***Measures to minimize the impacts of land acquisition***

The main issue at this stage is compensation, assistance and resettlement for people affected by the loss of land, house, income and assets. Compensation for site clearance will follow the updated resettlement plan of the project. The estimated cost of implementing the Resettlement Action Plan of the subproject is VND 2,275,354,800. This includes the compensation/assistance cost for land, structure and assets affected by the project, income restoration program, transitional support, monitoring and evaluation and redundancy costs.

Implementing compensation and assistance for affected households

- Project owners contract and coordinate with the Land Development Center, DoNRE, District People's Committee, Division of Natural Resources and Environment at district level, CPCs, organizations, concerned households and individual having land and assets associated with land to be acquired to inform and guide the measurement, identify land ownership, list the properties in an accurate and public manner, approve compensation and support options in the most exactly way.
- Widely communicate on compensation, support and resettlement policy of the subproject.
- Disseminate information on compliance to laws.
- Disclose compensation price details of each type of loss to affected households.
- Cary out timely payment of compensations to the right subjects as planned
- Coordinate with local authorities if any disputes occur to ensure that site clearance will be carried out smoothly.

Compensation, support and other management costs for affected land/property (land, house, works, structures and trees) in the subproject are shown in the table below. More details is presented in the RAP report.

Table 7 - 1: Cost estimate of compensations for affected items

No.	*Works*	*Total amount: exchange rate: US$ 1 = VND 22,700*

		VND	*USD*
I	Compensation for land	527,362,838	23,231.84
II	Compensation for structures	234,659,000	10,337.40
III	Compensation for trees and crops	616,571,000	27,161.72
IV	Assistances	556,460,200	24,513.67
V	Vulnerable group assistance	32,000,000	1,409.69
VI	Restoration program	51,000,000	2,246.70
VII	*Total: I+II+III+IV+V+VI*	**2,018,053,038**	**88,901.01**
VIII	*Management cost = 2% VII*	40,361,061	1,778.02
IX	*Replacement cost survey = 0.5% VII*	10,090,265	444.51
X	*Total: VII+ VIII+ IX*	**2,068,504,364**	**91,123.54**
XI	*Contingencies (10% total XII)*	206,850,436	9,112.35
	Total	**2,275,354,800**	**100,235.89**

Source: RAP report, 2018

- ***Measures to minimize impacts relating to permanent acquisition of production forest land and tree cutting***

Implementation of the subproject's items will affect 37,081 m^2 of Production forest land of 35 households planting Melaleuca, Eucalyptus, Acacia, Willow etc. According to IOL result, the portion of affected land is marginal, as compared with their total land holdings. Production forest land is a category of production land which is allocated by CPCs to households for cultivation and management (leased land) as described in RAP:

- Affected households to be notified at least 90 days before land acquisition by the subproject.

- The land owners will hand over lands within 20 days (in accordance with applicable laws at the project implementation time) from the date of full compensation for lands paid by the District Compensation Board.

- Compensation for affected production forest land is in line with RAP.

Households affected by the tree cutting in the sub-project will be notified of the site clearance plan at least 90 days before land acquisition by the subproject. Households will cut trees by themselves and can collect cut trees for fuels or other purposes. Waste from tree clearing, such as organic waste, leaves, branches, dead animals etc. will be cleared and transported to dumpsites for treatment by the project owner. Tree clearing should in line with following requirements to minimize impacts on environment in general and on biological environment in particular:

- Determine clear boundary of the land acquisition area.

- Areas to be cleared should be minimized as much as possible.

- The application of chemicals for vegetation clearing is not permitted.

- Prohibit cutting of any tree unless explicitly authorized in the vegetation clearing plan.

- The Contractor shall ensure that no hunting, trapping shooting, poisoning of fauna will take place in the sub-project area.

7.1.2. Mitigation measures during construction phase

7.1.2.1. Mitigation measures for generic construction-related impacts

Mitigation measures have been developed based on WBG EHS Guidelines and National Regulations and Standards to address the generic construction-related impacts, and presented in the form of Environmental Codes of Practice (ECOP). The ECOP describes typical requirements to be undertaken by Contractors and supervised by the Construction Supervision Consultant (CSC) during construction. The ECOP will be a reference for preparation of the Environmental, Social, Health and Safety (ESHS) requirements under Section VII – Works' Requirements of SPDs. The ECOP addresses the followings which would connect with ESHS issues.

- Dust and exhaust emission
- Noise and vibration impacts
- Management of wastes
- Management of hazardous materials
- Workers' camp management
- Disruption of vegetative cover and ecological resources
- Control of erosion and sedimentation
- Management of stockpiles and borrow pits
- Traffic safety management
- Chance Find Procedures or Discoveries
- Occupational Health and Safety
- Community Health and Safety
- Communication with local communities
- Natural disaster, heavy rain and flood management
- Labour influx management

Table 7 - 2: **Environmental Codes of Practice (ECOP) for Addressing Generic Construction-Related Impacts**

Environmental and social issues	***Mitigation measures***	***Applicable Standards, Regulations and Guidelines***	***Responsibility***	
			Implementation	*Supervision*
Dust and exhaust emission	The Contractor is responsible for compliance with relevant Vietnamese legislation with respect to ambient air quality. - Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone) - Minimizing dust from open area sources, including stockpiles, by using control measures such as installing enclosures and covers, and increasing the moisture content - Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements - The Contractor shall ensure that the generation of dust is minimized and is not perceived as a nuisance by local residents and shall implement a dust control plan to maintain a safe working environment and minimize disturbances for surrounding residential areas/dwellings - Material loads shall be suitably covered and secured during transportation to prevent the scattering of soil, sand, materials, or dust - All vehicles shall comply with Vietnamese regulations controlling allowable emission limits of exhaust gases - Vehicles should be maintained in accordance with manufacturers specifications - Vehicles in Vietnam shall undergo a regular emissions check and get certified named: "Certificate of conformity from inspection of quality, technical safety and	- TCVN 6438-2005: Road vehicles - Maximum permitted emission limits of exhaust gas - Decision No. 35/2005/QD-BGTVT on inspection of quality, technical safety and environmental protection - QCVN 05: 2013/MONRE: *National technical regulation on ambient air quality* - WBG EHS Guidelines	Contractor	PPMU, CSC

	environmental protection" following Decision No. 35/2005/QD-BGTVT - There shall strictly be no burning of solid wastes or construction materials (e.g. wood, rubber, oil-based rag, emptied cement bags, paper, plastic, bitumen, etc.) on site			
Noise and vibration impacts	- The contractor is responsible for compliance with the relevant Vietnamese legislation with respect to noise and vibration - Planning project activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance - Vehicles should be maintained in accordance with manufacturers specifications - Other measures to reduce noise to acceptable levels shall be implemented, including: • Selecting equipment with lower sound levels • Barriers should be located as close to the source or to the receptor location to be effective • Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas • Re-locating noise sources to less sensitive areas to take advantage of distance and shielding • Siting permanent facilities away from community areas if possible • Developing a mechanism to record and respond to complaints	- QCVN 26:2010 /BTNMT: National technical regulation on noise - QCVN 27:2010/BTNMT: National technical regulation on vibration - WBG EHS Guidelines	Contractor	PPMU, CSC
Management of wastes	**I. General Wastes** **(a) Wastewater**	QCVN 14:2008/BTNMT:	Contractor	PPMU, CSC

	- The Contractor shall be responsible for compliance with the relevant Vietnamese regulations on wastewater discharges into surroundings - Consider hiring local workers to reduce wastewater generation on site - For human waste (manure, urine): build 2-3 sanitary toilets in each construction site (10-15 workers/toilet) to comply with Decision no 08/2005/QD-BYT dated 11/3/2005 of Ministry of Health. It may be biodegradable toilets, bio-toilets or ready-made toilets available in the market. - Discharge waste water from kitchens bathrooms, wash sinks: Septic systems shall be provided for treatment and disposal of domestic sanitary sewage in areas with no sewerage collection networks. Septic systems should only be used for treatment of sanitary sewage. When septic systems are the selected form of wastewater disposal and treatment, they should be: • Properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater • Well maintained to allow effective operation • Installed in areas with sufficient soil percolation for the design wastewater loading rate • Installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters - Wastewater from washing vehicles and construction equipment shall be collected into a settling pond before being discharged into local drainage system - At completion of construction works, wastewater collection tanks and septic tanks	National technical regulation on domestic wastewater - QCVN 40: 2011/ BTNMT: National technical regulation on industrial wastewater - Decree No. 38/2015/ND-CP dated 24/04/2015 on waste and scrap management - Circular No. 36/2015/TT-BTNMT on Management of Hazardous Wastes - Decision No. 59/2007/ND-CP on solid waste management - WBG EHS Guidelines		

	shall be safely disposed of or effectively sealed off **(b) Runoff water** - Dig drainage canals along both the dam shoulders, arranging manholes (50 m/manhole) to separate solid materials. The canals have trapezoidal cross section, their bottom is 60 cm wide, their top is 100m wide and their height is 50 cm. - Dig similar canals around material yards and dumping sites. - Reduce construction activities during rainy season. **(c) Solid waste** - Before construction, a solid waste control procedure (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) shall be prepared by Contractors and it must be carefully followed during construction activities - Before construction, all necessary waste disposal permits or licenses shall be obtained. - For reservoirs of Loi Dong, Nuoc Xanh, Ba Khe, Khe De, Dap Buom, there is service to collect domestic waste and process at focusing region. Construction contractors can sign contract with service units to collect and treat waste. - For reservoirs of Khe Co, Khe Nhay and Da Den, there is no service to collect and process domestic waste at the locality, the contractors shall collect and process domestic waste by themselves at camp site in compliance with following provision: - For reusable waste (metal, plastic, glass such as cans, cartoon, paper) shall be collected and sold. - Biodegradable organic debris (fruit peel, vegetables, leftovers ...) should be contained in bins with lid and provided for people to collect food for livestock daily. In case of not using animal feed, use waste bins to make			

	compost. Prepare from three to five 240-litre bins for composting purpose at each construction site. - For inorganic waste, no reusability, sign contracts with the waste collection group of the communes to collect and dispose such waste in accordance with the local regulations related. If no collection groups are available, dig holes to bury the waste or burn flammable and non-toxic waste (paper, wood, leaves …) - Measures shall be taken to reduce the potential for litter and negligent behavior with regard to the disposal of all refuse. At all places of work, the Contractor shall provide litter bins, containers and refuse collection facilities - Solid waste shall be temporarily stored on site in a designated area approved by the CSC and relevant local authorities prior to collection and disposal through a licensed waste collector - Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof - No burning, on-site burying or dumping of solid waste shall occur - Recyclable materials such as wooden plates for trench works, steel, scaffolding material, site holding, packaging material, etc. shall be collected and separated on-site from other waste sources for reuse, for use as fill, or for sale - If not removed off site, solid waste or construction debris shall be disposed of only at sites identified and approved by the CSC and included in the solid waste plan. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas, such as in areas of natural habitat or in watercourses. **II. Hazardous Wastes**			

	(a) Storage of hazardous wastes Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in area location where: - Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatibles or physical separation such as walls or containment curbs - Store in closed containers away from direct sunlight, wind and rain - Storage should be on an impermeable surface that readily able to be cleaned, and that is appropriately bunded to contain any spills or leaks. The storage area should be covered to prevent rainwater from accumulating in the bunded area **(b) Hazardous Wastes Transportation** - On-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public - All waste containers designated for off-site shipment should be secured and labelled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance. **(c) Disposal of hazardous wastes** - The removal of hazardous wastes shall be performed and disposed of by specially trained and certified workers - Used oil and grease shall be removed from site and sold to an approved used oil recycling company;			

	- Routine maintenance of machines and trucks are carried out only at machine repair workshop and waste oil shall be collected by facility owners for treatment or reuse. - Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. - Regard to the small repair and maintenance of equipment's and tools due to unexpected damage, hazardous wastes such as waste oil and grease shall be collected and concentrated in solid waste bins. Construction contractors will sign contract with relevant units to transport for disposal in accordance with the guidance in Circular 36/2015/TT-BTNMT dated 30/6/2015 of the MONRE regulations on hazardous waste management.			
Disruption of vegetative cover and ecological resources	The Contractor shall prepare a Clearance, Revegetation and Restoration Management Plan for prior approval by the Construction Engineer, following relevant regulations. The Clearance Plan shall be approved by CSC and followed strictly by contractor. Areas to be cleared should be minimized as much as possible. - The Contractor shall remove topsoil from all areas where topsoil will be impacted on by rehabilitation activities, including temporary activities such as storage and stockpiling, etc.; the stripped topsoil shall be stockpiled in areas agreed with the CSC for later use in re-vegetation and shall be adequately protected. - The application of chemicals for vegetation clearing is not permitted. - Prohibit cutting of any tree unless explicitly authorized in the vegetation clearing plan. - The Contractor shall ensure that no hunting, trapping shooting, poisoning of fauna	- Law on biodiversity No.20/2008/QH12 - Decree 65/2010/ND-CP on biodiversity protection	Contractor	PPMU, CSC

	takes place. - Limit withdrawing water in reservoir during construction phase to avoid disturbing habitat of aquatic species			
Traffic safety management	- Contractor shall strictly comply with Law on Roadway Traffic - Adoption of best transport safety practices across all aspects of subproject operations with the goal of preventing traffic accidents and minimizing injuries suffered by subproject personnel and the public. Measures should include: - Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure - Minimizing pedestrian interaction with construction vehicles - Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns) - Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents	- Law on traffic and transport No. 23/2008/QH12; - Decree 46/2016/ND-CP on administrative penalty for traffic safety violation - Circular No. 22/2010/TT-BXD on regulation on labor safety in construction - WBG EHS Guidelines	Contractor	PPMU, CSC
Workers' camp management	- The camps will be constructed far enough from the places to be used for stockpile of construction materials, fuel storage, garbage storage, wastewater drainage canal, sensitive sites such as school, hospital, church, pagoda, temple, and other dangerous areas such as landslide, land subsidence, and erosion. - The camps must be ensured with good environmental conditions such as ventilation, full sunlight, clean water, garbage collection, hygienic toilets, mosquito net, fire extinguishers, First-aid Kits, and other health protection measures to all	- Law on Labor No.10/2012/QH13 - Workers" Accommodation: Process and Standards (IFC and EBRD)	Contractor	PPMU, CSC

	workers.			
Chance Find Procedures	Where the risk and identification process determines that there is a chance of impacts to cultural heritage, the Contractor will retain competent professionals to assist in the identification and protection of cultural heritage. If the Contractor discovers archaeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall: • Stop the construction activities in the area of the chance find; • Delineate the discovered site or area; • Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Department of Culture and Information takes over; • Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property of Viet Nam (within 24 hours or less); • Relevant local or national authorities or Department of Culture, Information and Tourism would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values; • Decisions on how to handle the finding shall be taken by the responsible authorities and Department of Culture, Information and Tourism. This could	Law on cultural heritage No. 28/2001/QH10; - Amended and	Contractor	PPMU, CSC

	include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage; • If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the subproject owner will need to make necessary design changes to accommodate the request and preserve the site; • Decisions concerning the management of the finding shall be communicated in writing by relevant authorities; and • Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage.			
Controlling erosion and sedimentation	- The contractor should follow the detailed drainage plan included in the construction plan, to avoid rainwater that might cause flooding or localized inundation or erode slopes and non-embanked lands. Increased sedimentation or affected local water resources can be among the consequences. - Ensure the drainage system is regularly maintained; mud and other obstructions are cleared; - Other areas in the construction site which are not affected by construction activities should be maintained. - The earthwork and roof curtailing should be carried out in accordance with the technical specifications of the work, including such items as installing drainage ditches and planting vegetation. - In order to make sure soil and rocks will not be swept away with runoff and water resource will be affected, sediment control devices should be installed where necessary to reduce the flow velocity or to orient flow to other directions and to trap sediments. They can be wooden trenches, stone curbs, settling basin, pipe protection equipment or fences.	- WB's EHS guidelines	Contract	PPMU, CSC

	- Separate water from the site and divert water flows: sediments in the water will be pumped out of the site and discharged into proper sediment control system for treatment prior to re-discharge into downstream areas. Construction of energy dissipation works downstream of the discharge point.			
Occupational health and safety	- Training and raising awareness of employees on health and safety. Provide first aid kits at the contractor's office - Provide appropriate safety equipment/devices for workers such as clothing, gloves, boots and hard hats and monitor their uses - Install fences, barriers and warning signs to restrict access to construction sites, signs must show potential hazards to the public. - Place signs reflecting safety regulations in the construction area - Provide enough light at night - Arrange the building materials neatly and tidily. Ensure that the transport of materials will not block the site entrance; - Do not store flammable materials near construction camps. - In the process of demolishing existing infrastructure, workers and residents must be protected from debris using such measures as screens, traffic control, and restricted access to the above areas. - Use safe traffic control measures, including roads/rivers/canals, installing signs to warn of hazardous conditions. - Ensure workers have access to safe water and toilets and mosquito nets. - Provide suitable fire extinguishers for on-site materials. Place fire extinguishers in a clear and accessible locations, etc. Good management of hygienic conditions in the construction areas and/or storage area: Ensure that easily damaged material or lightweight materials are contained in a covered area; Keep ladders and escalators away from material stockpiles and avoid interfering with other activities in the area; Lightweight materials are placed	Directive No. 02 /2008/CT-BXD on labor safety and sanitation in construction agencies; - Circular No. 22/2010/TT-BXD on regulation on labor safety in construction - QCVN 18:2014/BXD: Technical regulation on safety in construction - WBG EHS Guidelines	Contractor	PPMU, CSC

	against wall foot to a height of 2m; Cleaning or bending nails protruding from wooden bars; place pipes, wires etc. away from the access roads or within the site; ensure the construction site is fully protected.			
Community health and safety	**A. General Site Hazards** - Subproject should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction - Restricting access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community - Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape to open air and lock hazardous material stockpiles; **B. Disease Prevention** *Communicable Diseases* - Providing surveillance and active screening and health treatment to workers - Preventing illness among workers in local communities by: • Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counselling addressing systemic factors that can influence individual behaviour as well as promoting individual protection, and protecting others from infection, by encouraging condom use	- Law on Roadway Traffic No. 23/2008/QH12 - Directive No. 02 /2008/CT-BXD on labour safety and sanitation in construction agencies; - Circular No. 22/2010/TT-BXD on regulation on labour safety in construction - QCVN 18:2014/BXD: Technical regulation on safety in construction - WBG EHS Guidelines	Contractor	PPMU, CSC

	• Training health workers in disease treatment • Conducting immunization programs for workers in local communities to improve health and guard against infection • Providing health services • Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers • Promoting collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization *Vector-Born Diseases* - Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements - Elimination of unusable impounded water - Implementation of integrated vector control programs - Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread - Educating subproject personnel and area residents on risks, prevention, and available treatment - Distributing appropriate education materials - Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential of misuse and contact with *Vector medicine*			

Management of stockpiles and borrow pits	- All locations to be used must be previously identified in the approved construction specifications. - An open ditch shall be built around the stockpile to intercept wastewater. - Topsoil on the stockpile will be removed when a borrow pit is operated and will be restored to intitial conditions. - An open ditch shall be constructed around the area with an approved settling pond/oil trap at the outlet - Control water flow through construction sites or disturbed areas with ditches, check structures, grass and rock barriers - Contractor will carry out grading, levelling, compacting layer by layer in the course of dumping waste and at the same time filling embankments surrounding the dumping ground to avoid soil eroding and sliding. - If landowners are affected by use of their areas for stockpiles or borrow pits, they must be included in the subproject RAP. - If access roads are needed, they must have been considered in the environmental assessment. - Environmental remediation measures: Planting drought-resistant crops, crops being resistant to arid and leguminous plants that have ability to improve soil such as wild peanut mixed with forest trees, such as acacia, cajuput - For dumping sites: • Dumping sites of 8 works ara located in lowland areas, thus ther is no need to build surrounding embankment. They are also empty and vacant land area with no capacity for farming. However, to avoid subsidence, soil should be disposed in layers of 50cm and then compacted. The discharge height should be equal to		Contractor	PPMU, CSC

	natural ground so as not to alter the landscape and soil erosion. - Dumping site of Ba Khe reservoir is adjacent to kindergartens and residential areas, it needs to make fence to avoid dust and stop cattle from going into the disposal area, set the board at disposal area and restrict people from entering the area. Inform the local authorities, kindergartens and residents about the timing of disposal, measures to minimize the environmental and social impacts. - Compact the soil and cover the ground with fertilized topsoil after the completion of the project. • Borrow pits of 3 reservoirs Khe Co, Khe De, Khe Nhay: - Excavating soil in borrow pits of 3 reservoirs Khe Co, Khe De, Khe Nhay may disturb the soil layers, leading to cultivation capacity in ther future. Therfore, before exploiting materials, the farming soil or fertilized soil (25-30cm thick) should be removed and will be retunred on the cultivation land after the project. This is to shorten the land reclaimtion time and enure early soil environment restoration. • Only exploit construction materials to specified depth • After completion of the project, use waste soil from the demolition of cofferdam to level ground of borrow pits.			
Communication with local communities	- Maintain open communications with the local government and concerned communities; the contractor shall coordinate with local authorities (leaders of local wards or communes, leader of villages) for agreed schedules of construction activities at areas nearby sensitive places or at sensitive times (e.g., religious festival days). - Copies in Vietnamese of this ECOP and of other relevant environmental	Decree No. 167/2013/ND-CP on administrative penalty for violations related to	Contractor	PPMU, CSC

	safeguard documents shall be made available to local communities and to workers at the site. - Disseminate subproject information to affected parties (for example local authority, enterprises and affected households, etc.) through community meetings before construction commencement. - Provide a community relations contact from whom interested parties can receive information on site activities, subproject status and subproject implementation results. - Provide all information, especially technical findings, in a language that is understandable to the general public and in a form of useful to interested citizens and elected officials through the preparation of fact sheets and news release, when major findings become available during subproject implementation phase. - Monitor community concerns and information requirements as the subproject progresses. - Inform local residents about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition, as appropriate. - At least 15 days in advance of any service interruption (including water and electricity supply, telephone service, bus service, etc.) the community must be advised through postings at the subproject site, at bus stops, and in affected homes/businesses. - Provide technical documents and drawings to local authority and community, especially a sketch of the construction area and the ESMP of the construction site. - Notification boards shall be erected at all construction sites providing information about the subproject, as well as contact information about the site managers,	social security, order and safety issues		

	environmental staff, health and safety staff, telephone numbers and other contact information so that any affected people can have the channel to voice their concerns and suggestions.			
Labour influx management	A) Mitigate conflicts between workers and local residents: - Formulate a regulation on worker management and disseminate this regulation. - Register workers' temporary residence and cooperate with the local authorities as well as heads of villages to manage workers. - Employ as many as possible local unskilled laborers - Encourage local residents to support workers during the construction period - Cooperate with mass organizations to deal with conflicts between workers and local residents. B) Mitigate impacts of social problems - Inform workers about the local security and social evils. - Have workers sign commitments on non-violation of social evils. - Cooperate with commune police to manage social evils.			
Natural disaster, heavy rain and flood management	Do not execute construction activities during rainy season, especially earth moving activities to avoid erosion; Make plan to shield and respond to incidents during rainy season; Organize training and disseminate information on response to storm, flood, lightning, etc. for contractors and workers on construction site in line with EPP prepared in Dam Safety Plan; Construction contractors cooperate with the Client to regularly monitor storms, flood and unusual weather phenomena at the site for timely information and		Contractor	PPMU, CSC

	responses			

7.1.3. Mitigation measures for site-specific impacts on sensitive subject during construction phase

Mitigation measures for site-specific impacts on sensitive receptors during construction are depicted below.

Table 7 - 3: **Mitigation measures for site-specific impacts on sensitive receptors**

Affected subjects	*Potential impacts*	*Specific mitigation measures*	*Responsibility*	
			Implement ation	*Supervision*
Biological environment	The excavation, filling and discharge will cause loss of habitat, hatching grounds and death of some species of animals living in the soil such as insects, cave-dwelling animals such as snakes and frogs. During pre-construction and construction phase, this impact is difficult to avoid. As the survey results, there is no rare and protected species in the subproject area. Affected objects are common plants and species living in natural environment of the locality. When completing construction activities, the contractor will apply measures to recover environment as original. Regarding to position, nature and scale of the works, the impact is assessed as moderate.	- Stockpile topsoil when first opening a borrow pit and use it later to restore the area to near natural conditions. - Control water flow through construction sites or disturbed areas with ditches, check structures, live grass barriers, and rock - Contractor will carry out grading, levelling, compacting layer by layer in the course of dumping site and at the same time filling embankments surrounding the dumping sites to avoid eroding, sliding. - Planting crops being resistant to arid and leguminous plants that have ability to improve soil such as wild peanut mixed with forest trees, such as acacia, cajuput.	Contractor	PPMU, CSC
Transmission line 500kV	Although the construction sites are out of transmission line safety corridor, the incidents may occur. Construction activities may pose damage to the transmission line due to short-circuit by operation of cranes and concrete mixers	- Establishing “No-trepassing” zones around or under the transmission line within a minimum distance of 7 meters. - Not allowed to carry out construction activities	Contractor	PPMU, CSC

	operating close to the transmission line i.e. within safety corridor of the transmission line.  Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Workers working within safety corridor may be affected by magnetic field or electric shock, i.e. at a distance less than 7 meters from the transmission line. In addition, construction of dam and spillway under the 500KV transmission line might cause the utility poles to sink due to excavation, embankment or drilling activities. In Nuoc Xanh construction site: Nuoc Xanh construction site: Construction site of Nuoc Xanh reservoir is nearest to the line i.e. about 3-8m and this does not meet safety requirements for freeboard (> 10m). The impacts on the 500 KV high voltage power system in Nuoc Xanh work site are evaluated as high, the consequences can be serious, and so the opinion of the Electricity Transmission Authority of Ha Tinh is required. At the same time, safety regulations for	within 20 m of transmission line during rainy days; - Not allowed to carry out any works within safety corridor of 17 m (8.5 m each side) of the transmission line. Organize site meetings, inform workers about the danger of 500 KV high voltage electricity to human health. - Installing warning signs and post in the construction area so that the workers can see and will be always aware of danger of electric current during construction process. - Prohibiting the following activities (as per Decree 14/2014/ND-CP on Electricity Safety): + Using poles for building tents; + Using the transmission line for other purposes without approval of the management unit; + Using construction equipment that may cause vibration or damage to the transmission line; + Stockpiling soil, construction material, equipment or wastes within safety corridor; + Stockpiling explosive, inflammable materials and chemicals which may cause corrosion or damages to the transmission line; + Excavation and backfill activities that cause ultity poles to sink; + Stealing items of transmission line.		

	construction under 500 KV high voltage power system should be strictly complied with. The impact on the high voltage power system 500 KV in construction site of Loi Dong and Da Den reservoirs is assessed as medium, since the construction sites area are out of transmission line safety corridor. The consequences can be serious so it is necessary to comply with safety regulations when construction activities take place under the high voltage line.	- In construction sites of Nuoc Xanh, in addition to electrical safety measures as for Loi Dong and Da Den, the following measures should be taken: + Move the position of new spillway for 5m towards the K0 position to ensure that it is outside the safety distance of the national grid (the design has been adjusted according to the drawings in Appendix 1 and approved by the Ha Tinh power transmission agency in Official Document No. 232/TTDHT-KT dated 28/6/2018 on the agreed design option to ensure safety of electricity transmission lines during construction activities; - Prior to the construction within the electricity safety corridor, it is necessary to agree on the construction organization method with Ha Tinh Power Transmission Agency and announce the construction period so that the Agency can send their staff for supervision. Ensure safety of 500 KV lines during construction phase.		
The area of the corridor encroached for other purposes	Two households of Ky Thinh ward and two households of Ky Trinh ward are affected as they cultivate on encroached land in the dam protection corridor and these lands are acquired for construction. The households mainly plant short-term plants in this area so the impact is negligible	- Construction schedule and plans and associated impacts shall be sent to landholders at least 3 months before start of the construction. - Strictly comply with Resettlement Action Plan (RAP) to address the potential impacts related to land acquisition.	Contractor	PPMU, CSC

				
Agricultural production	Rehabilitation of upstream and downstream slopes, dam body waterproofing and construction of new intakes in 7 works (Loi Dong, Nuoc Xanh, Khe De, Khe Nhay, Da Den, Ba Khe) will require water level drawdown below normal water supply for construction. Thus, 1,115 ha of spring rice, 1,055 ha of summer –autumn rice and 3-5 ha of speciality orange will be affected. Income of local people in subproject area depends mostly on agricultural production. Thus, without proper mitigation measures, water cut for construction activities may adversely impact livelihood of local people. However, the impact is assessed as low since the construction time can be properly adjusted and remedial measures will be optimally applied. 115 ha of spring rice in Loi Dong reservoir 112 ha of spring rice and 112 ha of summer rice in Ky Phong commune in Nuoc Xanh reservoir 120 ha of spring rice crop and 120 ha of summer rice in Ky Bac commune in Ba Khe reservoir 3-5 ha of orange specialty, households renting water surface for fish raising, 55 ha of spring rice and 55 ha of summer-	- Construction time should be arranged when there is no water demand of downstream area or the demand is the lowest: Schedule the repair of dam body and construction of intakes should be between 20/6 and 30/8 which is the end of dry season and water level is at lowest level and water demand for the downstream area is negligible since summer-autumn crop has become ripen and ready to be harvested. This schedule helps to avoid impacts on the downstream. - While constructing 7 new intake sluices (except for Khe Co reservoir), it needs to use other water sources to supply for downstream. Specifically: water supply from Bau Son and hoi Lay reservoir instead of Loi Dong reservoir; Water supply from Song Rac canal instead of Ba Khe and Nuoc Xanh reservoir; Water supply from Cau Trang reservoir instead of Da Den reservoir; Water supply from Nuc Trong reservoir or from Linh Cam pump station	Client	- CSC - Ha Tinh DONRE

	autumn rice of village 1 and village 3 of Huong Tho commune in Dap Buom reservoir	instead of Khe De reservoir; Water supply from Vu Quang dam instead of Dap Buom reservoir; For Khe Nhay reservoir, since there is no alternative water sources, it is necessary to embank cofferdams for the construction of new culvert. Once new culvert is built and operated, the existing one will be demolished. - The subproject owner must inform the local authorities and water users about water cutting schedule at least 3 months prior to the construction, so that the local residents can store water in their canals and aquaculture ponds or harvest in early manner. - In case that reasonable construction time has been allocated and supplemental water sources are ready but water demands of production activities are not met, the contractors shall build cofferdam for the construction of new culverts		
	540 ha of spring rice and 540 ha of summer rice in Son Le commune in Khe Co reservoir			
	45 ha of spring rice and 45 ha of summer rice in Son Tien commune in Khe Nhay reservoir			
	150 ha of spring rice and 130 ha of summer-autumn rice in Son Mai commune in Khe De reservoir			
Water supply for domestic use	Lowering water level in reservoirs for construction activities in Khe Co, Khe Nhay, Khe De may affect water supply for domestic use of more than 600 households in downstream area, and mainly for bathing and breeding. Drinking water is used from drilled and dug wells.		Client, contractor	- CSC - Ha Tinh DONRE
	supply water for about 30 households but mainly for bathing and breeding in Son Le commune in Khe Co reservoir			
	supply water for about 200 households for domestic use in Son Tien commune in Khe Nhay reservoir			
	supplying water for about 400 households for domestic use in Son Mai commune in Khe De reservoir			
Livestock farm	Nuoc Xanh reservoir: Works affected by materials transportation: Pig farm of Mytraco company under Ha Tinh mineral company, 40m farm from the main dam to the west will not be demolished. However, noise and vibration and emission due to construction activities will affect cattles and traveling of local people. Works affected by construction of head-works: 3 livestock	- Strictly comply with Resettlement Action Plan (RAP) to address the potential impacts related to land acquisition. - The construction schedule, activities, and associated impacts shall be sent to land owners at least 1 month before start of the construction.	Contractor	PPMU, CSC

	farms of households located 100m far from the spillway and 2 farms located 30m away from the main dam to the North, will be demolished or stop raising cattle for the repair of head-works. Ba Khe reservoir: Works affected by construction of head-works: 01 livestock farm which is 700m away from the reservoir to the north east will be demolished or stop raising cattle for repair of head-works.  Da Den reservoir: Works affected by materials transportation: 03 farms, in which 1 livestock farm with 500 pigs and 2 forestry farms will not be demolished, however, noise and vibration and emission due to construction activities will affect cattle and travelling of local people.	- Maintaining access to the farm as much as possible - Restoring the landscape after construction completion		
Ky Bac primary school	Ho Ba Khe: Near the access road to the reservoir and 2km away from the reservoir: materials transport will generate smoke, dust, vibration to the building. Transported materials and wastes dropped on the route across Ky Bac Elementary School may increase the traffic accident risks for pupils and teachers in the school, especially during school starting and finishing time i.e. 7AM to 7.30 AM; 11AM to 11.30 AM; 13.30 PM to 14 PM and 16.30 PM to 17PM. This impact is assessed as moderate and	- The construction schedule, activities, and associated impacts shall be sent to the school at least one month before start of the construction. - Prohibit transportation during rush hours (7AM to 7.30 AM; 11AM to 11.30 AM; 13.30 PM to 14 PM and 16.30 PM to 17PM). - Worker camps must be located at least 200 m from the school.	Contractor	PPMU, CSC

	the contractor shall implement mitigation measures.	- Stockpiles and dumpsites and maintenance of construction equipment and machineries should be located at least 100 m away from the school. - Assign staff to regulate traffic (if needed), limit speed of material transportation trucks, and erecting warning signs.		
Huu Lac pagoda	Ho Ba Khe: Near the access road to the reservoir and 2km away from the reservoir: materials transport will generate smoke, dust, vibration to the building On the first and 15th of lunar months, the number of people going to the pagoda rises. Therefore, material transport will affect the silence forest the pagoda and traveling of visitors. This impact is assessed as moderate. 	- Detailed construction schedule, activities, and associated impacts shall be sent to the pagoda by contractors at least 1 month before start of the construction. - Prepare a proper construction schedule, particularly on the 1st and 15th of lunar months and Verak week (end of Lunar April). - Stockpiles and dumpsites and maintenance of construction equipment and machineries should be located at least 100 m away from the pagoda. - Worker camps shall be located at least 200 meters far from the pagoda. - Workers are required to have a good behavior with local culture and respect for local belief. - Limit material transportation on the 1st and 15th of lunar months, not honking at the pagoda and regularly watering the pavement to prevent dust.	Contractor	PPMU, CSC
Households living near the	Ho Dap Buom: Impacts by material transportation: 7 households living near the material transport road from Ho Chi Minh road to Dap Buom reservoir and 16 households of village 1, Huong Tho commune may be affected due to	- Construction schedule, activities, and associated impacts shall be sent to the households at least one month before start of the construction. - Honking is limited	Contractor	PPMU, CSC

transport ation road	increased traffic. They can be also affected by increased dust and noise 	- Pile driving shall not be applied. - Drivers shall comply with safety regulations during their operation. - Restoration of landscape after construction completion - Use trucks of ≤7 tons to avoid damaging concrete and asphalt roads. - Report to the competent agencies on any damages to the public utilities and repair such damages when possible - Compensate for damages to roads and infrastructure. - Collect and clean falling materials along the transportation roads		
	Ho Khe Nhay: Va Transporting materials may affect traffic safety of 6 households living along inter-village road (Hoi Son, Minh Giang and Kim Loc villages) Transporting of waste soil may affect traffic safety and air environment of over 100 households in villages Ha Tien, Thinh Tien and Ngoc Son in Son Tien commune.			
	Ho Khe Co: Transporting of waste soil may affect traffic safety and air environment of over 100 households in Khe Co village of Son Le commune and villages Ha Tien, Thinh Tien and Ngoc Son of Son Tien commute.			
Rural road used to transport materials	In all 8 construction sites, materials transportation will be on aggregate roads (access to the reservoirs) of 3-5m wide and not yet reinforced. Transportation of materials and wastes and large amount of vehicles in circulation in a short time may cause damages to roads, bridges and culverts surface. During the transport, spilt materials, if not cleaned up, may affect the aesthetics and threathen safety of people and means of transportation, and result in more traffic accident risks to workers and local people.	- Construction schedule, activities, and associated impacts shall be sent to the households at least one month before start of the construction. - Using of proper load trucks for transportation. - Water pavements frequently to reduce dust, especially in dry and hot days. - Collect spilt materials on roads and clean road every day. The Client should require contractors to commit to	Contractor	PPMU, CSC

		the use of suitable means of transport with proper load as prescribed for the transport routes and preparation of have a plan to return and restore roads damaged by transports of materials.		

7.1.3. Mitigation Measures for Impacts generated during Operation Phase

- **Measures to ensure the safety of works:**

  - In order to ensure the safety of the local population, the reservoir O&M unit will strictly comply with the current regulations on flood discharge and must promptly notify in order to minimize damage to human and property as much as possible. Providing an alarm system for people in the downstream in an emergency case relating to sudden discharge of a large amount of water;
  - In case of flood discharges that damage crops or infrastructure, the Client shall be responsible for compensation.
  - Monitoring and timely detecting soil subsidence, seepage, or cracking of breakwater walls, obstruction of water culverts causing mud accumulation on downstream slope etc. Pay special attention to seepage in the downstream drains of the dam, regularly check the infiltration flow and turbidity of the downstream infiltration flow.
  - Properly regulate flood to avoid danger to the dam safety during flood season, ensure design irrigation supply and meet different irrigation supply times during the year. Timely detecting and treating termite net that damage dam body. Clearing trees within the dam area. Assign a full-time staff to guard and prevent negative impacts of humans and animals on dam body, including collisions, timber fallings, and floating rafts. Effective protection of watersheds to create a stable source of water resources and avoid flash flood causing risks to the works.
  - Every year, in the dry season, there should be a regular dredging plan for intakes and outlets of culverts to clear the upstream and downstream flows. Monitoring erosion after the spillway if any so that timely treatment can take place.
  - The O & M Unit will work closely with local authorities during the operation and notification of flood discharges to ensure timely and adequate information to all affected households.
  - Planting grass on talus according to the approved plan. Tend and maintain grass according to technical requirements.

- **Measures to limit impacts on environment due to the increased irrigation area**

With the increased use of fertilizers and pesticides, if not controlled and mitigation measures are not in place. Negative impacts on environmental quality and people's health in the subproject area will be found.

However, the improved irrigation system is a basis for optimal water uses for System Rice Intensification (SRI) principle. Integrated Pest Management and System Rice Intensification (SRI) will result in minimum land preparation. Biological prevention measures should be included in contents of Farmer Field Schools - FFS, so that farmers in the subproject may improve their knowledge and skills relating to cultivation and effective development of soil eco-system. Crops will be able to withstand pests, extreme weather. Productivity will increase, chemical uses will be reduced, especially pesticides, fungicides, reducing greenhouse gas emissions. Also due to the effects of IPM, less harmful chemicals will

gradually replace toxic chemicals. Parallel to the training for farmers on IPM/SRI/minimum tillage, community activities on Pesticide risk reduction-PRR such as training for local leaders, pesticide users, pesticide supplier... regulations on pesticide management, risks from pesticides and labor protective measures needed for pesticides exposure, collection of pesticide packaging after using, etc. will have integrated effects to reduced risks generated from pesticide use in the project area.

Integrated pest management (IPM) will be prepared to provide mitigation tools to impacts caused by pesticide uses. The most relevant measures are training and raising awareness and knowledge of farmers on IPM, issues relating to increased use of chemicals and pesticides; increased hazardous wastes (bottles, pesticides packaging).

During the operation of the subproject, Plant Protection Sub-Department of the province will hold training course on IPM as attached in the Annex 3 of this Report.

Local governments and stakeholders should advocate local people in the subproject area to apply trained integrated pest management skills.

7.2. Implementation arrangement

7.2.1. Project management

Central level

The Ministry of Agriculture and Rural Development (MARD) is responsible for the implementation and management of the entire project. Provinces carrying out the repair and upgrading of dams under Component 1 and MARD will coordinate activities with the Ministry of Industry and Trade and MONRE under Component 2. The Central Project Management Unit (CPMU) under MARD is responsible for coordination and overall supervision of the project. Implementation of repair and preparation of dam safety plans, including protection and authorization are decentralized to provincial government. Provincial People's Committee, Department of Agriculture and Rural Development (DARD) are focal points at provincial level. The Provincial Project Management Unit (PPMU) is responsible for managing and supervising the works with support from the CPMU.

The central level project management unit will assist in the implementation of the project by the environmental and social technical support unit; in addition CPMU shall hire independent consultants to evaluate the implementation of environmental safeguard policy of the whole project for every 6 months. This is the organization which is selected through the competitive bidding process who will provide support and quality guarantee to the central level during the implementation process. This includes support to the central level project management unit in reviewing and adjusting as necessary and re-implementing the development framework during project implementation which can provide a framework for national programs. This process is ensured to be compliance with Decree 72 through the assistance to MARD in the establishment of necessary systems in place for the implementation of the National Dam Safety Program.

Provincial level

Ha Tinh PPC assigns MARD to implement the project in the province and establish the WB8 Provincial Project Management Unit (PPMU) who will carry out the bidding, construction supervision and implementation of resettlement action plan, environmental and social action plans and these action plans must be in line with the overall framework of the Project. The PPMU will be provided with technical and environmental supports from the CPMU and environmental and social Consultants. The implementation arrangements of the Project are presented in the following diagram:

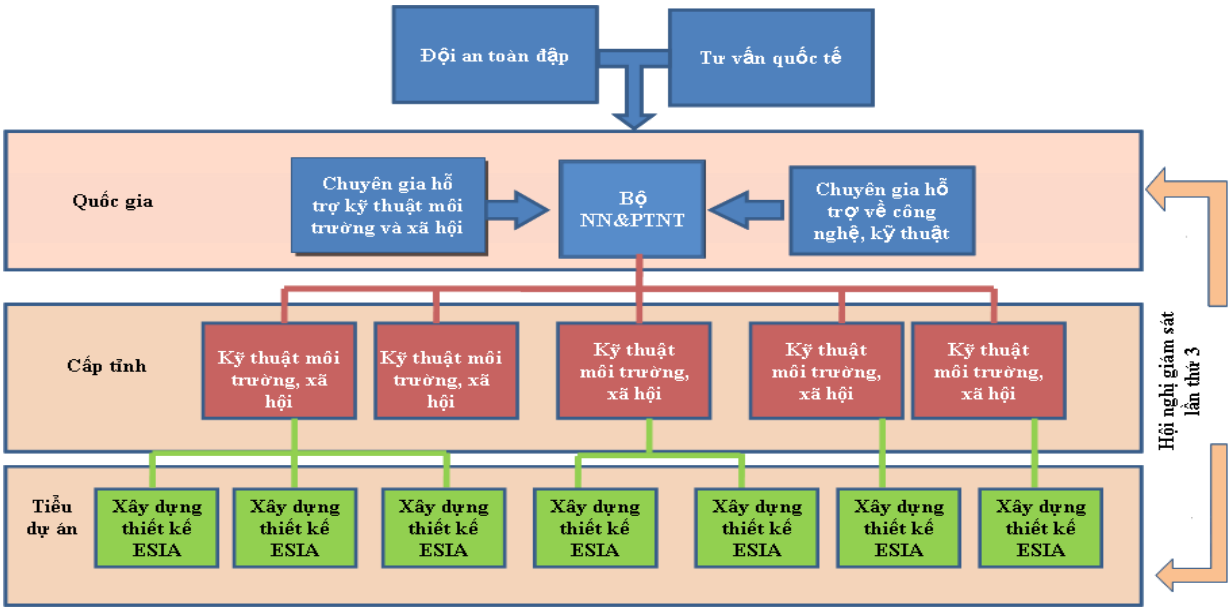

Figure 7 - 1: Project implementation arrangement

(Source: ESMF of DRSIP, 2015)

7.2.2. Roles and responsibilities for environmental and social safety management

During its regular investment monitoring activities, the CPMU will carry out inspections with local environmental authorities to determine whether the implementation of the project meets all the requirements of the ESMF, ESIA and ESMP. This agency will conduct field surveys at different stages of the project to confirm that the environmental and social management plan and the environmental and social monitoring plan are fully implemented. A monitoring report covering environmental and social management issues will be included in the overall field report. The designated environmental and social experts are responsible for preparing quarterly and annual reports on major project implementation steps, outputs and results of environmental management actions which are prepared for all investments content throughout the project cycle.

The CPMU requires the PPMU to have a corresponding environmental component in its investments, including significant mitigation activities and significant environmental incidents that have occurred. All PPMUs must include the environmental component in all reports prepared for the World Bank.

Stakeholders should be fully aware of the implementation mechanism of the ESMP in the project investments. This will be very important for the support and evaluation of their roles in environmental monitoring and evaluation of the subproject activities. Organization chart during the implementation of the ESMP is in the following diagram:

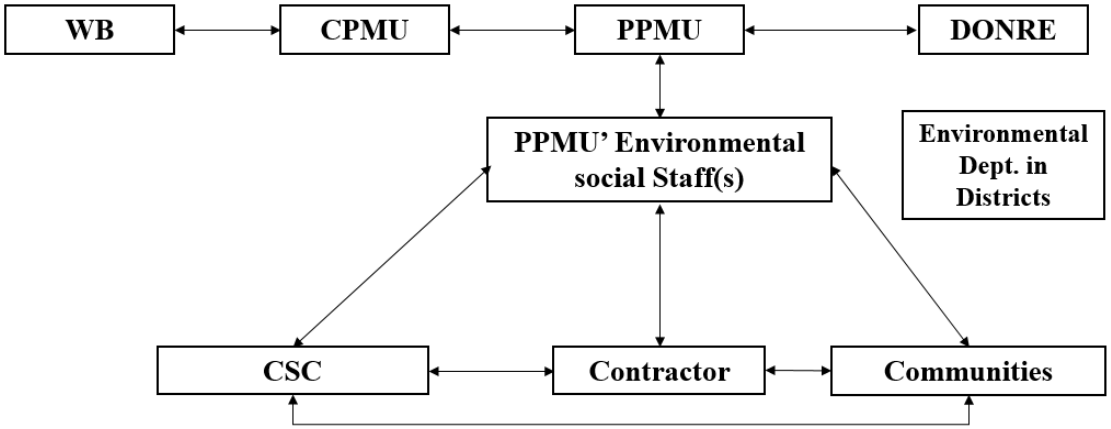

Figure 7 - 2: Organizational chart for ESMP Implementation

Details of roles and responsibilities of the stakeholders involved in environmental and social management activities during project implementation are presented in the following table.

Table 7 - 4: Roles and responsibilities of key stakeholders in ESMP Implementation

Community/ Agencies	*Responsibilities*
CPMU	CPMU on behalf of the Client as MARD will be responsible for monitoring the overall subproject implementation, including compliance to environmental and social safeguard policies of the subproject. - Responsible for reporting the implementation of environmental and social safeguard policy to the MONRE and the World Bank. - The CPMU will be assisted in the overall implementation of the project with a TA Consultant. The TA Consultant will develop a system to properly monitor environmental and social safeguard aspects during the project implementation. - Independent monitoring of the Third party will be carried out regularly for project activities. Independent monitoring of the third party will also assess the compliance to environmental and social safeguard policies and the implementation of safeguard instruments, including Environmental management plans/Practical environmental principles/Resettlement policy framework/resettlement action plan/ Ethnic minority development plan and Gender action plan.

PPMU	PPMU will be responsible for overall implementation of the sub-project including the compliance to environmental and social safeguard polices of the sub-project. PPMU have the final responsibility for ESMP implementation and environmental performance of the subproject during the construction and operation phases. Specifically the PPMU will: (i) closely coordinate with local authorities in the participation of the community during subproject preparation and implementation; (ii) monitor and supervise ESMP implementation including incorporation of ESMP into the detailed technical designs and bidding and contractual documents; (iii) ensure that an environmental management system is set up and functions properly; (iv) be in charge of reporting on ESMP implementation to the CPMU and the World Bank. For effective implementation, PPMU will assign an Environmental and Social Staff(s) (ES) to help with the monitoring of environmental aspects of the subproject.
PPMU Environmental and Social Staff(s) (ES)	- The ES is responsible for monitoring the implementation of the World Bank's environmental and social safeguard policies in all phases and process of the subproject. Specifically, ES will be responsible for: (i) supporting PPMU in the incorporation of ESMP into the detailed technical designs and civil works bidding and contractual documents; (ii) supporting PPMU in the incorporation of ESMP and RAP monitoring and supervision tasks into the TORs, bidding and contractual documents for the Construction Supervision Consultant (CSC) as needed; iii) providing relevant inputs to the consultant selection process; (iv) reviewing reports submitted by the CSC and safeguard consultants; (v) conducting periodic site checks; (vi) helping the PPMU with the preparation of social and resettlement issues of the subproject; and (vii) preparing environmental and social performance contents in the Progress reports and evaluation reports to be submitted to the CPMU and the World Bank.
Construction Supervision Consultant (CSC)	- The CSC will assign Environmental and Social Staff(s) and will be responsible for routine supervising and monitoring all construction activities and for ensuring that Contractors comply with the requirements of the contracts and the ESMP. The CSC will engage sufficient number of qualified staff (e.g. Environmental Engineers) with adequate knowledge on subproject environmental protection and construction management to perform required duties and to supervise the Contractor's performance. - The CSC will also assist the PPMU in (i) reporting on and maintaining close coordination with the local community, and (ii) strengthening environmental and social safeguard policies for civil contractors.

Bidders	The Bidders shall submit to PPMU the following additional documents in its Bids: Code of Conduct (ESHS) • The Bidder shall submit its Code of Conduct that will apply to its employees and subcontractors, to ensure compliance with its Environmental, Social, Health and Safety (ESHS) obligations under the contract. • In addition, the Bidder shall show details of how this Code of Conduct will be implemented. This will include: how it will be introduced into conditions of employment/engagement, what training will be provided, how it will be monitored and how the Contractor proposes to deal with any breaches Management Strategies and Implementation Plans (MSIP) to manage the (ESHS) risks • The Bidder shall submit Management Strategies and Implementation Plans (MSIP) to manage the following key Environmental, Social, Health and Safety (ESHS) risks to PPMU.
Contractor	- The contractor shall assign its Environmental and Social Staff(s) to carry out Environmental and Social mitigation measures proposed in the ESMP. - The Contractor shall be required to submit to PPMU/CSC for approval, and subsequently implement, the Contractor's Environment and Social Management Plan (C-ESMP), in accordance with the Particular Conditions of Contract Sub-Clause, that includes the agreed Management Strategies and Implementation Plans. - Take actions to mitigate all potential negative impacts in line with the objective described in the CESMP. - Actively communicate with local residents and take actions to prevent disturbance during construction. - Ensure that all staff and workers understand the procedure and their tasks in the environmental management program. - Report to the PPMU and CSC on any difficulties and their solutions. - Report to local authority and PPMU and CSC if environmental incidents occur and coordinate with agencies and keys stakeholders to resolve these issues.
Local governments and community	- Community: According to Vietnamese practice, the community has the right and responsibility to routinely monitor environmental performance during construction to ensure that their rights and safety are adequately protected and that the mitigation measures are effectively implemented

	by contractors and the PPMU. If unexpected problems occur, they will report to the CSC and PPMU.
Province and City People's Committees (PPCs/DPCs), Provincial DONRE	- Oversee implementation of subprojects under recommendations of DONRE and PPMU to ensure the compliance of Government policy and regulations. DONRE is responsible for monitoring the compliance with the Government environmental requirements.

7.3. Environmental Compliance Framework

Duties of the Contractor, the Social and Environmental Officer (SSEO) and the CSC which have not been set out in te SPD should be integrated into the Client's Requirements (Part 7 of the SPD).

7.3.1. Environmental Duties of the Contractor [3]

The contractor shall firstly comply with environmental regulations to ensure minimized impacts will be generated from the subproject and mitigation measures under ESMP must be applied to prevent harm and nuisances to local communities and environment which are caused by impacts during the construction and operation phases.

The Contractor shall be required to submit to PPMU/CSC for approval, and subsequently implement, the Contractor's Environment and Social Management Plan (C-ESMP), in accordance with the Particular Conditions of Contract Sub-Clause 16.2[4], that includes the agreed Management Strategies and Implementation Plans

[3]If the Contractor was, or is, failing to perform any ESHS obligations or work under the Contract, the value of this work or obligation, as determined by the Project Manager, may be withheld until the work or obligation has been performed, and/or the cost of rectification or replacement, as determined by the Project Manager, may be withheld until rectification or replacement has been completed. Failure to perform includes, but is not limited to the following:

- failure to comply with any ESHS obligations or work described in the Works‟ Requirements which may include: working outside site boundaries, excessive dust, failure to keep public roads in a safe usable condition, damage to offsite vegetation, pollution of water courses from oils or sedimentation, contamination of land e.g. from oils, human waste, damage to archeology or cultural heritage features, air pollution as a result of unauthorized and/or inefficient combustion;
- failure to regularly review C-ESMP and/or update it in a timely manner to address emerging ESHS issues, or anticipated risks or impacts;
- failure to implement the C-ESMP;
- failing to have appropriate consents/permits prior to undertaking Works or related activities;
- failure to submit ESHS report/s (as described in Appendix C of SPDs), or failure to submit such reports in a timely manner;
- failure to implement remediation as instructed by the Engineer within the specified timeframe (e.g. remediation addressing non-compliance/s)

[4] The Contractor shall not commence any Works, including mobilization and/or pre-construction activities (e.g. limited clearance for haul roads, site accesses and work site establishment, geotechnical investigations or investigations to select ancillary features such as quarries and borrow pits), unless the Project Manager is satisfied that appropriate measures are in place to address environmental, social, health and safety risks and impacts. At a minimum, the Contractor shall apply the Management Strategies and Implementation Plans and Code of Conduct, submitted as part of the Bid and agreed as part of the Contract. The Contractor shall submit, on a continuing basis, for the Project Manager‟s prior approval, such supplementary Management Strategies and Implementation Plans as are necessary to manage the ESHS risks and impacts of ongoing works. These Management Strategies and Implementation Plans collectively comprise the Contractor‟s Environmental and Social Management Plan (C-ESMP). The C-ESMP shall be approved prior to the commencement of construction

Remedial actions that cannot be effectively carried out during construction should be carried out on completion of the works *(and before the issuance of the acceptance of completion of works*) the duties of the Contractor include, but not limited to:

- Compliance with relevant legislative requirements governing the environment, public health and safety;
- Work within the scope of contractual requirements and other tender conditions;
- Organize representatives of the construction team to participate in the joint site inspections undertaken by the Environmental Staff of the CSC;
- Carry out any corrective actions instructed by the Environmental Staff of the PPMU and CSC;
- In case of non-compliances/discrepancies, carry out investigation and submit proposals on mitigation measures, and implement remedial measures to reduce environmental impact;
- Stop construction activities, which generate adverse impacts upon receiving instructions from the Environmental Staff of PPMU and CSC. Propose and carry out corrective actions and implement alternative construction method, if required, in order to minimize the environmental impacts; Non-compliance by the Contractor will be cause for suspension of works and other penalties until the non-compliance has been resolved to the satisfaction of the ES of PMU and CSC.

7.3.2. Contractor's Social and Environmental Safeguard Officer (SEO)

The contractor shall be required to appoint competent staff(s) as the Contractor's on-site Social and environmental safeguard officer (SEO). The SEO must be appropriately trained in environmental management and must possess necessary skills to transfer environmental management knowledge to all personnel involved in the contract. The SEO will be responsible for monitoring the contractor's compliance with the ESMP requirements and the environmental specifications. The duties of the SEO shall include but not be limited to the following:

- Carry out environmental site inspections to assess and audit the contractors' site practice, equipment and work methodologies with respect to pollution control and adequacy of environmental mitigation measures implemented;

- Monitor compliance with environmental protection measures, pollution prevention and control measures and contractual requirements;

- Monitor the implementation of environmental mitigation measures;

- Prepare audit reports for the site environmental conditions;

- Investigate complaints and recommend any required corrective measures;

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activities (e.g. excavation, earth works, bridge and structure works, stream and road diversions, quarrying or extraction of materials, concrete batching and asphalt manufacture). The approved C-ESMP shall be reviewed, periodically (but not less than every six (6) months), and updated in a timely manner, as required, by the Contractor to ensure that it contains measures appropriate to the Works activities to be undertaken. The updated C-ESMP shall be subject to prior approval by the Project Manager.

- Advise the contractor on environment improvement, awareness and proactive pollution prevention measures;

- Recommend suitable mitigation measures to the contractor in the case of non-compliance. Carry out additional monitoring of noncompliance instructed by the ES of PPMU and CSC

- Inform the contractor and ES (of PPMU and CSC) of environmental issues, submit contractor's ESMP Implementation Plan to the ES of PPMU and CSC, and relevant authorities, if required;

- Keep detailed records of all site activities that may relate to the environment.

7.3.3. Environmental and Social Supervision during Construction (CSC)

During construction phase, a qualified CSC reporting to the PPMU shall carry out the environmental supervision. The CSC will assign environmental and social staff(s) who will be responsible for inspecting and supervising all construction activities to ensure that mitigation measures adopted in the ESMP are properly implemented, and that the negative environmental impacts of the subproject are minimized. The CSC shall engage sufficient number of Environmental Supervision Engineers with adequate knowledge on environmental protection and construction subproject management to perform the required duties and to supervise the Contractor's performance. Specifically ES of CSC will:

- Review and assess on behalf of the PPMU whether the construction design meets the requirements of the mitigation and management measures of the ESMP,

- Supervise site environmental management system of contractors including their performance, experience and handling of site environmental issues, and provide corrective instructions;

- Review the ESMP implementation by the contractors, verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results;

- Report on ESMP implementation status to PPMU and prepare the environmental supervision statement during the construction phase;

7.3.4. Compliance with Legal and Contractual Requirements

The constructions activities shall comply not only with contractual environmental protection and pollution control requirements but also with Law on Environmental protection and pollution control of Viet Nam.

All the construction methods will be submitted by the Contractor to the CSC and PPMU for approval to make sure there are adequate environmental protection and pollution control measures included.

The CSC and PPMU shall also review the progress and program of the works to check that relevant environmental laws have not been violated, and that any potential violation can be prevented.

The Contractor shall copy relevant documents to the SEO and the ES of CSC and PPMU. The document shall at least include the updated work progress report, the updated work measure, and the application letters for different license/permits under the environmental protection

laws, and all the valid license/permit. The SEO and the ES shall also have access, upon request, to the Site Log-Book.

After reviewing the documents, the SEO or the ES of the CSC and PPMU will advise PPMU and the contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the SEO or the ES concludes that the status on license/permit application and any environmental protection and pollution control preparation works may not comply with the construction measure or may result in potential violation of environmental protection and pollution control requirements, they shall advise the Contractor and the PPMU accordingly and promply.

7.3.5. Reporting Arrangements

In addition to the progress report, the Contractor shall also provide a report on the Environmental, Social, Health and Safety (ESHS) data as set out in the Appendix B of SPDs. In addition to Appendix B reports, the Contractor shall also provide immediate notification to the PPMU of incidents in the following categories. Full details of such incidents shall be provided to the PPMU within the timeframe agreed with the PPMU.

- Any confirmed or likely violations to any law or international agreement;
- Any fatality, serious injury or damages (temporal damages)
- Significant adverse effects or damage to private property (e.g. vehicle accident, damage caused by flying rock or due to working beyond the boundary)
- Major pollution of aquifer or groundwater or damages or destruction of habitat of rare or endangered species (including protected areas) or species; or
- Any allegation of sexual harassment or sexual misbehavior, child abuse, defilement, or other violations involving children.

Table 7 - 5: Regular reporting requirement

No.	*Report Prepared by*	*Submitted to*	*Frequency of Reporting*
1	Contractors	CSC	Immediately, for certain aspects and on monthly basis with respect to a wider range of aspects
2	Construction Supervision consultant (CSC)	PPMU	Immediately or monthly basis
3	Community Monitoring Board (CMB)	PPMU	When the community has any complaint about the implementation of environmental and social safeguards policies
4	PPMU	DONRE and CPMU	Once every six months in accordance with the GoV"s environmental and social safeguard regulations

5	PPMU	WB	Once every six months in accordance with Section II of the Loan agreement

7.4. Grievance Redress Mechanism

Complaints relating to any subproject's problems will be solved through negotiations to achieve the consensus. A complaint will go through three stages at commune, district and provincial levels, before it can be transferred to the court. The enforcement unit (PPMU) will pay all administrative and legal fees relating to the acceptance of complaints. This cost is included in the subproject budget. Complaint procedures and resolution will be performed as follows:

7.4.1.Grievance Redress Mechanism

(i) People's Committee of ward /commune. An affected household is to take his/her complaint to any member of the People's Committee of the ward/commune, through the village head or directly to People's Committee of the commune/ward, in written or oral form. The said member(s) of the People's Committee or the village head will inform the People's Committee of the ward/commune on the complaint. The People's Committee of Ward/Commune will work directly in person with the said affected household and will decide on the settlement of the complaint within 5 days after receiving such complaint (this may take 15 days in mountainous or remote areas). The Secretariat of the People's Committee of the relevant commune/ward is responsible for documenting and recording all the complaints that it is handling.

After the Ward/Commune People's Committee issues its decision, the relevant household can make an appeal within 30 days. In case a second decision has been issued but the said household is still not satisfied with such decision, such household can appeal to the municipal (city) People's Committee (CPC).

(ii) People's Committee of district/town. Upon receiving a complaint from a household, the DPC will have 15 days (or 30 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The DPC is responsible for filing and storing documents on all complaints that it handles.

When the CPC has issued a decision, the household can make an appeal within 30 days. In case a second decision has been issued and the household is still not satisfied with such a decision, they can appeal to the Provincial People's Committee (PPC) in line with Law of Complaint 2011 and relevant documents.

(iii) Provincial People's Committee: Upon receiving a complaint from the household, the PPC will have 30 days (or 45 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The PPC is responsible for filing and storing documents for all complaints to be submitted.

After the PPC has issued a decision, the household can appeal within 45 days. In case a second decision has been issued and the household is still not satisfied with such decision, they can appeal to the court within 45 days. The PPC will then have to pay the compensation into an account.

(IV) Provincial Court. In case a complainant brings his/her case to a provincial court and the court rules in favour of the complainant, the provincial authorities will have to increase the

compensation up to such a rate as may be ruled by the court. In case the court's ruling is in favour of the PPC, the complainant will be refunded the amount of money that has been paid to the court.

The decision ruling the settlement of complaints will have to be sent to complainants and concerned parties, and shall be publicly posted at the headquarters of the People's Committee of the relevant level. The complainant will receive such ruling three days after the result of complaint resolution at the ward/commune/town level has been decided upon and 7 days at the district or provincial level.

To minimize the number of complaints at provincial level, the PPMU will coordinate with the District Compensation Committee of Cam Xuyen, Thach Ha, Ky Anh, Huong Son district to participate and provide consultation in solving complaints and respond to complainants. Its role and capacity is to carry out the compensation, support and arrange resettlement for affected households and displaced persons.

Personnel: The environment and resettlement staff chosen by the PPMU will design and maintain a database of the subproject-related complaints from affected households, including information such as: the nature of the complaint, the source and date of receipt of the complaint, the name and address of the complainant, action plan, and current status.

For oral complaints, the receiving/ mediator board will record these requests in a complaint form at the first meeting with the affected person.

7.4.2.Contractor and Construction Supervision Consultant:

During construction, the GRM will also be managed by the contractors under supervision of the CSC. The contractors will inform the affected communities and communes about the GRM availability to handle complaints and concerns about the subproject. This will be done via the community consultation and information disclosure process under which the contractors will communicate with the affected communities and interested authorities on a regular basis. Meetings will be held at least quarterly, monthly information brochures will be published, announcements will be placed in local media, and notices of upcoming planned activities will be posted, etc.

All complaints and corresponding actions undertaken by the contractors will be recorded in subproject safeguard monitoring reports. Complaints and claims for damages could be lodged as follows:

- Verbally: direct to the CSC and/ or the contractors' safeguard staff or representatives at the site offices.
- In writing: by hand-delivering or posting a written complaint to specified addresses.
- By telephone, fax, e-mails: to the CSC, the contractors' safeguard staff or representatives.

Upon receipt of a complaint, the CSC, the contractors' safeguard staff or representatives will register the complaint in a complaint file and maintain a log of events pertaining to it thereafter, until it is resolved. Immediately after receipt, four copies of the complaint will be prepared. The original will be kept in the file, one copy will be used by the contractor's

safeguard staff, and one copy will be forwarded to the CSC, and the fourth copy to the PPMU within 24 hours since receipt of the complaint.

Information to be recorded in the complaint log will consist of:

- The date and time of the complaint.
- The name, address and contact details of the complainant.
- A short description of the complaint.
- Actions taken to address the complaint, including contact persons and findings at each step in the complaint redress process.
- The dates and times when the complainant is contacted during the redress process.
- The final resolution of the complaint.
- The date, time and manner in which the complainant was informed thereof.
- The complainant's signature when resolution has been obtained.

Minor complaints will be dealt with within one week. Within two weeks (and weekly thereafter), a written reply will be delivered to the complainant (by hand, post, fax, e-mails) indicating the procedures taken and progress to date.

The main objective will be to resolve an issue as quickly as possible by the simplest means, involving as few people as possible, and at the lowest possible level. Only when an issue cannot be resolved at the simplest level and/ or within 15 days, will other authorities be involved. Such a situation may arise, for example, when damages are claimed, the to-be-paid amount cannot be resolved, or damage causes are determined.

7.4.3.World Bank Grievance Redress Mechanism

Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported subproject may submit complaints to existing subproject-level grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address subproject-related concerns. Subproject affected communities and individuals may submit their complaints to the WB's independent Inspection Panel which determines whether harms occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the WB's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit www.worldbank.org/grs. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

7.5. ESMP implementation plan

7.5.1. ESMP implementation plan of the Contractor

Shortly after the contract is signed, based on the approved subproject ESMP and construction methods, construction plan approved by CSC and PPMU, the Contractor prepares

Contractor's ESMP (C-ESMP) of the package and submits to the CSC for review and approval.

- After the C-ESMP is approved by CSC, the contractor carries out the environmental and social impact mitigation measures on site.
- The C-ESMP will be disclosed at worker's camp and site office to disseminate the information of mitigation measures to workers.
- Making the public information panel at entrances of construction site, address, representative, phone number of stakeholders for supervision by local community and contact as necessary.
- Assigning staff in charge of environment and safety, training, providing PPE, regular health examination for workers.
- Surveying, examination of environmental status on site, reporting to the CSC if there are significant differences compared to the environmental background.
- Contracting with the authorized units for treatment of domestic wastes, hazardous wastes, and clean water supply.
- Managing the workers and construction equipment and providing new certificate in case of expiration.
- Implementing ESMP and updating, and submitting to the CSC for approval if there are changes before application.
- Cooperating with the PPMU and CSC to deal with the complaint of local people about the environmental and safety problem of the package in a timely manner.
- Reporting on the package ESMP implementation monthly.

7.5.2. Start of the subproject and personnel

The staff in charge of environmental safeguards of the contractor must be environmental engineer or have relevant disciplines and must have a certificate of occupational health and safety and work fulltime on site.

Providing training in occupational health and safety for workers and regular conducting examination of worker's health.

7.6. Training and capacity building

7.6.1. Training on safeguard policy

Document on environmental safety policy of the sub-project since construction: Most of the dams and reservoirs had been built before 1980, when the environmental protection law has not been promulgated and there were no regulations on environmental impact assessment. In subproject 01, there are no records of design, completion of construction works and the works were built by the people themselves which do not have the design file

Regarding environmental and social management resources: At the Ha Tinh Sub-project, there are already professional sections or staffs in charge of Environment and Social issues

(already involved in projects funded by ADB or WB). Number of officials in charge of environmental management is 1-2 persons and mainly are irrigation engineers and economy engineers. There is no qualified official who is environmental engineer. However, these staffs, in addition to their environmental management tasks, also undertake other tasks and often change their positions.

Regarding to training programs have been involved: The staff in charge of environmental-social management of the subproject 011 has been involved in the implementation of projects related to safety policies of the WB through the projects that WB sponsored and participated in training programs such as: Environmental safety policy, involuntary resettlement policy, gender and gender equality. However, the knowledge and experience of the Bank's safety requirements on environmental and social issues is limited. Domestic capital projects do not have training programs on environmental safeguard policy.

Such training courses will be held at the early stages of the subproject process to ensure that the ESMP is properly integrated into the bidding documents (and subsequently the contract). Technical assistance should be provided by experienced and skilled staff the of construction supervision consultants, and be implemented in accordance with the terms of reference which consist of specific reference to the development of request of the Client for the standard tender documents.

Table 7 - 6: Capacity building training program on environmental management

No.	*Training contents*	*Cost (VND)*
1	Capacity building on environmental protection (1 class/district)	4 classes x VND 30 million/ class = VND 120 million
2	Capacity building on Environmental and Social monitoring (1 class/district)	4 classes x VND 30 million/ class = VND 120 million
3	Training on environmental health and labor safety measures and environmental safety (1 class/district)	4 classes x VND 30 million/ class = VND 120 million
4	Training to enhance awareness on dam safety (1 class/district)	4 classes x VND 30 million/ class = VND 120 million
Total		**480.000.000**

7.6.2. Training on safety and occupational health

Provisions will be prepared to provide orientation training on safety and occupational health for all new employees to ensure they are informed of site-specific requirements, on-site work and personal protection and injury prevention.

Training program will include awareness on basic hazard, specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disasters. Any specific hazard will be considered thoroughly as part of the orientation training.

7.6.3. Visitor Orientation

If visitors are allowed to access to areas with present of hazardous conditions or substances, visitor orientation and control programs will be established to ensure that visitors do not enter dangerous areas without the accompanying person.

7.6.4. Training for contractors and new workers

The PPMU will ensure that workers and contractors, before undertaking new jobs, receive adequate training and information so that they can understand the hazards of work and protect themselves from the surrounding hazards factors may be present. Training will fully cover:

- Understanding of materials, equipment and tools;
- Understand the hazards during operation and how to control them;
- Potential risks to health;
- Warnings to prevent exposure;
- Sanitary requirements;
- Wear and use protective clothing and equipment;
- The appropriate response to the harsh operating conditions, accidents and incidents

7.6.5. Training on basic health and occupational safety

A basic training program and intensive courses will be implemented as needed to ensure that workers are oriented towards the specific hazards of individual work tasks. Training will generally be provided to managers, supervisors, workers, and occasional visitors to areas with risk and hazards.

Workers in charge of first aid and rescue tasks will receive special training not to intentionally exacerbate the exposure and health hazards to themselves and their colleagues. Training will include the risk of transmitting the disease through blood due to contact with tissue and body fluids.

Through appropriate contractual terms and monitoring, the PPMU will ensure that service providers, as well as contract and subcontractors, are adequately trained before commencement of work.

The PPMU will be responsible for coordinating with the construction supervision consultants and the contractor's social environment officers to organize the training courses mentioned above.

7.7. Environmental and social monitoring plan

The environmental monitoring plan includes two types of environmental monitoring:

- Compliance monitoring: Periodic environmental and social monitoring to check the compliance with environmental and social management requirements of the subproject and to identify non-compliance actions or variations and to propose corrective actions.
- Environmental quality monitoring: Taking environmental quality assessment samples

to verify the effectiveness of mitigation measures, proposing solutions if environmental quality exceeds the allowable standards.

7.7.1. Compliance Monitoring:

Compliance monitoring will be done regularly by PPMU and its construction supervision consultant (CSC). PPMU and its CSC will be responsible for daily monitoring contractor's compliance with agreed mitigation measures. Results will be reflected in the monthly progress reports.

Local authority and community will be undertaking the monitoring task in accordance with the GoV's regulations, i.e. Law on Environmental Protection 2014 and Decree 80/2005/ND-CP - Regulation on community's investment monitoring.

In addition, contractors' ES officer will be responsible for daily monitoring labor safety and environmental hygiene on site and reporting to PPMU and CSC.

Detailed monitoring plan will be prepared during detailed design phase. The cost estimates for monitoring shall be included in the ESMP implementation cost.

7.7.2. Ambient Environmental quality monitoring:

a) Environmental quality monitoring program

Ambient environmental quality monitoring program such as air, soil and water quality provides information that can be used to assess the effectiveness of pollution management strategies. A systematic planning process is recommended to ensure that the data collected are adequate for their intended purposes (and to avoid collecting unnecessary data). This process, sometimes referred to as a data quality objectives process, defines the purpose of collecting the data, the decisions to be made based on the data and the consequences of making an incorrect decision, the time and geographic boundaries, and the quality of data needed to make a correct decision. The ambient environmental quality monitoring program shall consider the following elements:

- *Monitoring parameters*: The monitoring parameters selected should reflect the pollutants of concern associated with subproject processes.
- *Baseline calculations*: Before the subproject is developed, baseline ambient environmental quality monitoring at and in the vicinity of the site should be undertaken to assess background levels of key pollutants, in order to differentiate between existing ambient conditions and subproject-related impacts.
- *Monitoring type and frequency*: Data on ambient environmental quality generated through the monitoring program shall be representative of the pollutants emitted by the subproject over time. Monitoring frequency and duration may also range from continuous to less frequent, monthly, quarterly or yearly tests.
- *Monitoring locations*: Ambient environmental quality monitoring May consists of off-site or fence line monitoring either by the subproject owner, DONRE, or by collaboration between both. The location of monitoring stations should be established based on the results of scientific methods and mathematical models to estimate

potential impact to the receptors from an emissions source taking into consideration such aspects as the location of potentially affected communities.

- *Sampling and analysis methods*: Monitoring programs should apply national or international methods for sample collection and analysis, such as those published by the International Organization for Standardization (ISO). Sampling shall be conducted by, or under, the supervision of trained individuals. Analysis shall be conducted by entities permitted or certified for this purpose. Sampling and analysis Quality Assurance/Quality Control (QA/QC) plans shall be applied and documented to ensure that data quality is adequate for the intended data use (e.g., method detection limits are below levels of concern). Monitoring reports should include QA/QC documentation.

Details are presented in below table:

Table 7 - 7: Environmental quality monitoring during the construction and operation of the Sub-project

No.	*Sample*	*Location*	*Frequency*	*Parameter*	*Criteria*
I	***Construction stage***				
1	Air quality	1. Dam construction area; 2. Spillway construction area; 3. Management road construction area	Once every 3 months	- Noise - Dust TSP - Vibration	QCVN 05:2013/BTNMT QCVN 26:2010/BTNMT QCVN 27:2010/BTNMT
2	Surface water	1. Surface water in the Reservoir 2. Surface water at the intake 3. Surface water behind the dumpsites 4. Irrigation water right behind the dam	Once every 3 months	pH, DO, TSS, COD, BOD_5, Coliform	QCVN 08-MT: 2015/BTNMT
3	Domestic wastewater	1. 1 location at worker's camp 2. 01 location after construction wastewater treatment system	Once every 3 months	pH, DO, COD, BOD_5, SS, Coliform, grease. NH_4+	- QCVN 14:2008/BTNMT - QCVN 40:2011/ BTNMT
	Operation stage				
1	Surface water	1. At the outlet of the intake 2. On irrigation channel	Once every 6 months	pH, DO, TSS, COD, BOD_5, Coliform	QCVN 08-MT: 2015/BTNMT

The monitoring locations for each dam are shown in **Annex 2.**

b) Environmental monitoring costs

Total environmental monitoring cost during the construction and operation phase: VND **475,279,200 (*Four hundred seventy five million, two hundred seventy nine thousand, two hundred Vietnamese dongs)*** which is paid by the subproject owner **(Table 7.8).**

Table 7 - 8: Estimated costs for ambient environmental quality monitoring

No.	*Cost breakdown*	*Unit*	*Quantity*	*Unit cost (VND)*	*Amount (VND)*
I	**Construction phase**				**349,280,000**
1	Surface water: pH, DO, TSS, COD, BOD_5, Coliform (4 samples x 8 works x 4 times)	Sample	128	881,000	112,768,000
2	Air: Noise, Suspended Dust TSP, Vibration (3 samples x 8 works x 4 times)	Sample	96	294,000	28,224,000
3	Ground water: pH, DO, COD, BOD_5, SS, Coliform, grease. NH_4^+ (02 samples x 8 works x 4 times)	Sample	64	1,542,000	98,688,000
3	Write periodic monitoring reports	Report	04	8,000,000	32,000,000
4	Car rental for field monitoring (4 times x 4 days/time)	Day	16	1,800,000	28,800,000
5	Per diem and allowance (4 times x 4 days/time x 4 people)	Day	64	450,000	28,800,000
6	Others (stationaries, photocopying, printing)	time	4	5,000,000	20,000,000
II	**Operation phase**				**62,792,000**
1	Surface water: pH, DO, TSS, COD, BOD_5, Coliform (2 samples x 8 works x 2 times)	Sample	32	881,000	28,192,000
2	Write periodic monitoring reports	Report	2	8,000,000	16,000,000
3	Car rental for field monitoring (2 times x 2 days/time)	Day	4	1,800,000	7,200,000
4	Per diem and allowance (3 times x 2 days/time x 2 people)	Day	12	450,000	5,400,000
5	Others (stationaries, photocopying, printing)	time	2	3,000,000	6,000,000
6	Cost to monitor subsidence, erosion (estimated)	Time			20,000,000

	Total I+II				**432,072,000**
	VAT (10%)				**43,207,200**
	Total				**475,279,200**

Environmental quality monitoring during construction and operation phase is under responsibility of Ha Tinh Agricultural and Rural Development Construction Project Management Board.

(c) Incidents monitoring

The purpose of this monitoring is to assess the contamination level of land and water caused by sudden discharge such as discharge of wastewater and oil into nearby water and land and timely make decision on pollution control to reduce environmental risk.

An incident monitoring plan will be developed by the CSC in the initial stage of the subproject implementation and submitted to the PMU for approval. This plan identifies the potential environmental risks associated with the discharge of wastes such as waste water and waste oil into nearby water bodies. The plan also identifies resources to monitor this issue, such as personnel, equipment, location and monitoring parameters, analytical methods, dedicated laboratories, and cost estimates.

7.7.3. Dam safety monitoring

Once the reservoir complete storing water and the dam is operated, the dam owner is responsible for dam monitoring, which is executed by a qualified independent expert who was not involved in the investigation, design, construction or operation of the dam. After normal operation, regular inspections of the dam, including pre-flood and post-flood safety inspections, are carried out in accordance with the Government Decree (No. 72/2007/ND-CP) on Dam Safety Management.

7.8. Cost estimates

The budget for the implementation of the ESMP, including monitoring and capacity building, is summarized in **Table 7.9** below:

Table 7 - 9: Estimated costs of mitigation measures

No.	*Item*	*Cost (VND)*	*USD*
I.	**Cost estimates for environmental impact mitigation measures**	***280,000,000***	***12,296***
1.1	*Minimize impacts on the air environment due to dust* - Buy canvas to cover transportation vehicles: 8 works x 20 canvas sheets x VND 300,000/sheet = VND 48 million - Set up car wash before going to highways: 8 works x 2 car wash stations x VND 5 million = VND 80 million	 48,000,000 80,000,000	
1.2	Solid waste treatment during the construction:		

	- Buying trash bins: 8 works x 5 boxes for organic waste composting bins x VND 500,000/bin= VND 20 million - Transportation and treatment of inorganic waste: VND 500,000/month x 8 works x 1 month = VND 4 million	20,000,000 4,000,000	
1.3	*Minimize impacts on water environment due to domestic wastewater* - Expenses for building latrines at construction sites: 8 works x 2 latrines x VND 3 million = VND 48 million - Expenses for building domestic wastewater treatment tanks: 8 settling tanks + filter yards x VND 10 million = 80 million VND	48,000,000 80,000,000	
II.	**Estimated cost of EPP for 5 years (detail in Annex 4)**	**635,000,000**	**27,886**
III.	**Environmental monitoring**	**475,279,200**	**20,872**
IV.	**Capacity building: training program on improved environmental and social management capacity**	**480,000,000**	**21,079**
	Total	**1,870,279,200**	**82,133**

- Costs related to implementation of RAP (VND **2,275,354,800)** is covered in stand-alone plan
- Funds for IPM implementation includes fund for holding training courses of farmers calculated for the organization of class in each commune = unit price x number of commune in each sub-project. Depending on the number of administrative units in the sub-projects, DARD will hold reasonable, economical and effective seminars.

Table 7 - 10: Matrix of mitigation measures

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
Pre-construction	**Impact due to land acquisition for construction**	- Prepare and implement RAP based on the Resettlement Policy Framework of the project; disseminate policies on compensation to the public. - Implement well statistical work and damage inventory. - Organize community consultation with affected persons at commune/village meetings on the methods and time of payment; monitor strictly the compensation. - Strictly comply with Resettlement Action Plan (RAP) to address the potential impacts related to land acquisition - Deal with complaints timely	Acquisition land area in the subproject area	Land Law No. 45/2013/QH13 The Law on Complaint No. 02/2011/QH13 Involuntary Resettlement (OP/BP 4.12)	VND 2,275,354,800, based on RAP	PPMU Compensation and Land Acquisition Committees in the project districts. People's Committees in the project communes.	Resettlement supervision consultant - Ha Tinh DONRE - Ha Tinh PPC
	Impacts on biological environment	- Determine clearly boundary of the land acquisition area. Clear only necessary areas. - Do not use chemicals to clear plants. - Do not cut plants outside the land acquisition area. - Applying ECOP, details in table 7.2	Area where cutting plant, removing weathered top soil and 37,081 m^2 of affected production forest	- Law on biodiversity No.20/2008/QH12 - Decree 65/2010/ ND-CP on biodiversity protection		Contractor	PPMU, CSC

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
			land				
	Dust and exhaust emission	Applying ECOP, details in table 7.2	On 8 construction sites where cutting plant, leveling ground, demolishing existing structure Along roads transporting waste and material	- TCVN 6438-2005: Road vehicles - Maximum permitted emission limits of exhaust gas - Decision No. 35/2005/QD-BGTVT on inspection of quality, technical safety and environmental protection - QCVN 05: 2013/MONRE: *National technical regulation on ambient air quality* - WBG EHS Guidelines	Estimated in construction phase	PPMU - Material and waste transportation units	PMU CSC - Ha Tinh DONRE
	Noise and vibration impacts	Applying ECOP, details in table 7.2	On 8 construction sites where cutting plant,	- QCVN 26:2010 /BTNMT: National technical regulation on noise		Contractor Material and waste	PMU CSC - Ha Tinh DONRE

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
Construction phase	**Dust and exhaust emission**	- Cover material transportation vehicles and ensure safety of these vehicles during transportation to prevent soil, materials or dust particles from spreading in the air. - Have a vehicle washing place at each work to clean vehicles before they leave for national roads or residential areas - Applying ECOP, details in table 7.2	leveling ground, demolishing existing structure Along roads transporting waste and material On 8 construction sites, dumping sites, stock piles Along the transtrortation roads Location of Ky Bac primary school, Huu Lac pagoda, households living near the transportation roads	- QCVN 27:2010/BTNMT: National technical regulation on vibration - WBG EHS Guidelines - TCVN 6438-2005: Road vehicles - Maximum permitted emission limits of exhaust gas - Decision No. 35/2005/QD-BGTVT on inspection of quality, technical safety and environmental protection - QCVN 05: 2013/MONRE: *National technical regulation on ambient*	8 works x 20 PE canvas x 300,000 VND/sheet = VND 48 million 8 works x 2 vehicle washing places x VND 5 million = VND 80 million	transportation units Contractor	PPMU, CSC Ha Tinh DONRE

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
				air quality - WBG EHS Guidelines			
	Noise and vibration impacts	- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance - Vehicles should be maintained in accordance with manufacturers specifications - Applying ECOP, details in table 7.2	On 8 construction sites, dumping sites, stock piles Along the transtrortation roads Location of Ky Bac primary school, Huu Lac pagoda, households living near the transportation roads	- QCVN 26:2010 /BTNMT: National technical regulation on noise - QCVN 27:2010/BTNMT: National technical regulation on vibration - WBG EHS Guidelines		Contractor	PPMU, CSC Ha Tinh DONRE
	Management of wastes	**I. General Wastes** *(a) Wastewater* For human waste (manure, urine): build 2-3 sanitary toilets in each construction site (10-15 workers/toilet): biodegradable toilets, bio-toilets or ready-made toilets available in the market.	On 8 construction sites, dumping sites, stock piles, workers' camps Along the transtrortation	QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater - QCVN 40: 2011/	8 works x 2 toilets x VND 3 million = VND 48 million 8 sludge tanks	Contractor	PPMU, CSC Ha Tinh DONRE

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
		Discharge waste water from kitchens, bathrooms, wash sinks… to tanks and transport out of the construction sites or treat in accordance with technical regulation QCVN 14:2008/BTNMT before releasing to the environment, using sludge tanks and constructed wetland. Do not discharge untreated water directly to the environment. *(b) Runoff water* Applying ECOP, details in table 7.2 *(c) Solid waste* For organic waste (fruit peel, vegetables, waste food…), use waste bins to make compost. Prepare from three to five 240-litre bins for composting purpose at each construction site. For inorganic waste, sign contracts with the waste collection group of the communes to collect and dispose such waste in accordance with the local regulations related. If no collection groups are available, dig holes to bury the waste	roads	BTNMT: National technical regulation on industrial wastewater - Decree No. 38/2015/ND-CP dated 24/04/2015 on waste and scrap management - Circular No. 36/2015/TT-BTNMT on Management of Hazardous Wastes - Decision No. 59/2007/ND-CP on solid waste management - WBG EHS Guidelines	+ constructed wetlands x VND 10 million = VND 80 million 8 works x 5 organic waste composting bins x 500,000 VND/bin = VND 20 million Transportation and treatment of inorganic waste: 500,000 VND/month x 8 works x 1		

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
		or burn flammable and non-toxic waste (paper, wood, leaves …) Applying ECOP, details in table 7.2 **II. Hazardous Wastes** Applying ECOP, details in table 7.2			month = VND 4 million Funding for collecting and treating solid waste: 500,000 VND/month x 8 months x 8 construction sites = VND 32 million		
	Disruption of vegetative cover and ecological resources	- Applying ECOP, details in table 7.2	On 8 construction sites, dumping sites, stock piles, workers' camps, along the transportation roads where cutting plant and operation of machineries and	- Law on biodiversity No.20/2008/QH12 - Decree 65/2010/ND-CP on biodiversity protection		Contractor	PPMU, CSC

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
			vehicleds compating soil.				
	Traffic safety management	- Applying ECOP, details in table 7.2	On 8 construction sites, dumping sites, stock piles, workers' camps Along the transtrortation roads	- Law on traffic and transport No. 23/2008/QH12; - Decree 46/2016/ND-CP on administrative penalty for traffic safety violation - Circular No. 22/2010/TT-BXD on regulation on labor safety in construction - WBG EHS Guidelines	Included in construction cost	Contractor	PPMU, CSC
	Workers' camp management	- Applying ECOP, details in table 7.2	Workers' camps of 8 construction sites	- Law on Labor No.10/2012/QH13 - Workers' Accommodation: Process and Standards (IFC and EBRD)	Included in construction cost	Contractor	PPMU, CSC

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
	Chance Find Procedures	Where the risk and identification process determines that there is a chance of impacts to cultural heritage, the Contractor will retain competent professionals to assist in the identification and protection of cultural heritage. If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall comply with steps describing in ECOP, table 7.2	Location where construction activities require digging, such as location of repairing dam heel, spillway new building water intakes; location of borrow pits	Law on cultural heritage No. 28/2001/QH10 - Make adjustments	Actual expenses	Contractor	PPMU, CSC
	Occupational health and safety	- Training and use of safety labour equipment - Planning work site to miniimize unsafety condition for workers - Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks; - Use of control zones and safety monitoring systems and warning sign to warn workers. - Applying ECOP, details in table 7.2	Whole of 8 construction sites and at location of auxiliary works On transportation roads	Directive No. 02 /2008/CT-BXD on labor safety and sanitation in construction agencies; - Circular No. 22/2010/TT-BXD on regulation on labor safety in construction - QCVN 18:2014/BXD: Technical regulation on	Included in training cost	Contractor	PPMU, CSC

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
	Community health and safety	**A. General Site Hazards** - Subproject should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction. - Applying ECOP, details in table 7.2 **B. Disease Prevention** *Communicable Diseases* - Providing surveillance and active screening and treatment of workers - Preventing illness among workers in local communities *Vector-Born Diseases* - Implementation of integrated vector control programs - Distributing appropriate education materials Applying ECOP, details in table 7.2	8 construction site, workesr' camps, subproject communes	safety in construction - WBG EHS Guidelines - Law on Roadway Traffic No. 23/2008/QH12 - Directive No. 02 /2008/CT-BXD on labor safety and sanitation in construction agencies; - Circular No. 22/2010/TT-BXD on regulation on labor safety in construction - QCVN 18:2014/BXD: Technical regulation on safety in construction - WBG EHS Guidelines	Included in training cost	Contractor	PPMU, CSC

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
	Management of stockpiles and borrow pits	- All locations to be used must be previously identified in the approved construction specifications - Control water flow through construction sites or disturbed areas with ditches, check structures, live grass barriers, and rock - Environmental remediation measures: Planting drought-resistant crops, crops being resistant to arid and leguminous plants that have ability to improve soil such as wild peanut mixed with forest trees, such as acacia, cajuput - Applying ECOP, details in table 7.2	Stockpiles, borrow pits, dumping sites of 8 works		Included in construction cost	Contractor	PPMU, CSC
	Communication with local communities	- Maintain open communications with the local government and concerned communities; the contractor shall coordinate with local authorities (leaders of local wards or communes, leader of villages) for agreed schedules of construction activities at areas nearby sensitive places or at sensitive times - Applying ECOP, details in table 7.2	Villages and communes where the works are carried out on.	Decree No. 167/2013/ND-CP on administrative penalty for violations related to social security, order and safety issues		Contractor	PPMU, CSC
	Labour	**A) Mitigate conflicts between workers**			Included in	Contractor	PPMU, CSC

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
	influx management	**and local residents:** - Formulate a regulation on worker management and disseminate this regulation - Encourage local residents to support workers during the construction period **B) Mitigate impacts of social issues** - Inform workers about the local security and social issues. - Have workers sign commitments on non-violation of social issues. - Cooperate with commune police to manage social issues. - Applying ECOP, details in table 7.2			construction cost		
Operation phase	**Impacts of production development on the environment**	- Encourage application of scientific cultivation measures, integrated pest management; management of pesticides which have bad effects on environment and community health. - Collect empty pesticide containers in accordance with Circular 05/2015/TTLT – BNN - BTNMT guiding pesticide	Subproject communes	Circular 05/2015/TTLT – BNN - BTNMT	-	Reservoir Management Unit	People's Committees of the communes and districts in the project area, Ha Tinh DARD

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
		container collection. - Inspect regularly to prevent and punish violations related to occupation of reservoir area for private purpose. - Applying IPM, details in appendix 3.					
	Impacts due to emergency release of flood	- Notify local people and authorities about the time for flood release, flood water level and possible impacts. - Have plans for evacuation and asset protection for the people living in the downstream, when necessary. - Have plans to support local people during the flood release period (supporting drinking water, sanitation, disease control).	Community and communes in the downstream area	Decree no. 72/2007/ND-CP on Dam safety management	Including in training cost and in a seperated dam safety plan.	Reservoir Management Unit	People's Committees of the communes and districts in the project area, Ha Tinh DARD
	Impacts due to dam safety risks	- Assess dam safety and prepare a plan for emergency response during the project implementation. - Follow operation procedures to ensure reservoir safety - Reservoir Management Unit must work with Ha Tinh DONRE, People's Committees of the Project districts and	Community and communes in the downstream area	Decree no. 72/2007/ND-CP on Dam safety management	Including in training cost and in a seperated dam safety plan.	Reservoir Management Unit	People's Committees of the communes and districts in the project area, Ha Tinh DARD

Phase	*Issue*	*Mitigation measures*	*Locations for mitigation measures*	*Applicable Standard*	*Cost of mitigation*	*Responsible party*	
						Implementation	*Supervision*
		communes to set up reservoir protection corridor and submit such proposed corridor to Ha Tinh PPC for approval.					
	Total cost estimate:				**VND 280 million**		

Table 7 - 11: Social and Environmental Monitoring Plan

Phase	*Parameter is to be monitored?*	*Where the parameter monitoring will take place?*	*How are parameters monitored?*	*When are parameter monitored? monitoring frequency?*	*Responsible agency*
Pre-construction phase	Permanent or temporary land acquisition of living or agriculture land	Location where land acquisition to be implemented	Monitoring plan is described in the separately prepared RAP.	Prior to construction activities, when land acquisition and other related activities happening	Resettlement supervision consultant CPCs in the subproject area
Construction phase	*Monitoring of waste sources management*				
	Potential source: Volume of solid waste The number of latrines, tents and waste water treatment systems Volume of harmful waste Waste's components;	Camps of workers Dumping sites	Field inspection and observing	3 months/time	Environmental supervision consultant Construction supervision consultant PPMU Ha Tinh DONRE
	Management measures of potential waste: Amount of dustbins Receipts of collection and transport services.	Construction sites, Camps of workers Dumping sites	Field inspection and observing	3 months/time	Environmental supervision consultant Construction supervision consultant PPMU Ha Tinh DONRE
	Monitoring impacts on natural environment				
	Air environment: -Noise - Total suspended particles (TSP)	The earthen dam, spillway and water intake construction area	Measuring on field	6 months/time 2 times/day in each time (totally 4 times)	Environmental supervision consultant Construction supervision consultant

	- Vibration	Transportation road to construction area			PPMU Ha Tinh DONRE
	Surface water: pH, DO, TSS, COD, BOD_5, Coliform	4 position of each reservoir: regulator, downstream of regulator, spillway, in canal after water intake.	Taking sample and analyzing in laboratory	6 months/time (totally 4 times)	Environmental supervision consultant Construction supervision consultant PPMU Ha Tinh DONRE
	Ground water: pH, DO, COD, BOD_5, SS, Coliform, grease.	Dug wells of some household near the construction sites	Taking sample and analyzing in laboratory	6 months/time (totally 4 times)	Environmental supervision consultant Construction supervision consultant PPMU Ha Tinh DONRE
	Landslie, erosion: Scale of landslide; Landslide level	Spillway construction sites	Field inspection and observing	3 months/time	Construction supervision consultant PPMU Ha Tinh DONRE
	Monitoring the social impacts				
	Social impact: Income, employment, the number of crops, average yield, water supply calendar Reflection and complaint of local residents	Commune at downstream	Field inspection and observing Interviewing Consultation meeting	6 months/time	Resettlement supervision consultant PPMU
	Environmental sanitation				
	Environmental sanitation: - Quantity and condition of	Construction sites, camps of workers	Field inspection and observing	3 months/time	Environmental supervision consultant

	latrines - Quantity and condition of sanitation instruments - First aid box - Health activity - The number of infectious cases - Communication plan on community health	Dumping sites Stockpiles	Interviewing Checking construction diary and report of CSC		Construction supervision consultant PPMU Ha Tinh DONRE
	Labor safety: - Labor safety instruments - Safety note - The number of accidents	Construction sites, camps of workers Dumping sites Stockpiles	Field inspection and observing Interviewing Checking construction diary and report of CSC	3 months/time	Environmental supervision consultant Construction supervision consultant PPMU Ha Tinh DONRE
Operation phase	Surface water: pH, DO, TSS, COD, BOD_5, Coliform	2 position of each reservoir: Water of the reservoir at regulator and on canal after dam	Taking sample and analyzing in laboratory	6 months/time in the first operation year	Environmental supervision consultant
	Landslie, erosion: - Scale of landslide; - Landslide level	At downstream of spillway	Field inspection and observing Interviewing	Prior to flood season 02 years after operation	Reservoir management unit
	Dam safety: - Condition of dam body and auxiliary works	Position of earthen dam and auxiliary works	Field inspection and observing Interviewing	Regularly	Reservoir management unit

	- Detecting abnormal status of works				

CHAPTER VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

8.1. Objectives of the public consultation

- Consultation to get consensus among relevant authorities, local authorities and communities on the subproject implementation;
- Share full subproject information on the subproject scope and its potential environmental and social impacts;
- Encourage the participation of local community in identifying subproject environmental and social impacts;
- Gather information on needs and feedback of local people and governments to measures to minimize, mitigate or offset environmental and social impacts or consider adjustments during the formulation of investment subproject.

8.2. Summary of the organization of public consultations

The PPMU of the Component Sub-project "Repair and Improvement for safety of Ha Tinh Dams" has cooperated with the Consultant in charge of Environmental and Social Impact Assessment (ESIA) to organize consultations with CPCs, organizations directly affected by the subproject and affected communities in form of village meetings.

Figure 8 - 1: Photos of public consultation meeting

Summary of the two community-based consultations in following paragraphs:

8.2.1. Summary of consultations with Commune People's Committees and organizations directly affected by the sub-project

During the 4/9/2017 - 8/9/2017, the PMU of the Component Sub-project has cooperated with the Consultant in charge of Environmental and Social Impact Assessment (ESIA) to organize consultations to share information on the sub-project and environmental and social impacts. The consultations are reported as follows:

a) Participants of the consultation meetings:

- Chairman: PMU of the Sub-project
- Coordinating agency: Environmental and Social Impact Assessment Consultant

(ESIA)

- Participants: Representatives local authority, local NGOs (Women's Union, Youth Union, Farmer's Union, Veterans Association); Village chiefs; Representatives of affected households

b) Consultations with CPCs and affected organizations:

- Representative of the PMU of the Sub-project introduced main objectives, main items of the sub-project, scope of the Sub-project and affected objects;
- Environmental and Social Impact Assessment Consultant provided information on Environmental and Social Safeguard Policy as defined in the WB8 Environmental and Social Management Framework. Expected negative impacts of the sub-project on environment and society. Identify affected objects and level of impacts. Propose mitigation measures to impacts of the subproject on environment and society.
- Commune People's Committees and affected organizations discuss to get consensus on the sub-project implementation and provide information on the current state of the environment, natural and socio-economic conditions and discuss positive and negative impacts of the subproject on environment and society.

Table 8 - 1: Summary of consultations with CPCs and affected organizations in the subproject area

Name of work	*Consultation date*	*Location*	*Total participants*	*Female participants*	*Minutes of consultation meetings*
Loi Dong Reservoir	18/9/2017	CPC of Ky Trinh	25	5	Document No. 37/UBND, 18/9/2017 of Ky Trinh CPC
Nuoc Xanh Reservoir	19/9/2017	CPC of Ky Phong	28	8	Document No.134/UBND 19/9/2017 Ky Phong CPC
Ba Khe Reservoir	20/9/2017	CPC of Ky Bac	23	5	Document No.211/UBND, 20/9/2017 Ky Bac CPC
Dap Buom Reservoir	18/9/2017	CPC of Huong Tho	25	4	Document No.157/UBND 18/9/2017 Huong Tho CPC
Khe Co Reservoir	20/9/2017	CPC of Son Le	36	4	Document No.206/UBND 20/9/2017 Son Le CPC
Khe Nhay Reservoir	18/9/2017	CPC of Son Tien	29	7	Document No.273/UBND 18/9/2017 Son Tien CPC

Khe De Reservoir	19/9/2017	CPC of Son Mai	24	3	Document no 159/UBND 19/9/ No.Son Mai CPC
Da Den Reservoir	18/9/2017	CPC of Ngoc Son	21	3	Document No.241/UBND 18/9/2017 Ngoc Son CPC

8.2.2. A summary of community-based consultation meetings for directly affected communities

After the draft of the ESIA report of Sub-project No. 1 - Repairing and improving safety for dams in Ha Tinh, the PMU issued Official Letter No. 146/WB8-KHKT dated 15/9/2017 to Commune People's Committees in the subproject area to consult on the ESIA report and to jointly organize consultation meetings with affected local communities.

a) Participants

Consultation meetings were held at CPCs in the subproject area with following participations:

- Chair: PMU in collaboration with CPCs in the subproject area

- Village Party Secretary

- Head, vice heads of villages

- All households affected by sub-project activities such as households whose lands have been acquired, crops are affected or ones affected by the transportation of materials or water cut, lonely households or households with difficult conditions etc.

b) Contents of community consultation meetings

At these consultation meetings, the PMU presented objectives of the subproject and summarized construction/repair works, location of auxiliary works, implementation progress and construction methods.

Consultant who prepares Environmental and Social Impact Assessment report presented contents of the ESIA report and proposed measures to mitigate impacts on environment and society.

The subproject owner declared commitments, acceptable feedbacks, and added proper information into the ESIA and responded to unacceptable feedbacks and mentioned the reasons for non-acceptance.

Local authorities and the community discussed and agreed on solutions committed by the subproject owner. At the same time, local authorities and communities also expressed their expectations that the subproject would be soon implemented to stabilize their lives and promote economic developments. Local community also pledges to create favorable conditions for the early and smooth project implementation.

In response to Official Letter No. 146/WB8-KHKT dated 15/9/2017, the CPCs of all communes in the subproject area sent an official letter to the PMU to provide their feedbacks on the Environmental and Social Impact Assessment report. Summary of community

consultation activities is in **Table 8.2.**

Table 8 - 2: Summary of consultations with affected households

Name of work	*Consultation date*	*Location*	*Total participants*	*Female participants*	*Minutes of consultation meetings*
Loi Dong Reservoir	18/9/2017	CPC of Ky Trinh	25	5	Document No. 37/UBND, 18/9/2017 of Ky Trinh CPC
Nuoc Xanh Reservoir	19/9/2017	CPC of Ky Phong	28	8	Document No. 134/UBND 19/9/2017 Ky Phong CPC
Ba Khe Reservoir	20/9/2017	CPC of Ky Bac	23	5	Document No. 211/UBND, 20/9/2017 Ky Bac CPC
Dap Buom Reservoir	18/9/2017	CPC of Huong Tho	25	4	Document No. 157/UBND 18/9/2017 Huong Tho CPC
Khe Co Reservoir	20/9/2017	CPC of Son Le	36	4	Document No. 206/UBND 20/9/2017 Son Le CPC
Khe Nhay Reservoir	18/9/2017	CPC of Son Tien	29	7	Document No. 273/UBND 18/9/2017 Son Tien CPC
Khe De Reservoir	19/9/2017	CPC of Son Mai	24	3	Document No. 159/UBND 19/9/2017 Son Mai CPC
Da Den Reservoir	18/9/2017	CPC of Ngoc Son	21	3	Document No. 241/UBND 18/9/2017 Ngoc Son CPC

8.3. Community consultation results

8.3.1. Feedbacks of the CPCs and directly affected organizations

The feedbacks of the 8 directly affected communes are summarized in **Table 8.3.** It is found that all communes agreed with the subproject implementation and ask the subproject owner to accelerate the subproject progress and carry out all mitigation measures as presented in the report.

Table 8 - 3: Feedbacks of CPCs of affected communes and affected organizations

Work	*Consulted agency*	*Feedbacks in writing from CPCs*

Loi Dong Reservoir	UBND P. Ky Trinh	- High consensus on the repair and raising dam height of Loi Dong Reservoir - Agree with contents of Environmental and Social impact assessment and mitigation measures in ESIA Report - Construction activities and transportation of materials are far away from residential areas so impacts are not significant. - Noise only affects 2 households at the dam heel. - During the construction period, the People's Committee of Ky Trinh Ward is responsible for coordinating with the subproject owner and contractors in the implementation of measures to minimize impacts on the environment and society; - Recommendations: i) Loi Dong Reservoir is composed of 03 reservoirs: Loi Dong, Bau Son and Hoi Lay; 02 intakes of the remaining 02 reservoirs should be repaired; ii) Contractor must pledge not to affect schools and make a plan available to shield construction vehicles and works under construction from surrounding area
Nuoc Xanh Reservoir	CPC of Ky Phong	- Agree with impact assessments of Nuoc Xanh Reservoir repairs on the environment and society in the affected area. Impacts are minimal and mitigation measures can be applied. - The proposed environmental and social mitigation measures are appropriate. Local authorities agreed with and will coordinate with subproject owner and contractors in site clearance, worker management and monitoring of mitigation measures to mitigate impacts on environment and society. - It is recommended that the subproject owner inform early and in details the construction plan to local governments and stakeholders so that they can cooperate in the implementation of mitigation measures. - It is recommended that Nuoc Xanh Reservoir is repaired as soon as possible to ensure the safety of the reservoir and of local people living in the downstream area
Ba Khe Reservoir	CPC of Ky Bac	- Agree with the repair of Ba Khe reservoir to ensure safety for production activities and people living downstream. - Agree with environmental impact assessment for Ba

		Khe Reservoir as presented by the Consultant - Agree with mitigation measures to reduce impacts on the environment and society of the subproject owner. - The People's Committee of Ky Bac Commune will facilitate the land acquisition and support the subproject owner in the implementation of mitigation measures for impacts on the environmental and society. - If water is cut for construction during cropping time, the subproject owner has to coordinate with Nam Ha Irrigation Management Company (IMC)
Dap Buom Reservoir		The irrigation water will be supplied from Rac River canal under Rac River irrigation system to make sure cultivation activities will not be affected. - *Recommendation*: Ba Khe Reservoir is silted up due to upstream mining activities and reservoir capacity has decreased by 40-50% (from over 1 million m3 of water to only 500 – 600,000 m3). This Reservoir should be significantly dredged and rehabilitated to restore its water volume to 700-800,000 m3 of water
Khe Co Reservoir	CPC of Huong Tho	- The ESIA report lists all possible impacts of the subproject on natural environment, socio-economic and community health. Local stakeholders agreed with the above assessment - Agree with mitigation measures for environment and society as proposed by the subproject owner. They are proper and highly feasible measures. - *Recommendation*: i) The subproject owner should comply with their commitments in the ESIA report; ii) Information related to the subproject implementation should be disclosed as regulated. - Agree with social and environmental impact assessment contents relating to the repair of Khe Co reservoir. The construction activities and transport of materials are far away from the residential areas so impacts are minimal

Khe Nhay Reservoir	CPC of Son Le	- Agree with the impact mitigation measures for environmental and social impacts proposed by the subproject owner. The subproject owner should pay attention to mitigation measures for affected production activities and domestic activities of local people during water cut. Mitigation measures for affected infrastructure and rural transport should be focused during the transporting of construction materials - *Recommendations*: i) The downstream of the two main and auxiliary spillways are inter-village roads. Therefore, the subproject owner has to work out effective structural solutions to ensure traffic safety in the area; ii) Make sure that construction schedule will help minimize impacts on production activities and domestic activities; iii) Inform local authorities in time of any problems for prompt solutions
Khe De Reservoir	CPC of Son Tien	- Strongly agree with the subproject owner on the repair and improvement of Khe Nhay reservoir. - Agree with the environmental and social impacts assessments. The construction of the new sluice will require lowered water level in the reservoir, which means impacts on downstream production activities so adequate assessments should be made. - Agree on environmental and social mitigation measures suggested by the subproject owner. Local authorities will coordinate with the subproject owner in the management of workers and supervision of environmental and social impacts as well as solutions to incidents. - *Recommendations*: i) The subproject implementation should be synchronous and due construction progress should be ensured so that the subproject will be completed on time.
Da Den Reservoir		ii) Khe Nhay reservoir spillway threshold has a transport road of submerged overflow style. The upgrading of the Reservoir should design safety plan for travellers. iii) The Khe Nhay Reservoir dam crest can operate as a transport road at the same time. Currently the road pavement is narrow and should be expanded once the dam is rehabilitated.
Khe De Reservoir	CPC of Son Mai	- The ESIA report fully described impacts of the subproject on the natural environment, socio-economic conditions and community health,

		especially the negative impacts. Local government agreed with the assessment. - Local authorities fully agree with the mitigation measures for affected natural environment, socio-economic conditions and public health proposed by the subproject owner as these measures are proper and feasible. - *Recommendations*: i) the subproject owner should to strictly comply with solutions suggested in the ESIA report; ii) The subproject owner should coordinates with local authorities to disseminate project information to stakeholders as regulated.
Da Den Reservoir	CPC of Ngoc Son	- The People's Committee of Ngoc Son Commune agreed with the Environmental and social impact Assessment relating to negative impacts of the project. - The People's Committee of Ngoc Son Commune also agrees with mitigation measures to minimize negative impacts on the environment and society as suggested in the ESIA report. - *Recommendations*: subproject management unit should coordinate with contractors to carry out environmental protection measures during the subproject implementation.

8.3.2. Feedbacks of local communities who are directly affected by the Sub-project

Summary of feedbacks of local communities in 8 communes directly affected by the Sub-project in **Table 8.4:**

Table 8 - 4: Feedbacks of local communities who are directly affected by the Sub-project

Works	*Location*	*Feedbacks of local community on the subproject*
Loi Dong Reservoir	Ky Trinh Ward	- Households are very happy with the subproject as it will help improve the safety of Loi Dong dam and expect the subproject will be soon implemented. - Local people agree with the Environmental and Social impact assessment Report and mitigation measures presented by the Consultant - Loi Dong reservoir does not supply water for summer-autumn and winter crop. The construction of intakes and dam below the full supply level during June-August will not affect cultivation activities.
		- *Recommendation*: paying labor costs for people involving in the digging of trench to avoid leakage from the Reservoir (local parish mobilized labors many years ago for this activity).

Nuoc Xanh Reservoir	Ky phong commune	- All participants agreed with the Sub-project. - Agree with environmental and social impact assessments and mitigation measures proposed by the ESIA consultant and hope the subproject will be implemented soon. - *Recommendations*: i) if water cut is inevitable, the subproject owner should pump water from the main canal of Song Rac Irrigation system to irrigate affected cultivation areas; ii) To minimize impacts on lives of local people, it is proposed that materials and wastes will be transported along the National Defence Road after the ranch; iii) the spillway as transport road serving 9 households in the downstream area become slippery during the rainy season and local people cannot travel on that and it is recommended for repairs and upgrading.
Ba Khe Reservoir	Ky Bac CPC	- Requesting the Client to fully implement compensation and support policies for affected households due to land accquisition - It is recommended to improve the reservoir bed to restore the water capacity and irrigation area as designed - If water is to be cut for construction during the irrigation time, water should be pumped from main canal of Song Rac irrigation system to irrigate the affected area. - Local households all look forwards to early implementation of the subproject, especially village 1 and 3. - Agree with Environmental and social impact assessments and mitigation measure proposed by the subproject owner.
Dap Buom Reservoir	Residential group of Vil 1 - Huong Tho commune	- The rehabilitation of Dap Buom reservoir is quite necessary. Local authorities and people have been expecting for this subproject for a long time. - The subproject owner should consider the application of advanced technologies in upgrading items, especially for improvement of drainage valve, intakes and outlets. - The subproject owner should arrange a temporary road during the construction time to ensure uninterrupted transfer for local people - Head of residential group of Village 1 hopes that local authorities will support affected households whose lands has been acquired for dam construction.
Khe Co Reservoir	CPC of Son Le	- Local people and stakeholders in the commune are excited and agreed with the repair and upgrading of Khe Co Reservoir. - Agree with environmental and social impacts assessments as well as mitigation measures proposed in the ESIA and hope the subproject will be implemented soon.
		- *Recommendation*: i) Khe Co Reservoir is to irrigate 560 ha in Son Le, Son Tien and Son An communes. The Reservoir also

		supplies domestic water to nearly 1,000 people of Son Le commune. Thus it is necessary to allocate proper construction schedule in order to minimize impacts on downstream areas; ii) In case of water cut for construction, the subproject owner should calculate and make sure that minimal adverse impacts will happen to local people and production activities; iii) Repair and upgrade flood spillway to ensure safety for downstream travelling; iv) Canals after dams have been damaged and should be upgraded.
Khe Nhay Reservoir	Son Tien CPC	- Local households agreed with the repairing and upgrading of Khe Nhay Reservoir. - Agree with environmental and social impacts assessment and mitigation measures as proposed by the subproject owner. - *Recommendation*: i) the construction has to be very quick as the main road crosses the dam and spillway; ii) Bridge should be built over spillway instead of submerged overflow; iii) There should be a bypass for the dam, or dam surface will be expanded using concrete; iv) The subproject owner should inform local people and governments of construction schedule and plan and mitigation measures for local monitoring and supervision.
Khe De Reservoir	Village common house of Minh Giang village, Son Mai commune	- Local authorities and people support the subproject and hope it will be implemented soon. Participants in the consultation meeting agreed with environmental and social impact assessments. - The local authorities commit to carrying out land acquisition procedure for 5% (0.5 ha) which is temporarily allocated to the Hoang Van Tai family to make sure construction site in place for the subproject. - The subproject owner should consider replacing the rescue road with the construction of a new road of 800m connecting the dam heel base as the locality is planning the construction of 2.5 km of rescue road under the new rural development program. - During the construction phase, the subproject owner is asked to produce specific instructions on the use of temporary roads and bypass to ensure smooth ensure traffic by local people.
Ho Da Den	CPC of Ngoc Son	- Local authorities and people support the subproject and hope it will be implemented soon. - Agree with environmental and social impact assessments and mitigation measures - The subproject owner is requested to dredge the reservoir area to increase storage capacity for more irrigation water storage during dry season.

		- The subproject owner is requested to work out water supply solutions for local people during the construction time.

8.3.3 Responses and commitments of the subproject owner to recommendations and suggestions of consulted agencies, organizations and communities

Following the feedbacks are received during the consultations with affected CPCs and communities in Sub-project 1 "Dam Rehabilitation and Safety Improvement Project - Ha Tinh province", the subproject owner responded and committed as follows:

a) Feedback

Summary of subproject owner's feedbacks to acceptable and unacceptable suggestions in **Table 8.5**:

Table 8 - 5: The subproject owner's feedbacks and and commitments

Works	*Location*	*Acceptable comments*	*Unacceptable comments and reasons*
Loi Dong Reservoir	Ky Trinh Ward	- The subproject owner will arrange the construction time of intakes and dam repairs below full water supply during June to August so that downstream production activities will not be affected	- Labor of local people for dugging trench to prevent water leakage which have been done some years ago is feree free mobilized labor activities so it is not accepted for financial supports in the project. - The repair of intakes of Bau Son and Hoi Lay Reservoirs is not under the scope of the Sub-project
Nuoc Xanh Reservoir	Ky Phong commune	- If water is cut for construction during cropping time, the subproject owner will coordinate with Nam Ha Irrigation Management Company (IMC) and the irrigation water will be supplied from Rac River canal under Rac River irrigation system to make sure cultivation activities will not be affected - The subproject owner will consider transporting materials and wastes along the National Defence Road after the ranch; - The subproject owner has planned to build a new spillway, and line the spillway surface with	None

		concrete which is also the farmer road for 9 households downstream	
Ba Khe Reservoir	Ky Bac commune	- The subproject owner will consider suggestions of local people relating to the dredging and renovating of the reservoir to restore design irrigation capacity.	None
Dap Buom Reservoir	Huong Tho commune	- The subproject owner will consider applying advanced technologies for automatically operated sluice to ensure design requirements and meet subproject cost. - The subproject owner commits to arranging a temporary road and publicly announcing the use of temporary road before and during the construction process to ensure transport of local people. - Stakeholders closely coordinated during the site clearance to ensure the construction progress and implementation of environmental and social safety policy.	None
Khe Co Reservoir	Son Le commune	- Khe Co reservoir only relates to the repairs and upgrading of spillways. As the intake is not repaired, water supply is not affected - The subproject owner will arrange the construction of items below the full water supply during June - August (the lowest water demand) to avoid impact to production activities and living of people	The repair and upgrading irrigation canals are not under the scope of this Sub-project
Khe Nhay Reservoir	Son Tien commune	- The subproject owner has had a plan to expand dam surface to B = 5m and line dam surface using concrete M250 and 20cm thick and upgrade flood spillway to ensure traffic over dam and spillway. - The dam and spillway surface	The construction of bridge over the spillway is difficult to be implemented as the spillway is located ahead of the dam, the bridge may affect dam structure as well as flood drainage capacity of the spillway

		construction options will be carried out in as fastest as possible to minimize traffic block.	
Khe De Reservoir	Son Mai commune	- The subproject owner will consider replacing rescue road with a new road of 800m connecting to the dam heel (on the left shoulder of the dam) as this road is quite necessary for rescue work and management and operation of the subproject later. - The subproject owner undertakes to notify and provide specific guidance on the use of temporary roads and bypass for local people. - Stakeholders will cooperate in site clearance work to ensure construction progress and compensations for damages per project policies.	In 2015, local government built a transport road under the spillway using funding from new rural development program and the design sluice has an aperture of D = 50 cm. Given such small aperture, the system cannot meet flood drainage requirements and the sluice aperture should be D = 80 cm. However, upgrading of the road under the spillway cannot be funded in the Sub-project and it should be upgraded using other sources of funding to make sure local economic and social activities can be stabilized.
Da Den Reservoir	Ngoc Son commune	- The construction of items under the full water supply will take place during June – August so not to affect production activities downstream. Water from Lam River will be supplied to compensate the water cut during construction time. - Contractors are asked to comply with allowed load and speed during the transport of materials so not to affect traveling of local people in the subproject area.	- The repair of irrigation canal in the downstream of the dam is not in the scope of the Sub-project

b)) Commitments of the subproject owner

- Commit to compensating affected households having lands acquired and households with affected production lands in accordance with the Resettlement policy framework of the "Repair and improvement safety for dams" and Resettlement Action Plan of Subproject 1 "Repairing and improving for safety of dams in Ha Tinh Province".
- Commit to compensating for damages of infrastructure and rural transports due to the construction of subproject.
- Commit to full implementation of pollution mitigation measures as described in the

Sub-project Environmental and Social Impact Assessment Report.

- Commit to regularly coordination with local authorities and contractors for effective management of staff during the implementation of the subproject so as to avoid conflicts with local people and to prevent any traffic accidents, labor accidents, and incidents that threat local people and infrastructure.
- Commit to ensuring smooth traffic along the material and waste transport routes throughout the construction period.
- After the completion of each work, construction site will be cleaned and restored to the initial conditions and environmental sanitation is ensured as regulated.

8.4. Information Disclosure

In compliance with the WB's policy on access to information and OP 4.01 (Environmental Assessment), the ESIA report will be locally disclosed on the project website and at subprojects sites accessible to locally-affected people and local NGOs in Vietnamese language and on the Bank external website in English prior to appraisal of the subproject.

Table 8.6 indicates the dates and locations of disclosure of the draft and final ESIA of the subproject.

Table 8 - 6: Tentative plan for information disclosure

Instrument	*Disclosure in*	*Location*	*Tentative dates*
Draft ESIA	(a) Subproject sites on Information board (b) PPMU Office and Website (d) DONRE Office	(a) Ky Phong, Ky Bac, Ky Trinh, Son Le, Son Mai, Son Tien, Ngoc Son, Huong Tho communes (b) Ha Tinh province (c) Ha Tinh province	(a) September 2018 (b) September 2018 (c) September 2018
Final ESIA	(a) Subproject sites on Information board (b) The Bank's external website (c) PPMU Office and Website (d) DONRE Office (e) project website	(a) Ky Phong, Ky Bac, Ky Trinh, Son Le, Son Mai, Son Tien, Ngoc Son, Huong Tho communes (b) The Bank's external website (c) Ha Tinh province (d) Ha Tinh province (e) project website	(a) October 2018 (b) October 2018 (c) October 2018 (d) October 2018 (e) October 2018

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1. Report on curen environmental status of Ha Tinh province in 2015 - Ha Tinh Department of Natural Resources and Environment;
2. Report on environmental protection planning in Ha Tinh province for period 2010-2020 - Ha Tinh Department of Natural Resources and Environment;
3. Statistical yearbook of Ha Tinh province, 2016;
4. Report on the implementation of socio-economic, defense-security tasks in 2016 and objectives, tasks and solutions in 2017 of the communes in subproject area;
5. Land use planning up to 2020, land use planning for the first 5 years (2011 - 2015) of Ha Tinh province, Ha Tinh Department of Natural Resources and Environment, 2011;
6. Overall planning of irrigation system of Ha Tinh province, Ha Tinh Department of Agriculture and Rural Development, 2012;
7. Decision no. 82/2008/QD-BNN dated 17/7/08 of MARD on announcement of the list of endangered precious and rare aquatic species in Vietnam to be protected, rehabilitated and developed;
8. Ha Tinh Irrigation Department, research topic "Assessment of surface water resources in Ha Tinh terrain for sustainable socio-economic development strategy", 2008;
9. Report on investment preparation of subproject 1 “Dam safety repair and improvement of Ha Tinh province”;
10. Dam safety report of subproject 01, Ha Tinh province;
11. Environmental impact assessment report of the subproject “Dam safety repair and improvement of Ha Tinh province”;
12. Social impact assessment report of the project “Dam safety repair and improvement of Ha Tinh province”;
13. Resettlement action plan report of the subproject “Dam safety repair and improvement of Ha Tinh province”.
14. Project operation manual of Dam rehabilitation and safety improvement project (attached with Decision no. 2793 /QD-BNN-HTQT dated July 6th, 2016 of Minister of MARD, 2016;
15. Environmental and social management framework of Dam rehabilitation and safety improvement project, 2015.

APPENDIX

Appendix 1- Maps and diagram of sampling locations

Appendix 2 - Analysis results of ambient environmental quality

Appendix 3- Integrated pest management plan (IPM)

Appendix 4- Emergency preparedness plan

Appendix 5– Technical parameter of the works

Appendix 6- List of participants preparing ESIA

Appendix 1- Maps of sampling and monitoring environment

1. Diagram of location sampling environmental background

Table 1: Surface water sampling locations and field descriptions

No.	*Code of water sample*	*Monitoring position*	*Coordinate*	*Field description*
I/ Surface water sampling locations of Loi Dong Reservoir				
1	NM1	Water of Loi Dong reservoir at the regulator	X = 1995040 Y = 0641943	Dark green water, no smell, no source of waste affecting water quality
2	NM2	Water of Loi Dong reservoir downstream of regulator	X = 1995044 Y = 0641939	Brown, odorless, less trash around the sampling locations.
3	NM3	Water of Loi Dong at the spillway	X = 1995071 Y = 0641928	The water is green, odorless, with lots of rubbish around the sampling location.
4	NM4	Water in canals of Con Dinh village, Ky Trinh commune Ky Anh district, Ha Tinh	X = 1994959 Y = 0640292	Light brown water, odorless, weak flow, no garbage around. Affected by domestic waste
5	NM5	Water in canal in Trot Me village, Ky Trinh ward, Ky Anh, Ha Tinh	X = 1995805 Y = 0640704	Light brown water, odorless, weak flow, less rubbish. Affected by domestic waste
II/ Surface water sampling locations of Nuoc Xanh Reservoir				
6	NM6	Water of Nuoc Xanh Reservoir at the spillway	X = 2009647 Y = 0570316	Water is green and clear, odorless
7	NM7	Water of Nuoc Xanh Reservoir downstream of spillway	X = 2009682 Y = 0570123	Water is green and clear, odorless
8	NM8	Water of Nuoc Xanh Reservoir at the regulator	X = 2010208 Y = 0570563	Water is green and clear, odorless
9	NM9	Water in Bôm stream at Con Hoang, Ky Phong, Ky Anh	X = 2010658 Y = 0570244	Water is green and clear, odorless
10	NM10	Water in Bôm stream downstream of Nuoc Xanh dam	X = 2010450 Y = 0570445	Water is green and clear, odorless
III/ Surface water sampling locations of Ba Khe Reservoir				

11	NM11	Water of Ba Khe Reservoir at the regulator	X = 2015003 Y = 0568807	Colorless, odorless water, the dam surrounding area are some small farms (raising chickens, ducks)
12	NM12	Water in Cuong Ca stream in the downstream of diversion canal after dam	X = 2014751 Y = 0569110	Colorless, odorless water
13	NM13	Water in stream Dap Một in Kim Son village, Ky Bac, Ky Anh	X = 2014199 Y = 0570550	Colorless, odorless water, the dam surrounding area are some small farms (raising chickens, ducks)
14	NM14	Water in Ba Khe Reservoir at the spillway	X = 2015481 Y = 0568967	Colorless, odorless water
15	NM15	Water in stream Dap Một after the spillway	X = 2015034 Y = 0569251	Colorless, odorless water
IV/ Surface water sampling locations of Dap Buom Reservoir				
16	NM16	Water in Dap Buom Reservoir	X = 2027231 Y = 0508568	Colorless, odorless water
17	NM17	Water of Dap Buom Reservoir at the regulator	X = 2027243 Y = 0508581	Colorless, odorless water
18	NM18	Water of Dap Buom Reservoir at the spillway	X = 2027221 Y = 0508639	Colorless, odorless water
19	NM19	Stream water of Hoi Buom in village 1, Huong Tho, Vu Quang, Ha Tinh	X = 2027487 Y = 0508696	Colorless, odorless water, small flow
20	NM20	Stream water of Hoi Buom in village 1, Huong Tho, Vu Quang, Ha Tinh	X = 2027631 Y = 0508644	Colorless, odorless water, small flow
V/ Surface water sampling locations of Khe Co Reservoir				
21	NM26	Water in Khe Co Reservoir at the spillway	X = 2055294 Y = 0493140	Clear green, odorless water
22	NM27	Water of Khe Co Reservoir at the regulator	X = 2055447 Y = 0493154	Clear green, odorless water
23	NM28	Water in Khe Co Reservoir	X = 2055480 Y = 0493058	Clear green, odorless water

24	NM29	Water in canals of village 3, Son Le, Huong Son, Ha Tinh	X = 2055255 Y = 0493492	Clear green, odorless water
25	NM30	Water of Stream Hac in village 15, Son Tien, Huong Son	X = 2055777 Y = 0493787	Clear green, odorless water
VI/ Surface water sampling locations of Khe Nhay Reservoir				
26	NM31	Water of Khe Nhay Reservoir at the regulator	X = 2057107 Y = 0496907	Clear green, odorless water
27	NM32	Water of Khe Nhay Reservoir at the spillway	X = 2057220 Y = 0496882	Clear green, odorless water
28	NM33	Water of Khe Nhay Reservoir	X = 2057150 Y = 0497000	Clear green, odorless water
29	NM34	Water of Khe Nhay Reservoir at Côn Son village, Son Tien, Huong Son	X = 2055933 Y = 0497228	Clear green, odorless water
30	NM35	Canal water after the regulator of Khe Nhay Reservoir	X = 2057058 Y = 0496780	Clear green, odorless water
VII/ Surface water sampling locations of Khe De Reservoir				
31	NM36	Water of Cua Ông canal in Kim Loc village, Son Mai, Huong Son	X = 2043398 Y = 0495609	Clear green, odorless water
32	NM37	Water of Khe De Reservoir in the spillway	X = 2042838 Y = 0495057	Clear green, odorless water
33	NM38	Water in Dong Ha downstream of main dam of Khe De Reservoir	X = 2043198 Y = 0495124	Clear green, odorless water
34	NM39	Water of Khe De Reservoir at the spillway	X = 2042912 Y = 0495308	Clear green, odorless water
35	NM40	Water of Khe De Reservoir at the regulator	X = 2043000 Y = 0495041	Clear green, odorless water
VIII/ Surface water sampling locations of Da Den Reservoir				
36	NM46	Water in Da Den Reservoir near the regulator	X = 2026917 Y = 0529300	Water is slightly opaque green (color of algae). The west of the Reservoir is a 300 pig farm

				discharging waste water into the Reservoir
37	NM47	Water in Da Den Reservoir	X = 2020877 Y = 0529384	Water is slightly opaque green (color of algae), light stinky small
38	NM48	Water in Da Den Reservoir at the spillway	X = 2026957 Y = 0529030	Water is slightly opaque green (color of algae), light stinky small
39	NM49	On-farm canal water downstream of Da Den dam	X = 2026939 Y = 0529415	Greenish and odorless water
40	NM50	Water in Dinh stream in village Ngoc Son, Ngoc Son commune, Thạch Ha district	X = 2028972 Y = 0531239	Clear and odorless water

Table 2: Location of groundwater sampling site and field description

No.	*Sample code*	*Monitoring locations*	*Coordinate*	*Field description*
I/ Sampling locations of groundwater in Loi Dong Reservoir				
1	NN1	Well water of Mr. Vo Van Thi, Trot Me village, Ky Trinh Commune, Ky Anh District, Ha Tinh	X = 1995406 Y = 0641118	Clear and odorless water
2	NN2	Well water of Ms. Nguyen Thị Hong Van, Con Ho Village, Ky Trinh Commune, Ky Anh District, Ha Tinh	X = 1995697 Y = 0640963	Clear and odorless water
3	NN3	Well water of Mr. Tran Van Duong Con Quan Village, Ky Trinh Commune, Ky Anh District, Ha Tinh	X = 1995044 Y = 0641496	Clear and odorless water
II	***Sampling locations of groundwater in Nuoc Xanh Reservoir***			
4	NN4	Drilled well water of household Nguyen Xuan Luong, Bac Son Village, Ky Phong Commune, Ky Anh District	X = 2009754 Y = 0570215	Clear and odorless water
5	NN5	Dug well water of household Nguyen Van Chan, Bac Son Village, Ky Phong Commune, Ky Anh District	X = 2010169 Y = 0570286	Clear and odorless water
6	NN6	Dug well water of household Tran van Duan, Bac Son Village, Ky	X = 2010393 Y = 0570123	Clear and odorless water

		Phong Commune, Ky Anh District		
III	***Sampling locations of groundwater in Ba Khe***			
7	NN7	Dug well water of household Bui Van Son, Lạc Tien Village, Ky Bac Village, Ky Anh District	X = 2014828 Y = 0568657	Clear and odorless water
8	NN8	Well water of household Nguyen Tien Nang, Ky Bac Village, Ky Anh District	X = 2014811 Y = 0568791	Clear and odorless water
9	NN9	Well water of household Tran Van Hoang, Lac Tien Village, Ky Bac Village, Ky Anh District	X = 2014737 Y = 0568875	Clear and odorless water
IV	***Sampling locations of groundwater in Dap Buom Reservoir***			
10	NN10	Drilled well water of household Tran Phuc Dong, Village 1, Son Tho Commune, Vu Quang District	X = 2077401 Y = 0508669	Clear and odorless water
11	NN11	Dug well water of household Ho Thi Lieu, Village 1, Son Tho Commune, Vu Quang District	X = 2027478 Y = 0508636	Clear and odorless water
12	NN12	Drilled well water of Mr. Tran Van Tuan, Village 1, Huong Tho commune, Vu Quang District	X = 2027477 Y = 0508666	Clear and odorless water
V	***Sampling locations of groundwater in Khe Co Reservoir***			
16	NN16	Dug well water of household Le Van Giap (Village 16), Village Hoa Tien, Son Tien Commune	X = 2055031 Y = 0493883	Clear and odorless water
17	NN17	Dug well water of household Le Van Ton, Village 3, Son Le Commune, Huong Son District	X = 2055355 Y = 0493171	Clear and odorless water
18	NN18	Dug well water of household Nguyen Van Anh, Village 3, Son Le Commune, Huong Son District	X = 2054823 Y = 0493657	Clear and odorless water
VI	***Sampling locations of groundwater in Khe Nhay Reservoir***			
19	NN19	Dug well water of household Nguyen Khac Chien, Hung Son Village, Son Tien Commune	X = 2057134 Y = 0496732	Clear and odorless water
20	NN20	Drilled well water of household Dinh Van Hung (at the depth of 19 m), Village 8, Con Son Village, Son Tien Commune	X = 2057010 Y = 0496799	Clear and odorless water
21	NN21	Drilled well water of household Le Tam, Village 9, Hung Son Village, Son Tien Commune	X = 2057159 Y = 0496708	Clear and odorless water
VII	***Sampling locations of groundwater in Khe De Reservoir***			
22	NN22	Dug well water of household Ha	X = 2043177	Clear and odorless

		Trong Han, Kim Loc Village, Son Mai Commune, Huong Son District	Y = 0494978	water
23	NN23	Dug well water of household Pham Dinh Minh, Kim Loc Village, Son Mai Commune, Huong Son District	X = 2042959 Y = 0495266	Clear and odorless water
24	NN24	Dug well water of household Pham Dình Thong, Kim Lộc Village, Son Mai Commune, Huong Son District	X = 2042939 Y = 0495310	Clear and odorless water
VIII	***Sampling locations of groundwater in Da Den Reservoir***			
28	NN28	Drilled well water of Mr. Ho Xuan Huong, Nam Son Village, Ngoc Son Commune	X = 2027599 Y = 0529246	Little turbid and odorless
29	NN29	Drilled well water of Mr. Le Van Lan, Village 6, Ngoc Son Commune	X = 2027618 Y = 0529106	Clear and odorless water
30	NN30	Dug well water of Mr. Tran Huu Vinh, Nam Son Village, Ngoc Son Commune	X = 2027114 Y = 0529535	Clear and odorless water

Table 3: Air quality sampling locations

No.	*Sample code*	*Monitoring locations*	*Coordinate*	*Field description*
I/ Air quality sampling locations of Loi Dong Reservoir				
1	KK1	Head of farmer road connecting to dam of Loi Dong Reservoir, Ky Trinh Ward	X = 1995084 Y = 0642747	There is less traffic near the sampling point, less dust
2	KK2	On the dam surface of Loi Dong Reservoir near the intake - Ky Trinh Ward	X = 1995042 Y = 0641926	Less dust, light wind, fresh air
3	KK3	On the dam surface near intake of spillway of Loi Dong Reservoir, Ky Trinh Ward	X = 1995293 Y = 0641373	Less dust, light wind, fresh air
II/ Air quality sampling locations of Nuoc Xanh				
4	KK4	Earth road on the spillway of Nuoc Xanh Reservoir	X = 2009617 Y = 0570295	No means of transports during the sampling time
5	KK5	On the management road of Nuoc Xanh	X = 2010121 Y = 0570236	No means of transports during the sampling time

		Reservoir		
6	KK6	Earth road on dam body of Nuoc Xanh Reservoir	X = 2010199 Y = 0570470	No means of transports during the sampling time
III/ Air quality sampling locations of Ba Khe Reservoir				
7	KK7	Inter-commune concrete road crossing road to the main dam of Ba Khe Reservoir	X = 2014898 Y = 0568742	No means of transports during the sampling time
8	KK8	On the main dam of Ba Khe Reservoir	X = 2014978 Y = 0568799	No means of transports during the sampling time
9	KK9	Inter-commune concrete road in the downstream of spillway	X = 2015521 Y = 0568980	No means of transports during the sampling time
IV/ Air quality sampling locations of Dap Buom Reservoir				
10	KK10	On the dam site of Dap Buom Reservoir	X = 2027262 Y = 0508590	Little traffic during the sampling time
11	KK11	On the spillway of Dap Buom Reservoir	X = 2027224 Y = 0508638	Little traffic during the sampling time
12	KK12	On the management road of Dap Buom Reservoir	X = 2027361 Y = 0508639	Little traffic during the sampling time
V/ Air quality sampling locations of Khe Co Reservoir				
13	KK16	On the spillway of Khe Co Reservoir	X = 2055267 Y = 0493230	No means of transports during the sampling time
14	KK17	In the Dông Village (near the main outlet)	X = 2055375 Y = 0493219	No means of transports during the sampling time
15	KK18	On the management road of Khe Co Reservoir	X =2055409 Y = 0493300	Little traffic during the sampling time
VI/ Air quality sampling locations of Khe Nhay Reservoir				
16	KK19	On the dam site of Khe Nhay Reservoir	X = 2057106 Y = 0496894	Little traffic during the sampling time
17	KK20	On the spillway of Khe Nhay Reservoir	X = 2057222 Y = 0496879	Little traffic during the sampling time
18	KK21	On the management road of Khe Nhay Reservoir	X = 2057021 Y = 0496970	Little traffic during the sampling time
VII/ Air quality sampling locations of Khe De Reservoir				
19	KK22	On dam site of Khe De Reservoir	X = 2043059 Y = 0494972	Little traffic during the sampling time
20	KK23	On the management road of Khe De Reservoir	X = 2042979 Y = 0495154	Little traffic during the sampling time

21	KK24	On the spillway of Khe De Reservoir	X = 2042838 Y = 0495057	Little traffic during the sampling time
VIII/ Air quality sampling locations of Da Den Reservoir				
22	KK28	On the management road of Da Den Reservoir	X = 2026932 Y = 0529440	Some soil trucks acrosing sampling location during the observation time.
23	KK29	On the earth road crossing the spillway of Da Den Reservoir	X = 2027023 Y = 0528932	Little traffic during the sampling time
24	KK30	On dam site of Da Den Reservoir	X = 2026949 Y = 0529312	Little traffic during the sampling time

Table 4: Soil environment sampling locations

No.	*Sample code*	*Monitoring location*	*Coordinate*	*Field description*
I/ Soil quality sampling locations of Loi Dong Reservoir				
1	MD1	Rice field lands downstream of Loi Dong, Ky Trinh Ward, Ky Anh Town, Ha Tinh	X = 1995658 Y = 0640828	Black soil, slightly fishy.
2	MD2	Soil at the flood of Con Mộc, Ky Trinh Ward, Ky Anh Town, Ha Tinh	X = 1995639 Y = 0640612	The soil is black and fine
3	MD3	Rice field lands downstream of Loi Dong, Ky Trinh Ward, Ky Anh Town, Ha Tinh	X = 1995621 Y = 0640580	Grey soil
II/ Soil quality sampling locations of Nuoc Xanh Reservoir				
4	MD4	Soil. in Con Hoang hill, Ky Phong Commune, Ky Anh District (Planned dumpsite)	X = 2010576 Y = 0570186	Yellow soil
5	MD5	Land in the management road for the management of Nuoc Xanh Reservoir	X = 2010126 Y = 0570233	Yellow soil
6	MD6	Lands planned as borrow pits for back fill in Nuoc Xanh Reservoir	X = 2009574 Y = 0570409	Yellow soil with grit
III/ Soil quality sampling locations of Ba Khe Reservoir				
7	MD7	Planned site as borrow pit for dam backfill soil- Ba Khe Reservoir in site 02 at the slope of Cau Nhung, Ky Bac Village, Ky Anh District	X = 2015485 Y = 0569134	The soil is grayish yellow
8	MD8	Soil from management road of Ba Khe Reservoir	X = 2015315 Y = 0569015	The soil is grayish yellow
9	MD9	Soil in the new stadium Ky Bac Village (planning of dumpsite No. 1)	X = 2013917 Y = 0570315	The soil is gray
IV/ Soil quality sampling locations of Dap Buom Reservoir				
10	MD10	Soil from Khe Gieng dam, Village 1, Huong Tho commune, Vu Quang	X = 2027505 Y = 0508509	Yellow soil

		District (Planned dumpsite)		
11	MD11	Planned dumpsite for dam backfill soil Dap Buom Reservoir	X = 2027262 Y = 0508539	Yellow soil
12	MD12	Soil from management road of Dap Buom Reservoir	X = 2027365 Y = 0508647	Yellow soil
V/ Soil quality sampling locations of Khe Co Reservoir				
13	MD16	Planned dumpsite for dam backfill soil Khe Co	X = 2055602 Y = 0493242	Yellow soil
14	MD17	Dat khu vực Bãi Hoang 1, Village 15, Son Tien Commune, Huong Son District (Planned dumpsite 1)	X = 2056088 Y = 0493605	The soil is grayish yellow
15	MD18	Soil from management road of Khe Co Reservoir	X = 2055400 Y = 0493307	The soil is grayish yellow, with grit
VI/ Soil quality sampling locations of Khe Nhay Reservoir				
16	MD19	Stadium of Côn Son Village, Son Tien Commune, Huong Son District (planned dumpsite)	X = 2055968 Y = 0497361	Soil is yellow
17	MD20	Lands in management road of Khe Nhay Reservoir	X = 2057010 Y = 0496982	Soil is yellow with grit
18	MD21	Planned dumpsite for dam backfill soil of Khe Nhay	X = 2057317 Y = 0497192	The soil is yellow, with grit
VII/ Soil quality sampling locations of Khe De Reservoir				
19	MD22	Planned dumpsite for dam backfill soil of Khe De Reservoir	X = 2043060 Y = 0495162	Soil is yellow
20	MD23	Soil from planned campsite of Khe De Reservoir	X = 2042932 Y = 0495118	The soil is grayish yellow, with grit
21	MD24	Soil from management road of Khe De Reservoir	X = 2042980 Y = 0495145	The soil is grayish yellow, with grit
VIII/ Soil quality sampling locations of Da Den Reservoir				
22	MD28	Soil from management and rescue road of Da Den Reservoir	X = 2026916 Y = 0529444	Soil is yellow
23	MD29	Planned dumpsite for dam backfill soil of Da Den Reservoir	X = 2026732 Y = 0529458	The soil is light yellow, with grit
24	MD30	Planned dumpsite for dam backfill soil in 19/5 field, Ngoc Ha Village, Ngoc Son Commune	X = 2028631 Y = 0531814	The soil is dark color, with grit

Table 5: Sedimentation sampling locations

No.	*Sample code*	*Monitoring locations*	*Coordinate*	*Field description*
I/ Bed load sampling locations in Loi Dong				
1	BD1	Sedimentation in canal of Village Hòa Lộc, Ky Trinh Ward, Ky Anh, Ha Tinh	X = 1995048 Y = 0641938	Fine mud, black, fishy smell

2	BD2	Sedimentation in canal of Village Con Dinh, Ky Trinh Ward, Ky Anh, Ha Tinh	X = 1995152 Y = 0641407	Fine mud, brownish gray
3	BD3	Sedimentation in canal of Village Tan Son, Ky Trinh Ward, Ky Anh, Ha Tinh	X = 1995438 Y = 0641024	Mud of many tree leaves, black, fishy smell
II/ Bed load sampling locations in Nuoc Xanh				
4	BD4	Sedimentation in Nuoc Xanh Reservoir	X = 2010105 Y = 0570609	The mud is black, the smell is a little fishy
5	BD5	Sedimentation in stream of Nuoc Xanh Reservoir, Con Ngang, Ky Phong Commune, Ky Anh, Ha Tinh	X = 2009687 Y = 0570112	The mud is black, the smell is a little fishy, with grit, pebbles
6	BD6	Sedimentation in Bôm stream downstream of Nuoc Xanh dam, Con Ngang, Ky Phong Commune, Ky Anh, Ha Tinh	X = 2010465 Y = 0570429	The mud is black, the smell is a little fishy, with grit, pebbles
III/ Bed load sampling locations in Ba Khe				
7	BD7	Sedimentation in Ba Khe Reservoir	X = 2015199 Y = 0568673	The mud is black, the smell is a little fishy
8	BD8	Sedimentation in Cuong Ca stream downstream of diversion canal after dam	X = 2014723 Y = 0569134	The mud is black, the smell is a little fishy
9	BD9	Sedimentation in Dap Một stream after the spillway	X = 2015042 Y = 0569233	The mud is black, the smell is a little fishy
IV/ Bed load sampling locations in Dap Buom Reservoir				
10	BD10	Sedimentation in the Reservoir, near the regulator	X = 2027243 Y = 0508581	The mud is dark gray, slightly fishy
11	BD11	Sedimentation in the Reservoir near the spillway	X = 2027231 Y = 0508568	The mud is dark gray, slightly fishy
12	BD12	Sedimentation in Hoi Buom stream in Village 1, Huong Tho commune, Vu Quang District, Ha Tinh	X = 2027487 Y = 0508674	The mud is gray, with leaves and pebbles and grit, pebbles
V/ Bed load sampling locations in Khe Co Reservoir				
13	BD16	Sedimentation in canal of Village Khe Co, Son Le Commune, Huong Son, Ha Tinh	X = 2055201 Y = 0493502	The mud is gray, the smell is a little fishy
14	BD17	Sedimentation in the Reservoir, near the regulator	X = 2055447 Y = 0493154	The mud is gray, the smell is a little fishy
15	BD18	Sedimentation in Khe Hac stream,	X = 2054905	The mud is grayish

		Village Khe Co, Son Le Commune, Huong Son, Ha Tinh	Y = 0493851	yellow with grit, pebbles
VI/ Bed load sampling locations in Khe Nhay Reservoir				
16	BD19	Sedimentation in Reservoir, near the regulator	X = 2057107 Y = 0496907	The mud is grayish black, with grit, pebbles, fishy smell
17	BD20	Sedimentation in Khe Nhay Reservoir	X = 2057150 Y = 0497000	The mud is grayish black, with grit, pebbles, fishy smell
18	BD21	Sedimentation in Khe Nhay Reservoir, Son Tien Commune, Huong Son, Ha Tinh	X = 2056907 Y = 0496670	The mud is grayish yellow, with grit, pebbles
VII/ Bed load sampling locations in Khe De Reservoir				
19	BD22	Sedimentation in Khe De Reservoir	X = 2042900 Y = 0494942	Mud is fine and black, fishy smell
20	BD23	Sedimentation in Khe De Reservoir, near the regulator	X = 2043012 Y = 0495018	Mud is fine and black, fishy smell
21	BD24	Sedimentation in Khe De Reservoir downstream of spillway	X = 2043222 Y = 0495154	Mud is gray yellow, with grit, pebbles, and stinky smell
VIII/ Bed load sampling locations in Da Den Reservoir				
22	BD28	Sedimentation in Da Den Reservoir, near the regulator	X = 2026917 Y = 0529300	Mud is fine and black, fishy smell
23	BD29	Sedimentation in drainage canal near Provincial road 21, Ngoc Son Commune, Thạch Ha, Ha Tinh	X = 2027089 Y = 0529577	Mud is fine and black, fishy smell
24	BD30	Sedimentation in Da Den Reservoir, near the spillway	X = 2026957 Y = 0529030	The mud is dark gray, fishy smell

2. Location sampling for environmental quality monitoring during construction and operation phase

Table 6: **Describe environmental monitoring locations during construction stage**

Work (Reservoir)	*Surface water sample*			*Air sample*		
	Sample code	*Location*	*Coordinate*	*Sample code*	*Location*	*Coordinate*
Loi Dong	NM1	Water of Loi Dong Reservoir at the regulator	X = 1995040 Y = 0641943	KK1	Farmer road to Loi Dong dam, Ky Trinh ward	X = 1995084 Y = 0642747
	NM2	Water of Loi Dong Reservoir downstream of the regulator	X = 1995044 Y = 0641939	KK2	On the dam surface of Loi Dong Reservoir near the intake Ky Trinh ward	X = 1995042 Y = 0641926
	NM3	Water of Loi	X = 1995071	KK3	On the dam	X = 1995293

		Dong Reservoir at the spillway	Y = 0641928		surface of Loi Dong Reservoir near the flood outlet	Y = 0641373
	NM4	Water in canals of Con Dinh village, Ky Trinh commune Ky Anh district, Ha Tinh	X = 1994959 Y = 0640292			
Nuoc Xanh	NM6	Water of Nuoc Xanh Reservoir at the spillway	X = 2009647 Y = 0570316	KK4	Earth road in the spillway of Nuoc Xanh Reservoir	X = 2009617 Y = 0570295
	NM8	Water of Nuoc Xanh Reservoir at the regulator	X = 2010208 Y = 0570563	KK5	On the construction and management road of Nuoc Xanh Reservoir	X = 2010121 Y = 0570236
	NM9	Water in Bom stream at Con Hoang, Ky Phong, Ky Anh	X = 2010658 Y = 0570244	KK6	Earth road on the dam body of Nuoc Xanh Reservoir	X = 2010199 Y = 0570470
	NM10	Water in Bom stream downstream of Nuoc Xanh dam	X = 2010450 Y = 0570445			
Ba Khe	NM11	Water of Ba Khe Reservoir at the regulator	X = 2015003 Y = 0568807	KK7	Inter-commune Concrete road crossing path to main dam body of Ba Khe Reservoir	X = 2014898 Y = 0568742
	NM12	Water in Cuong Ca stream in the downstream of diversion canal after dam	X = 2014751 Y = 0569110	KK8	On the main dam body of Ba Khe Reservoir	X = 2014978 Y = 0568799

	NM13	Water in stream Dap Mot in Kim Son village, Ky Bac, Ky Anh	X = 2014199 Y = 0570550	KK9	Inter-commune Concrete road downstream of the spillway	X = 2015521 Y = 0568980
	NM15	Water in stream Dap Mot after the spillway	X = 2015034 Y = 0569251			
Dap Buom	NM16	Water in Dap Buom Reservoir	X = 2027231 Y = 0508568	KK10	On the dam site of Dap Buom Reservoir	X = 2027262 Y = 0508590
	NM17	Water of Dap Buom Reservoir at the regulator	X = 2027243 Y = 0508581	KK11	Spillway of Dap Buom Reservoir	X = 2027224 Y = 0508638
	NM19	Stream water of Hoi Buom in village 1, Huong Tho, Vu Quang, Ha Tinh	X = 2027487 Y = 0508696	KK12	Management road of Dap Buom Reservoir	X = 2027361 Y = 0508639
	NM20	Stream water of Hoi Buom in village 1, Huong Tho, Vu Quang, Ha Tinh	X = 2027631 Y = 0508644			
Khe Co	NM27	Water of Khe Co Reservoir at the regulator	X = 2055447 Y = 0493154	KK16	At the spillway of Khe Co Reservoir	X = 2055267 Y = 0493230
	NM28	Water in Khe Co Reservoir	X = 2055480 Y = 0493058	KK17	In the Dong village (near main outlet)	X = 2055375 Y = 0493219
	NM29	Water in canals of village 3, Son Le, Huong Son, Ha Tinh	X = 2055255 Y = 0493492	KK18	Management road of Khe Co Reservoir	X = 2055409 Y = 0493300
	NM30	Water of Stream Hac in village 15, Son Tien, Huong Son	X = 2055777 Y = 0493787			

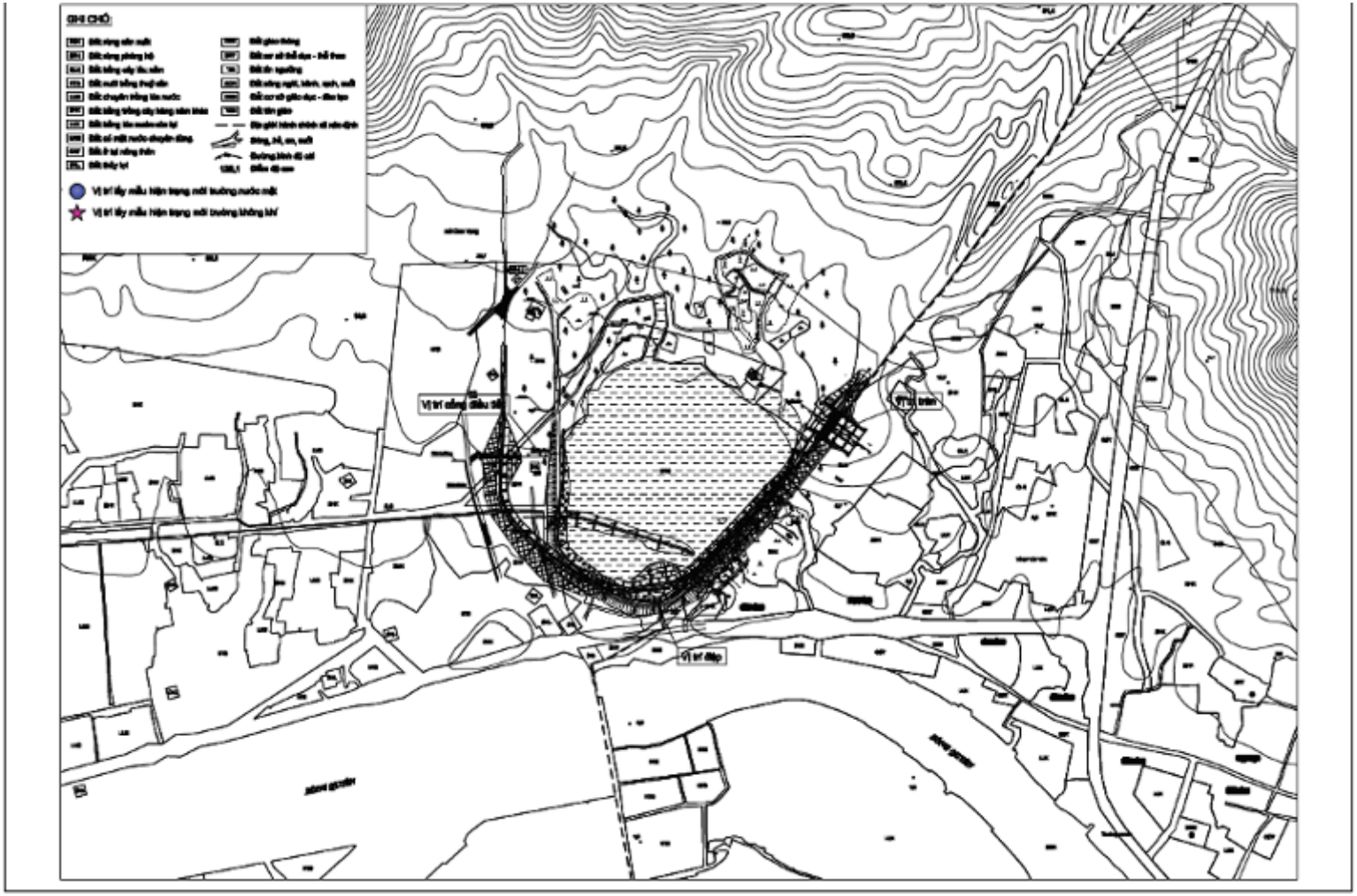
Khe Nhay	NM31	Water of Khe Nhay Reservoir at the regulator	X = 2057107 Y = 0496907	KK19	On the dam site of Khe Nhay Reservoir	X = 2057106 Y = 0496894
	NM33	Water of Khe Nhay Reservoir	X = 2057150 Y = 0497000	KK20	Spillway of Khe Nhay Reservoir	X = 2057222 Y = 0496879
	NM34	Water of Khe Nhay Reservoir at Con Son village, Son Tien, Huong Son	X = 2055933 Y = 0497228	KK21	Management road of Khe Nhay Reservoir	X = 2057021 Y = 0496970
	NM35	Canal water after the regulator of Khe Nhay Reservoir	X = 2057058 Y = 0496780			
Khe De	NM36	Water of Cua Ong canal in Kim Loc village, Son Mai, Huong Son	X = 2043398 Y = 0495609	KK22	On the dam site of Khe De Reservoir	X = 2043059 Y = 0494972
	NM37	Water of Khe De Reservoir in the spillway	X = 2042838 Y = 0495057	KK23	Management road of Khe De Reservoir	X = 2042979 Y = 0495154
	NM38	Water in Dong Ha downstream of main dam of Khe De Reservoir	X = 2043198 Y = 0495124	KK24	Spillway of Khe De Reservoir	X = 2042838 Y = 0495057
	NM40	Water of Khe De Reservoir near the regulator	X = 2043000 Y = 0495041			
Da Den	NM46	Water in Da Den Reservoir near the regulator	X = 2026917 Y = 0529300	KK28	Management road of Da Den Reservoir	X = 2026932 Y = 0529440
	NM47	Water in Da Den Reservoir	X = 2020877 Y = 0529384	KK29	On earth road crossing the	X = 2027023 Y = 0528932

					spillway of Da Den Reservoir	
	NM49	On-farm canal water downstream of Da Den dam	X = 2026939 Y = 0529415	KK30	On the dam site of Da Den Reservoir	X = 2026949 Y = 0529312
	NM50	Water in Dinh stream in village Ngoc Son, Ngoc Son, Thach Ha	X = 2028972 Y = 0531239			

Table 7: **Description of surface water quality monitoring locations during operation stage**

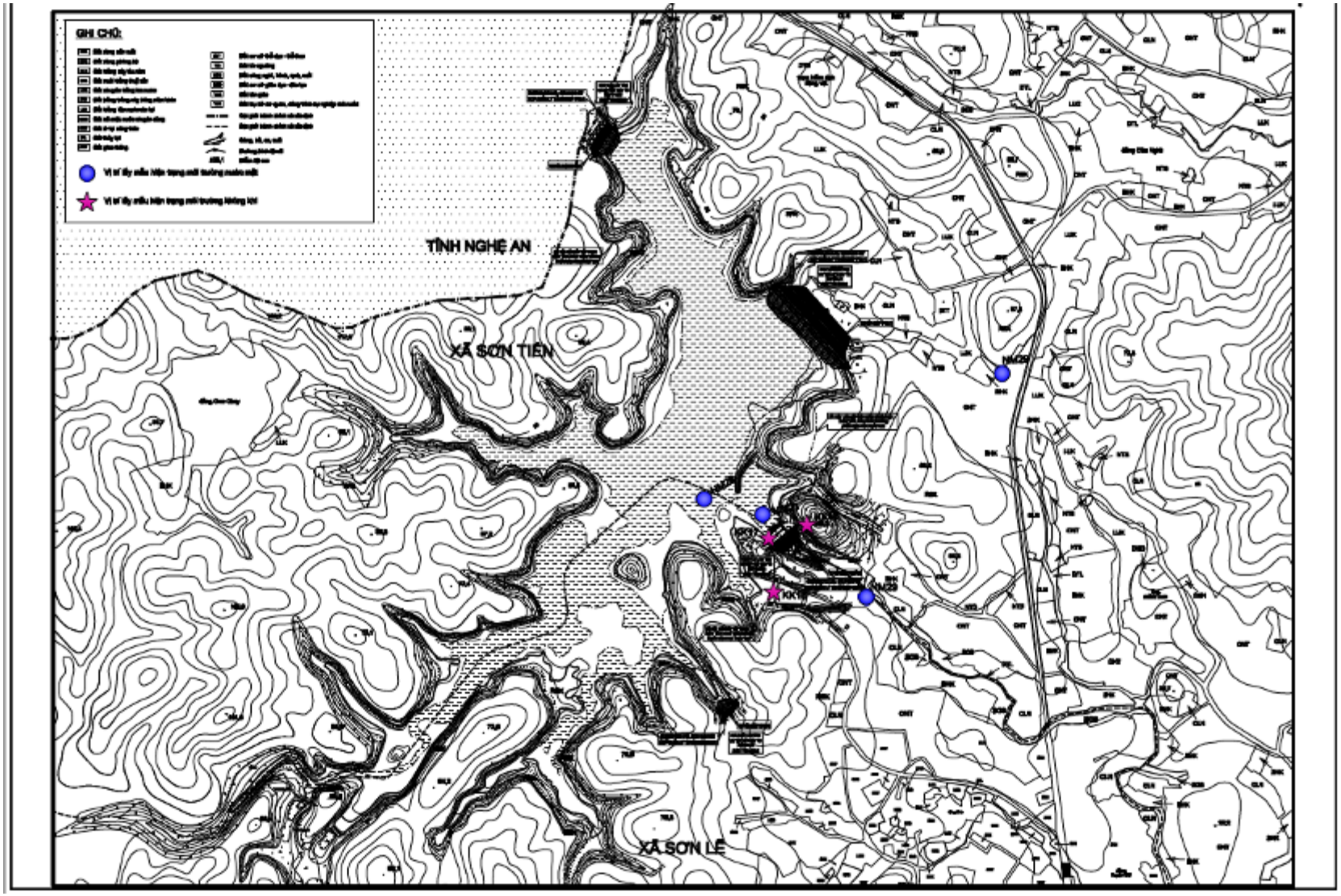
Project (Reservoir)	*Surface water sample*		
	Code	*Locations*	*Coordinate*
Loi Dong Reservoir	NM1	Water of Loi Dong Reservoir at the regulator	X = 1995040 Y = 0641943
	NM4	Water in canals of Con Dinh village, Ky Trinh commune Ky Anh district, Ha Tinh	X = 1994959 Y = 0640292
Nuoc Xanh Reservoir	NM8	Water of Nuoc Xanh Reservoir at the regulator	X = 2010208 Y = 0570563
	NM10	Water in Bom stream downstream of Nuoc Xanh dam	X = 2010450 Y = 0570445
Ba Khe Reservoir	NM11	Water of Ba Khe Reservoir at the regulator	X = 2015003 Y = 0568807
	NM12	Water in Cuong Ca stream in the downstream of diversion canal after dam	X = 2014751 Y = 0569110
Dap Buom Reservoir	NM17	Water of Dap Buom Reservoir at the regulator	X = 2027243 Y = 0508581
	NM19	Stream water of Hoi Buom in village 1, Huong Tho, Vu Quang, Ha Tinh	X = 2027487 Y = 0508696
Khe Co Reservoir	NM27	Water of Khe Co Reservoir at the regulator	X = 2055447 Y = 0493154
	NM29	Water in canals of village 3, Son Le, Huong Son, Ha Tinh	X = 2055255 Y = 0493492
Khe Nhay Reservoir	NM31	Water of Khe Nhay Reservoir at the regulator	X = 2057107 Y = 0496907
	NM35	Canal water after the regulator of Khe Nhay Reservoir	X = 2057058 Y = 0496780
Khe De Reservoir	NM38	Water in Ha field canal downstream of main dam of Khe De Reservoir	X = 2043198 Y = 0495124
	NM40	Water of Khe De Reservoir near the regulator	X = 2043000 Y = 0495041
Da Den Reservoir	NM46	Water in Da Den Reservoir near the regulator	X = 2026917 Y = 0529300
	NM49	On-farm canal water downstream of Da Den dam	X = 2026939 Y = 0529415

3. Diagram of environmental monitoring location during construction phase

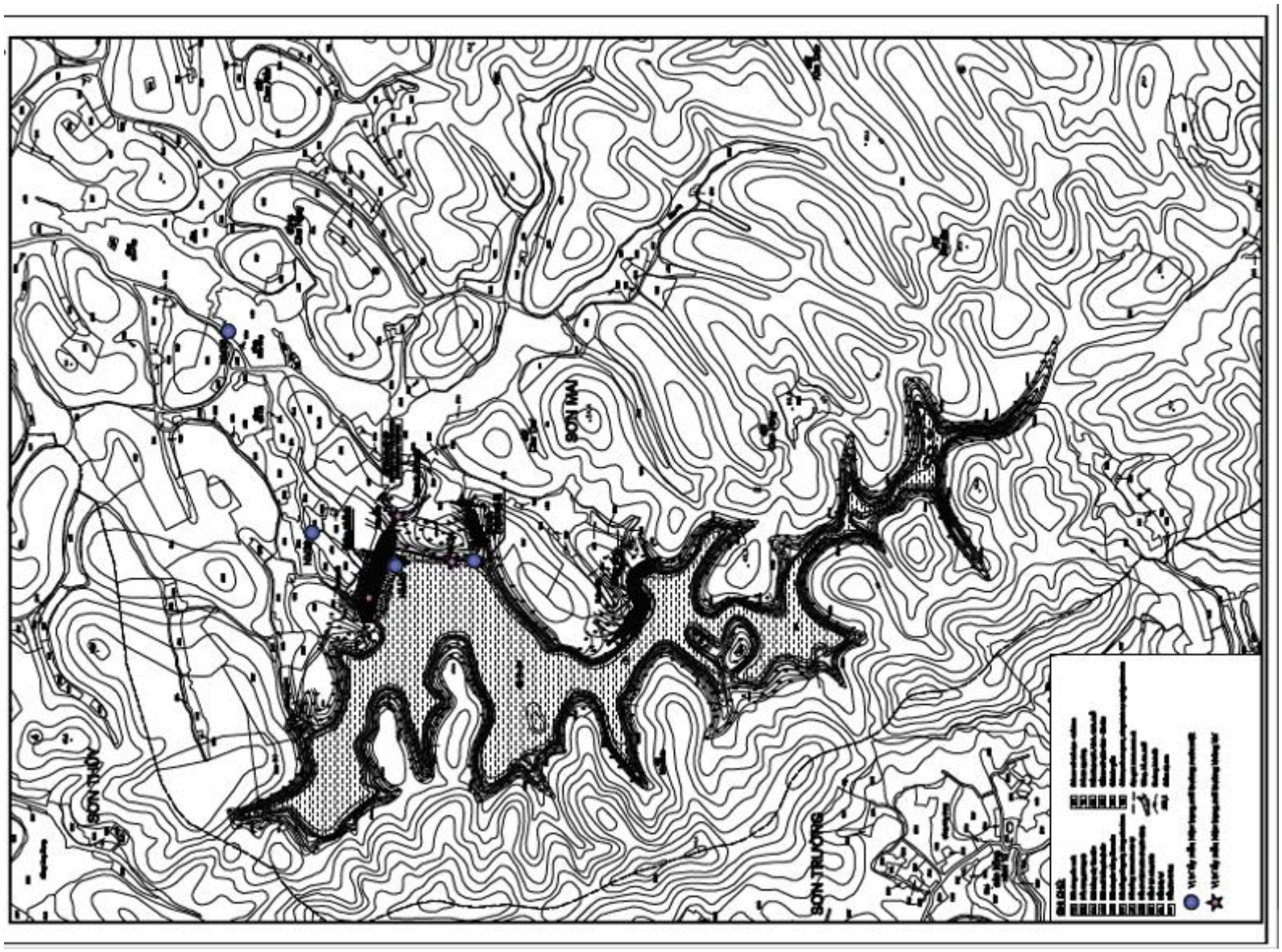


Loi Dong reservoir in Ky Trinh ward, Ky Anh town, Ha Tinh

Nuoc Xanh reservoir, Ky Phong commune, Ky Anh disitrict, Ha Tinh



Khe Co reservoir, Son Le commune, Huong Son district, Ha Tinh


SƠN TÂY
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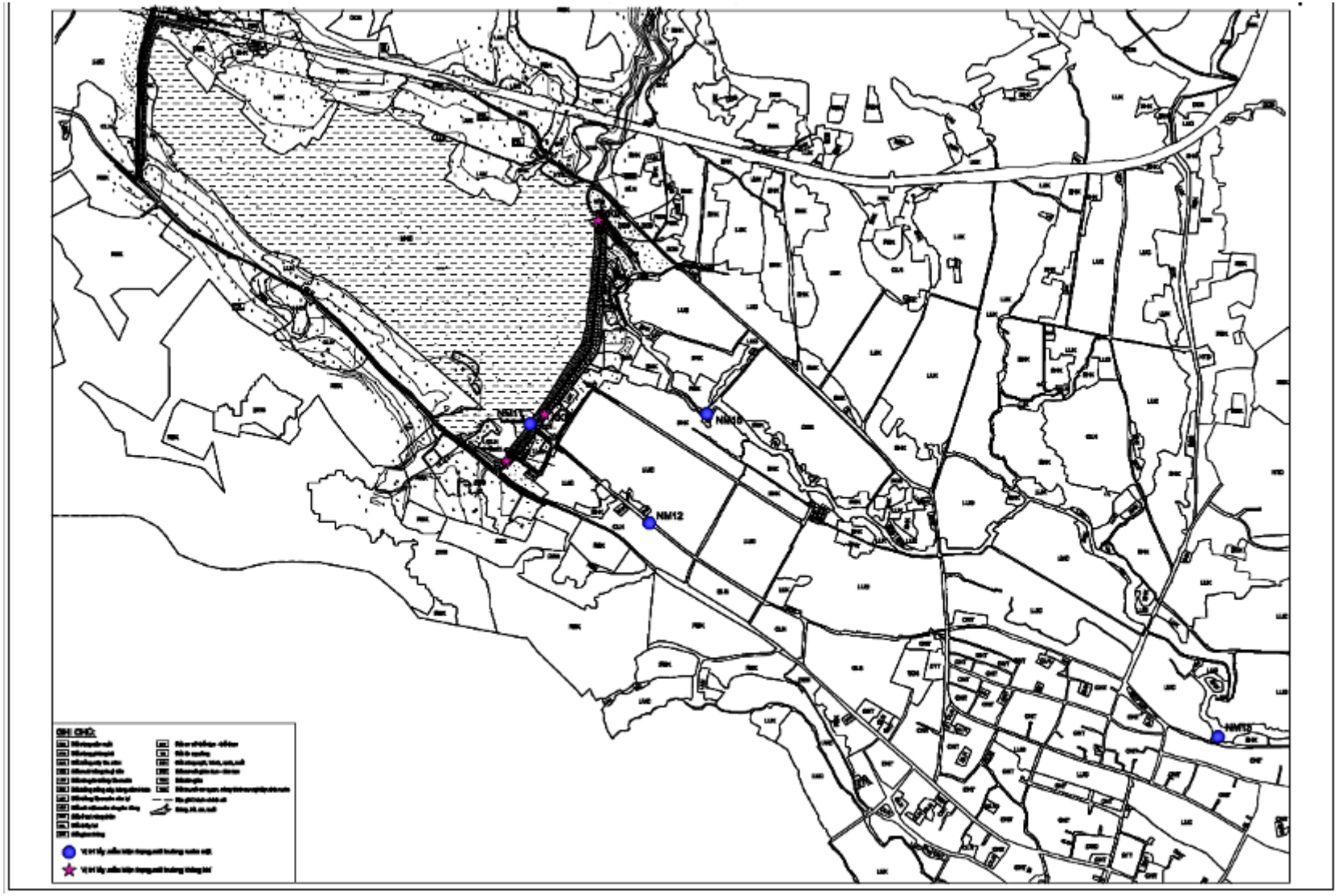
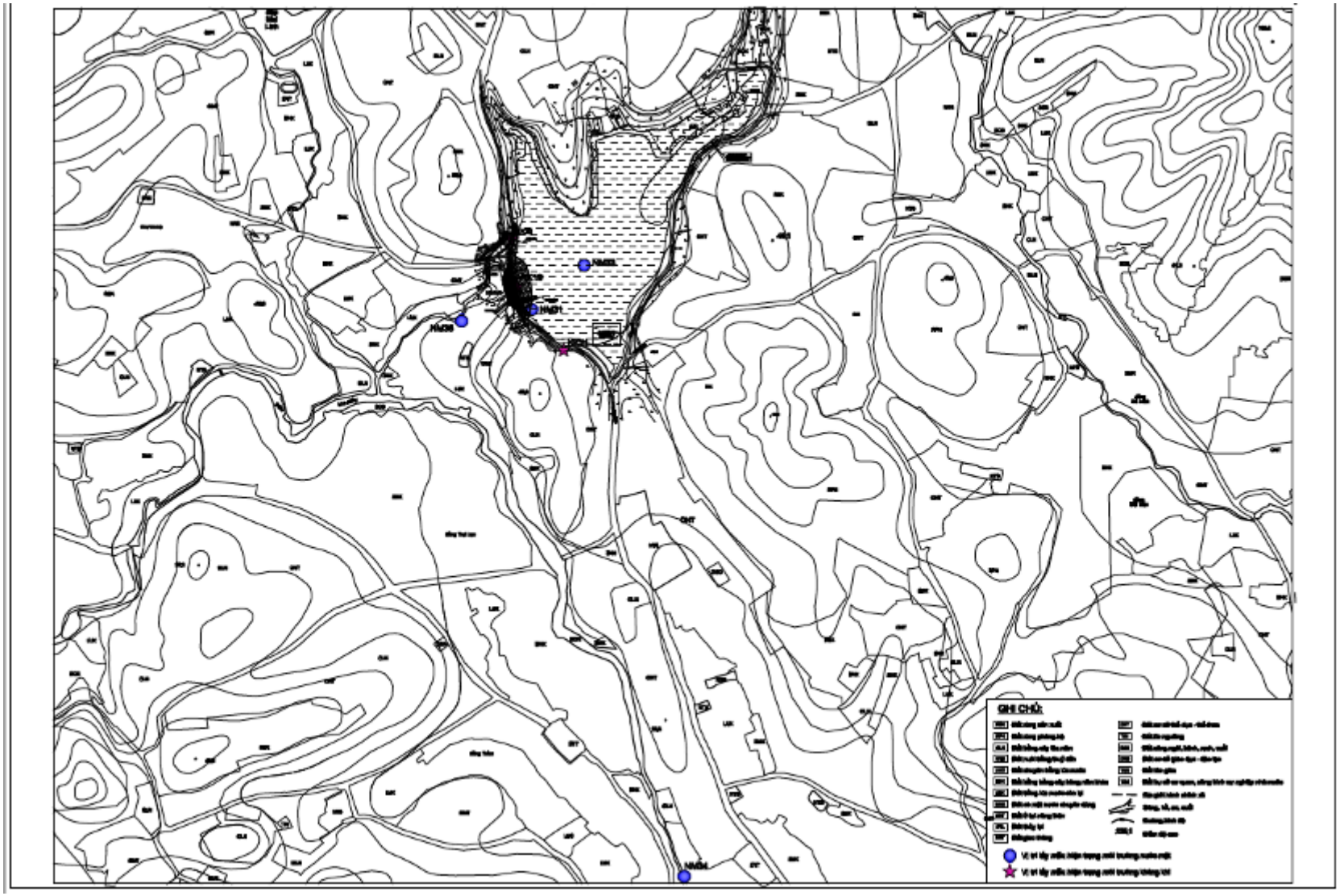
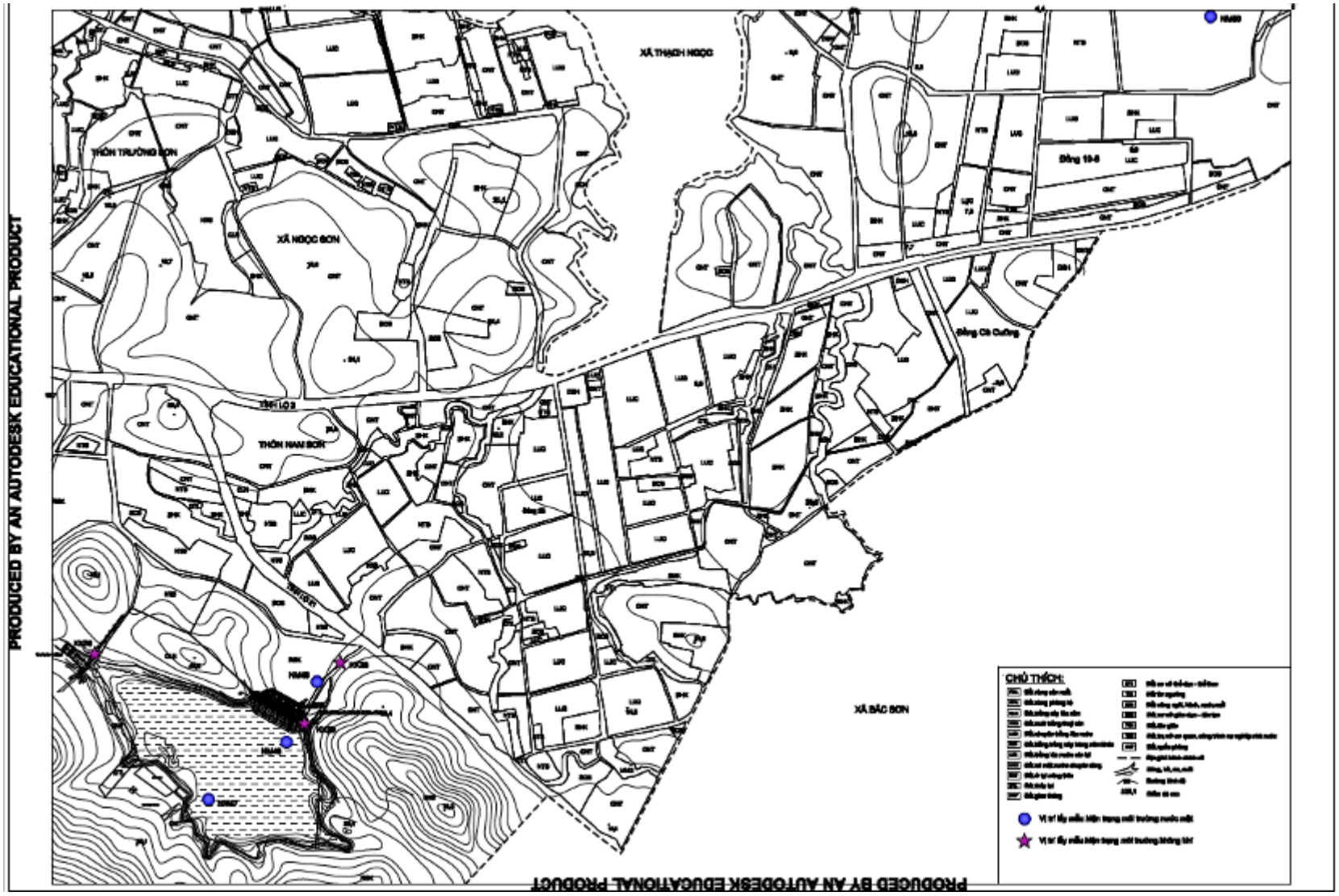
Khe De reservoir, Son Mai commune, Huong Son disitrict, Ha Tinh



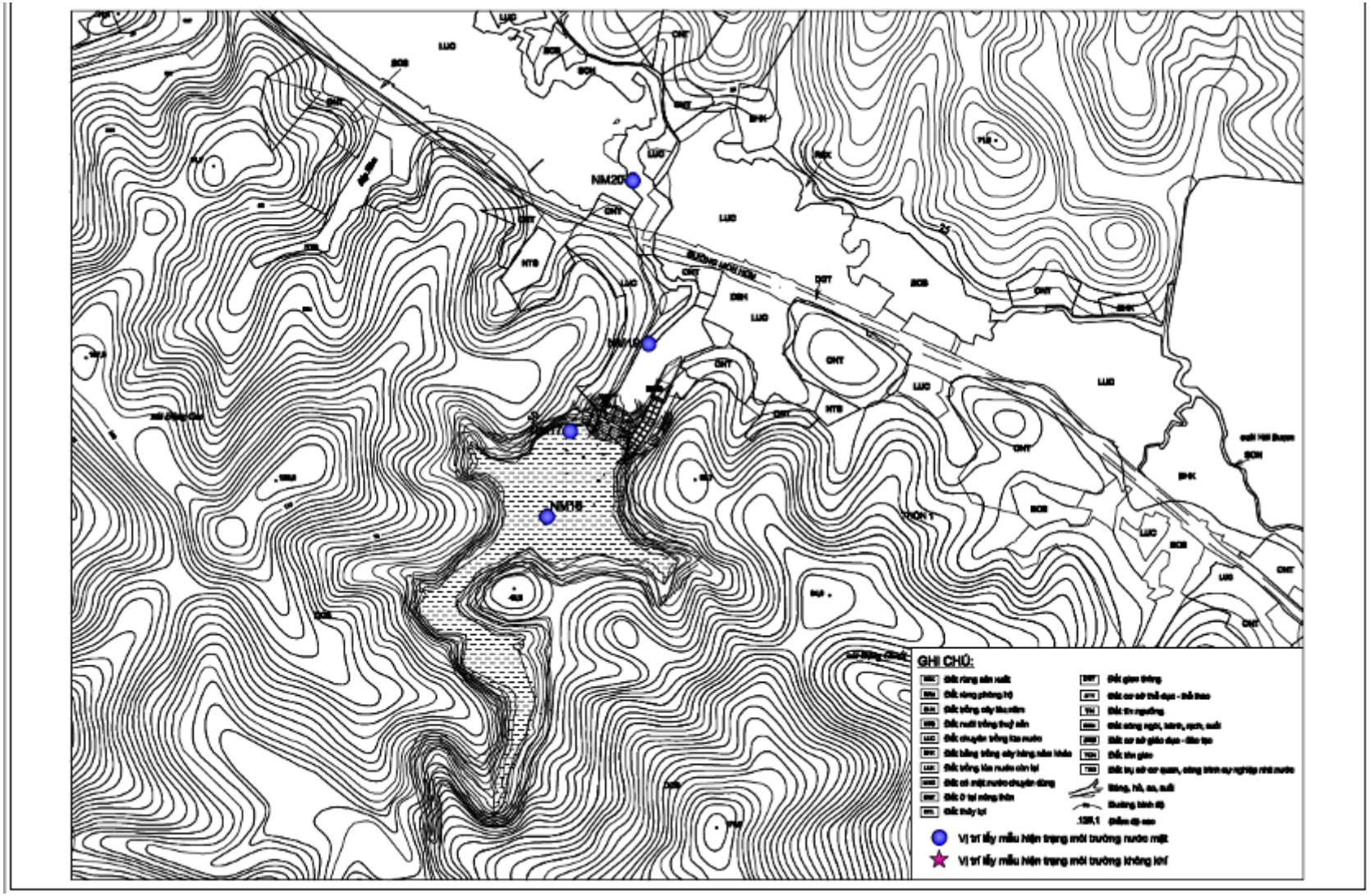
Ba Khe reservoir, Ky Bac comnune, Ky Anh district, Ha Tinh



Khe Nhay reservoir, Son Tiencommune, Huong Son disitrct, Ha Tinh

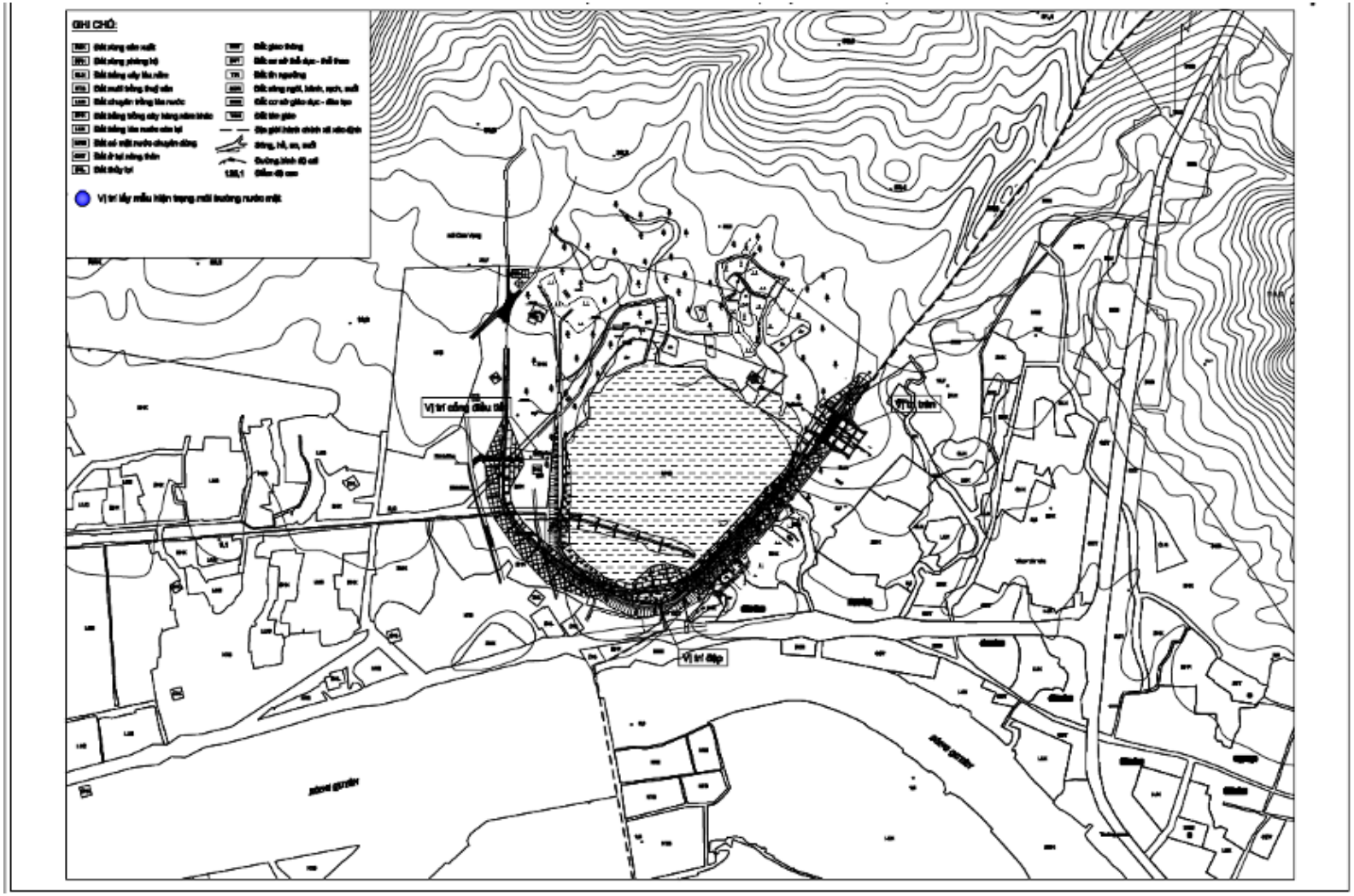


Da Den reservoir, Ngoc Son commune, Thach Ha district, Ha Tinh

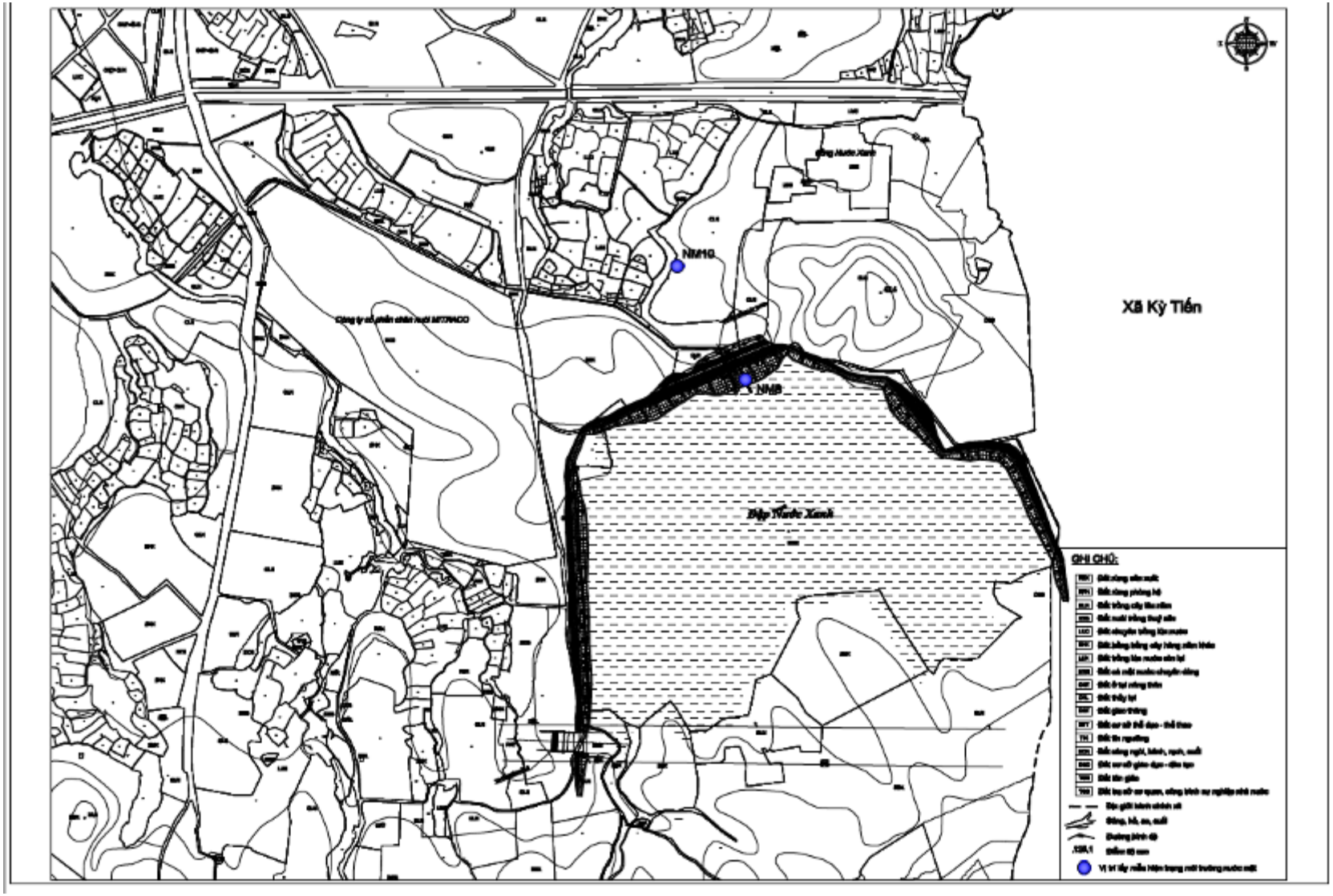


Dap Buom reservoir, Huong Tho commune, Vu Quang disitrict, Ha Tinh

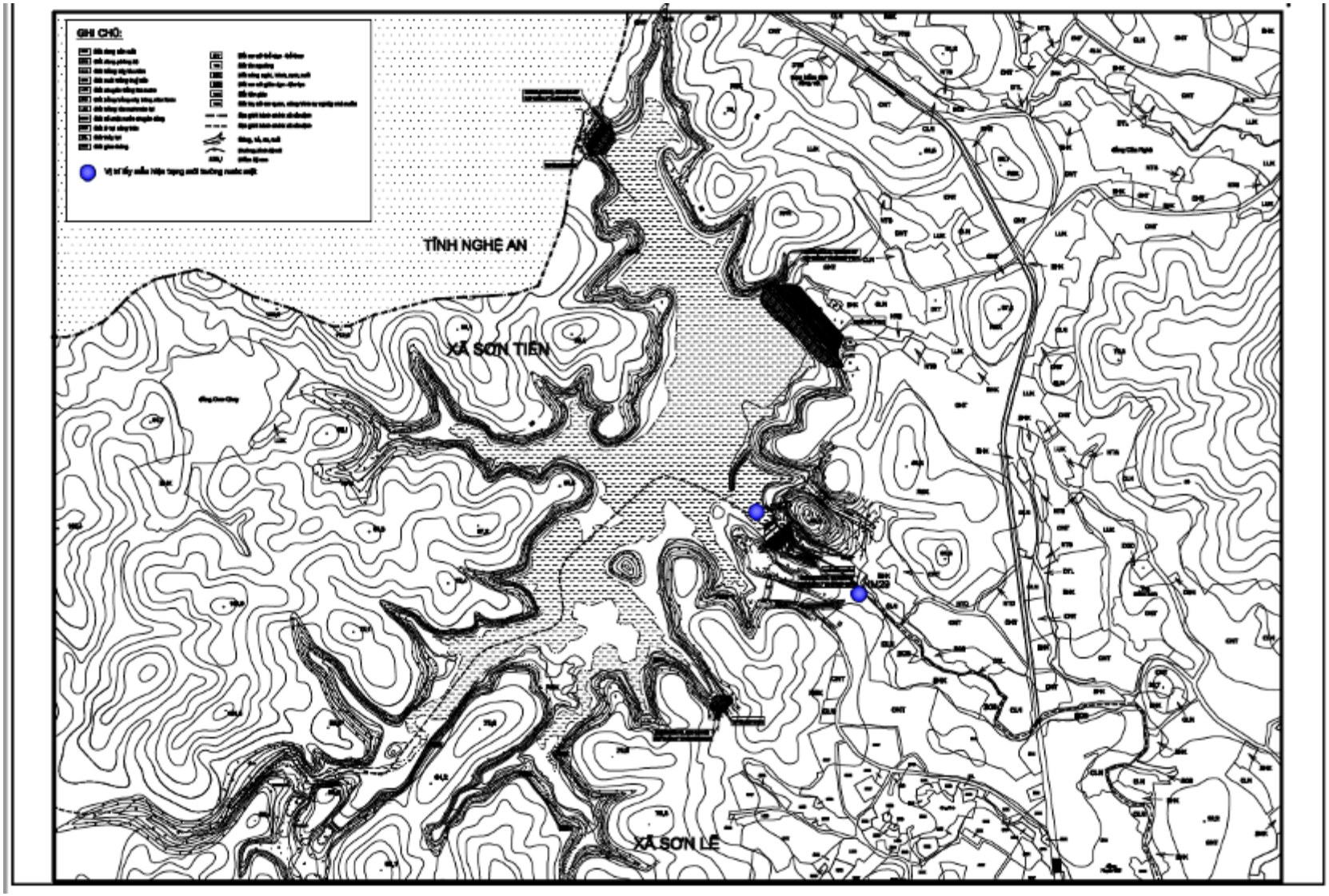
4. Diagram of environmental monitoring location during operation phase



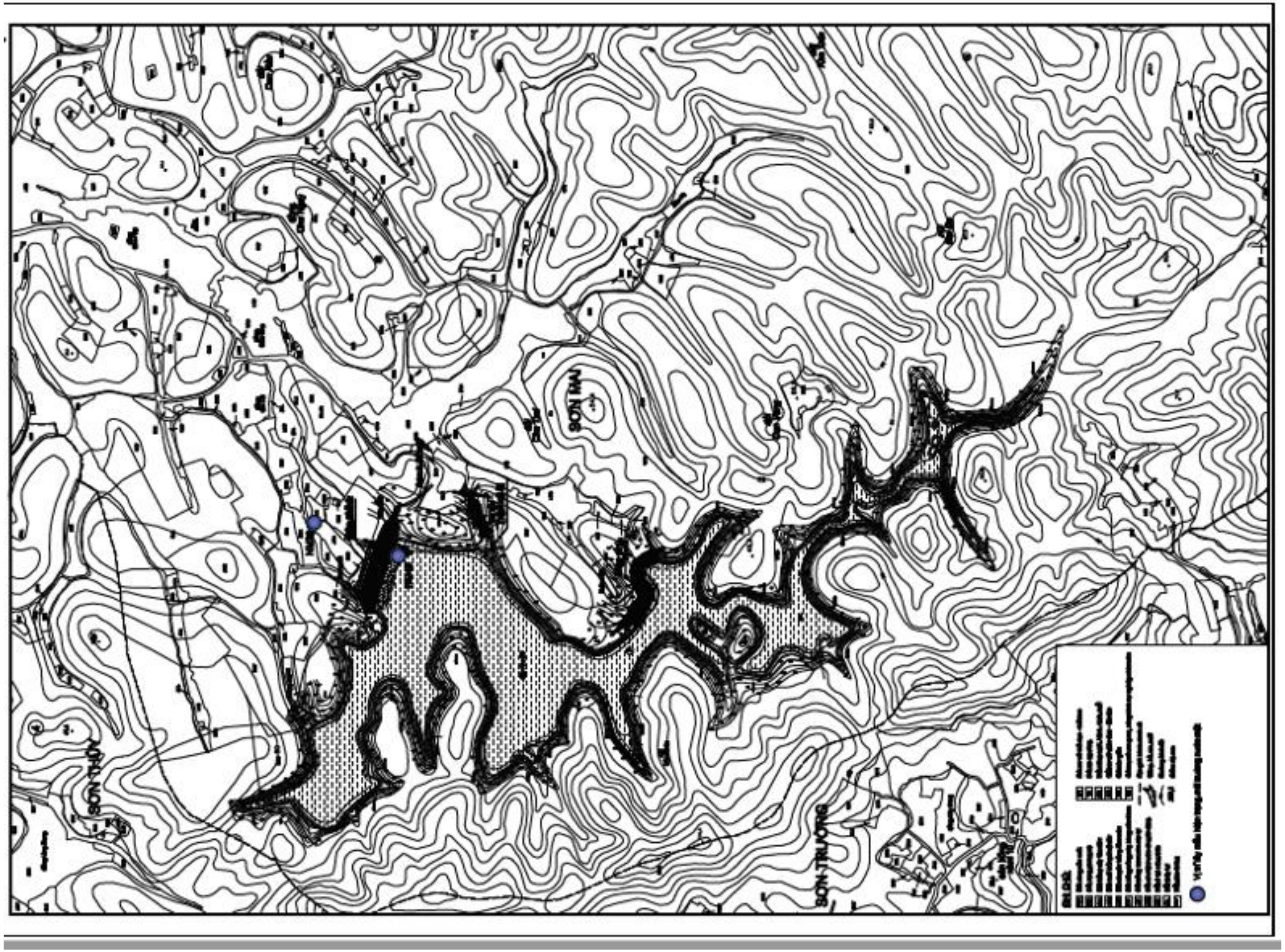
Loi Dong reservoir in Ky Trinh ward, Ky Anh town, Ha Tinh



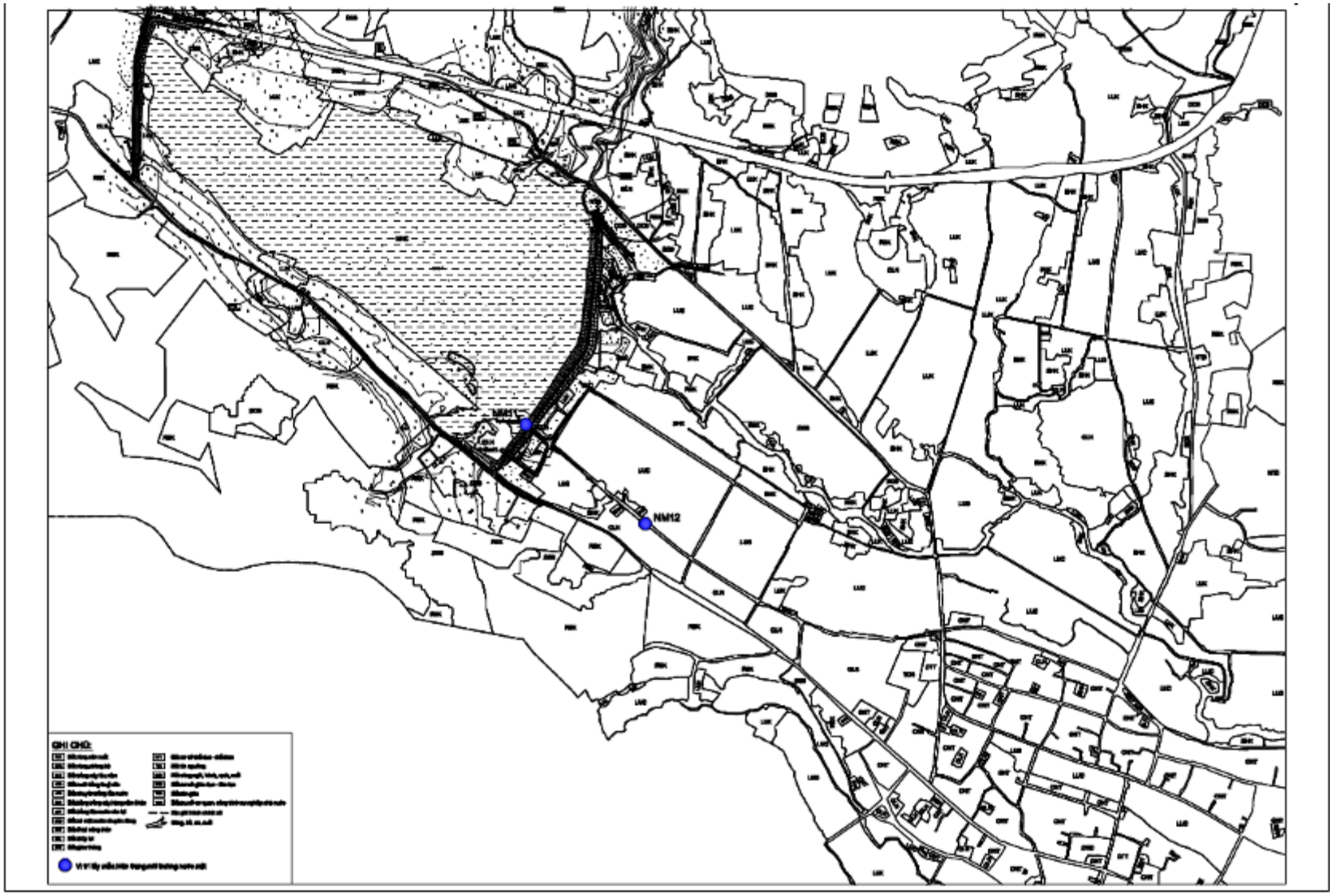
Nuoc Xanh reservoir, Ky Phong commune, Ky Anh disitrict, Ha Tinh



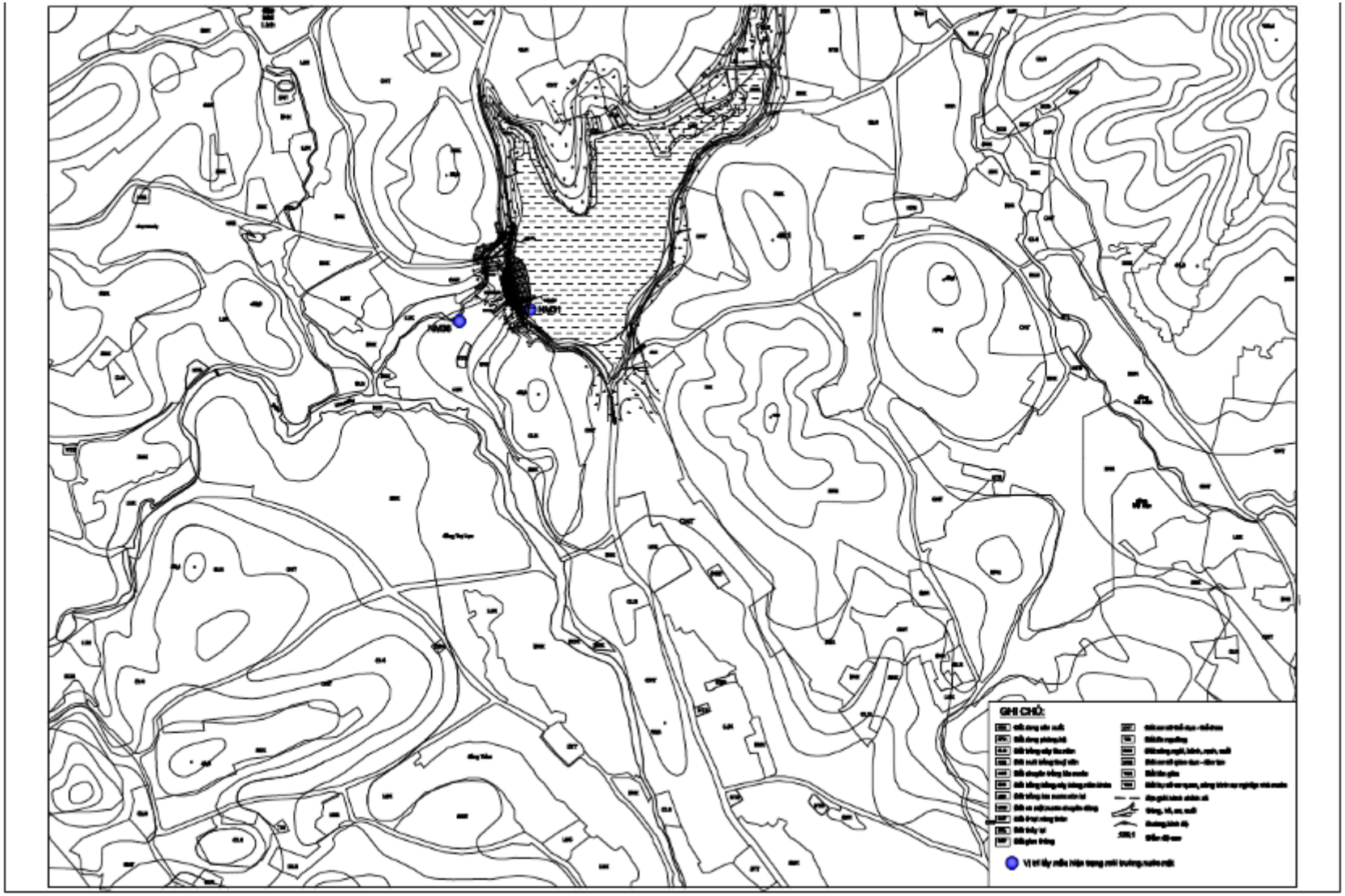
Khe Co reservoir, Son Le commune, Huong Son district, Ha Tinh



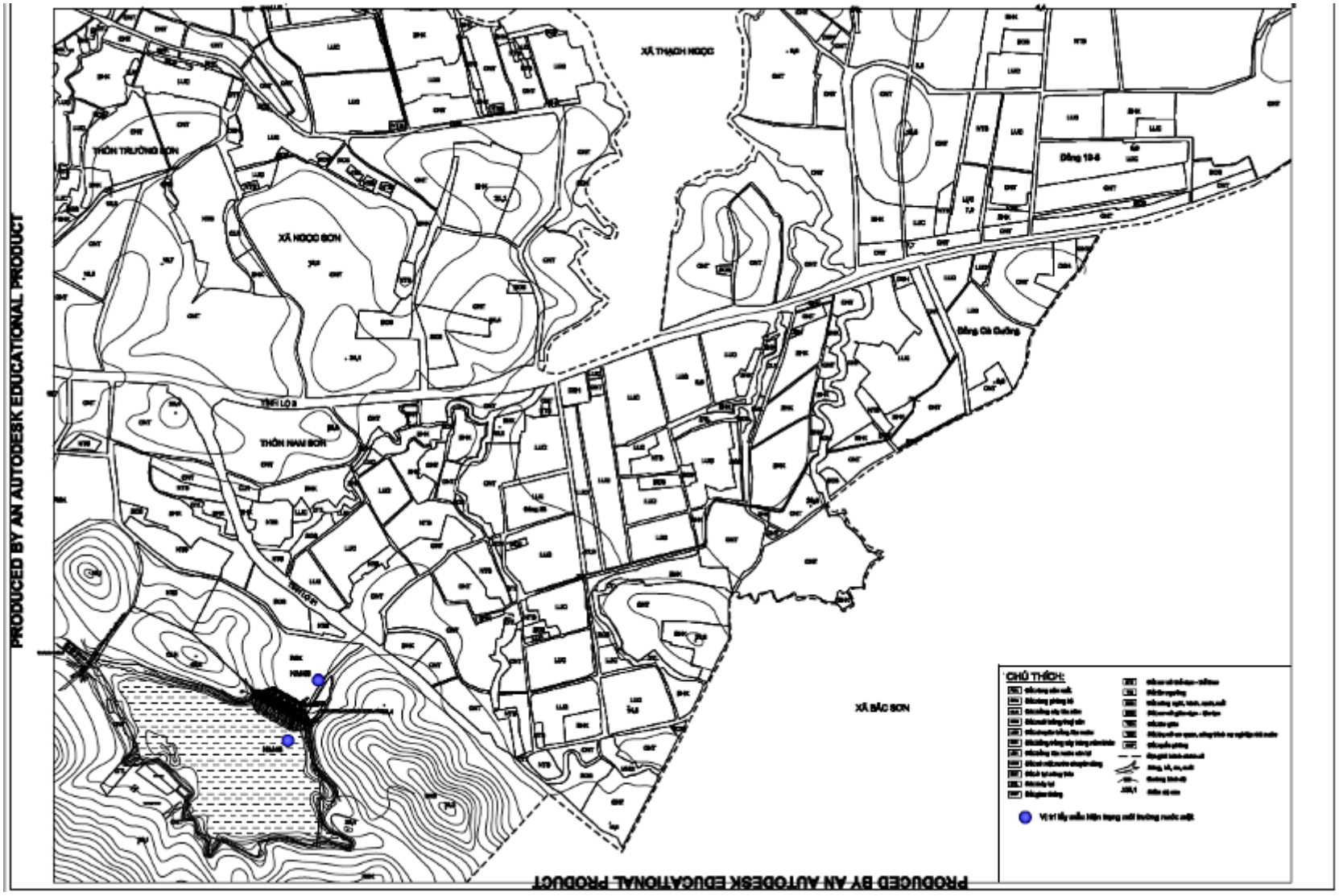
Khe De reservoir, Son Mai commune, Huong Son disitrict, Ha Tinh



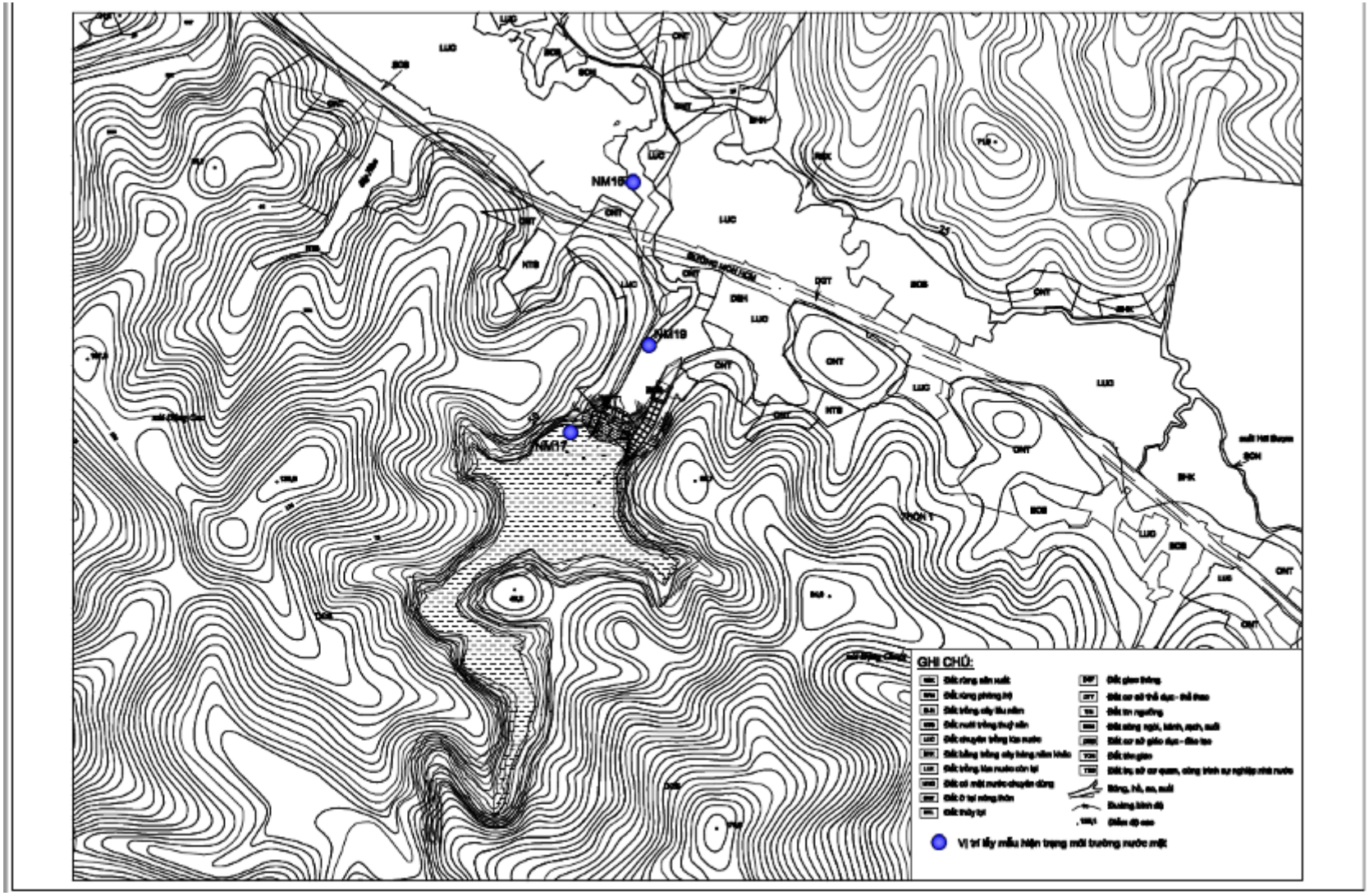
Ba Khe reservoir, Ky Bac comnune, Ky Anh district, Ha Tinh



Khe Nhay reservoir, Son Tiencommune, Huong Son disitrct, Ha Tinh



Da Den reservoir, Ngoc Son commune, Thach Ha district, Ha Tinh



Dap Buom reservoir, Huong Tho commune, Vu Quang disitrict, Ha Tinh

Appendix 2 - Analysis results of environmental samples

Table 1: Analysis results of surface water

Symbol	*Indicator (mg/l)*															
	pH	*DO*	*TSS*	*COD*	*BOD_5*	*NO_2^-*	*NO_3^-*	*NH_4^+*	*PO_4^{3-}*	*Cl^-*	*FeTS*	*Total lubricant*	*As*	*Pb*	*Cd*	*Coliform (MPN/100ml)*
I/ Analysis results of surface water in Loi Dong reservoir																
NM1	7.2	6.1	23	12	5.9	<0.01	0.16	0.31	0.01	8.6	0.15	<0.10	<0.003	0.001	<0.002	130
NM2	6.9	6.5	45	26	9.6	0.02	0.22	0.34	0.13	6.6	0.18	<0.10	<0.003	0.001	<0.002	355
NM3	7.0	5.5	78	13	5.0	0.10	0.20	1.08	0.36	5.3	0.26	<0.10	<0.003	0.002	<0.002	950
NM4	6.8	4.8	35	14	5.8	0.02	0.22	1.22	0.01	9.5	0.22	<0.10	<0.003	0.002	<0.002	1.100
NM5	7.1	6.2	28	16.	7.4	<0.10	0.18	0.25	0.01	9.1	0.37	<0.10	<0.003	0.001	<0.002	1.600
II/ Analysis results of surface water in Nuoc Xanh reservoir																
NM6	6.2	6.7	18	16	7.3	<0.01	0.16	<0.06	<0.01	<5.0	0.21	<0.10	<0.003	<0.002	<0.002	148
NM7	6.7	6.6	8.6	<10	4.6	<0.01	<0.10	<0.06	<0.01	<5.0	0.20	<0.10	<0.003	<0.002	<0.002	173
NM8	6.4	6.7	7.8	<10	3.7	<0.01	<0.10	<0.06	<0.01	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	84
NM9	6.8	6.2	14	12	5.2	<0.01	<0.10	<0.06	<0.01	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	117
NM10	6.7	6.6	9.8	12	7.2	<0.01	0.12	<0.06	<0.01	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	220
III/ Analysis results of surface water in Ba Khe reservoir																
NM11	6.8	6.7	9.6	<10	<3.0	<0.01	<0.10	<0.06	<0.01	7.0	<0.20	<0.10	<0.003	<0.002	<0.002	94

NM12	7.1	6.4	7.7	16	5.3	<0.01	0.15	<0.06	<0.01	6.3	<0.20	<0.10	<0.003	<0.002	<0.002	118
NM13	7.2	6.9	8.3	12	5.3	<0.01	<0.10	<0.06	0.01	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	170
NM14	6.8	6.6	11	12	4.8	<0.01	<0.10	<0.06	<0.01	7.7	0.23	<0.10	<0.003	<0.002	<0.002	132
NM15	6.7	6.4	18	20	13	<0.01	<0.10	<0.06	<0.01	8.4	<0.20	<0.10	<0.003	<0.002	<0.002	320
IV/ Analysis results of surface water in Dap Buom reservoir																
NM16	7.1	6.9	11	<10	3.7	<0.01	0.66	<0.06	<0.01	<5.0	0.45	<0.10	<0.003	<0.002	<0.002	174
NM17	7.3	6.4	14	20	9.3	<0.01	0.56	<0.06	<0.01	<5.0	<2.0	<0.10	<0.003	<0.002	<0.002	240
NM18	7.1	7.4	8.4	12	6.3	<0.01	1.2	<0.06	<0.01	<5.0	0.57	<0.10	<0.003	<0.002	<0.002	210
NM19	7.3	6.8	12	<10	3.8	<0.01	1.1	<0.06	<0.01	<5.0	0.69	<0.10	<0.003	<0.002	<0.002	160
NM20	7.1	7.1	13	<10	4.2	0.01	1.2	0.06	<0.01	<5.0	0.66	<0.10	<0.003	<0.002	<0.002	153
V/ Analysis results of surface water in Khe Co reservoir																
NM26	6.3	7.7	8.3	<10	3.7	<0.01	<0.10	<0.06	<0.01	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	260
NM27	6.4	7.5	11	16	7.5	<0.01	<0.10	0.93	<0.01	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	310
NM28	6.6	7.5	7.4	12	5.7	<0.01	<0.10	<0.01	<0.01	<5.0	0.23	<0.10	<0.003	<0.002	<0.002	150
NM29	6.7	6.4	9.6	<10	<3.0	<0.01	<0.10	<0.01	<0.01	<5.0	0.57	<0.10	<0.003	<0.002	<0.002	170
NM30	6.8	6.3	13	16	7.4	<0.01	<0.10	0.06	<0.01	<5.0	0.57	<0.10	<0.003	<0.002	<0.002	360
VI/ Analysis results of surface water in Khe Nhay reservoir																
NM31	6.3	7.0	8.8	16	7.3	<0.01	<0.10	<0.06	<0.01	<5.0	0.94	<0.10	<0.003	<0.002	<0.002	140
NM32	6.4	7.3	15	20	13	<0.01	<0.10	<0.06	<0.01	<5.0	0.94	<0.10	<0.003	<0.002	<0.002	260
NM33	6.7	7.1	13	16	8.3	<0.01	<0.10	<0.06	0.01	<5.0	0.94	<0.10	<0.003	<0.002	<0.002	210

NM34	6.5	6.4	7.9	20	11	<0.01	<0.10	<0.06	<0.01	<5.0	2.62	<0.10	<0.003	<0.002	<0.002	130
NM35	5.8	6.5	18	28	16	<0.01	<0.10	<0.06	<0.10	<5.0	4.2	<0.10	<0.003	<0.002	<0.002	530
VII/ Analysis results of surface water in Khe De reservoir																
NM36	5.1	7.3	14	12	4.7	<0.01	<0.10	9.0	<0.01	<5.0	0.24	<0.10	<0.003	<0.002	<0.002	184
NM37	5.3	7.4	8.5	<10	<3.0	<0.01	<0.10	<0.06	<0.01	<5.0	0.20	<0.10	<0.003	<0.002	<0.002	81
NM38	4.5	5.3	9.5	16	6.9	<0.01	<0.10	0.18	<0.01	<5.0	1.8	<0.10	<0.003	<0.002	<0.002	170
NM39	4.5	6.4	14	20	9.3	<0.01	<0.10	0.64	0.03	<5.0	3.4	<0.10	<0.003	<0.002	<0.002	280
NM40	4.9	7.3	9.6	12	5.5	<0.01	<0.10	<0.06	<0.01	<5.0	0.42	<0.10	<0.003	<0.002	<0.002	310
VIII/ Analysis results of surface water in Da Den reservoir																
NM46	7.0	7.1	8.0	27	13	<0.06	<0.10	<0.06	0.03	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	86
NM47	7.1	7.3	9.4	25	12	<0.06	<0.10	<0.06	0.02	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	150
NM48	6.8	7.1	8.9	<10	3.8	<0.06	<0.10	<0.06	0.02	<5.0	<0.20	<0.10	<0.003	<0.002	<0.002	240
NM49	5.6	4.6	12	<10	4.1	0.52	<0.10	0.52	0.02	<5.0	0.73	<0.10	<0.003	<0.002	<0.002	130
NM50	5.8	4.4	12	12	6.2	0.01	<0.10	0.51	0.02	<5.0	0.84	<0.10	<0.003	<0.002	<0.002	260

Note:

- Water quality of Khe De and Khe Co reservoir was compared with QCVN 08-MT:2015/BTNMT – National technical regulation on surface water. columnt A_2 – use of living purpose but must apply appropriate treatment technology or for purposes as type of B_1 and B_2 column;

- Other samples appying QCVN 08-MT:2015/BTNMT to evaluate - National technical regulation on surface water. B_1 column- use for irrigation or other purposes with similar requirement on water quality or for purposes the same as in B_2 column.

Table 2: Analysis results of ground water

Symbol	*Indicators (mg/l)*															
	pH	*TDS*	*COD_{KMnO4}*	*Hardness*	*NO_2^-*	*NO_3^-*	*NH_4^+*	*Mn*	SO_4^{2-}	*Cl^-*	*FeTS*	*As*	*Pb*	*Cd*	*Coliform (MPN/100ml)*	*E. Coli (MPN/100ml*
I	***Analysis results of ground water – Loi Dong work***															
NN1	6.1	85	3.6	22	<0.01	0.32	<0.06	<0.06	<5.0	15	<0.20	0.003	<0.002	<0.002	4	KPH
NN2	5.6	24	<2.0	10	<0.01	0.10	<0.06	0.08	<5.0	21	<0.20	<0.003	<0.002	<0.002	2	KPH
NN3	6.5	49	2.8	18	<0.01	0.14	<0.06	0.15	<5.0	11	<0.20	<0.003	<0.002	<0.002	2	KPH
II	***Analysis results of ground water –Nuoc Xanh work***															
NN4	5.8	30	<2.0	10	<0.01	0.10	<0.06	0.08	<5.0	12	<0.20	0.003	<0.002	<0.002	3	KPH
NN5	6.1	26	<2.0	10	<0.01	0.15	<0.06	0.11	<5.0	7.0	<0.20	<0.003	<0.002	<0.002	6	KPH
NN6	5.8	32	<2.0	12	<0.01	0.13	<0.06	0.09	<5.0	13	<0.20	<0.003	<0.002	<0.002	5	KPH
III	***Analysis results of ground water – Ba Khe work***															
NN7	5.8	25	<2.0	<5.0	<0.01	0.17	<0.06	0.08	<5.0	6.3	<0.20	<0.003	<0.002	<0.002	5	KPH
NN8	5.7	26	<2.0	<5.0	<0.01	0.13	<0.06	<0.06	<5.0	<5.0	<0.20	<0.003	<0.002	<0.002	2	KPH
NN9	6.2	47	<2.0	20	<0.01	<0.10	<0.06	0.09	<5.0	16	<0.20	<0.003	<0.002	<0.002	3	KPH
IV	***Analysis results of ground water – Dap Buom work***															
NN10	5.7	25	<2.0	14	<0.01	0.16	<0.06	0.06	<5.0	19	0.25	<0.003	<0.002	<0.002	2	KPH
NN11	5.6	24	<2.0	15	<0.01	0.22	<0.06	0.12	<5.0	30	<0.20	<0.003	<0.002	<0.002	6	KPH
NN12	5.6	24	<2.0	10	<0.01	0.88	<0.06	<0.06	<5.0	<5.0	0.43	<0.003	<0.002	<0.002	3	KPH

V	***Analysis results of ground water – Khe Co work***															
NN16	5.7	55	<2.0	20	<0.01	2.0	<0.06	<0.06	<5.0	7.0	<0.20	<0.003	<0.002	<0.002	6	KPH
NN17	4.8	13	<2.0	5.0	<0.01	0.17	<0.06	<0.06	<5.0	<5.0	0.21	<0.003	<0.002	<0.002	11	KPH
NN18	6.4	21	<2.0	10	<0.01	0.59	<0.06	<0.06	<5.0	<5.0	<0.20	<0.003	<0.002	<0.002	8	KPH
VI	***Analysis results of ground water – Khe Nhay work***															
NN19	6.0	130	2.4	22	<0.01	5.8	<0.06	0.09	<5.0	49	<0.20	<0.003	<0.002	<0.002	13	KPH
NN20	6.0	61	2.7	35	<0.01	0.12	<0.06	0.12	<5.0	<5.0	1.3	<0.003	<0.002	<0.002	2	KPH
NN21	6.1	60	2.4	33	<0.01	0.12	<0.06	0.12	<5.0	<5.0	1.5	<0.003	<0.002	<0.002	5	KPH
VII	***Analysis results of ground water – Khe De work***															
NN22	4.3	21	<2.0	5.0	<0.01	1.4	<0.06	0.16	<5.0	<5.0	0.22	<0.003	<0.002	<0.002	5	KPH
NN23	3.9	20	<2.0	5.0	<0.01	1.3	<0.06	<0.06	<5.0	<5.0	<0.20	<0.003	<0.002	<0.002	8	KPH
NN24	4.2	21	<2.0	24	<0.01	1.3	<0.06	<0.06	<5.0	<5.0	<0.20	<0.003	<0.002	<0.002	11	KPH
VIII	***Analysis results of ground water – Da Den work***															
NN28	7.5	37	<2.0	9.3	<0.01	0.63	0.6	<0.06	6.8	6.3	<0.20	<0.003	0.002	<0.002	2	KPH
NN29	6.0	37	2.1	23	<0.01	0.22	0.15	0.24	<5.0	<5.0	2.9	<0.003	0.003	<0.002	3	KPH
NN30	4.8	31	<2.0	5.0	<0.01	0.45	<0.06	0.11	<5.0	<5.0	<0.20	<0.003	0.002	<0.002	KPH	KPH

Note: Limited value QCVN 09-MT:2015/BTNMT – National technical regulation on ground water quality

Table 3: Analysis results of air environmet

Symbol	*Indicators*

	Vibration	*Noise*	*Total suspended particle*	*SO_2*	*NO_2*	*CO*
I/ Analysis results of air environment – Loi Dong work						
KK1	35	47.5	147	39	26	<3.000
KK2	41	33.6	115	28	14	<3.000
KK3	32	41.2	126	33	19	<3.000
II/ Analysis results of air environment – Nuoc Xanh work						
KK4	37	48.1	119	27	14	<3.000
KK5	33	54.1	132	40	21	<3.000
KK6	31	50.0	109	32	16	<3.000
III/ Analysis results of air environment – Ba Khe work						
KK7	32	50.6	132	36	17	<3.000
KK8	31	52.1	121	29	14	<3.000
KK9	34	52.6	115	24	16	<3.000
IV/ Analysis results of air environment – Dap Buom work						
KK10	30	49.7	95	21	13	<3.000
KK11	36	48.1	117	27	15	<3.000
KK12	31	53.1	124	23	18	<3.000
V/ Analysis results of air environment – Khe Co work						
KK16	33	54.4	117	26	13	<3.000
KK17	31	54	132	21	15	<3.000
KK18	35	53.1	138	27	19	<3.000
VI/ Analysis results of air environment – Khe Nhay work						

KK19	31	49.6	128	24	15	<3.000
KK20	34	50.7	142	32	18	<3.000
KK21	36	54.0	124	26	14	<3.000
VII/ Analysis results of air environment – Khe De work						
KK22	34	49.8	119	29	15	<3.000
KK23	38	53.2	136	35	18	<3.000
KK24	30	54.2	112	25	14	<3.000
VIII/ Analysis results of air environment – Da Den work						
KK28	33	55.6	138	32	18	<3.000
KK29	39	53.2	144	21	15	<3.000
KK30	38	54.0	127	23	14	<3.000

Note:
Limited value QCVN 05:2013/BTNMT – National technical regulation on ambient air quality;
.: QCVN 26:2010/BTNMT - National technical regulation on noise: Maximum permitable limit on noise in public area from 6 AM. to 21 PM.*
***: QCVN 27:2010/BTNMT - National technical regulation on vibration: Maximum permitable limit on vibration acceleration for normal area construction with a time of day from 6 AM. to 21 PM.*

Table 4: Analysis results of soil quality

Symbol	*Indicator*												
	pH_{KCl}	*Total organic matter (mg/100g soil)*	*Density*	*Proportion*	*Porosity (%)*	*Mechanical composition (%)*			*Cu (mg/kg dry soil)*	*Zn (mg/kg dry soil)*	*As (mg/kg dry soil)*	*Pb (mg/kg dry soil)*	*Cd (mg/kg dry soil)*
						Sand	*Lime*	*Clay*					
I/ Analysis results of soil quality – Loi Dong work													
MD1	5.2	1.36	0.95	2.51	62.15	77.14	11.92	10.04	21.6	44.7	0.82	11.5	0.18
MD2	5.3	1.02	1.25	2.76	54.71	76.26	10.05	9.69	18.3	35.8	0.56	8.7	0.15
MD3	5.0	1.15	1.09	2.56	57.42	80.16	12.67	7.08	24.0	51.5	0.75	13.5	0.26
II/ Analysis results of soil quality – Nuoc Xanh work													
MD4	5.3	1.23	0.95	2.45	61.22	83.46	15.64	0.90	19.4	52.7	0.68	12.7	0.22
MD5	5.1	1.16	1.18	2.66	70.68	78.56	4.85	16.59	20.5	42.8	0.73	14.1	0.36
MD6	5.4	1.33	1.05	2.52	66.27	82.46	6.64	10.90	22.3	54.7	0.57	11.8	0.21
III/ Analysis results of soil quality – Ba Khe work													
MD7	6.3	1.33	0.88	2.42	63.64	83.15	12.43	4.42	17.9	51.6	0.48	12.3	0.21
MD8	6.1	1.01	1.49	2.73	45.42	91.23	7.15	1.62	20.4	48.4	0.64	16.3	0.17
MD9	5.8	1.22	0.92	2.62	64.88	87.46	11.63	0.91	19.6	43.7	0.57	14.8	0.23
IV/ Analysis results of soil quality – Dap Buom work													
MD10	5.8	1.42	0.93	2.45	62.04	87.46	8.68	3.86	19.4	42.5	0.66	11.6	0.22

MD11	6.2	1.36	0.88	2.53	65.22	82.87	5.78	11.35	17.9	45.3	0.54	12.3	0.19
MD12	5.9	1.04	1.25	2.76	54.71	79.47	13.74	6.79	21.4	39.6	0.51	11.7	0.17
V/ Analysis results of soil quality – Khe Co work													
MD16	5.6	1.15	1.07	2.62	59.16	83.36	11.56	5.08	17.9	39.4	0.72	13.2	0.22
MD17	6.2	1.01	1.19	2.74	56.57	79.53	7.53	12.04	19.3	46.2	0.65	11.8	0.31
MD18	5.8	1.17	0.92	2.68	65.76	88.36	1.68	9.96	22.3	41.7	0.78	11.3	0.37
VI/ Analysis results of soil quality – Khe Nhay work													
MD19	6.3	1.02	1.23	2.75	55.27	79.53	9.63	10.84	17.9	42.6	0.53	14.2	0.13
MD20	6.1	1.32	0.89	2.52	64.68	73.78	19.63	6.59	20.5	51.6	0.78	11.6	0.21
MD21	5.8	1.14	0.99	2.64	62.50	88.53	5.36	6.11	21.2	46.2	0.67	13.5	0.18
VII/ Analysis results of soil quality – Khe De work													
MD22	6.1	1.32	0.98	2.57	61.87	83.36	7.47	9.17	16.8	42.5	0.46	13.5	0.24
MD23	5.7	1.26	1.09	2.59	57.92	79.63	11.63	5.74	24.1	46.6	0.66	11.2	0.21
MD24	5.9	1.03	1.14	2.73	58.24	84.36	2.63	13.01	18.5	52.8	0.57	9.6	0.36
VIII/ Analysis results of soil quality – Da Den work													
MD 28	5.7	1.13	0.97	2.63	63.12	85.46	11.64	2.90	18.9	41.5	0.62	11.3	0.18
MD29	6.0	1.57	0.83	2.57	67.70	92.57	2.74	4.69	21.5	44.7	0.83	13.4	0.25
MD30	5.3	1.84	0.79	2.44	67.62	79.53	17.53	2.94	20.6	43.8	0.73	8.3	0.15

Table 5: Analysis results of sludge samples

Symbol	*Indicators*										
	pH_{KCl}	*Total organic matter (mg/100 g soil)*	*Mechanical composition (%)*			*Cr (mg/100g dry soil)*	*As (mg/100g dry soil)*	*Pb (mg/100g dry soil)*	*Cd (mg/100g dry soil)*	*Cu (mg/100g dry soil)*	*Zn (mg/100g dry soil)*
			Sand	*Lime*	*Clay*						
I/ Analysis results of sludge samples – Loi Dong reservoir											
BD1	5.3	2.05	79.63	13.85	6.52	61.2	3.8	27.3	0.22	12.2	137
BD2	5.9	1.87	82.0	16.58	1.42	55.8	3.8	8.5	0.16	25.6	116
BD3	5.0	1.69	82.12	11.08	6.80	51.1	5.1	16.8	0.15	21.3	95
II/ Analysis results of sludge samples – Nuoc Xanh reservoir											
BD4	5.6	1.75	91.63	4.46	3.91	57.8	6.8	35.2	0.26	24.3	131
BD5	5.3	2.01	83.57	9.46	6.97	45.9	6.3	24.8	0.19	18.6	122
BD6	6.0	1.89	79.64	13.46	6.90	53.3	7.5	29.5	0.22	19.5	132
III/ Analysis results of sludge samples – Ba Khe reservoir											
BD7	5.6	2.07	78.5	6.38	15.08	65.4	3.4	19.4	0.18	21.6	107
BD8	6.3	2.54	83.66	11.43	4.91	59.5	7.2	10.5	0.22	20.7	116
BD9	5.8	2.41	73.78	10.74	15.48	10.5	6.8	11.3	0.17	22.5	102
IV/ Analysis results of sludge samples – Dao Buom reservoir											
BD10	5.7	<100	91.57	7.47	0.96	59.5	7.6	22.6	0.26	24.2	122

BD11	5.5	<100	84.74	4.68	10.58	64.2	6.5	21.6	0.14	17.9	116
BD12	5.8	<100	86.36	10.65	2.99	54.8	7.0	18.5	0.17	23.6	118
V/ Analysis results of sludge samples – Khe Co reservoir											
BD16	5.2	1.64	71.68	22.67	5.65	53.8	8.2	27.9	0.18	21.6	104
BD17	5.6	1.97	89.57	8.52	1.91	62.8	6.4	31.1	0.13	18.9	114
BD18	5.8	1.81	91.44	2.36	6.2	63.1	7.7	28.4	0.21	20.3	119
VI/ Analysis results of sludge samples – Khe Nhay reservoir											
BD19	5.6	2.38	74.85	17.75	7.40	61.6	7.4	29.5	0.16	24.2	113
BD20	5.3	2.16	90.52	8.53	0.95	60.7	6.6	32.6	0.13	21.7	124
BD21	5.7	2.10	76.94	16.74	6.32	62.1	7.0	31.7	0.18	19.6	116
VII/ Analysis results of sludge samples – Khe De reservoir											
BD22	5.7	1.50	76.84	16.74	6.42	66.4	8.1	32.6	0.18	25.2	126
BD23	5.4	2.08	82.47	4.47	13.06	61.7	6.5	29.5	0.26	17.8	166
BD24	6.1	1.62	90.36	8.63	1.01	58.4	7.7	31.2	0.30	23.4	143
VIII/ Analysis results of sludge samples – Da Den reservoir											
BD25	5.6	1.72	77.57	17.42	5.01	59.7	7.3	32.6	0.17	24.5	116
BD26	5.2	1.90	86.46	11.85	1.69	60.3	7.1	29.5	0.22	21.3	113
BD27	5.7	2.21	76.85	2.85	20.30	61.4	6.7	31.7	0.16	22.7	124

Note:

Limited value: QCVN 43:2012/BTNMT – National technical regulation on sediment quality.

Appendix 3- Integrated pest management plan (IPM)

1. Objectives

a. General objectives

Strengthening the plant protection at local level, reducing pesticide use in fields, improving the efficiency of pest prevention, management and application of plant protection chemicals to reduce the risks of pesticide contamination in the environment and on human health.

b. Specific objectives

- Strengthening environmental protection through strengthening the role of natural predators; reducing pesticide residues, reducing environmental pollution (on water, land, air);
- Improving farmers' knowledge: distinguish major and secondary pests; identify predators and their role in the field, clearly understand two side effect of pesticides, properly use and know how to survey pest and use control threshold, understand the application of pest control measures adopting IPM to increase income for farmers.

2. Basic principles of IPM plan

The following principles will be applied to the sub-projects:

1 "Prohibited list": As defined in the screening criteria in Environmental and social Management Framework (ESMF), the project will not finance the purchase of pesticides in large quantities and hence do not trigger OP4.09 as the project is aimed at repairing headwork to improve dam safety other than increasing the storage capacity and expanding the downstream irrigated area. However, if there is a serious infestation of pests in the region, the procurement, storage and transportation of pesticide will be subjected to the provisions of the Government. The list of banned pesticides will not be used and circulated.

2 The project will apply IPM programs as a method to minimize the potential negative impact of the increased use of fertilizers and chemicals.

3 In normal conditions, if pesticide use is considered to be a necessary option, only pesticides registered with the government and the international recognition in use and project will also provide technical and economic information for chemicals use demand. The use and management of non-harmful chemicals should be considered to reduce the reliance on pesticides. Measures will be incorporated into the project design to reduce risks related to the handling and use of pesticides to allowable level and to be managed by users.

3. The approach of IPM

Focus more on the risks of plant protection chemcical overuse. Such important crops as rice, vegetables, etc. are those in higher need of pesticides.

Focus on awareness raising and capacity building for trainer/facilitators of IPM. The training program will be enriched with the integration of many activities such as System Rice Intensification (System Rice Intensification - SRI), minimum tillage, community producing

and using bio-products in place of plant protection chemicals, training activities and applications for duplication on wider scale.

For this activity, following steps should be carried out:

- Step 1: Identify training needs of the application of restriction and management measures for plant chemicals. Consultation with key agencies on the organization of training courses and registration of farmers' participation in these trainings;
- Step 2: Develop work plan and schedule including budgeting and implementation targets. The work plan will be approved by PMU and will be carried out by provincial Department of Plant Protection either independently or to be integrated in current local programs.
- Step 3: Implement and carry out annual review. After the approval of the work plan, activities will be implemented. Implementation progress will be included in the project progress reports. An annual evaluation report will be implemented by PMU and Sub-Department of Plant Protection.

4. The contents of the sub-projects

(i) Collection of information and selection of solutions

Before implementing IPM program, Consultants must carry out initial investigation to get necessary information, including:

- Survey to collect data on: staple crops have economic significance in the project area: seeds, crop, growth characteristics, and farming techniques.
- Survey to collect data on soil conditions, pedology, local climate.
- Investigate the situation of major pests, operating rules, economic damages caused to major crops in the project area.
- Investigate role and components of natural enemies parasitic of pests on major crops in the project area.
- Investigate the actual situation of pest control measures, pesticide use and their effects in the locality.
- Investigate socio-economic conditions, income, technical knowledge, and practices.

On the basis of these findings, evaluate IPM measures which will be applied on specific crops in regions and localities as follows:

- Cultivation methods: land preparation, field cleaning, cropping rotation, intercropping, suitable cropping seasons, reasonable sowing and planting density, rational use of fertilizers; appropriate caring measures.
- Using seed: the traditional seed varieties and proposed seed varieties for use.
- Biological measures: taking advantage of available natural enemies in the field, using biological products.
- Determine the harmful level and prevention threshold.

- Chemical measures: make sure the safe application of chemicals on natural enemies, adopting economic threshold; 4 correct uses of pesticides.

(ii) Training of IPM staff/trainers

TOT (Training of trainers) and Farmer Field School (FFS):

- Each sub-project will organize IPM training workshops. The contents of the training workshops are as follows:
  - Distinguish major and secondary pests.
  - Identify natural enemies of pests and diseases in the field.
  - Investigate methods to detect worms and diseases.
  - Understand impact of two side effects of pesticides and know how to use pesticides properly
  - Pest control techniques under IPM principles.
  - Advanced farming techniques.
- Trainees : The technical staff of the Department of Agriculture, Sub-department of Plant Protection, Agricultural Extension of districts, communes, and cooperatives. These trainees will train farmers in the project area and guide the implementation of models.
- The size of each class is 20 to 30 trainees and classes are held in communes. Training time can be by period and by topics. Each training course may last for 3-5 days including both theory and practice.
- Lecturer: experts are hired from University/Research institute/Agricultural Extension Centers...

(iii) Coaching and training of farmers

Training of Farmers (TOF) in Farmer Field School (FFS):

- Method: Combine theoretical training and base on practical fields of farmers and demonstration model on IMP in pilot fields.
- Training contents are the same as IMP ToT training.
- Participants: farmers in the project areas, farmers directly implement models and farmers outside the sub-project area if they are interested.
- Classes are organized in each commune.
- Lecturer: trained trainers from TOT courses.

(iv) Evaluate and visits to fields applying farmer based IPM models

Visit the coast conference, farmers performing the demonstration models are reporters. The farmers implement the model directly with the participants; visiting farmers will calculate, compare economic performance and identify lessons, limitations and the work being done and not being done

Organize a field based visit, farmers who involved in demonstration models are also the reporters and they will together with other farmers to visit, calculate, compare economic efficiency, draw lessons and challenges to be overcome.

5. Expected results

- Capacity of Thach Ha, Ky Anh, Vu Quang, Huong Son PPDs and farmer trainers are improved after IPM training and IPM practices will be maintained.
- Support farmer groups following IPM training courses in the application of training knowledge to make sure safe production and say no to the overuse of plant protection chemicals and disseminate the knowledge among communities.
- Support local governments in the reinforcement of pesticide management including the implementation and enforcement of legislations controlling plant protection products.

6. Implementation of IPM programs

Currently, Vietnam is implementing the national IPM program, so sub-projects requires coordinated planning and integration of the IPM program of the project in the National IPM program for more effective performance within each sub-project.

- Ha Tinh Project Management Unit PPMU:
  - Developing and organizing the implementation of IPM program.
  - Responsible for the preparation of periodic reports on the UPM implementation and submitting to CPO and WB. Final plan and budget will be completed and consulted with the CPO. All documents will be stored in the project profiles.
- Ha Tinh Sub-Department of Plant Protection:
  - Provide policy and technical guidelines for the implementation of the IPM program.
  - Participate in ToT IPM training courses.
- Thach Ha, Ky Anh, Vu Quang, Huong Son Plant Protection Stations
  - Coordinate with IPM staff to implement farmer training courses on IPM through the provision of knowledge and supports to safe use of pesticides when necessary.
  - Introduce the list of banned pesticides
  - Examine the distribution facilities selling pesticides to ensure safe pesticides are sold to farmers
- PPCs in the subproject area:

Maintain the success of IPM training courses by organizing diversified IPM clubs of farmers at different organizational levels and structures management (integrating livestock, credit, market access contents etc.)

- Households in the project area:

Implementing measures to reduce the use of plant protection chemicals, applying IPM as trained.

Members of the IPM club support each other in agriculture developments. They also play a central role in the organization of community based IPM program and agricultural development planning at commune and district levels.

- Environmental Safety Monitoring Consultant:
  - Monitoring the implementation of IPM program of sub-projects;
  - Guides PPMU in the implementation of IPM program;
  - Recommend measures to improve the efficiency of IPM program of sub-projects.

7. Funds for the implementation of IPM program

Cost estimates of IPM program in sub-projects as follows:

- ToT IPM training: Calculated for the classes held in each district = unit price x number of district of each sub-project.
- ToF IPM training: Calculated for the organization of class in each commune = unit price x number of commune in each sub-project.
- Cost of organizing evaluation and study visits to fields applying farmer based IPM models. Study visits to fields is 1 day for 1 commune.

Appendix 4- Emergency preparedness plan (EPP)

1. Overview of emergency preparedness plan

The existence of large dams and reservoirs at the upstream of the residential areas requires the preparation of an Emergency Preparedness Plan (EPP) relating to the professional for each dam. The purpose of the emergency preparedness Plan aims to assist the authorities responsible for public safety issues in order to take the proper and necessary measures for preventing injury and minimizing material damages by the accidents predicted in case of occurring the dam failures.

Each dam, reservoir and risk-containing areas have its own characteristics, and so each Emergency Preparedness Plan shall be prepared taking into account the specific conditions of such work. However, there are some general issues need to be mentioned for each work in need of the emergency preparedness Plan.

So far, the Consultant has yet to determine the guidelines of Vietnam on the issue of the requirements for the preparation of emergency preparedness Plan or the directives such as the responsibilities relating to the preparation and implementation of emergency preparedness Plan shall be handed over to anyone.

Finally, a sample estimation for making the emergency preparedness Plan has also been formulated. It is more difficult to determine the problem of benefit. Generally, it should be considered that if the dam safety management is better and the emergency preparedness Plan is made for all existing dams, the average number of accidents caused by the floods shall be reduced.

2. General requirements for emergency preparedness plan

To turn an emergency preparedness Plan into a useful tool for prevention of disasters and mitigation of disasters, it is necessary to have the certain legal tools in order to allow the relevant authorities responsible for the formulation and implementation of emergency preparedness Plans to implement their necessary powers. These powers shall be decentralized and specified for the urgent conditions relating to legislation. If the current law is proved to be insufficient for this purpose, it is necessary to consider the adjustment of the legal framework.

In principle, the organizations responsible for the management and the operation and maintenance of a certain dam shall also have the primary responsibility for making the emergency preparedness Plan. These organizations should have the reasonable knowledge relating to the risks associated with dams and reservoirs of a certain work. In case of project for supporting the water resources of Vietnam, the hydraulic works management and exploitation Companies shall take primary responsibility for the formulation and implementation of emergency preparedness Plans for each certain work .

The provincial People’s Committees, where the dams are located in, shall be able to play a supervisory role. Other relevant authorities can also be entrusted to set out the rules and regulations, and to make, implement, inspect and promote the emergency preparedness Plans.

The preparation of an emergency preparedness Plan in detail for a dam and reservoir requires the proper maps, data relating to river, dam, topography, hydrology, rural and urban infrastructure, population and the physical assets at risk, etc.as well as the special skills and

computer programs to assess the potential impacts of various risk scenarios. These tools are not available in the hydraulic works management and exploitation Companies and before making the emergency preparedness Plans of such Companies, it is necessary to have a certain investment and extensive preparation. There are many methods for dealing with this issue, and they can support the hydraulic works management and exploitation Companies through the National Dam Safety Authority expected or relevant professional Consultants or institutes.

Since there is no (extensive) emergency preparedness Plan for most of the dams and reservoirs, the costs related to the preparation and implementation of emergency preparedness Plans funded by the budget have not been allocated.

If additional resources for the budget cannot be from the people, then it is predicted that the relevant authorities shall take advantage as much as possible the existing resources such as human resources, equipment and telecommunication and communication devices etc. This would require a very detailed plan and the close coordination among the telecommunication and communication actions.

The emergency preparedness Plan should be updated annually and submitted to the Provincial People's Committee for approval.

3. The emergency preparedness plan for 8 reservoirs

Downstream of the upgraded reservoirs in the project area are crowded residential areas and cultivated areas of high economic value. These will be severely impacted areas within the extreme frontier. According to the report of the management unit, due to sedimentation, the blockage caused by vegetation as well as the activities of people led to heavy flooding when the flood drainage capacity is smaller than the design. Damage to these reservoirs could result in major damage to people and facilities, so an emergency preparedness plan is needed for the eight reservoirs.

4. Overview

After completion, the work is expected to hand over to the company of irrigation work management and use for management, this company is responsible for preparing the emergency preparedness Plan for the relevant dams and reservoirs. The emergency preparedness Plan must be prepared on the basis of close cooperation with the provincial authorities responsible for flood prevention, and shall be submitted the Provincial People's Committee for approval. This plan must be updated and the submitted for approval once a year before the flood season.

An outline of the emergency preparedness Plan, with its form is the list of items to be checked with a series of headers relating to the Emergency Preparedness Plan and the actions required. The list of items to be checked can be used for making the emergency preparedness Plan in the future. In general, the following main activities are particularly noticeable upon making (emergency) plans for potential problems of dam.

5. Strengthen supervision of the IMC

The Emergency Preparedness Plan should be started with the detailed guidelines on monitoring the dam and ancillary works of the IMC's employees, especially the monitoring in

the periods of extreme rain in the basin or in the case of the reservoir water level rising. The guidelines should detail the special points in need of observe, especially in the case of rapidly rising the reservoir water level. The work of monitoring consist of the regular observe of seepage along the dam heel and in any position along the dam in the place where is expected that the seepage shall only occur upon the high reservoir water level. Depending on the number of parameters, for example:

- The heavy and widespread rainfall in the basin for a prolonged period;

- The rainfall in the basin of water collected in a short period;

- The water level of the reservoir and the rising of water level in the reservoir;

- The increase of seepage; or

- The cloudy seepage in the downstream slope or at the dam heel;

- The movement of the dam crest and the downstream of dam.

The IMC should calculate a reasonable alarming level in more detail, and adjust according to the actual situation.

6. Definitions and notice of alarming level

For each alarming level or a specific situation, it is necessary to initiate the measures that would be widely deployed in the future when the conditions become deteriorated and the situation becomes more serious. These measures shall start with the internal information of the IMC, and increase in terms of intensity along with increase of the severity of the situation, for example:

- The IMC must be continuously informed;

- Suspend the annual leave of a certain number of staff of the IMC;

- Police and local rescue forces must be in alarming condition;

- Some certain staff and operators with the devices transferred to the dam or other locations;

- Notify through local media and radio stations;

- The officials of Provincial People Committee, the military, the public work department and other departments must be in alarming condition, and must be instructed;

- Mobilize support units (firefighting forces, the army, the Red Cross) and equipment;

- Public information and ensure that everyone is informed;

- Block some certain routes, stop or strengthen bus and train;

- Mobilize helicopters, boats and other transport equipment;

- Prepare shelter;

- Request removal for the most dangerous areas;

- Request the entire removal;

- Notify the emergency situation.

The alarming level should be clearly defined, and the definition should be distributed to all staff and agencies concerned immediately after the approval of emergency preparedness Plan. The people need to be fully aware of the alarming levels which shall be clearly informed to them by sirens or similar things. After consulted by the local authorities, the IMC shall be guided to achieve the best results for alarming people.

7. Data collection

To establish an emergency preparedness plan, firstly the hydraulic work management and irrigation management company require detailed maps of the entire region which can be affected. The buildings, roads, bridges, high and low areas, dam banks, canals, etc. must be presented on the map. Especially for the preparation of dam failure analysis, it is necessary to have the detailed information, including cross section of the river basin, the main obstacles for the progress of a flood wave in the flow of the river or the mudflats, sunken areas can temporarily act as reservoirs, dykes, water dividing roads, ditches, creeks and other topographical factors which can affect flood wave. The terrain maps must extend beyond the project area in order to determine the approach road and areas and works (such as schools and community halls) which can be used as a place for shelter and a place of relocation for the victims of the flood. The hospitals near the flooded areas must be identified and be informed on the tasks which they may have in the event of injury from broken dam problem.

8. Dam failure analysis

It is necessary to conduct a dam failure analysis to map the boundaries of the area may be affected by the flood. The analysis is recommended to conduct many different conditions such as assumption of the normal water level, the full reservoir water level with maximum flood load, a quickly open hole in the dam body, a lot of preliminary cases such as an alluvial flooded, and the relatively dry conditions, high surface water flows at the same time from the river tributaries in the downstream.

Moreover, the computer programs, upon analyzing dam failure, can be run on multi coefficient of roughness and possible measures to reduce or otherwise affect flood conditions in some certain locations such as decrease of flooding speed near the residential areas, or lifting to the roads to access or exit some certain areas.

The impact of the obstacles in the flow of a river or mudflats should also be evaluated in the regulatory view to limit the flooding level on the river, not only in the catastrophic cases but also for ‘‘normal’’ extreme point floods. The implementation of most possible measures to minimize the impact of extreme point flood discharge cannot be conducted in the short term, it must be used as tools for planning and policy for the river basin in the future, or it must be gradually implemented.

9. Flooding map

Dam failure analysis must identify clearly the most dangerous areas in case of occurring disaster. Results of the analysis shall be presented on the flooding maps, describe the possible depth, flood velocity (as a sign of potentially dangerous conditions), the progression of waves interrupted in the basin, and mention the time for salvage activity.

When a preliminary dam failure analysis may briefly indicate above mentioned flooding parameters, sooner or later the dam failure analysis shall be upgraded under the same relevant and better conditions. Especially the influence of the embankment (slightly) improved which is used for road, railway, irrigation canal, flood prevention, sediment piles along the canal, is also notable. In such locations, the maximum flood velocity can also increase making it impossible to access the embankment or the roads and causing the landslides destroying a part or whole of this embankments. A network of high obstacles in sunken areas may divert flood flows and cause more serious conditions at the locations where these conditions are not desired.

The flooding maps for selected conditions must be available to submit to the important agencies relating to the physical planning of the area, and submit to the relevant authorities relating to the salvage activities if possible (province, city, police, firefighting, hospital, military, etc.). Such maps need to be updated and redistributed in cases of determining the conditions with the important changes. Number of agencies and organizations receive such maps (and other information) depend on the severity of the conditions, and generally depend on the water collecting function of the reservoirs, the dam height and areas directly affected.

10. Organizational issues

Although the IMC shall be responsible for preparing and maintaining an emergency preparedness Plan, most of the activities after a catastrophic event shall be carried out by other agencies and organizations. The task of the IMC for the dams and reservoirs is that preventing the critical situations. It is assumed occurrence of emergency case, the IMC shall take all primary measures possible to avoid a disaster. As long as the conditions become more serious, the IMC should not wait for being warned and assigned by the higher levels. In case of occurring those conditions, it is necessary to clearly define the person who is responsible for their own job. A detailed plan with an extended information system must be continuously sustained until occurrence of disaster.

Firstly the IMC must prepare an Emergency Preparedness Plan for the internal purposes in the flood conditions and in case where the expression of the dam shall require more attention. The internal organization of the IMC shall immediately deal with at the first alarming level, and inform higher authorities about the concerns and the consequences in case of occurrence.

In the next alarming higher level, it is possible to need the support of other organizations, and a responsibility can be transferred to such organizations. For these cases, it is necessary to have a detailed planning, and the information shall be ready for the necessary actions. It is necessary to be aware that in the bad weather condition, there would have no electricity, the roads can be flooded, the telephone line can be damaged, and the publication of print, photocopy of maps and planning documents or other directives cannot be implemented.

When the situation become serious, the functional authority of the province shall implement all their responsibilities, and shall need to be provided the plan for the actions to be implemented, which were established in the previous stage. These plans should include organizational issues for emergency activities expected, and should state clearly the responsible lines and communication for all activities and actions decentralized (but well-coordinated), depending on the specific situation.

The competent authority under the emergency preparedness Plan responsible for a number of activities and certain inputs in any alarming phase should be fully informed for any changes of the emergency preparedness Plan. And similar to the organizations designated to support activities such as means of transportation, equipment, material resources and other inputs required in the case of occurring disaster.

11. Procedures

In the lowest alarming level, the relatively simple internal application procedure of the IMC shall remain in effect as action procedure for the monitor and management of dam and ancillary works. When the situation become worse, and the next alarming level starts, the normal operating procedure of the IMC shall be supplemented and replaced by a new procedure focusing on the implementation of the emergency preparedness Plan.

The management guidelines of main dam shall be valid, and the dam management shall be implemented by the experts of the IMC as specified in the procedure of the IMC for that year. Other agencies have no right to make temporary decision where spillway gate or other inlet or outlet gates shall be opened or not.

The procedure for the higher alarming level shall transfer the entire responsibility for the implementation of emergency preparedness Plan to the higher authority levels (preferably PPC). These procedures shall be clearly allocated for the responsibility and the right for the certain agencies with the cooperation or support of emergency activities.

The emergency preparedness Plan should include the clear organization plans for easily following the levels of emergency activities. These plans should also include the main telecommunication and communication lines and procedures in need of following for some certain activities, for example requesting the central government to help and requesting the military forces for more support.

In case where the situation become deteriorated, and the displacement becomes the only option, the area to be relocated shall be protected by the police or other armed forces. The emergency preparedness Plan also proposes some provisions for these conditions, and they shall be discussed with the executive agencies which are responsible for maintaining order and rules. The last provisions should include arrangements for taking the necessary forces (such as the red cross society and similar forces) to the higher residential area in the heart of flooded areas.

12. Communication

Communication is a vital part of any emergency plan. In the very special conditions, most of the means of communication can be damaged. The emergency preparedness Plan should take into account this fact, and identify the means of communication that can be used in the emergency conditions.

The normal telephone lines and mobile phones cannot be used in extremely emergency conditions. The communication via radio can solve somehow of the problem. In this regard, the mobilization of police and the armed forces involved in making emergency preparedness Plan is vital.

First of all, the communications between the field of dam and the headquarters of the IMC must be ensured safety. These communication lines must be active at all times, and the information about the water level of reservoir can be read at the IMC's headquarters at any time. During the regular dam inspections, the dam safety inspector must pay attention to the means of communication established for each dam (or saddle dam).

Secondly, the communication with higher levels should be well structured. When the dam's situation become deteriorated, and when the responsibilities are beyond the capacity of the IMC, a higher authority must be able to smoothly receive the responsibilities (or part) and continue to cooperate in the implementation of the emergency preparedness Plan. In such situation, the means of communication are in need of capacity of receiving multiple incoming calls.

The contacts and communication procedures must be clearly and fully documented. All agencies, where have primary responsibility for making emergency plan, shall be received a copy of these procedures as well as the directives and supporting guidance.

13. The training and exercise of emergency preparedness plan

An emergency preparedness Plan shall include the training and exercise of a selected number of components in the emergency preparedness Plan. It is best to have a need analysis as the basis for the program. The exercise program must be prepared in conjunction with other relevant agencies. The training and exercise shall focus on the components that the parties concerned are not familiar.

14. The participation and information of community

The main beneficiaries of the emergency preparedness plan are the general population who can be affected by the risks of an incident which can occur on the dam. In order to achieve their full cooperation, then the raising of public awareness and support received from the public are essential.

The emergency preparedness Plan must mention the issue of public awareness as an important content, because of the lack of public awareness and support and involvement of the public, all emergency preparedness Plans shall become useless.

After established and approved the draft of the emergency preparedness Plan by the Provincial People's Committee, the public must be informed about the characteristics of the dam, the risks can occur, the measures are implemented and plans are prepared to avoid the negative impacts or mitigate the consequences. For this purpose, the types of information shall be conveyed to the public through the media such as posters and informing to the students, information on Televisions, announcing in the local newspapers and other mass media.

15. Legislation

After all the plans are established, it is necessary to analyze whether the proposed measures have been backed by a full legal framework or not. In case where the legal system is somehow defective, requesting the competent authority to immediately start adjusting the current law in order to allow the implementation of essential measures. The legislation shall

give the authority with the rights to take necessary measures in order to deal with the emergency conditions.

16. Reporting

The emergency preparedness Plan should also include requirements for annual report on its objectives, the process of implementation and the problems encountered. The People's Committee of the provinces and the Ministry of Agriculture and Rural Development need this information to be able to identify what is a common problem to be solved, and learn from the hydraulic work management and exploitation Companies. The experience gained is to draw in an adjusted approach for the problem of establish and implementation of the emergency preparedness plans.

Annual report should be brief and include:

- Plans of the previous year;

- Training and practice have been carried out, results and recommendations for upgrading and improvements;

- Adjustments required for the emergency preparedness Plan of next year;

- Training program for next year;

- Information and data changed;

- Finalization of the budget of the previous year and the budget of the following year.

17. Estimation relating to the emergency preparedness plan

A series of actions and requirements determined above need an estimated budget and allocated approximately one year before the planned activities are implemented in practice.

The degree of costs depends on many conditions. Apart of the costs can be covered from the operating expenses of the IMCs but others may need to be covered by the budget as well as additional funding, and must be allocated specifically for the establishment and implementation of emergency preparedness Plans. The specific costs related to an emergency preparedness Plan include the following items:

- Public information materials;

- Computers, softwares for dam failure analysis;

-The printed materials, instructions, reports, flooding maps, and other materials;

- Means of enhancing communication (telephone, radio);

- Additional transport costs;

- The costs related to the implementation of training and exercise.

- Costs are summarized in the table below:

Table 1. Estimation of EPP for 5 years

Year	Basic cost (million VND)	Human resources cost	Cost of office operation	Total cost (million VND)

		(million VND)	(million VND)	
1	50	120	30	200
2	20	120	30	170
3	5	120	30	155
4	5	120	30	155
5	5	120	30	155
Total	**85**	**500**	**150**	**635**

These costs as mentioned above do not include costs for local consultants, because it is not clearly known that the local consultants shall provide services to which extent through this project component or not.

Appendix 5 – Technical parameters of the works

Table 1: Technical parameters before and after the repair of Loi Dong reservoir

Technical parameters	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*
1. ***Reservoirs***			
- Catchment area	Km^2	1.15	1.15
- Dead Water Level	m	+7.54	+7.54
- Full supply level	m	+11.75	+11.75
- Surcharged water level (MNDGC)	m	+12.58	+12.79
- Dead storage capacity	10^6 m^3	0.036	0.065
- Useful storage capacity	10^6 m^3	0.385	0.365
- Super high storage capacity	10^6 m^3	0.530	0.555
2. Earthen dam:			
- Dam crest elevation	m	+(13.10 ÷13.30)	+13.80
- Wave wall crest elevation	m	-	+14.50
- Highest dam height	m	12.0	13.0
- Dam surface width	m	2.6 ÷ 3.1	5.0
- Total dam length	m	825	793
3. Flood spillway (upgraded)			
- Form, structure		Wide crest, stone masonry	Ophicerop spillway, reinforced concrete
- Spillway threshold elevation	m	+(11.73÷11.89)	+11.75
- Spillway width	m	30.00	20.00
- Design flood discharge	m^3/s	-	41.25
- Design overflow water head	m	-	1.04
4. Intake (newly built)			
- Submerged sluice		Pressured	Pressured
- Aperture D/(BxH)	m	D=0.40	D=0.40

Table 2: Technical parameters before and after the repair of Nuoc Xanh Reservoir

Technical parameters	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*

1. ***Nuoc Xanh Reservoir***			
- Catchment area	Km^2	1.90	1.90
- Dead Water Level	m	+ 17.50	+ 17.50
- Full supply level	m	+23.34	+ 23.34
- Surcharged water level	m	+24.15	+ 24.15
- Dead storage capacity	10^6 m^3	0.13	0.13
- Useful storage capacity	10^6 m^3	1.476	1.476
- Storage responding to NWL	10^6 m^3	1.606	1.606
- Super high storage capacity	10^6 m^3	1.906	1.906
2. Earthen dam (upgraded)			
- Dam crest elevation	m	+(24.25 ÷25.30)	+25.60
- Highest dam height	m	8.26	8.56
- Dam surface width	m	2.85 ÷ 3.5	5.0
- Total dam length	m	1800	1800
3. Spillway (upgraded)			
- Form, structure		Free overflow Spillway: natural earth	Free overflow spillway, wide crest, reinforced concrete
- Spillway threshold elevation	m	+23.54	+23.40
- Spillway width	m	65-70	70
- Design flood discharge	m^3/s	-	64.06
- Design overflow water head	m	-	0.747
4. Intake (new)			
Submerged sluice		Pressured	Pressured
Aperture D/(BxH)	m	D = 0.60	D = 0.80
Design flow	m^3/s	-	0.208
5. Access and rescue road (upgraded)			
Type of road		Earth road	Concrete
Road pavement width	m	2.0÷3.0	3.5
Length	m	700	700
6. Construction road			

Type of road		Earth road	Earth road
Road pavement width	m		4.0
Length	m	604.66	604.66

Table 3: **Technical parameters before and after the repair of Ba Khe Reservoir**

Technical parameters	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*
1. Ba Khe Reservoir			
- Catchment area	Km^2	4.17	4.17
- Dead Water Level	m	+15.7	+15.7
- Full supply level	m	+18.00	+18.00
- Surcharged water level	m	+19.38	+19.38
- Dead storage capacity	10^6 m^3	0.206	0.206
- Useful storage capacity	10^6 m^3	1.017	1.017
- Super high storage capacity	10^6 m^3	-	1.864
2. Earthen dam (upgraded)			
- Dam crest elevation	m	+(18.90 ÷ 19.00)	+20.00
- Wave wall crest elevation	m	+19.05	+20.80
- Highest dam height	m	10	11.0
- Dam surface width	m	2.8 ÷3.5	5.0
- Length of maim dam	m	725	805
- Length of auxiliary dam	m	496	508.8
3. Spillway (upgraded)			
- Style and structure		Free spillway, side spillway, reinforced concrete	
- Spillway threshold elevation	m	+17.70	+18.00
- Spillway width	m	25.0	35.0
- Design flood discharge	m^3/s	96.85	110.78
- Design overflow water head	m	1.40	1.38
4. Intake (upgraded)			
Submerged sluice		Pipe culvert. Pressured	Pipe culvert. Pressured

a. Sluice 1			
- Aperture D	m	0.40	0.40
- Length	m	24	32
b. Sluice 2			
- Aperture D	m	0.60	0.80
- Length	m	28	26.95

Table 4: **Technical parameters before and after the repairs of Dap Buom Reservoir**

Technical parameters	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*
1. ***Dap Buom Reservoir***			
- Catchment area	Km^2	4.25	4.25
- Dead Water Level	m	12.45	12.45
- Full supply level	m	+17.00	+17.00
- Surcharged water level	m	18.73	18.73
- Dead storage capacity	10^6 m^3	0.036	0.045
- Full supply level storage capacity	10^6 m^3	0.301	0.301
- Useful storage capacity	10^6 m^3	0.256	0.256
- Super high storage capacity	10^6 m^3	-	0.434
2. Earthen dam (upgraded)			
- Dam crest elevation	m	+(18.5 ÷ 18.9)	+20.00
- Highest dam height	m	8.75	10.15
- Dam surface width	m	3.8 ÷ 4.0	5.0
- Dam length	m	80	88
3. Spillway (new)			
- Style and structure		Free overflow spillway, natural soil	Free overflow spillway, concrete
- Spillway threshold elevation	m	+17.00	+17.00
- Spillway width	m	20.0	35.0
- Design flood discharge	m^3/s	170.93	156.68
- Design overflow water head	m	-	1.73

4. Intake (new)			
- Submerged sluice		Pipe culvert. Pressured	Pipe culvert. Pressured
- Dimension D. (BxH)	m	D= 0.40	D= 0.80
- Length	m	24	47
5. Canal after the intake (upgraded)			
- Structure		Concrete	Reinforced concrete M200
- Dimension (BxH)	m	0.4x0.6	0.5x0.65
- Length	m	224.2	224.2
6. Access and rescue road and service river			
- Road structure		Earth road	Concrete M200 of 20cm thick
- Road width	m	2.5÷3.0	3.5
- Total length	m	200	338

Table 5: **Technical parameters before and after the repair of Khe Co Reservoir**

Technical parameters	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*
1. ***Khe Co Reservoir***			
- Catchment area	Km^2	8.04	8.04
- Dead Water Level	m	+21.69	+21.69
- Full water supply	m	+38.50	+38.50
- Surcharged water level	m	+41.19	+41.12
- Full supply capacity	10^6 m^3	4.128	4.605
- Dead storage capacity	10^6 m^3	0.269	0.414
- Useful storage capacity	10^6 m^3	3.859	4.191
- Super high storage capacity	10^6 m^3	-	5.975
2. Earthen dam (upgraded)			
- Dam crest elevation	m	+(42.53 ÷42.67)	+42.60
- Wave wall crest elevation	m	None	None
- Highest dam height	m	22.0	22.0

- Dam surface width	m	3.0 ÷ 3.5	6.0
- Length of main dam	m	90.7	90.7
- Total length auxiliary dam (03 dams)	m	403.16	420.9
3. Auxiliary spillway (new)			
- Style and structure		Free overflow Spillway: natural earth	Free overflow Spillway, wide crest, reinforced concrete
- Spillway threshold elevation	m	+38.57	+39.50
- Spillway width	m	20.0	15.0
- Design flood discharge	m^3/s	-	11.68
- Design overflow water head	m	-	0.62
4. Access and rescue and rescue road			
Road structure		Earth	Concrete pavement
Length	m	2371.70	2.371.70
Road pavement width	m	2.5÷3.0	3.50

Table 6: **Technical parameters before and after the repair of Khe Nhay Reservoir**

Technical parameter	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*
1. ***Khe Nhay Reservoir***			
- Catchment area	Km^2	0.60	0.60
- Dead Water Level	m	+17.90	+17.90
- Full supply level	m	+22.40	+22.40
- Surcharged water level	m	+23.51	+23.51
- Dead storage capacity	10^6 m^3	0.033	0.033
- Useful storage capacity	10^6 m^3	0.375	0.375
- Super high storage capacity	10^6 m^3	0.408	0.408
2. Earthen dam (upgraded)			
- Dam crest elevation	m	+(22.82 ÷ 23.34)	+23.50
- Wave wall crest elevation	m	None	+24.60
- Highest dam height	m	7.5	9.0

- Dam surface width	m	3.0 ÷ 3.5	5.0
- Length of main dam	m	222	222
3. Spillway (upgraded)			
- Style and structure		Free overflow spillway, natural soil	Free overflow and wide crest, reinforced concrete spillway
- Spillway threshold elevation	m	+22.40	+22.40
- Spillway width	m	13.60	5.0
- Design flood discharge	m^3/s	-	9.36
- Design overflow water head	m	-	1.113
4. Intake (new)			
- Style and structure		Submerged sluice. Pressured. reinforced concrete	Submerged sluice. Pressured. reinforced concrete
- Aperture D. (BxH)	m	D=0.60	D=0.80
- Design flow	m^3/s	-	0.063
- Sluice length	m	-	30.0

Table 7: **Technical parameters before and after the repair of Khe De Reservoir**

Technical parameters	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*
1. ***Khe De Reservoir***			
- Catchment area	Km^2	2.5	2.5
- Dead Water Level	m	+19.50	+19.50
- Full supply level	m	+26.70	+26.70
- Surcharged water level	m	+28.20	+28.20
- Surcharged water storage capacity	10^6 m^3	2.158	2.158
- Dead storage capacity	10^6 m^3	0.2702	0.2702
- Useful storage capacity	10^6 m^3	1.888	1.888
- Surcharged water storage capacity	10^6 m^3	-	2.720
2. Earthen dam:			

- Dam crest elevation	m	+(28.84÷29.26)	+29.60
- Highest dam height	m	8.5	9.0
- Dam surface width	m	3.2 ÷ 4.2	5.0
- Length of main dam	m	227	227
- Length of auxiliary dam 2	m	238.0	238.0
3. Spillway (upgraded)			
- Style, structure		Free overflow Spillway: natural earth	Free overflow spillway, wide crest, reinforced concrete
- Spillway threshold elevation	m	+26.70	+26.70
- Spillway width	m	8.0	14.0
- Design flood discharge	m^3/s	-	36.46
- Design overflow water head	m	-	1.50
4. Intake (new)			
- Submerged sluice		Pressured	Pressured
- Aperture D. (BxH)	m	D = 0.60	D = 0.80
- Design flow	m^3/s	-	0.266
- Sluice length	m	-	37.6
5. Access and rescue road			
Road pavement structure		Earth	Concrete M200
Total length	m	1.960.0	1.960.0
Road pavement width	m	2.0-2.5	3.5

Table 8: **Technical parameters before and after the repair of Da Den Reservoir**

Technical parameters	*Unit*	*Parameters before the repairs*	*Parameters after the repairs*
1. Da Den Reservoir			
- Catchment area	Km^2	0.75	0.75
- Dead Water Level	m	+19.65	+19.65

- Full supply level	m	+26.00	+26.00
- Surcharged water level	m	+27.12	+26.76
- Dead storage capacity	10^6 m^3	0.638	0.638
- Useful storage capacity	10^6 m^3	0.048	0.048
- Surcharged water capacity	10^6 m^3	0.590	0.590
2. Earthen dam (upgraded)	10^6 m^3	0.680	0.680
- Dam crest elevation			
- Wave protection wall crest elevation	m	+(27.0÷27.30)	+27.70
- Highest dam height		None	+28.50
- Dam surface width	m	10.0	11.0
- Total dam length	m	2.0 ÷ 3.0	5.0
- Total dam length	m	150	153
3. Spillway (new)			
- Style and structure		Free overflow Spillway: natural earth	Free overflow spillway, wide crest, reinforced concrete
- Spillway threshold elevation	m	+26.10	+26.00
- Spillway width	m	6.0	30.0
- Design flood discharge	m^3/s	-	28.20
- Design overflow water head	m	-	0.76
4. Intake (new)			
- Submerged sluice		Pressured	Pressured
- Aperture of sluice D. (BxH)	m	D = 0.40	D = 0.80
5. Management and rescue road			
- Road pavement structure		Earth	Concrete M250
- Total length	m	544	544
- Road pavement width	m	2.5-3	3.5

Appendix 6: List of Consultantmembers preparing ESIA report

Table: List of Consultant members involving in the assessment of Environmental and Social Impacts

No.	*Name*	*Professional tittle/degree*	*Position in the Package*
1	Vu Thị Thanh Huong	Assoc.Prof.Dr.	Team Leader/Environmental Expert
2	Pham Thanh Binh	M.A.	Environmental Expert
3	Bui Thi Ban Mai	M.A.	Environmental Expert
4	Pham Thi Phuong Thao	M.A.	Environmental Expert
5	Le Anh Duc	M.A.	Environmental Expert
6	Tran Ngoc Son	M.A.	Environmental Expert
7	Vu Quoc Chinh	M.A.	Agricultural Expert
8	Mai The Hung	Dr.	Agricultural Expert
9	Le Van Truong	Engineer	Agricultural Expert
10	Bui Thi Minh Quyen	Engineer	Water Resource Expert
11	Tran Xuan Tung	M.A.	Water Resource Expert
12	Phan Van Truong	Engineer	Water Resource Expert
13	Nguyen Xuan Thanh	Dr.	Ecological Expert
14	Nguyen Thi Ha Chau	M.A.	Ecological Expert
15	Bui Hong Quang	M.A.	Ecological Expert