DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT OF QUANG NINH PROVINCE

WATER RESOURCES INVESTMENT AND DEVELOPMENT MANAGEMENT UNIT NO. 2

DAM REHABILITATION AND SAFETY IMPROVEMENT PROJECT (WB8)

REPORT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

Sub-project: REPAIRING AND UPGRADING HEADWORKS COMPLEX OF KHE CHE RESERVOIR

HANOI, MARCH 2015

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ON BEHALF OF EMPLOYER **ON BEHALF OF CONSULTANT**

HANOI, MARCH 2015

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ABBREVIATIONS AND TERMS

PMU	: Project Management Unit
MOH	: Ministry of Health
BW	: Bore well
HDND	: People's Council
BH	: Bore hole
P&I	: Planning and Investment
Economy - Society	: Economy - Society
ND-CP	: Decree - Government
ARD	: Agriculture and rural development
PCCC	: Fire prevention and fighting
QD-SNN	: Decision - Department of Agriculture
QCKT	: Technical regulation
QCVN	: Vietnamese regulation
QD-TTg	: Decision - Prime Minister
NA	: National Assembly
TCVN	: Vietnamese standard
TCXDVN	: Vietnamese construction standard
TNHH	: Limited liability
TP	: City
TT-BTNMT	: Circular - Ministry of Natural resources and Environment
TTr-BQL	: Submission - Management unit
PC	: People's Committee
WHO	: World Health Organization
XHCN	: Socialism

EXECUTIVE SUMMARY

1. The "Repairing and upgrading headworks complex of Khe Che reservoir" is one of the sub-projects being proposed for funding under the World Bank-assisted Dam Rehabilitation and Safety Improvement Project (DRSIP). The objectives of the subproject are: (i) to ensure flood fighting safety for head works of Khe Che reservoir; (ii) to create stable irrigation water source for about 1,000 hectares of cultivated land, including 534 ha of rice; (iii) to create environmental landscapes, ecology of project zone for tourism; (iv) to contribute to the economic growth of the project zone, development of aquaculture. Project of "Repairing, upgrading headworks complex of Khe Che reservoir" proposed for implementation funded by the World Bank belongs to the project of improving and upgrading dam safety. This environmental and social impact assessment (ESIA) was undertaken to comply with the World Bank's Environmental Assessment Policy and the Vietnam's Law on Environment Protection.

2. The work of Khe Che reservoir is located at An Sinh Commune, Dong Trieu District, Quang Ninh Province, 78 km from Ha Long City and Hanoi Capital from 90 km, the reservoir was calculated and designed in1986, until 1995-1998, the work was repaired and upgraded a number of items under head works system. So far this work has been operating for nearly 30 years. The lake has basin area: 22.4 km2. Total capacity is 12 million m3

The head works and auxiliary works complex of Khe Che reservoir consist of the following items:

- Dam: Dam is built by homogeneous soil with 20m in height, 658m in length. The crown level is at 26.9m, 4.2m in width
- Flood spillway: Type of spillway is long based weir; spillway structure is cement rock wall, the overflow weir width of 4 m, the overflow weir length of 5m, and the overflow weir level of 23.48m.
- Off take regulator: The off take regulator at the right abutment of dam is arranged a valve house at the upstream of dam, the regulator has reinforcement concrete structure with dimension of b×h = 1.0×1.3m.

Management and operation road: Management and operation road along the inter-commune road to bridge is built by concrete; the section from bridge to dam surface with 110 m in length is currently soil road. After running through the dam surface, this section is linked with the local road next to the lake. The road surface is rough with many pot-holes, which is not convenient for management and especially for flood prevention and fighting.

3. Up to now, the works of Khe Che reservoir has been operating for nearly 30 years, during the process of operation; it has been repaired, upgraded locally, but only temporarily. The project is rated as the level III project, the calculations, designs for work criteria are severed for the level III works. However, in recent time,

the climate change, weather complexity show that the actual flood situation has exceeded the designed calculation criteria. The issues related to the degradation of Khe Che reservoir include: The overflow channel to the surface has not been reinforced; the left abutment has a 30m long section of wall by masonry. The wing wall at right abutment of the input section has been cracked, the dam surface has been raised by masonry, in the course of long-term use, the travel has caused landslide on surface and sweating potholes, underbrush has grown sparsely along the crest, the upstream wall with masonry structure plastered at the coping has had some cracks, the head of coping dam has been broken with a length of 1.5 m. Current management road is soil road, after running through the dam surface; this section is linked with the local road next to the lake. The road surface is rough with many pot-holes, which is not convenient for management and especially for flood prevention and fighting. Off take regulator with downstream valves used from the 1990s has been rusted and no longer used. 02 underground lines through stream, namely Tam Viet and Ba Xa currently have not enough capacity for flood drainage.

Besides, the downstream of Khe Che reservoir is the residential area of over 3000 persons of three communes, namely An Sinh, Tan Viet, Viet Dan, but Khe Che reservoir is not designed for emergency spillway, intake sill and narrowed bed level; therefore some floods in past years have shown the severity of ensuring the safety of reservoirs.

Thus, the implementation of sub-project for repairing and upgrading Khe Che reservoir works is extremely essential.

4. Rehabilitation and Upgrading Works:

- *Items for repairing and upgrading:*

- Expanding flood spillway
- Executing concrete for dam surface
- Hardening concrete for management road.
- Improving and installing of equipment for offtake regulator

- *Items for newly building:*

- Building house for flood prevention and work management
- Executing salvage and rescue road in combination with spillway line construction
- Rebuilding 02 undergrounds through stream with reinforced concrete structure M250:

+ Tan Viet underground with 4 gates: 4 x (6x3.5)m.
+ Ba Xa underground with 2 gates: 4 x (6x3.5)m.

- Providing equipment for salvage and rescue
- Installing survey system

The project is designed and carried out in accordance with the Environmental and Social Management Framework (ESMF) of the project and Dam safety framework of the World Bank, in order to ensure strict compliance with administrative regulations as well as standards of the Socialist Republic of Vietnam. The arisen impacts during the preparation and implementation of the project is fully defined, strictly managed and monitored by the detailed plans and periodic reports to the management levels. Khe Che reservoir is proposed to be 01 of the 12 sub-projects carried out in the first year of the project of improving and enhancing safety for dams and lakes (WB8) funded by the World Bank with development goals for supporting the implementation of the Government's dam safety program. There are 5 safety policies of the World Bank to be enabled in this sub-project.

5. Environmental and Social Screening: Based on the Environmental and Social Screening, the sub-project is eligible for financing under DRSIP. The subproject is a Category B under the World Bank's classification. It is not located within or near any sensitive environment or natural habitat and there are no structures or sites in the area of cultural and historical significance that will be impacted by the rehabilitation. There are also no ethnic minorities in the area. The dam to be rehabilitated is by definition a small dam.

6. Environmental and Social Impacts

The implementation of project will bring huge benefits to the local community such as: (i) providing a stable water supply, facilitating production conditions, improving the lives of people; (ii) enhancing dam safety to help people comfortably live and produce in the downstream area; (iii) improving the landscape, lake ecosystems and microclimate conditions. However, the project will cause some negative effects and potential risks of the natural environment and society related to: (i) land acquisition and land clearance, (ii) construction and (iii) reservoir operation.

- The plan on prevention or mitigation is specifically presented in the Environmental and Social Management Plan (ESMP).

- Project zone, An Sinh commune, with mainly inhabited community is Kinh ethnics. There are no ethnic minorities household affected so EMDP shall not be implemented in this sub-project.

- According to the calculations, the total volume of excavation soil for construction works of the project is about 55,459 m3, volume of backfill soil is 3,412 m3. In particular, the required volume of backfill soil is 996 m3; the remaining amount will be made use of excavated volume. Thus, about 51,051 m3 needs to be moved to the disposal area. The disposal area is located along the foot of the dam, with dimension of 35 * 500m. The total capacity of disposal area is about 52,500 m3. The building raw materials are purchased from Dong Trieu far from the work around 8-10km. The number of workers in the peak

period is about 50 workers. The number of trucks is 3600 turns over a period of 10 months.

- The process of construction of the project can cause negative impacts to the natural environment (air, water, soil pollution, noise, vibration...) and social environment (traffic jams, social security...). However, these effects are only partial, temporary, in a small scale and can be prevented/ minimized by:

- Comply with environmental and social management plan prepared for project;
- Consult with local authorities and local people from the phase of project preparation and during project construction process;
- Closely monitor the implementation of the project.

7. Mitigation Measures – An Environmental Management Plan (ESMP) has been developed as part of this ESIA to address these impacts. The ESMP requires the adoption/implementation of the various other safeguardes instruments which have been prepared for the sub-project such as, the Resettlement Action Plan/Compensation Plan, the Communication Plan, the Gender Action Plan, the Grievance Redress Procedure, the Chance Find Procedure, and the Unexploded Ordinance Procedure. Specific measures in the ESMP include, close consultation with the affected farmers for the optimal scheduling and timing of construction activities to minimize cropping disruptions, proper housekeeping at the construction site, disposal of construction spoils to a properly sited landfill, regular sprinkling of roads in residential areas during dry days, and the preparation and submission by the Contractor of its own Environmental and Occupational Health and Safety Plan for the construction site, incorporating construction-related measures and standard construction EHS practices such as wearing of PPEs, provision of adequate water and sanitation facilities at campsite, medical screening of workers, installation of fences and warning signs at dangerous areas and good community relations. The ESMP also requires the installation of a capacitated Dam Management Unit and the preparation of Emergency Preparedness Plan as recommended in the Dam Safety Assessment Report.

10. Institutional Arrangements: The Central Project Office (CPO) is responsible for the overall supervision of the sub-project implementation, including the implementation of environmental protection measures proposed in the ESMP. The Nghe An Agriculture and Rural Development Project Unit (NARDU) will be responsible for preparing detail bids/tenders information, selecting the contractor, preparing contracts and ensuring effective implementation and close supervision of ESMP.. The contractor will be responsible for implementing the sub-project as planned including measures that are related to construction site management. The CPO will associate closely with local dam management authority to ensure the effectiveness of stakeholder consultation and ensure compliance with the requirements and measures. The Department of Natural Resources and Environment of Quang Ninh province will bear responsibility of supervising the

implementation of environmental policies as per regulated by Vietnam Government. After project completed, the operation organization will take responsibility of maintenance and periodic inspection project's works.

12. Budget allocation: The estimated cost of the implementation of the ESMP, including compliance monitoring is 993,491,281 VND. The total estimated cost of the sub-project including implementation of the ESMP is 52,914,333,000 VND.

PART I: INTRODUCTION

1.1. General information of the project

"Dam Repair and Safety Improvement Project (DRASIP)"is targeted to support in implementation of dam safety program given by the Government by improving the safety of preferential dam and water reservoir as well as protecting residents and assets of the community downstream. It is expected that the project will improve the safety of the dam and relevant works as well as the safety of people and socio-economic infrastructure of the community downstream as stated in Decree No. 72 about management of dam safety in Vietnam. Components of the project include:

- Component 1: dam safety rehabilitation (about 385 million US dollar)
- Component 2: Management of dam safety and planning (about 60 million US dollar)
- Component 3: Project management support (about 15 million US dollar)
- Component 4: Provision for natural disasters (not over 20% out of total project expenditure)
- Project Participants

The Project is proposed to be deployed over 31 Provinces stretched from the North to Central and the Highland. It is expected that more than 400 dams selected basing on criteria "the most priority" have been approved to provide interference measures to solve risks in the framework of poverty and inequality.

Time to deploy the Project is expectedly prolonged for 6 years from December 1, 2015 to December, 1, 2021. Environmental and Social Impact Assessment Draft (ESIA) of the sub-project in the first years and Environmental and Social Management Framework (ESMF) will be finalized and published on May 12, 2015. The ESIA for the following years will be based on the first year's assessments and ESMF had been approved by the Vietnamese Government and the World Bank.

Ministry of Agriculture and Rural Development (MARD) will take the joint-responsibility in implementing and managing the Project. The Central Management Board of Water Projects under the MARD will be responsible for coordination and supervision of the Project. Implementation of dam repair and safety plans, including protection and authorization, will be administered by the provincial authority. Department of Agriculture and Rural Development (DARD) will become the chair at provincial level. Project Management Unit (PMU) of each DARD in each province will be responsible for management and supervision of damp repair Works with the support from MARD.

The project will support in repairing irrigation dam constructed from the years of 1980 and 1990. About 90% of dams expected to be repaired are soil-structured small dams with the height less than 15m and design volume smaller than 3million m^3(MCM). The Project is not intended to invest in changing the whole structure of the dam or new

construction or expansion of the main structure, but the main job of the project is to repair and reshape the structure of the main dam, saddle dam; reinforce upstream roof by concrete or stone; reinforce or expand dimension of spillway to enhance water drainage capacity; repair or improve the existing water intake; replace hydraulic lifting system at the suction inlet (water intake) and spillway opening; waterproof the main dam; improve service roads (for construction, management and operation of the lake).

1.2. Approaches and methodology for environment assessment

1.2.1. Objective

a) General objective:

To carry out an environmental and social assessment of a specific sub-project, including the preparation of relevant environmental and social assessments and required tools to improve dam safety and DRASP in accordance with the requirements of Socialist Republic of Vietnam's Government and the World Bank.

b) Specific objectives:

- To conduct ESIA of the renovation of Khe Che reservoir's key works.
- To develop an Environmental and Social Monitoring Plan (ESMoP) including appropriate monitoring and reporting regime.
- Create communication channels to allow local communities to participate in the decision making process.

1.2.2. Scope of EIA

a) Scope of assessment under affected areas (divided into 02 areas):

The affected area shall be considered in impact assessment for the sub-project of "Repairing and upgrading headworks complexes of Khe Che reservoir" including: Main construction areas at dam, offtake regulator, spillways; rock and soil pit, construction site, materials gathering area (warehouse), machinery and equipment, parking area, disposal site, temporary and permanent sewage, accommodation for workers, etc. ...; public service road to dam, material and rock pits, waste dump; water level in reservoirs; downstream channel.

- Operation area of project: The construction area of the repairing work items to upgrade dam, spillway, sewer, construction road....of An Sinh commune, Dong Trieu district.
- Affected area (benefited or damaged) from sub-project: including local without having direct activities of the project but benefited from activities of the sub-project or damaged (if any). With Khe Che reservoir, 03 communes/towns at downstream area (including An Sinh, Tan Viet, Viet Dan,) are benefited/ damaged most from sub-project, for example: Supply of more active irrigation water, or no risk of flooding due to dam breakdown.

b) Scope of assessment over time

- The report will review the report on environmental and social impact of the project during the implementation process, includes: i) from the preparation stage (survey, design, land clearance...); ii) Construction stage; and iii) Management and operation stage.

- In addition, the report on environmental impact assessment should be also considered to incidents that happened in the past (from the construction of reservoir and dam) and the impacts on the environment, society and performed measures.

c) Objects for consideration and assessment:

- The environmental, social components and factors are affected include: Natural environment (climate, water, soil, minerals, and ecosystems), socio-economic and socio-cultural environment.

- Impact assessment should consider: a) physical environment (water resources, hydrology, air/ water / soil pollution , erosion and sedimentation, drainage, safety for stakeholders and existing infrastructure, taking into account for basic conditions such as climate, geography, topography, air quality), b) issues regarding history, culture and archaeology; c) biological system such as flora and fauna, natural habitat, fisheries, etc. and d) (socio-economic and environmental social aspects such as health care and medicine, employment and income, gender, social security and life stability, access to basic services such as water, energy, health and education, etc.).

1.2.3. Approaches

- ESIA assessment must be combined with the economic, financial, institutional, social and technical analysis of the project to ensure that environmental and social issues are paid full attention to selection of project, location and decisions regarding technology solutions

- Forecasting and quantitative assessment of impacts likely occurred by the sub-project.

- Distinguishing between pairs of positive - negative, indirect - directly impacts, cumulative impacts, and medium - long term impacts. Identification of potential impacts that may occur during construction process and unavoidable and irreversible impacts.

1.2.4. Method of implementation

- *Method of field investigation, survey*: Investigation, survey for the current state of environmental resources, rapid assessment of some indicators of water quality in the field to update and supplement the newest materials for project area.

- *Method of sociological investigation*: Investigation, interview of people, leaders of affected and benefited areas.

- *Method of actual environment survey*:

+ Survey of actual environment in the field by sampling and analysing indicators in the laboratory to determine the current status of air atmosphere, surface water quality,

groundwater quality and soil quality in project area and surrounding areas.

+ Air samples are taken by the absorption method with appropriate solutions, stored in accordance with TCVN 5975-1995, ISO 7934-1998; TCVN 5978-1995, ISO 4221-1980; TCVN 5968-1995; TCVN 5971-1995, ISO 6767-1990 and analysed under TCVN 5971-1995, ISO 6768/1995.

+ Soil samples are taken under the guideline of sampling, preservation engineering in accordance with TCVN 7538-2: 2005: (Soil quality - Guideline for sampling engineering)

+ Quality of surface water, ground water is taken by water sampling device according to TCVN 6663-6: 2008 (ISO 5667-6: 2005). Handling and storage of water samples according to TCVN 6663-14: 2000 (ISO 5667-14: 1998);

+ Soil, water samples shall be preserved and taken to the laboratory to ensure standards.

- *Statistical method*: Collection, processing and analysis of meteorological, hydrological, environmental and socio-economic data.

- *Method of expert advice*: Through meetings, discussions with experts to obtain advices on the proposed measures to mitigate the negative impacts of the project.

- *Method of analysis synthesis for report development*: Analysis and synthesis of impacts of the project on natural environment and socio-economic components at project areas.

- *Method of rapid assessment*: Usage of pollution factors of the World Health Organization (WHO) to estimate the amount of waste and forecast pollution.

- *Method of network diagram*: Identification of primary, secondary and higher level impacts.

- *Method of environmental matrix*: Assessment of environmental impacts, semi-quantitative due to the activities of the project.

- *Method of modelling (if any)*: Using model to calculate and forecast the average concentration of pollutants in emission gas, waste water to assess impacts of such pollutants on the environment.

1.3. Approaches and methodology for social assessment

The purpose of this social assessment (SA), conducted in an integral manner with environmental assessment for this subproject, is two-fold. First, it examined the potential impacts of the subproject positive and adverse impact on the basis of planned project activities. Second, its findings inform the design of measures addressing identified potential adverse impact and proposing community development activities that are relevant to the project development goal. For identified adverse impact that could not be avoided, consultation with local people, governmental agencies, project stakeholders, etc., were carried out to ensure affected peoples will be appropriately compensated for, and supported in a manner that their socioecononmic activities will be promptly and fully

restored to the pre-project level, at least, and that their livelihoods will not be worsen off, in the long run, as a result of the subproject.

As part of the social assessment, where ethnic minority (EM) peoples are present in the subproject area as confirmed by the EM screening (as per Bank's OP 4.10), consultation with them were carried out in a free, prior, and informed manner, to confirm if there is broad community support from affected EM peoples for the subproject implementation. EM screening was conducted as per Bank's OP 4.10, and was done the scope and coverage of the social assessment vis-à-vis the environmental assessment (OP 4.01). A gender analysis was also done as part of the SA to understand underlying gender dimensions (from project impact perspective) to enable gender mainstreaming to promote gender equality, and enhance further the development effectiveness of the subproject, and the project as a whole. Depending on the magnitude of the identified potential project impact, and the project development objective, a gender action plan and gender monitoring plan were prepared (please see these plans in the Appendix 4 of this SA).

To ensure all potential impact could be identified during project preparation, the SA was conducted through series of consultations with various project stakeholders. A particular focus was maintained on households who are potentially affected (both positively and adversely). The research techniques employed for this SA include 1) review of secondary data, 2) field observations; 3) focus groups discussions/ community meetings, 4) key informant interview, and 5) households survey (Please see Appendix 1 for how the Sampling Frame). A total of 165 of respondents participated in the SA exercise for this subproject, of which 127 people participated in the households survey (quantitative), and 29 people participate in focus groups discussions, community meetings, key informant interview (qualitative).

In part 4; 5 , we will present the findings of the SA (positive and positive impact), including the result of the gender analysis. In section 4, we will present briefly the SA results, along with the recommendations on the basis of the SA findings. Please note that a gender action plan and gender monitoring plan are presented at Appendix 4 of this SA, and the public health intervention plan and public consultation and communication plan were presented at Appendix 2and 3, respectively).

1.4. Consultant

- Consultant: Institute for Hydropower and Renewable energy
- The list of involved officer:

No.	Full name	Qualification	Position in ESIA performance
Employer			
1	Mr. Tran Van Nang	Engineer of Hydraulics	Director of Water resource Investment and Construction

			No. 2
Consultant for ESIA			
1	Pham Thi Ngoc Lan	Doctor of Environment	The head of ESIA report, general management; field investigation; preparation of environmental management program; environmental monitoring program
2	Bui Thi Thuy	Master of Environmental Engineering	Field investigation, preparation of ESIA report
3	Pham Thi Thuan	Engineer Environmental Engineering	Field investigation, preparation of ESIA report
4	Le Hung Anh	Doctor of Ecology	In charge of ecology
5	Nguyen Duc Long	Engineer Environmental Technology	Field investigation, water quality analysis
6	Nguyen Thanh Hoa	Master of Environmental Technology	Water quality analysis

PART II: SUB-PROJECT DESCRIPTION

2.1. Overview of sub-project

1. *Name of sub-project*: Repairing and upgrading headworks complex of Khe Che reservoir.

2. *Objectives of Sub-project*:

- To ensure safety for flood prevention of headworks complex of Khe Che reservoir;
- To create stable irrigation source for about 1,000 ha of cultivated land, including 534 ha of rice;
- To create landscape, ecology for project area to serve for tourism;
- To contribute to economic growth of project area, development of aquaculture.

3. *Employer*: Water resources Investment and Construction Management Unit No. 2 - Address: No. 85, Nguyen Luong Bang, Hai Duong City, Hai Duong.

4. *Location for project implementation*: The project is implemented at headworks complex of Khe Che reservoir under An Sinh Commune, Dong Trieu District, Quang Ninh Province, 78km far from Ha Long City; 90km far from Hanoi (see Figures 1.1 and 1.2). Location of headworks at:

- $21^0$08'30" North latitude.
- $06^0$31'30" East longitude.

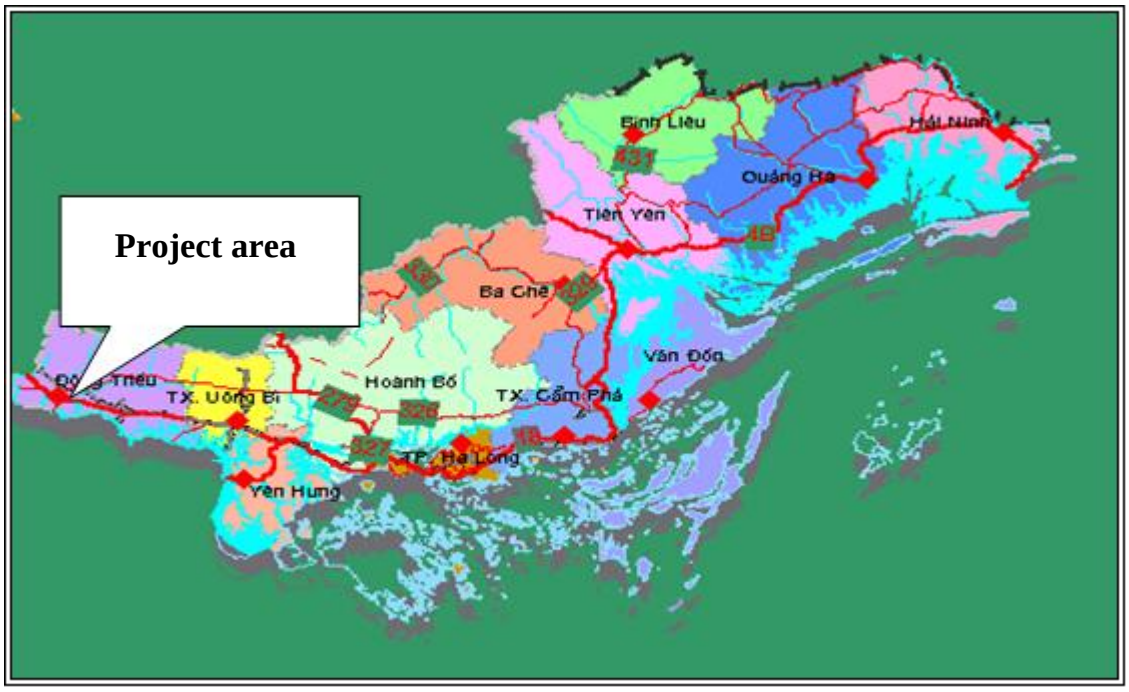

Figure 2.1. Location of project area

(Source: Water resources Investment and Construction Management Unit No. 2)

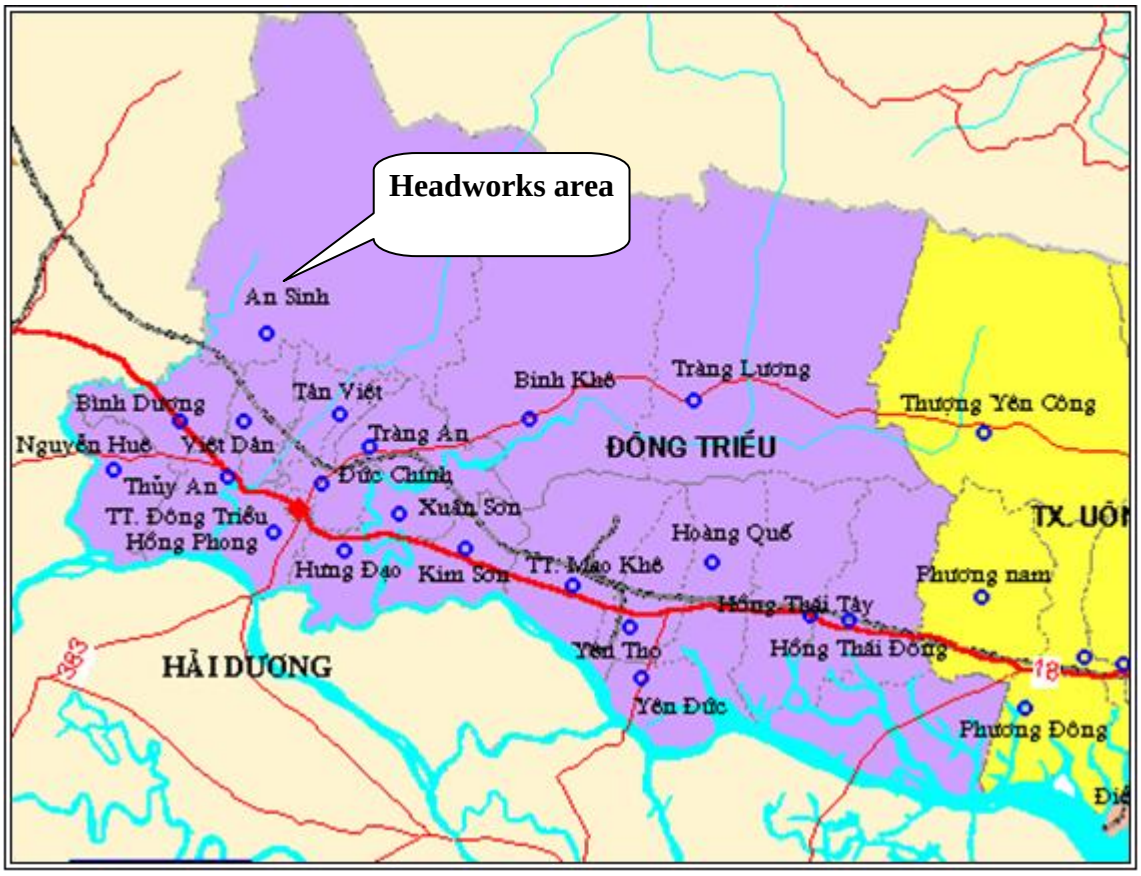

Figure 2.2. Location of work in Dong Trieu District

(Source: Water resources Investment and Construction Management Unit No. 2)

- There are 21 administrative units in the district, including 2 towns and 19 communes: Dong Trieu Town, Mao Khe Town, Binh Duong Commune, Nguyen Hue Commune, Thuy An Commune, Viet Dan Commune, An Sinh Commune, Tan Viet Commune, Hong Phong Commune, Duc Chinh Commune, Trang An Commune, Hung Dao Commune, Xuan Son Commune, Kim Son Commune, Yen Tho Commune, Binh Khe Commune, Trang Luong Commune, Hoang Que Commune, Hong Thai Dong Commune, Yen Duc Commune and Hong Thai Tay Commune.

- The headworks complex of Khe Che reservoir supply production water for 3: An Sinh, Tan Viet, Viet Dan in Dong Trieu District.

5. Total investment capital:

NO	ITEMS	EXPENDITURE		
		BEFORE-TAX CONSTRUCTION PRICE	VAT	AFTER-TAX CONSTRUCTION PRICE
1	Construction	33,309,769,616	3,330,976,962	36,640,746,578

2	Equipment	426,957,591	42,695,759	469,653,350
2	Project management	650,842,120		650,842,120
3	Construction investment consultancy	5,441,638,430	544,163,843	5,985,802,273
4	Other expenses of the Project	675,308,752	67,530,875	742,839,628
5	Implementation of social and environmental management plan	273,240,000	27,324,000	300,564,000
6	Social and environmental monitoring plan	903,173,891	90,317,389	993,491,281
5	Provision	4,050,451,651	398,536,744	4,578,393,923
6	Site clearance support	2,500,000,000		2,500,000,000
7	Support programs to improve environment management capability and techniques	52,000,000		52,000,000
TOTAL VALUE		**47,106,968,161**	**4,383,904,183**	**52,914,333,153**
ROUNDED UPTO				**52,914,333,000**
In words: Fifty two billion nine hundred fourteen million, three hundred thirty thousand dong				

2.2. The proposed scope of work

2.2.1. Current situation of the Work

The work of Khe Che reservoir was calculated design in 1986, until 1995 to 1998, the work was repaired and upgraded some items under the headworks system. So far this work has been operating for nearly 30 years.

However, due to changes in natural conditions, weather, climate with unfavourable tendency, the situation of fast economic - social development, residential people at the downstream - affected as well as benefited area including 3 communes: Tan Viet, Viet Dan, An Sinh has grown up over 3000 persons. Accordingly, many schools, government offices, temples, playground, recreation areas have rapidly developed making Khe Che reservoir cause tremendous impacts on people' lives and economic development of the project area.

The irrigation system of Khe Che reservoir creates irrigation water for about 1000 ha of cultivated land, including 534 ha of rice. The dam made of soil, rock has the maximum height of 10-25m with a rock foundation (group A). The capacity of reservoir is from $3x10^6$ m^3-$20x10^6 m^3$. The work is ranked to be the work level IV.

QCVN 04-05: 2012/ BNNPTNT was developed in 2012 with many improvements, innovations in accordance with specific conditions of the current buildings. This regulation includes major provisions on design that are compulsorily applied to the preparation, evaluation and approval of Water resources projects, including: Planning

project, investment project (Report on pre-feasibility study, report on feasibility study or investment report), Work construction design (technical design, design on construction drawings or technical - construction design). This regulation replaces TCVN 285-2002 - Hydraulic works - The basic stipulation on design. This regulation applies to all water resources projects carried out in Vietnamese territory, under all types: new construction, repair, rehabilitation, upgrade or expansion; regardless of budget source. Other standards shall be only applied with this regulation upon the approval of the competent State management agencies.

Level of hydraulic works shall be considered to raise up to one level (except for special level work) in accordance with Article 3.2.4-page 9 if one item of the work happens risks of rising water, retaining water causing enormous damages to people - properties - environment, leading to disasters for residential areas, industrial zones, existing reservoirs, main traffic routes at the downstream area etc..

The downstream of Khe Che reservoir is the residential area of over 3000 persons of three communes, namely An Sinh, Tan Viet, Viet Dan, but Khe Che reservoir is not designed for emergency spillway, so it is so dangerous for local people when incident happens. In historical flood in 2005, the water level inside the bed far from the crest of spillway wall 20cm, Dong Trieu District People's Committee had to evacuate people of three communes mentioned above in order to ensure the safety for persons and property.

Thus, at the present time, to calculate construction design for headworks complex of Khe Che reservoir, Dong Trieu District, the work level is selected to be level II.

2.2.2. Main items of sub-project

Operating time of Khe Che reservoir has been nearly 30 years, it has been executed some local repairs and upgrades. The project is ranked as the level III project, the calculations, designs for work criteria are severed for the level III works; however, in recent time, the climate change, weather complexity show that the actual flood situation has exceeded the designed calculation criteria.

A crowded residential area of An Sinh is behind Khe Che reservoir which has rich economic development with many buildings and structures: recreation areas, high-rise buildings, temples, pagodas and relics, etc.

Currently, Khe Che reservoir is not designed for emergency spillway, intake sill and narrowed bed level; therefore some floods in past years have shown the severity of ensuring the safety of reservoir.

Main activities of the sub-project include:

- *Items for repairing and upgrading:*

- Expanding flood spillway
- Executing concrete for dam surface
- Hardening concrete for management road.

- Improving and installing of equipment for off take regulator

- *Items for newly building:*

- Building house for flood prevention and work management

- Executing salvage and rescue road in combination with spillway line construction

- Rebuilding 02 undergrounds through stream with reinforced concrete structure M250:

+ Tan Viet underground with 4 gates: 4 x (6x3,5) m.

+ Ba Xa underground with 2 gates: 4 x (6x3,5) m.

- Providing equipment for salvage and rescue

- Installing survey system

Construction items: (see Table 2.1)

Table 2.1. Work Items of the Sub-project and their configuration

No.	Items	Parameters of current situation	Contents of repair
1	**Flood spillway**	*Configuration of current situation:* Type of spillway: Long based weir. Number of chamber: 1 piece. Spillway structure: Masonry wall plastered cement. Overflow weir width: 14m. Overflow weir length: 5m. Overflow weir level: 23.48 m. Length after sill: 9.46 m. Width after sill: 14.00 m. Slope after sill: 1.0 %. Length of narrowed section: 15.58 m. Width of narrowed section: 7.80 m. Slope of narrowed section: 1.00%. Length of transition section: 31.40 m. Width of transition section: 7.80 m. Slope of transition section: 1.00 %. Length of slope section: 43.40 m. Width of slope section: 7.80 m. Slope of slope section: 12.00 %. Length of injecting nozzle section: 2.21 m. Opposite slope of injecting nozzle: 10.0 %. Open angle of injecting nozzle: 9.0^0 *Current situation:*	*Configuration:* + Overflow weir width: 24.0m. + Width of narrowed section: 24.0m --> 18.90m + Width of transition section: 18.90m. + Width of slope section: 18.90m + Length of bed to overflow weir: 41.80m + Overflow weir thickness: 5.00m + Length after sill: 9.46m + Length of narrowed section: 15.58m + Length of transition section: 31.41m + Length of slope section: 43.40m + Length of injecting nozzle section: 2.21m + Slope of bed to overflow weir: 1^o + Overflow weir level: +23.68m + Level after sill: +23.68m + Slope of narrowed section: 1^o + Slope of slope section: 12^o + Opposite slope of injecting nozzle: 10% + Level of injecting nozzle: +14.77m + Level of left spillway wall to overflow weir: +26.25m + Level of crest on overflow weir: +27.08m + Level of wall base of injecting nozzle: +8.16m + Height of wall after overflow weir, transition, narrowed, slope, injecting nozzle sections:

		Flood spillway at the left abutment of dam, long based weir, water level at the time of survey is lower than the overflow weir of 60cm; the overflow channel to the surface has not been reinforced, the left abutment has a 30m long section of wall by masonry, some sections have been come off cement mortar. The wing wall at right abutment of the input section has been cracked, come off cement mortar. The surface of spillway base with cement mortar have been come off; the slope with spilling abutments bxh = 0.2x0.2m in distance of 1.15 m per abutment; the spillway tail unreinforced has been eroded, erosion hole on the bed-rock.	2.20m + Open angle of injecting nozzle: 9^o + Length of wing wall: 6.66m + Dimension of lateral ditch: bxh=(0.5x0.7)m + Dimensions of speed bump: bxh=(0.2x0.2)m + Distance of speed bumps: 1.54m + Spillway structure: Load-bearing reinforced concrete structure with form of harden frame on base-rock + Structure of injecting nozzle wall: Mass reinforced concrete structure with form of counterfort wall on base-rock. *Contents of repair and upgrade:* + Expanding flood spillway, ensuring safety of reservoir.
2	**Surface of soil dam**	*Parameters:* + Length of dam surface: 658.0m + Width of dam surface: 4.20m + Width of circulation: 4.20m + Horizontal slope of dam surface: 1,5% + Structure of dam surface: structure of hard pavement, coated concrete M200 with 20 cm in thickness. *Current situation:* - The dam surface is raised by masonry wall, coated by fine stone to protect surface. During	*Parameters:* Concrete for dam surface: + Length of dam surface: 658.0m + Width of dam surface: 4.20m + Width of circulation: 4.20m + Horizontal slope of dam surface: 1.5% *Contents of repair and upgrade:* + Hardening dam surface by concrete, repairing cracks, breaks on breakwater. + Structure of dam surface: structure of hard pavement, coated concrete M200 with 20 cm in

		the long-term use process, the dam surface is rough with many pot-holes, underbrush has grown sparsely along the crest. - The upstream breakwater with masonry structure and plastered crest has some breaks with dimensions of bxh=0.3x1.0m, the head of crest has a break of 1.5m in length. - The downstream dam surface is also raised by masonry wall with 30cm in height; the crest is plastered by cement mortar.	thickness.
3	**Management road**	*Parameters:* + Length of management road: 139.56m + Width of road surface: 5.0m + Width of road base: 3.50m + Maximum vertical slope of road surface: 10.97% + Horizontal slope of road surface: 1.5% + Width of road-side: 2x0.75m + Road line: based on current soil road line + Structure of management road: The structure of management road is hard pavement structure, lower-layer foundation is made of rubble, upper-layer foundation is made of crushed aggregate, and pavement is coated by M200-20 cm concrete, road-side of 0.75m in width making use of waste soil and stone. *Current situation:* Management and operation road along the	*Parameters:* Hardening concrete for management road: + Length of management road: 139.56m + Width of road surface: 5.0m + Width of road base: 3.50m + Maximum vertical slope of road surface: 10.97% + Horizontal slope of road surface: 1.5% + Width of road-side: 2x0.75m + Road line: based on current soil road line *Contents of repair and upgrade:* + Hardening concrete for management road. + Structure of management road: The structure of management road is hard pavement structure, lower-layer foundation is made of rubble, upper-layer foundation is made of crushed aggregate, and pavement is coated by M200-20 cm concrete, road-side of 0.75m in width making use of waste soil and

		inter-commune road to bridge is built by concrete; the section from bridge to dam surface with 110 m in length is currently soil road. After running through the dam surface, this section is linked with the local road next to the lake. The road surface is rough with many pot-holes, which is not convenient for management and especially for flood prevention and fighting.	stone.
4	**Offtake regulator:**	*Parameters:* + 01 main gate: b x h = (2,20 x 2,30) m + Colour paint for interior and exterior decoration of offtake regulator tower house has been faded + Current system of the tower house's door: wooden door. *Current situation:* + The offtake regulator at the right abutment of dam is arranged a valve tower house at the upstream of dam, the regulator has reinforcement concrete structure; the downstream of offtake regulator has standing water holes under the dam. The tower house of offtake regulator has wooden doors and windows, for a long time, such doors and windows have been damaged and not ensured usability, the door leaves have been rotten, the tower is often splashed in it	*Parameters:* + 02 main doors: b x h = (2,20 x 2,30) m. + System of the tower house's door: two-layer iron door. *Contents of repair and upgrade:* + Supplementing a main door: b x h = (2,20 x 2,30) m + Supplementing three windows: b x h = (2,00 x 2,50)m + Painting interior and exterior decoration of offtake regulator tower house; + The current system of tower house's doors area replaced by two-layer iron doors, decorated by cast-iron patterns with shutter, inside door is protected by shape steel - square steel 12.

		when it rains. + The inside and outside paint of the tower house has been come off, the walls have been painted and dirty. + Valve leaf at downstream used from the 1990s has been rusty and no longer used.	
5	**Salvage and rescue road in combination with spillway line construction**	*Parameters:* + Length of road: 480.0m + Width of road surface: 6.50m + Width of road base: 6.50m + Width of road-side: 2x0.m *Current situation:* Soil road surface, many potholes, difficult to travel.	*Parameters:* + Length of road: 480.0m + Width of road surface: 6.50m + Width of road base: 6.50m + Width of road-side: 2x0.m *Contents of repair and upgrade:* + Upgrading road surface. + Road structure: The road foundation is paved by rubble, road base by grade 2 crushed aggregate, road-side by compacted soil and stone.
6	**Attendant house for flood prevention and work management**	*Parameters:* + Grade 4 houses. + Tone roof. + Wooden doors, windows. *Current situation:* + Main door and side doors are broken + Current door system: wooden door. + Inside and outside walls and ceiling painted have been come off and fusty.	*Parameters:* + Used area: 250m^2. + Two-floor structure. *Contents of repair and upgrade:* Newly building attendant house for flood prevention and work management, use area of 250m2, two floors, reinforced concrete structure: + Floor 1: Arranging working offices and common toilet (for male and female). + Floor 2: Arranging meeting room, attendant room, + control room, working offices and common toilet

			(for male and female). + The elevation of Operation house is designed under modern architecture in combination with finish materials such as: finishing colour paint, plastic door with steel core, white glass etc… + The roof of Operation house is designed with large cantilever, in accordance with height of the house together with concrete cons on system to support lower roof, the upper false roof is covered by red tile creating shadow to the work to avoid rain, sunny for door system.
7	**Rebuilding 02 undergrounds through spring: Tan Viet and Ba undergrounds**	*Current situation:* No capacity enough for flood discharge.	*Parameters:* + Tan Viet underground with 4 gates: 4 x (6x3,5)m. + Ba Xa underground with 2 gates: 4 x (6x3,5)m. *Contents of repair and upgrade:* + Rebuilding 02 undergrounds through spring by M250 reinforced concrete structure on management road due to no capacity enough for flood discharge (designed calculation of flood discharge of 1%): + The upstream and downstream of undergrounds are arranged to connect to natural spring bed by 2 stone lines with dimension of (0,5 x 1,0 x 2,0)m.

Table 2.2. Auxiliary work items

Items	Location	Quantity (deposit of exploitation)	Description
Borrow pit	Hai San pit, located in the West side of the project and	Hai San pit is being operated in An Sinh Commune with the reserve of	5km far from the Work, contiguous with asphalt road being exploited

	5km far from project	3.3 million cubic meter	Specialized vehicles used to transport soil taken from Hai San pit (about 300 meters from the provincial road) will take the route along the inter-communal road routes (in Tan Vietnam on to the construction site. This route is only serving households scattered on both sides of the road, and passes over the residential area of Ba Xa commune (next to the Work).
Landfill site	Poured at the position of the dam foot	Area: 17.500 m^2 with the capacity of 52.500 m^3.	Within the scope of project, right at the foot of the dam, it is arranged along the dam foot (dimension 35x500m). 200m far from the construction road. Scope of transport from construction position to the landfill site is smaller than 1000m along the construction road route
Lay-down yard	Warehouse area, downstream dam foot, near the operator house (the hut area) on its right side. Area of the material lay-down yard is 200m^2.	Area: 200 m^2	100m far from the foot of spillway 300m far from the inter-communal road(asphalt road) The current status of the area: Greenfields of the downstream, under the management area of Khe Che Lake.
The hut area		Area: 400m^2	100m far from the foot of spillway

	Arranged near the operator house		300m far from the inter-communal road(asphalt road) The current status of the area: Greenfields of the downstream, under the management area of Khe Che Lake.

About selection of landfill site position, the Employer has agreed about landfill site position basing on the following advantages

- Transport distance is near to the construction site for the convenience of discharging waste
- Selection of landfill site is located in the greenfield right on the foot of the dam (under management of Khe Che Lake), so, it has no relation to residential area. As a result, site clearance is not necessary
- Selection of landfill site at the foot of the dam will enhance downstream face of the dam by backfilling the counter for the downstream time. In order to ensure that techniques are guaranteed, landfill site will be backfilled with roof which is larger than natural angle of rest of waste material to prevent landslide from the landfill site.

Figure 2.3. The sub-project area

b) Transport of soil, stone and building materials

Table 2.3. Volume of main materials for the project

No.	Materials/ manpower	Calculating unit	Total
1	Stone powder	kg	1,385.444
2	Fine sand	m^3	180.019
3	Black sand	m^3	9.638
4	Yellow sand	m^3	393.235
5	Crushed aggregate 0.075-50mm (upper layer)	m^3	1,216.998
6	Steel wire	kg	4,022.506
7	Stone (rubble)	m^3	1,475.364
8	Crushed stone 1x2	m^3	2,953.179
9	Crushed stone 4x6	m^3	293.707
10	Rubble	m^3	1,273.368
11	Bitumen No. 4	kg	2,411.829
12	Asphalt	kg	611.800
13	Soldering stick	kg	904.159
14	Synthetic paint	kg	28.445
15	Square hollow iron 12x12	kg	745.350
16	Steel pipe	kg	83.349
17	Steel shape	kg	1,644.299
18	Plae steel	kg	3,957.976
19	Round steel d<=10mm	kg	91,142.133
20	Round steel d<=18mm	kg	148,518.752
21	Round steel d >18mm	kg	32.391
22	Backfill soil for items	m^3	3,412
23	Volume of excavation soil for items	m^3	55,459

Source: Collection from cost estimate of the project

According to the calculations, the total volume of excavation soil for construction works of the project is about 55,459 m3, volume of backfill is 3,412 m3. In particular, the required volume of backfill soil is 996 m3, the remaining amount will be made use of excavated volume. Thus, about 51,051 m3 needs to be moved to the disposal area. The disposal area is located along the foot of the dam, with dimension of 35 * 500m. The total capacity of disposal area is about 52,500 m3.

- *Material transport route*

Materials are purchased at Dong Trieu Town where it is 8-10km far from the site. Material transport route: material, fuel, supplies purchased from Dong Trieu Town will be transported along Inter-communal route to Tan Lap, Tan Thanh, Dong Tranh, Dong Dung, Ba Xa and to the foot of the site. Along the route, only people of Dong Trieu Town, Tan Lap and Dong Tranh Communes are living along the road. The remaining route is available with fields (some household are living scattered)

- *Soil transport route for backfilling*

Backfilling soil is purchased at Hai San pit of An Sinh Commune. Vehicles used to transport backfilling soil from Hai San pit (about 300m far from provincial road) along the inter-communal road (through Tan Viet Commune to the foot of the site. Some households are living sporadically on both sides of the road. This route travels through Ba Xa commune only (right next to the foot of the Work).

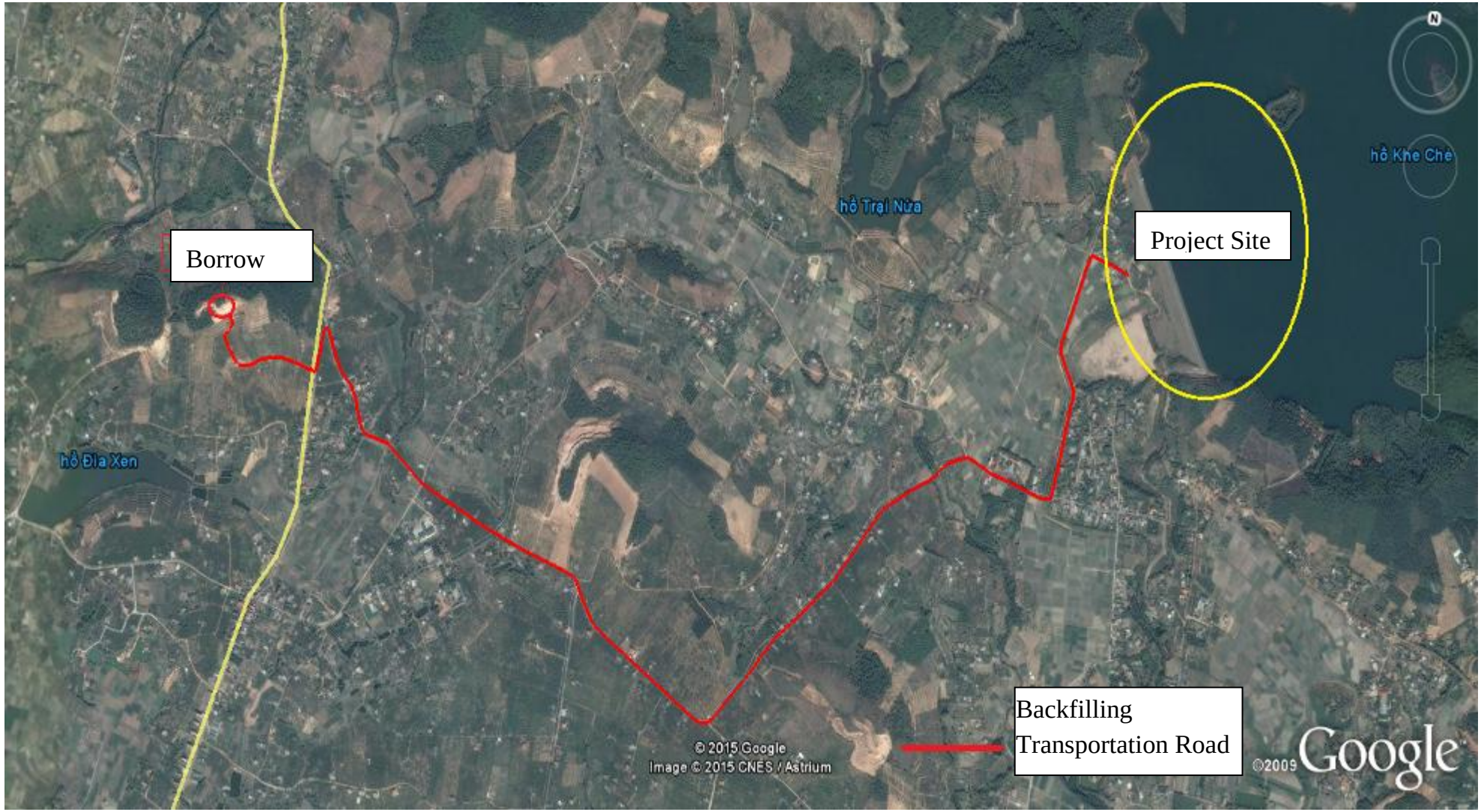

Figure 2.4. Layout of estimated transport route for backfill soil

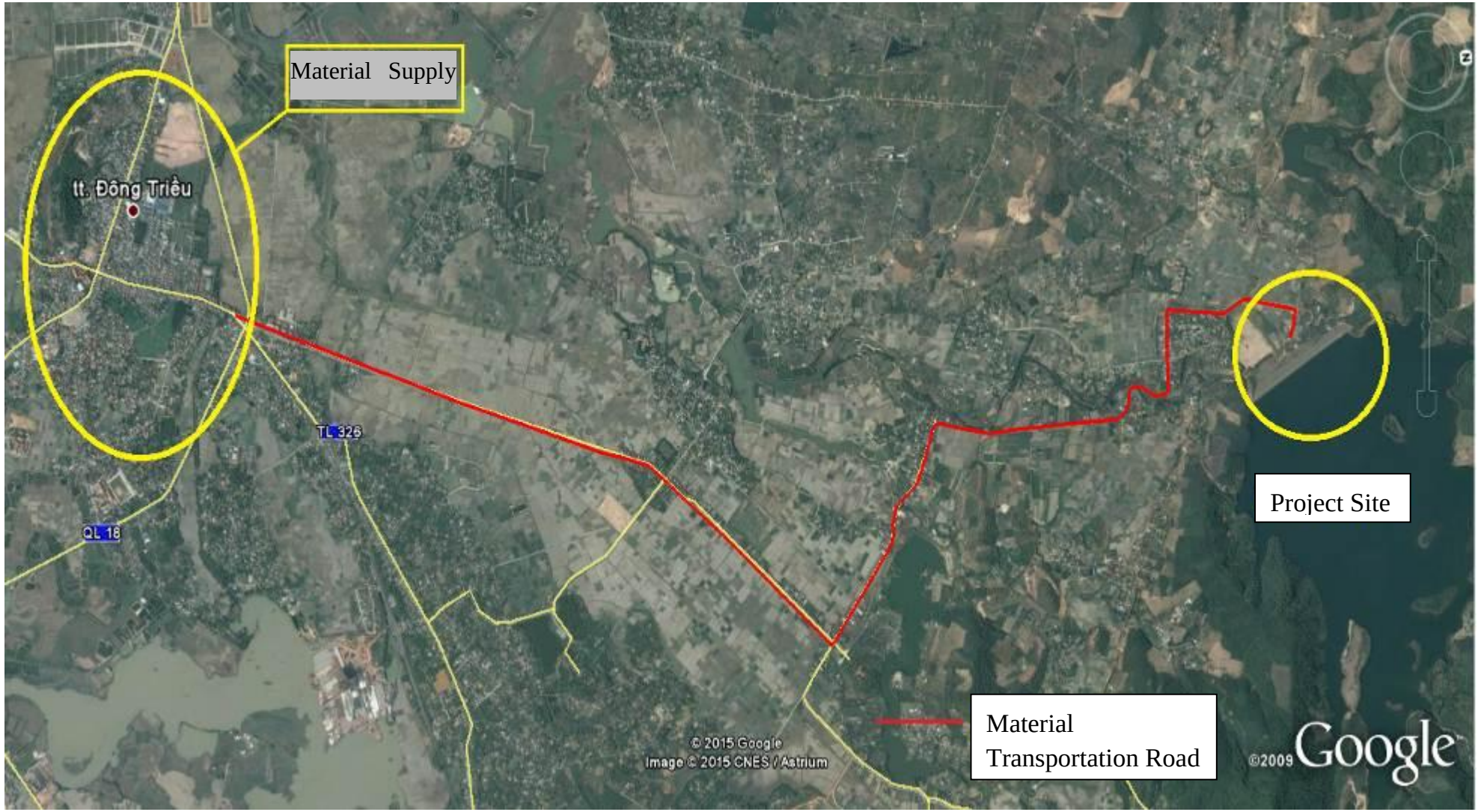

Figure 2.5. Layout of estimated transport route for materials

c) List of machineries

Table 2.4. List of used machineries

Name of machineries	Function	Quality requirement
Excavator 0.8m^3	Land excavation	All means and vehicles must be provided with: 'Certificate of Conformity to Quality Standard, Technical Safety and Environmental Protection" in accordance with Decision no 35/2005/QD-BGTVT to prevent excessive noise from machines which are not maintained properly. - Certificate of Conformity to standard of technical safety and environmental protection applied to motorbike participating in road traffic (22 TCN 278 - 01) - Certificate of Conformity to the technical safety and environmental protection standard applied to motorized vehicles (22 TCN 224 - 01)
Bulldozer 110 CV	Land excavation	
Roller 9T	Base backfill	
Dump truck	Transport for materials	
Water sprinkler 5m^3	Watering	
Compactor 8,5T	Construction of aggregate base course, culvert.	
Compactor 10T	Construction of aggregate pavement	
Tire compactor 16T	Construction of aggregate pavement	
Vibratory compactor 25T	Construction of aggregate pavement	
Paver 50 – 60 m^3/h	Construction of aggregate pavement	
Mixer 500L	Mixing concrete	
SIR system – 10B machine	Termite treatment	
Sonic detector – 3A	Detecting termite and other incidents	
Pumper 7 CV	Pumping water	
Injection boring machine KPV-DB30	Termite treatment	
Drilling rig YRB 50 m	Drilling	

2.3. The construction schedule

Total estimated execution time of sub-project is 14 months, estimated preparation time is the first 2 months. Estimated time to complete the rest of the work as well as land recovery is the last 2 months. Thus direct construction period is 10 months.

Based on the layout of dam, volume and nature of work of each item and hydrological documents showing that the work has small workload, on extensive scope. In addition, the construction work is done when the reservoir stores water for agricultural production in downstream areas. The construction shall not affect to water supply for agricultural production and not have significant impact on aquaculture. The amount of water in the reservoir in months of dry season (from November to next March) is small,

large area. Based on the above principles, the expected construction progress is as follows:

The work is executed in 2 dry seasons (from October to next April).

- Dry Season 01:

+ Performing the preparation of construction: gathering machinery, equipment, accommodation and warehouse (October – November);

+ Embanking construction road on spillway tail from downstream of the soil dam (December - January);

+ Opening foundation and completing construction of flood spillway (February – April).

- Dry Season 02:

+ Construction for hardening surface of soil dam (October – November);

+ Construction for hardening management road (December – January);

+ Completion for items, accommodation, warehouse clearance, land recovery, disposal of refused materials (February – April).

PART III: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Subproject of "Repairing and upgrading headworks complex of Khe Che reservoir" does not impact to the ethnic minorities groups, the sub-project areas does not have natural forests, biodiversity conservation areas, wetlands or the threatened species. The major impacts of the sub-project to the natural environment relate to the activities of land excavation, reparation of headwork of dam, material and waste transportations, borrow pit exploitation, and some impacts on the local committees due to forestry land acquisition. The applicable policies, institutional frameworks for environmental and social impacts assessment of the sub-project can be explained below:

3.1. Applicable National Law and Regulations

a) Environment

Law on environmental protection no.55/2014/QH13, on Regulating Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment. Environmental report should be carried out simultaneously with the establishment of investment projects (Feasibility study report). Requesting time for EA report making, delivery and appraisal are specified in section no.2 of Article no.13 of Decree no.21/2011/ND-CP. Environmental screening steps (typical environmental assessment to the project) should be done in accordance with the list of projects type in Annex 2 of the Decree no.18/2015/ND-CP

Environmental impact assessment (EIA). In chapter 4 of Decree no.18/2015/ND-CP on date 14/02/2015, from the article 12 to article 17 were specified in the formulation, evaluation and approval of environmental impact assessment reports, the implementation of projects and the designed mitigation measures to protect environment before and after a project officially operation. In the article 12 of this Decree also regards on environmental impact assessment process to the project implementation, the project owner have to organise meetings to public consultants, such as Provincial People's Committees, local authority (Commune People's Committees level- CPC), affected (direct or indirect) people or committees in the local by the project implementation, mandatory; analysis the feedbacks, comments obtained from the affected groups, and consider advantage or disadvantage the impacts of the project to community and to design the mitigation measures to reduce the negative impacts on natural environment, biodiversity, community. According to the annex no.2 of the Decree, the project has to make EIA if the reservoir capacity is of 100,000m^3 or more.

Environmental protection plan. Chapter 5 of Decree no.18/2015/ND-CP on date 02/14/2015, from Articles no. 18 and no.19 and the Annex II of this Decree defined that a new project implementation, or scale extension, increasing capacity have to identify the affecting objects and have to make a plan of environmental protection

According to the regulations of Vietnam Government, the subproject " *Repairing and upgrading headworks complex of Khe Che reservoir*" have to perform the report of Environment Impact Assessment.

b) Dam safety regulations

Decree no. 72 /NĐ-CP on date 07/05/2007 of the government of Vietnam 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 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.

c) Land acquisition by the State and Resettlement policies

Land Law no. 45/2013/QH13, effected on 07.01.2014, this law 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. The law also gives the guidance on Land acquisition, recovery and compensation, resettlement and the requirement to ensure safety of dam corridor and reservoir, irrigation works, etc.

3.2. World Bank Safeguards policies Triggered

The safeguards policies of World Bank given in the form of operational policies (OPs), which includes 10 triggered policies, included the important policy OP 4:01 environmental assessment. Here are a summary of World Bank's policies that's related to the sub-project:

Table 3. 1. Selected environmental and legal safeguard policies of WB relate to the sub-project

Name	*Objective*
OP 4.01 Environmental Assessment	• To ensure the environmental and social soundness and sustainability of investment projects. • To provide decision makers with information on potential environmental and social impacts related to the project. • To enhance the transparency and participation of affected communities into the decision making process.
OP 4.37	• Issues have vital impact on dam safety, specified in:

Safety of Dams	• The policy involve to new dams construction • The issues occurs by the existing dams and dams under Construction he • The other important issue: dam height, reservoir capacity, suitability of safety standards
OP 4.12 Involuntary Resettlement	• Avoid or minimize involuntary resettlement and impacts on economic activities, including loss of livelihoods • Provide transparent compensation procedures during involuntary taking of land and other assets • Provide sufficient investment resources to enable the persons displaced by the project to share in project benefits (implemented through the Resettlement Action Plan) • Restore and improve the standards of living of persons affected by the project • Provide prompt and effective compensation at full replacement cost for losses of assets attributable directly to the project. Development of Resettlement Plan and mitigation measures must be carried out based on consultation with affected populations and participatory approaches.

PART IV: ENVIRONMENT AND SOSIO-ECONOMIC CHARACTERISTIC OF THE PROJECT AREA

4.1. Physical environment

4.1.1. Natural conditions

a) Climate features

- *Temperature*

Average air temperature in many years is 23.3^{o}C, the highest level are from June to August and the lowest level is on January and February. (See Table 4.1).

Table 4.1. Average air temperature in the last 5 years in the project area

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Avg.	16.4	17.2	20.0	23.5	27.1	28.4	28.8	28.0	27.0	24.7	21.2	17.8	23.3
Max	30.8	28.9	33.6	32.2	36.6	37.9	37.8	36.2	35.4	32.9	31.7	30.1	37.9
Year	1980	NN	1970	1966	1967	1983	1968	1978	1968	1976	1967	1974	1983
Min	3.3	5.4	7.9	11.4	17.5	19.6	21.9	22.0	17.3	12.7	6.7	3.2	3.2
Year	1967	1974	1972	1970	1984	1967	NN	1965	1966	1971	NN	1975	1975

(Source: http://quangninh.gov.vn/vi-VN/huyenthi/huyendongtrieu/Trang/default.aspx/)

- *Humidity*

Average air humidity in many years is 82%, the highest level are on February, March and August with average value of 86% (see Table 4.2).

Table 4.2. Average air humidity in the last 5 years in the project area

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
%	80	83	86	86	83	83	84	86	83	79	75	76	82

(Source: http://quangninh.gov.vn/vi-VN/huyenthi/huyendongtrieu/Trang/default.aspx/)

- *Amount of evaporation*

Average amount of evaporation in many years is 998.2mm at Uong Bi (measured by Piche tube). The minimum level is on February and March and maximum level if on October and November (see Table 4.3).

Table 4.3. Average amount of evaporation in the last 5 years in the project area

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Z(mm)	74.6	57.8	58.5	63.4	89.4	94	93.2	75.1	82.5	102.8	107.7	99.2	998.2

(Source: http://quangninh.gov.vn/vi-VN/huyenthi/huyendongtrieu/Trang/default.aspx/)

- *Wind*

Table 4.4. Average wind speed in the last 5 years in the project area

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
V(m/s)	1.8	1.9	1.9	2.1	2.2	2.2	2.3	1.8	1.5	1.7	1.6	1.7	1.9

(Source: http://quangninh.gov.vn/vi-VN/huyenthi/huyendongtrieu/Trang/default.aspx/)

- *Precipitation*

Dong Trieu is the region with low average annual precipitation of Quang Ninh, X_o=1459,4mm, the maximum daily precipitation measured on 28 October 2005 is 335mm (see Table 4.5).

Table 4.5. Average Annual Precipitation in the last 5 years in the project area

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Avg.	18.3	19.1	42.5	72.1	189.4	216.0	246.5	290.6	204.1	94.6	42.6	23.5	1459.4
Max	45.5	37	335	96	166	140.7	153	261.3	335	140.2	200.6	72.5	335
NXH	1983	1990	2005	1984	2007	2005	1997	1981	2005	1990	1984	1994	2005

(Source: http://quangninh.gov.vn/vi-VN/huyenthi/huyendongtrieu/Trang/default.aspx/)

- *Meteorological Observation Status*

At the basin without any meteorological observation station, the region has the weather stations as follows:

Table 4.6. Weather station

No.	*Name*	*Location*		*Measuring factors*	*Measuring time*
		Longitude	*Latitude*		
1	Uong Bi	106°46’	21°02’	Rain, wind, evaporation, temperature	1961-2008
2	Dong Trieu	106°30’	21°05’	Rain	75, 78~2008

(Source: http://quangninh.gov.vn/vi-VN/huyenthi/huyendongtrieu/Trang/default.aspx/)

- *Unpredictable weather phenomena*

- *Hurricane*: Each year Dong Trieu must suffer the impacts of about 5 – 6 hurricanes with the wind speed of 20 – 40m/s that causes heavy rain, precipitation of from 100 – 200mm, evenly up to 500mm for some places. The hurricane makes the huge damages for activities in fields of agriculture – forestry – fishery, living activities and people’s livelihood.

b) *Salt flog*: At Dong Trieu, salt flog is always observed within from December of the previous year to March of following year, focusing on the regions of An Sinh, Binh Khe, Trang Luong mountains when the temperature falls to 3^0C.

c) Terrain

The region planned for the project is the area transforming from the mountains to the plain so much of Quang Ninh is sloping terrain with round peak, gentle slope, attitude of 5-100m that is good for development of industrial and agricultural crops, forest planting. However, Quang Ninh has many high peaks of approximately 1000m comparing to the slopes, mixing the sharp peaks with deep creeks on the West side of the Province.

Basin of Khe Che Lake is in the low mountainous area of Dong Trieu at the average level of vegetation. The work for supplying about 1000ha cultivated land.

Typical features of Khe Che basin as follows:

- Basin area: $F = 22,4\ km^2$.
- River length: $L_s = 6km$.

d) Geology

The formation in this region is characterized as the water penetration from the average level to the weaker one, monolithic bedrock which is less cracks, weak penetration and considered as the waterproof layer, covering layer and chronozone IA2 with water penetration from the average level to the higher level with the thin layer.

- *Features of aquifers, auriferous complex:*

- The formation is characterized as water penetration from the weak level to the higher one, monolithic bedrock which is less cracks and considered as the waterproof layer. Groundwater is stagnated in the empty holes of covering layer and in the cracks of weathered zones. It could be divided the aquifers under the studied zones as followed:

- The aquifers in the alluvia, deluvia-proluvia sediments: Water stagnates and moves in the empty holes formed by clay loam, clay sand, pebble stone that are derived from the alluvial grounds and mixture of proluvia-deluvia.

- The main water sources are rainfall, water from the surface of auriferous complexes and Khe Che lake. Movement mechanism and chemical composition of alluvia, deluvia-proluvia accumulated water are closely related to the conditions and chemical composition of lake.

- Aquifer in the rock formations: Because the lithological components are formed by quaternary sediment and terrigenous sediment under the mixed and layered structure, water storage capacity of the complex is higher. It probably relates to pressured water.

- Groundwater is clear, odourless, tasteless and used as domestic water source of residents.

- Topography, geomorphology: Spillway line is located on the left of Khe Che dam, on a hillside with an average slope of 20-250.

- Stratum, lithology: According to the results after drilling, the spillway line appears fine rock, purple grits classified under Binh Lieu layer, weak-weathered rock with purple brown or reddish brown colour, layered structure, and medium hardness.

- Mash and compress: According to the results after drilling, there is no sign of broken stone in the drilling holes. Rocks are weathered at the medium level to high level so the RQD ratio of stone is low.

- *Chronozone:*

- The entire length of the spillway line shall drill 4 holes (HK1, HK2, HK3, HK4). According to the drilling results, geological and stratigraphical conditions at this area is detailed:

- ChronozoneIA1 is the thin layer with the component of fine rock, strongly weathered red brown grits, distributed the high area and upstream of the spillway.

- Chronozone IA2 is distributed at the downstream and crown glass along to the cracks, thickness of 3-6m, components of red brown clay loam in the malleable and hard status and grits. Chronozone IA2 is the products of the strongly weathered process for bedrock.

- Lower part of Chronozone IA2 belongs to the average wethered layer IB with the main component of fine rock, grits making to the layer. It is cracked and weathered along to the cracks, average thickness of about 1-4.5m.

- Chronozone IIA is the quite intact one, less cracks. The analysis result is shown in the table on stone experimental results

In general, the geological condition of the dam line is quite favourable for the design of concrete spillway.

4.1.2. Water environment

4.1.2.1. Surface water

Location of headwork of Tea Khe reservoir locates in areas with abundant precipitation, total average annual precipitation of 1495.5 mm. Basin of Khe Che reservoir is low hills, average-level phytoplankton, and basin area of 22.4 km2. Residents here live mainly on agriculture and industrial production. The reservoir is responsible for providing water to irrigate about 1,000 hectares of cultivated land.

Water quality is determined through analysis of typical samples of the lake. Because of having the ecological activities in this area, the investigation team took 06 samples and the specific sampling locations are shown in Table 4.7 below.

Table 4.7. Sampling location at Khe Che Lake

(Time: Morning 11 March 2015)

No.	KH	Coordinate		DESCRIPTION OF SAMPLING POINT
		Latitude	Latitude	
1	**H1**	21°08’38.1”	106°32’20.9”	Far from the ecological zone, depth of 10m, small rain, temperature of 24^{o}C
2	**H2**	21°08’51.7”	106°31’57.9”	Water near the ecological zone, next to the spillway. In summer, the ecological zone is crowded with tourism services and festival activities.
3	**H3**	21°08’38.0”	106°31’30.6”	Water: 3m far from the sewer
4	**H4**	21°08’23.3”	106°31’37.6”	Water: 3m far from the spillway
5	**H5**	21°08’33.7”	106°31’51.3”	Water: 3m far from the lake bank, green colour from the aquatic organisms
6	**H6**	21°08’16.3”	106°31’52.6”	H6: Water at the centre of lake, depth of 13-14m

The project area has many ponds, lakes, rivers with the average-to-high density comparing with the rest of country, abundant water surface resource.

Table 4.8. Sampling point at other locations of the project

(Sampling time: Morning 11 March 2015)

No.	KH	Coordinate		DESCRIPTION OF SAMPLING POINT
		Latitude	Longitude	
1	**N1**	21°07'59.7"	106°31'32.8"	Sewer 1 An Sinh contains the stagnant water when draining through channels
2	**N2**	21°07'15.2"	106°31'47.1"	Sewer 2 Tan Viet contains the stagnant water
3	**N3**	21°06'52.3"	106°32'03.6"	Tan Viet pump station, Dong Khe Ha hamlet
4	**N4**	21°05'39.9"	106°31'03.0"	Duc Chinh drainage ditch, cultivated land is near to the Tan Viet livelihood zone.
5	**N5**	21°05'45.3"	106°31'05.1"	Viet Dan pump station, the surrounding is cultivated zone
7	**N6**	21°05'41.3"	106°29'45.3"	Ba Xa Hamlet, An Sinh Commune
8	**N7**	21°07'37.6"	106°31'54.3"	Binh Duong pump station locates at Dang Thuy village
9	**N8**	21°07'38.0"	106°31'43.0"	Thuy An pump station; water in the pump station is low and dirty
10	**N9**	21°08'07.0"	106°31'07.3"	Trang An drainage ditch, dirty

To specify quality of surface water environment in the area under the sub-project's impacts, sampling points are defined at 3 communes (An Sinh, Tan Viet, Viet Dan) where suffer the impacts from headworks of Khe Che reservoir. Sampling is conducted at underground sewers (An Sinh and Tan Viet Commune) and drainage stations (An Sinh, Tan Viet, Viet Dan Commune). Locations of other sample area in the affected and beneficiary area are presented in Table 4.8.

Comments: By analysis results of sampling the lake water and surface water at communes within the affected areas of the project that upgrades and extends the spillway for headworks of Khe Che reservoir (Appendix A3.1), we can see that:

- Generally, surface water quality at the areas under the acceptable limit of QCVN 08: 2008/BTNMT.

- Several criteria have not met the requirements:

+ At the sampling point H1 and H6 in Khe Che lake, COD concentration (31 and 34 mg/L) exceeds the acceptable values under QCVN (30 mg/L); However, these value are under the limit. Moreover, at sampling locations at Duc Chinh, Viet Dan drainage ditch, Thuy An sewer, water also is polluted by the organic matters (COD level exceeds the acceptable standards). It can be predicted that initial cause is due to the local residents washing their tools and pesticide bottle on the drainage system , leading to increase COD concentration at the above-mentioned positions.

+ Almost water samplings in the lake have not met the standards on the level and microorganism, shown by Coliform or E.Coli concentration subject to QCVN 08:2008/BTNMT. Coliform concentration in the surface water at most of sampling points

exceeds the limited values (except for underground sewer 2 Tan Viet and Thuy An pump station).

- Basically, quality of water surface at the affected areas of the project is quite good.

4.1.2.2. Groundwater

Terrain of Dong Trieu District has sloped from North to South. In the North, Dong Trieu Mountains consecutively run in the curve shape with Bay Deo peak of over 1,000 meters. In the South, there is Cao Bang, Dong Son, Dao Quan Mountains with the height of approximately 500m. From the North, many rivers and stream flow down. The West has Vang river. Dam Thuy River, Ky Cam River, Trang Bang River in order of appearance. The East is Tan Yen River. Rivers are small and upstream slope is high, the downstream is quite wide, groundwater source is abundant because of dense limestone mountains.

The headwork of Khe Che reservoir mainly affects to 03 communes: An Sinh, Viet Dan and Tan Viet so the groundwater shall be sampled at these points to assess the water quality.

Location for sampling at 03 communes: An Sinh, Tan Viet and Viet Dan are shown in the table below.

Table 4.9. Sampling locations at the affected area of the project

(Time: Afternoon, 11 March 2015)

No.	KH	Coordinate		DESCRIPTION OF SAMPLING POINT
		Latitude	Longitude	
1	**NN1**	21°07’47.7”	106°30’25.5”	An Sinh well, Mr. Pham Van Tien and his family - livestock farming at large scale (20 pigs). Sampling depth of 15m.
2	**NN2**	21°06’19.4”	106°28’21.8”	An Sinh well, Mr. Pham Phu Be and his family - livestock farming at small scale. Sampling depth of 20m.
3	**NN3**	21°05’41.6”	106°29’11.3”	Tan Viet well, Mrs. Luu Thi Men and her family – using water from the drilling well. Sampling depth of 25m.
4	**NN4**	21°05’17.0”	106°29’11.2”	Tan Viet well, Mr. Vuon Van Chinh and his family – using water for livestock farming. Sampling depth of 20m.
5	**NN5**	21°05’18.6”	106°30’59.1”	Viet Dan well, Mr. Nguyen Van Thanh and his family – Khe Ha. Water has abnormal smell. Sampling depth of 20m
6	**NN6**	21°06’30.1”	106°31’37.3”	Viet Dan well, Mr. Nguyen Van Thuc and his family –

				An Lang. Water has abnormal smell but be used for living activities. Sampling depth of 20m
7	**NN7**	21°05'45.6"	106°30'03.9"	Viet Dan well, Mr. Nguyen Van De and his family – An Trai. Water has abnormal smell. Sampling depth of 25m

Quality of groundwater at these sampling points is shown in Appendix A3.2.

Comments: By the analysis results of groundwater samples taken at 03 communes that have suffered the most impacts from the headwork of Khe Che reservoir, we can see that:

- The quality of underground water at 03 communes does not meet the standards on microbiology (Coliform and E. coli levels exceed the permissible limit).

- At An Sinh commune, COD concentration meets the standard QCVN 09: 2008 / BTNMT (National Technical Regulations on groundwater quality) while the groundwater at Tan Viet and Viet Dan commune has a signal of organic pollutants (COD values in the samples exceeds the permissible limit prescribed under QCVN).

- Other factors are under the permissible limits. Generally, groundwater quality of the three communes is relatively good.

4.1.3. Air environment

- To assess the air quality of the project area, conduct the survey and measure 4 air samples: KK01: Air sample from the main dam (X:574641,32; Y:2258850,51); KK02: Air sample form the entry to the main dam (X:574728,86; Y:2258698,76); KK03: Air sample from spillway (X:574337,74; Y:2259062,54); KK04: Air sample from paddy field (X: 574612,45; Y:2259128,53);

- Analysis results of air quality of the sub-project area are shown in Appendix A3.3.

Comment: Basing on the observation results of air environment at 4 points KK01. KK02, KK03, KK04, we can produce some comments as follows:

- Comparing the criteria on TSSP, noise, concentration of CO, SO_2, NO_2 with QCVN 05-2008/BTNTM (Air quality), it is proved that these criteria have satisfied the standards.

- Basically, air quality of this area is quite good, has not appeared the pollution signs yet.

4.1.4. Soil environment

The terrain of the lake centre is mainly hill with the slope of approximately 15-200, average level of 180. The streams at the spillway flow from the Southwest to the Northeast, width of 30-70m, mountain slope of $20\text{-}25^0$

Geomorphology of the survey area is divided under the patterns and backgrounds, including:

− The original surface inclined from the synthetic erosion: Widely distributed on the hillside. On the topographical surface, development of erosion and landslide processes forms thick coating layer made by eluvial-deluvial components.

− The original side eroded and wiped out: Unconsolidated materials are weathered and washed away, accumulating the large and multi-components block on the washout surface, evenly exposed bedrock

According to planning documents, land in the project area is mainly formed from weathered rocks, sediments washed out. So, it should not be fertile.

To determine soil quality of areas around the headwork, soil samples were taken at 3 communes An Sinh (D01), Viet Dan (D02) and Tan Viet (D03). This is the area suffering the most impacts from Khe Che reservoir.

The results on analysing the land samples at 03 communes An Sinh, Viet Dan and Tan Viet are shown Appendix A3.4.

Remark:

- Đ1: Sediment sample at Tan Viet pump station (X: 21°06’52.3” ;Y:106°32’03.6”).
- Đ3: Sediment sample at Viet Dan pump station (X: 21°05’45.3”;Y:106°31’05.1”)
- Đ4: Sediment sample at An Sinh Commune (X: 21°05’41.3”;Y:106°29’45.3”)

Comment: According to the analysis results of soil samples at 03 communes suffering the most impacts from the headwork, we can see that:

− Comparing metal content in soil samples with the standard QCVN 03-2008/BTNTM (Soil quality - National technical regulation on the allowable limits of heavy metals in the soils), it is seen that the metal contents can be acceptable. Soil at the sampling points belongs to the neutral type, no signs of alum or saline.

− Area of soil sampling is mainly used for agricultural purposes (rice planting), no waste sources and far from residential zones so that the metal content is low. The soil quality is quite good, no signs of contamination.

4.2. Biological environment

4.2.1. Observation location of ecological background

Irrigation systems for controlling the water flow and irrigating the near-by villages and private farms for industrial plants, fruit trees, especially in the channels, has certain affected to aquatic system in this area. Research and survey activities were conducted at the end of the spring season, or 11 March 2015. Location of sampling stations is positioned by the following coordinates:

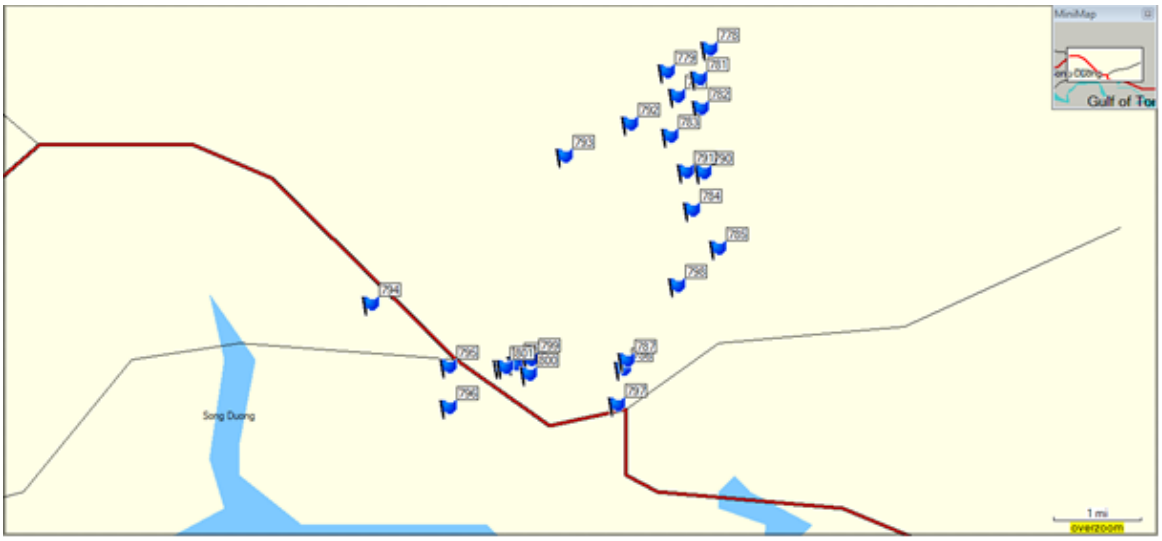

Figure 4.1. Location of sampling station at the sub-project area of Khe Che reservoir

Table 4.10. Coordinate of survey points at Khe Che Lake, Dong Trieu, Quang Ninh

(Time: 11 March 2015)

Code of Coordinate	Latitude	Longitude	Attitude (m)
Points on Khe Che lake			
777	21°08'38.1"	106°32'20.9"	10
778	21°08'51.7"	106°31'57.9"	9
779	21°08'38.0"	106°31'30.6"	11
780	21°08'23.3"	106°31'37.6"	12
781	21°08'33.7"	106°31'51.3"	16
Others			
782	21°08'16.3"	106°31'52.6"	16
783	21°07'59.7"	106°31'32.8"	1
784	21°07'15.2"	106°31'47.1"	1
785	21°06'52.3"	106°32'03.6"	7
786	21°05'39.9"	106°31'03.0"	1
787	21°05'45.3"	106°31'05.1"	2
788	21°05'43.3"	106°29'54.0"	17
789	21°05'41.3"	106°29'45.3"	16
790	21°07'37.6"	106°31'54.3"	24
791	21°07'38.0"	106°31'43.0"	22
792	21°08'07.0"	106°31'07.3"	18
793	21°07'47.7"	106°30'25.5"	40
794	21°06'19.4"	106°28'21.8"	13
795	21°05'41.6"	106°29'11.3"	11
796	21°05'17.0"	106°29'11.2"	11
797	21°05'18.6"	106°30'59.1"	10
798	21°06'30.1"	106°31'37.3"	12
799	21°05'45.6"	106°30'03.9"	4

800	21°05'36.9"	106°30'02.5"	5
801	21°05'40.9"	106°29'47.6"	6

4.2.2. Flora

Studied area belongs to agricultural ecosystem with the landscape of low hills in Red River Delta. In this type, it is mainly planted forests, cultivation of industrial plants, fruit trees, waters rice, and irrigation channels. Therefore, biological system in the study area is mainly aquatic groups.

By the field surveys, interview of residents and the published and approved documents, the project have listed components of terrestrial flora and fauna (the area around the project at An Sinh Commune) as follows: flora has 38 species, 27 families under 2 divisions: Pteridophyta and Magnolia.

There are three main types of vegetation:

- Flora covers different tree species planted in the agricultural land: There are 13 plant species belonging such flora. Most of them are short-term cultivated plants with the largest area. This flora occupies up to 2/3 entire area relating to irrigation dam.
- Flora covering forestry trees and fruit trees planted in the hills and uplands: There are 22 plant species and wild species allocated in such flora. This flora covers the second-largest area behind the flora planted in the agricultural land.
- Flora covering plants for fruits, foods and routine consumption purposes in the residential areas: There are 26 plant species in such flora. This flora covers the smallest area among 3 types of flora.

a) Macrophyta

Macrophyta in the survey area includes the habitats:

- *Floating-leaved macrophyte* refers to species with roots buried into the water basin bottom and leaves to be floated in the water or water surface: including different types of *Nelumbo nucifera*, *Nymphaea nouchali*, *N. pubescens*, *N. tetragona*, *Cyperus spp*., *Phylidrum lanuginosum*, etc
- *Freely floating macrophyte* refers to the water-fens of various species with fasciculate root submerged in water: *Pistasia stratiotes*, *Salvia cuculata*, and *Eichnornia crassipes*
- *Emergent macrophyte* refers to species with roots submerged inside the water basin bottom with body and leaves floating above water, including: *E. dulcis*, *Ludwidgia adscendens*, *Centrostachys aquatica*, *Hymenachne acutigluma*, *Coix aquatica*, *L. hexandra*, etc. Besides, the natural aquatic plants as mentioned above include water rice population regarded as crops.
- S*ubmerged macrophyte* cover seaweed species with roots deeply submerged into water basin bottom, all of its body and leaves completely submerged into water, including *Ceratophyllum demersum*, *Nymphoides indicum*, *Utricularia flexuosa*, *U. fasciculata*, *U. confervifolia*, *Hydrrilla verticilata*, etc

Moreover, together with the above aquatic plants, there are some floating plants such as *Lemna tenera, L. aequinoctialis, Azolla pinnata*, etc

Submerged macrophyte may not find the effect signs from pesticide. However, it is possible to find with rice. With pesticide quantity as mentioned above, rice-originated products are not consumed at the local people but it is sold to elsewhere then rice produced by other areas is bought to consume here.

b) Phytoplankton

The primary analysis results of floating macrophyte determined 42 species under 17 families and 6 braches (Appendix 1). *Bacillariophyta* has 16 species, accounting for 38.1%, *Chlorophyta* has 14 species, accounting for 33.33%, *Cyanophyta* has 7 species, accounting for 16.67%, *Pyrrophyta* has 1 species, accounting for 2.38% and *Euglenophyta* has 4 species, accounting for 9.52%. The floating macrophyte is many popular and widely allocated tropical species without specific species. With about 42 species of floating macrophyte as mentioned above, it is relatively low against the same aquatic macrophyte forms at other places.

The density analysis results of floating macrophyte (Table 1) unveiled some comments: Density of floating macrophyte rarely varies among survey stations. It fluctuates within the range of 2,000-4,000 TB/L. The Bacillariophyta, Chlorophyta and Cyanophyta branches domain in terms of density. The Cyanophyta branch obtains the least domain, accounting for 35-40% among total floating macrophytes. The Euglenophyta branch obtains low rate (3-5%), in accordance with the aquatic form in the agricultural ecosystem in the plain and highland landscape.

4.2.3. Fauna

The fauna in the sub-project site is described as follows:

- Regarding animal: 15 species belonging to 8 families and 4 sets.
- Regarding bird: 74 species belonging to 37 families and 15 sets.
- Regarding reptile: 19 species belonging to 9 families and 2 sets.
- Regarding amphibians: 13 species belonging to 5 families and 1 set.

- ***Zooplankton***

The sample analysis results determined 28 species of Zooplankton belonging to 12 families and 21 breeding (Appendix 2), in which *Copepoda* has 7 species, accounting for 25% of total species, *Cladocera* has 10 species, accounting for 35.71%, *Rotatoria* has 10 species, accounting for 35.71% and insect larvae has 1 species, accounting for 3.57%. Quantity of Zooplankton determined in the site may be lower than that in practice. There is no specific water basin species.

In the reservoir-shaped waters, the largest quantity of species (21 species) is available at irrigation channel (16-18 species), irrigation ditch (15-16 species) and the smallest quantity of species is available at ditch and rice paddy field (8-12 species).

The Zooplankton density analysis results (Table 2) releases some comments as follows:

- Regarding the Zooplankton density, the variation is remarkably high, from 50 units/m3 to 18,000 unit/m3. Concretely, at Khe Che Irrigation Reservoir (T1; T2; T3; T4; T5), the highest density is available (3,333-17,959 units/m3), the next is the large channel and internal irrigation ditch (T 6; T7) with density of 1,450-3,300 units/m3 and the lowest is available in small ditch (where directly circulates the rice paddy field and suffers the significant impacts of pesticides as well as pesticide bottle and empty container after directly discharging here). The density is suddenly reduced and obtained only 50-100 units/m^3.
- In general, the waters are characterized by non-diversified components of species and sharp fluctuation in terms of Zooplankton density. At such waters, the random water discharging of pesticide bottles, empty containers and application of many pesticide types in a rice crop may be a pollution source.

b) Zoobenthos

The Zoobenthos analysis results determined over 13 freshwater oysters and snails belonging to 6 families and 10 breeding (Appendix 3), in which Viviparidae, Corbiculidae and Bithyniidae had 3 species. At the survey sites in the irrigation channel or ponds or reservoirs, some species were higher than that in others, the lowest was available at small ditches bordering with rice paddy field. Generally, the local freshwater oysters and snails are popular in waters of Vietnam.

Therefore, the oyster and snail components of served site were not diversified. Among the obtained snails, there were two species of yellow snails namely *Pomacea canaliculata* and *P. bridgesi*. These two species has been immigrated into Vietnam since the early of 1980s and 1990s. It was originated from Amazon River delta (Argentina, Brazil), migrated to Asian and Southeast Asia counties for food purposes. However, after a short period of time, such nails released adverse impacts after being discharged into the natural environment. They destroyed plants in the field with fast speed and caused remarkable damages to Vietnam agriculture.

c) Components of domestic and natural fishes

Through survey and statistics in the region, the fish components included 22 species belonging to 8 families and 5 sets. Number of natural fishes available in the survey area was not larger than that of domestic fish raised by households (surrounding ponds or lakes).

Popular domestic fishes include *Cyprinus carpio*, *Cirrhinus molitorella*, *Labeo rohita*, *Cirrhinus mrigala*, *Hypophthalmichthys molitrix*, *Hypophthalmichthys nobilis*, *Oreochromis mossambicus* and *Colossoma brachypomum*.

Popular natural fish species include *Acheilognathus cf. kyphus*, *Anabas testudineus*, *Hemiculter leucisculus*, *Monopterus albus*, *Anabas testudineus*, *Macropodus opercularis*. There is no rare and specific fish species.

4.2.4. Sensitive area

Within the site to be launched with the sub-project on "Rehabilitating and improving head works complex of Khe Che Reservoir", no sensitive areas are available such as wetlands, parks and protected areas, conservation areas and ecological zones, gene and biosphere reserves, and national defence areas.

4.3. Socio-economic and socio-cultural environment

4.3.1. Overview on socio-economic situation in the project site

4.3.1.1. Population

- Dong Trieu District

According to the figures released by Statistics Department of Dong Trieu District, the average population of Dong Trieu District was 172,178 persons, including 85,427 female. The urban population was 44,412 persons, accounting for 25.8%, the rural population was 127,766 persons, accounting for 74.2% of population in the District.

Dong Trieu was the home of 14 ethnic groups, in which Kinh ethnic accounted for 97.6% of population and the remaining was other ethnic groups.

+ Number of household in the district: 48,329 household, 3.5 persons/household on average, in which:

Urban area: 11,300 households, 3.9 persons/household on average;

Rural area: 37,029 households, 3.4 persons/household on average.

+ Households by production field:

Industrial household: 2,628 households, accounting for 5.44%

Agricultural household: 25,624 households, accounting for 53.02%

Trading and service household: 7,715 households, accounting for 15.96%

Transportation household: 1,400 households, accounting for 2.9%

Others: 10,962 households, accounting for 22.7%

+ Average population density in 2013 were 433 persons/km^2 increase by 39 persons/km^2 compared to 2010 (394 persons/km^2).

Table 4.11. Population structure of communes at the downstream of Khe Che reservoir

No.	Content	Name of communes								
		An Sinh	**Binh Duong**	**Duc Chinh**	**Nguyen Hue**	**Tan Viet**	**Thuy An**	**Trang An**	**Viet Dan**	**Dong Trieu Town**
11	Total	6904	8213	7740	6188	3311	4200	6071	4240	5282
22	Female	3592	4124	4016	3155	1725	2200	3053	2164	2506
33	Male	3312	4089	3724	3033	1586	2000	3018	2076	2776

Source: Statistics from Department of Statistics of Dong Trieu District (2014)

4.3.1.2 Socio-economic

Lowlands of Dong Trieu District cover 8 communes and 01 town, in which 3 communes obtained the highest benefits and impacts from the project during the Project was launched, namely An Sinh, Viet Dan and Tan Viet. According to the statistics of Dong Trieu district: the overall production value growth of the District was 16.9%/ year in the period of 2010 – 2013, in which the average growth of industries namely: Agro-fisheries and forestry obtained 11.7%, Industry and construction industries obtained 17.37% and service obtained 18.94%. The above indicators were relatively higher than that of the entire province (at the same period of 2010 – 2013, production value growth of Agro-fisheries and forestry, Industry and construction, Trading and Services of the Province obtained 3.6%, 7.29% and 12% /year, respectively.

Table 4.12. Several criteria for economic development in period of 2010 - 2013

No.	Items	2010	2011	2012	preliminary 2013	Average increasing rate (%/year)
	Competitive price in 1994	**2,207**	**2,710**	**3,004**	**3,527**	**16.90**
II	***Agriculture-Forestry-Fishery***	***357***	***387***	***404***	***499***	***11.77***
1	Farming	191	244	240	239	7.89
2	Breeding	167	128	142	210	7.92
4	Forestry		1.1	2.3	4.3	
5	Fishery		14.1	19.7	45.7	
III	***Industry – construction***	***1,300***	***1,628***	***1,798***	***2,102***	***17.37***
IIII	***Service***	***550***	***695***	***802***	***926***	***18.94***
	Existing price	**8,176**	**12,665**	**16,488**	**18,515**	
	Agriculture, forestry, fishery	1,251	1,760	2,143	2,148	
	Industry – construction	4,865	7,637	9,926	11,368	
	Service	2,060	3,267	4,419	4,999	
	Structure (%)	**100.00**	**100.00**	**100.00**	**100.00**	
	Agriculture, forestry, fishery	15.30	13.90	13.00	11.60	-8.82
	Industry – construction	59.50	60.30	60.20	61.40	1.05
	Service	25.20	25.80	26.80	27.00	2.33

**Source: Department of Statistics, Reports of Dong Trieu District People's Committee*

- **Economic structure and transformation of economic structure:**

Overall economic transformation of the District were actively progressed and gradually decreased by structure of agro-fisheries and forestry and gradually increased by industry, construction and service. The structure of agro-fisheries and forestry reduced from 15.3% in 2010 to 11.6% in 2013, the average reduction speed was 8.82%/year. The structure of construction, industry and service increased from 59.5% to 61.4%, with

transformation speed of 1.05%/year; the service industry increased from 25.2% to 27% with transformation speed of 2.33% in the period of 2010 – 2013.

- **Concentrated on directing the agro-forestry and fishery development**

+ Continue maintaining the stable growth rate of agro-forestry and fisheries. Closely and successfully direct the agricultural economic development plan to associate with transforming the crop, breeding and plant structures. Actively direct to transform and improve the performance of Agricultural Service Cooperatives. Strengthen the technological transfer, agricultural and fisheries encouragement works and out-perform the agricultural services.

+ Strengthen farming and gradually improve the farming density in the agriculture. Continue expanding and developing cattle, poultry rising and aquaculture. Actively prevent epidemics for domestic animals. Actively prevent the natural disasters, flood and protect production and life of local people.

+ To enhance the forestation, forest care and protection and forest fire safety. Check, prevent and strictly handle the violations of Law on Forest Protection and Development. Ensure the plantation plan and tree planting in 2009. Launch the transformation of the poor litchi regions to other plants.

Table 4.13. Agricultural production at downstream areas

Items	Unit	Name of Commune							
		An Sinh	Duc Chinh	Nguyen Hue	Tan Viet	Thuy An	Trang An	Viet Dan	Dong Trieu Town
Farming									
Total area	ha	576,3	551,2	798,9	406	439,4	403,1	435	103
Rice	ha	230,6	468,7	731,1	268,2	428	290	369,5	93
Yield	Ton/ha	5,25	5,6	5,65	5,42	5,45	5,3	5,67	5,5
Crops of all types	ha	345,7	82,5	67,8	137,8	11,4	113,1	65,5	10
Yield	Ton/ha	23,65	23,7	22,8	22,23	22,37	23,8	23,71	21,9
Breeding									
Livestock, poultry	Con	56253	28178	86379	31473	39569	55966	24185	485
Buffalo		370	14	104	61	16	160	21	5
Cow	Con	257	6	137	7	48	58	42	0
Goat	Con	596	0	0	0	0	0	0	0
Others	Con								
Pig	Con	7430	1058	5238	2181	2605	2348	2222	180
Fishery	ha	204	27,3	24,4	23,5	55,6	39	35,7	1,8

4.3.2. Results of the Survey

Through the approaches to livelihood resources of households, this section will make an analysis of the socio-economic characteristics of surveyed households according to the human resources (demographic and labor, education, occupation, health), natural capital (productive land: agricultural land, forest land and aquatic land, land use), physical capital (housing, property for living, property for production and business), financial

capital (income, changes in living standards, poverty, loans), and social capital (community relations, relatives, authorities and their support) and consider the impact factors including the potential impacts of the project. These resources have been analyzed with the integration with elements such as Gender, ethnic minorities and vulnerability.

4.3.2.1. Demographics

The average number of household members in the survey sample in the project area is 3.4, lower than the national average demographics in households, which is 3.89 (Statistical Yearbook, 2013). There are no difference in the number of inhabitants per household between communes, ethnic groups, income groups, female-headed households and male-headed households. (Pls refer to Table 4.14)

Table 4.14. Demography and averag laborers per household

	Demography	HH structure by scale of Demography (%)			
	Average in HHs	1-2 people	3-4 people	5-8 people	Above 9 people
Total sample	**3,4**	**28,2**	**47,0**	**24,8**	**0,0**
By commune/ Ward					
An Sinh ward	3,5	26,3	46,2	27,5	0,0
Tan Viet ward	3,4	21,5	55,0	23,5	0,0
Viet Dan ward	3,5	20,4	52,1	27,5	0,0
By HH gender					
+ Male Headed households	3,4	29,7	47,3	23,0	0,0
+ Female Headed households	3,3	28,6	44,9	26,5	0,0
By income group					
Group 1 (the poorest)		22,1	51,6	26,3	0,0
Group 2		11,6	53,8	34,6	0,0
Group 3		20,0	40,9	39,1	0,0
Group 4		27,5	46,7	25,8	0,0
Group 5 (The richest)		22,3	53,3	24,4	0,0

Source : Survey Data

By income groups, it is noted that the HH size of 3-4 persons is quite similar in all income groups. This has shown that nuclear HHs are popular, which explains the better household development compared to other sub-project areas (Figure 4.2).

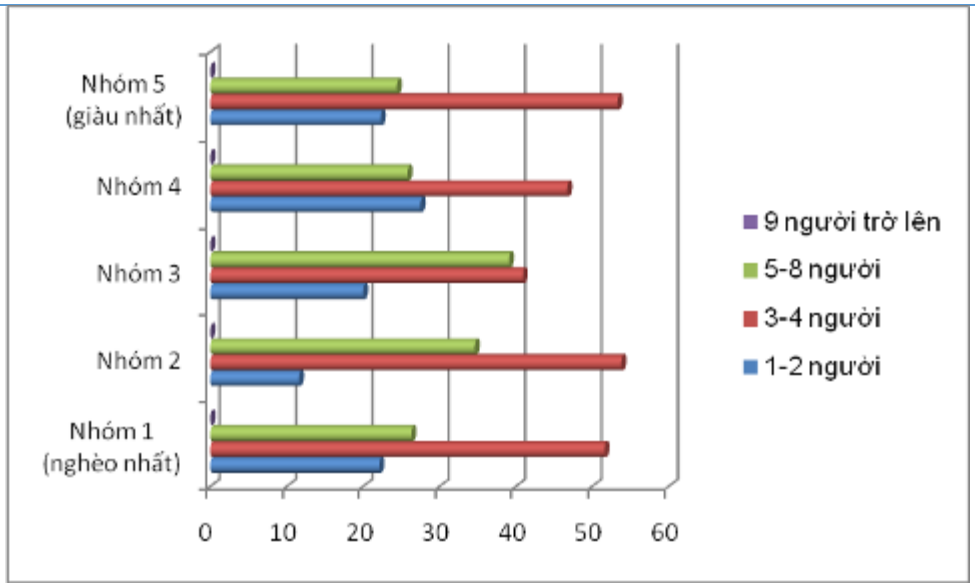

Figure 4.2. The size of households by income group

The analysis of the household structure by demographic scale in the project area showed a majority of households has 3-4 person (47.0%) and 4-5 persons (24.8%); 1-2 person (28.2%) and there is no HHs of 9 people or more. If small family size with a few children is universal as a recognition in Vietnam today, this survey shows that the nuclear family model accounts for around 80%.

Thus, the survey data shows that the model of few member family and nuclear family occupies higher percentage indicating that the development of the project areas is higher than other communes in the province.

4.3.2.2. Occupation

Among the occupational structures of family members having jobs and income in the project area survey, agro-forestry-fishery sector accounts for 65.6% as the highest; pupils, students have the percentage of 12.5% as the second rank; remaining are staff-officers, employees, workers with the percentage of less than 10% for each category; people doing business / services, and housewives are particularly low of less than 1.4%; handicraft is not included in the struture (see table 4.15). Thus, the agriculture-forestry-fishery is the dominant sector in the economy - society of the project area, where the majority of the workforce lives.

Table 4.15. Main occupation of laborers
(including all member of HHs involved in labor force)

	Labor health loss	Agriculture forestry and fishery	Trade and services	Officials and employees	Pupils and students	Handicraft	Hired	Jobless	Not suitable	Others
Total samples	**2,2**	**65,6**	**6,3**	**6,5**	**12,5**	**0,0**	**4,9**	**2,0**	**1,5**	**0,0**
By communes										
An Sinh ward	2,2	66,0	6,5	6,5	11,5	0,0	5,2	0,0	2,1	0,0
Tan Viet ward	0	64,0	6,2	6,2	12,0	0,0	4,7	5,4	0,6	0,0
Viet Dan ward	1,5	65,5	6,2	6,5	12,5	0,0	5,2	1,5	1,1	0,0

In terms of occupational status, the contribute to the family income at present, the survey showed that the proportion of dependents is rather high accounting for 20%, of which a significant proportion of the unemployed and semi-unemployment. The subjects included eat most students, students, and the rest are still small / elderly, lost labor and even are in working age, health but does not have a job. The project will increase the area of irrigated land, more seasonal produce in a year, diversifying outside the plantation industry (such as livestock, and professional services that use other countries); thereby increasing jobs and eliminate unemployment and underemployment present in the project area.

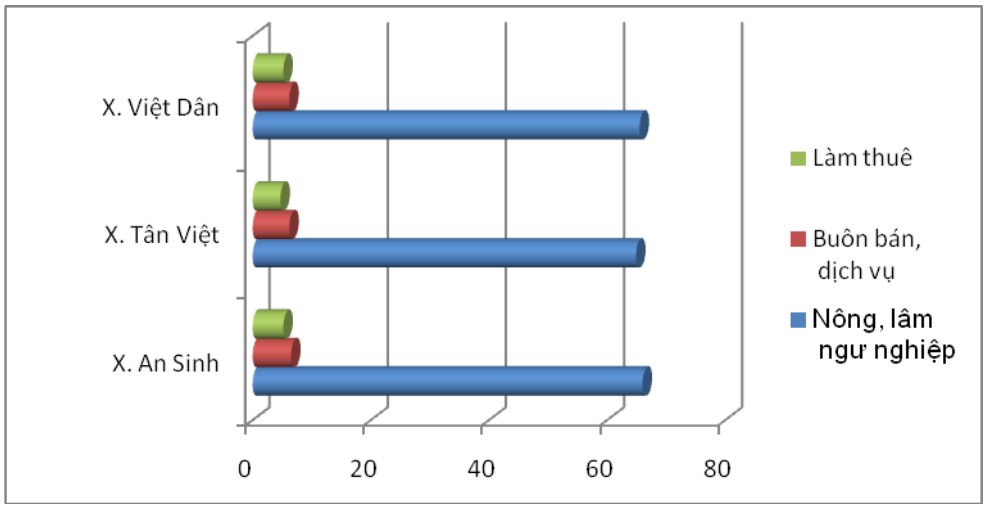

Figure 4.3. Occupation of Householders in commune/ward

In general, the livelihood of people living in 3 communes benefiting from the surveyed project area is mainly agriculture, commonly two rice crops and one secondary crop a year. Therefore, the safety of dams and water stability for irrigation is very important for agricultural production in the residential areas, while there is a high demand of water for agriculture activities in most surveyed areas but actually it is not proactive.

In actual qualitative surveys in the project area show that in the past there were some contradictions, conflicts between farmers, inequality of water supply amount because some households have more favorable conditions in receiving more water for their slots if they are at the upstream of the water resources. This is caused by the reservoir's water loss. The repair and rehabilitation of reservoirs will address the lack of equality of water supply for the upstream and downstream.

4.3.2.3. Education

About 95.0% of the project population graduated from elementary school to college/ university or higher, in which more than 60% people who graduated from junior high school and high school.Up to 18.3% people graduated from college/ university or higher. The illiteracy rate is 0.1% and the rate of preschool people in communes of project areas is 5%, which is lower than the national average as stated in the Statistical Yearbook 2013. This rate does not differ greatly between the surveyed communes.

It is noteworthy that the illiteracy rate of people in ethnic minorities is also very low, only 0.1% (this rate focuses on the elders who are more than 60 years old). According to the standard of living, the illiteracy rate in the poorest income group (group 1) only accounts for 0.1%).

Percentage of children at the 6-18 age dropped out of school is 0.2% and majority is incapable or poorly able at studying. (Refer to Table 4.16).

Table 4.16. Education level of household members (Unit %)

	Highest education level							
	Illiteracy	Primary School	Junior high school	High school	College/ University or above	Not suitable	Pre-school	No infor
Total	**0,1**	**15,2**	**31,1**	**30,3**	**18,3**	**0,0**	**5,0**	**0,0**
By commune								
An Sinh ward	0,1	15,0	30,2	34,5	15,2	0,0	5,0	0,0
Tan Viet ward	0,1	15,5	30,3	32,1	17,5	0,0	4,5	0,0
X.Viet Dan ward	0,1	14,7	30,9	32,5	17,8	0,0	4,0	0,0
By income								
Group 1 (the poorest)	0,1	16,5	35,5	37,4	5,5	0,0	5,0	0,0
Group 2	0,1	15,6	35,5	31,09	10,0	0,0	6,9	0,0
Group 3	0,0	15,0	34,1	33,4	12,5	0,0	5,0	0,0
Group 4	0,0	15,0	35,5	30,5	15,0	0,0	4,0	0,0
Group 5 (the richest)	0,0	14,5	23,9	40,6	18,0	0,0	3,0	0,0

The reason for children to quit from school accounts for 0.2 % because they are not good at learning, not directly related to economic reasons of HHs.

4.3.2.4. Health

There is about 18.7% of surveyed households last month were ill (see Table 4.17). This is a high rate and a worrying matter on the health of people in the project areas compared to the average health and better conditions for health care now. There are no large differences in sickness among the surveyed households as well as between rich and poor income groups. Table 4.17. Health and health care conditions

	With sick person in the past one month	**With medical insurance**
Total	**18,7**	**90,3**
By commune		
An Sinh ward	20,0	90,0
Tan Viet ward	17,5	89,9
Viet Dan ward	16,5	85,0
By income		
Group 1 (the poorest)	18,7	85,0
Group 2	18,0	85,0
Group 3	15,8	90,0
Group 4	16,3	93,5
Group 5 (the richest)	5,2	95,5

The number of surveyed households having insurances of all kinds is relatively high, accounting for 90.3%. In particular, the health insurance rate in the highest income group is 95.5%, which is not much higher than that of lowest group (85.0%). This shows that the local

people in the project area (including lowest income HHs) all are aware of the necessity of participation in health insurance

According to the respondents of surveyed households, there are four main reasons causing negative impacts on the health situation are listed as follows from the highest to lowest level, namely: polluted water, foods insecurity, lacking of running water and living pollution (see Figure 4.4)

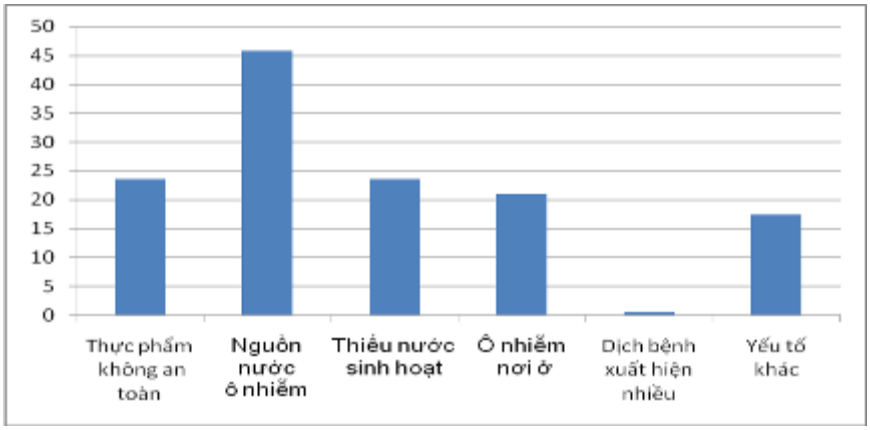

Figure 4.4. Percentage (%) of the causes adversely affecting to the health today

Two out of five main causes adversely impact public health relates to polluted water and lacking of domestic water (accounting for the highest rate of 69.3%).

4.3.2.5. Land

In surveyed area, agriculture is the main production activities, the basic livelihood of the people, so that land is the main production resource of farmers. Of which, 99.5% HHs have residential land, 95.2% HHs have paddy land, 59.2% HHs have land for vegetables, 13.3% of HHs have land to plant industrial trees and 15.3% of HHs have ponds and water surface.

The data of land of all types of surveyed households in the project area showed that agriculture and farming are popular in the localities. Therefore, the demand for irrigation for agriculture in these regions is very high; the lack of water in 1-2 months will certainly affect the lives of local people.

By income, the two lowest income groups (group 1, 2) have the lowest percentage of arable land types, in contrast, the HHs of higher income shall have higher rate of cultivating land. Poor household have no pond or water surface, so they depend on agriculrual land. It is obvious that the lack of arable land is now only one of the reasons causing poverty in agriculture area, rural areas. For the purpose of reducing poverty, the stability and increasing of irrigated areas, increasing crops/ season/ year for the existing area as well as increasing activities of non-agricultural employment is very important.

Table 4.18. Kinds of land of households

Unit %

	Residential land	Paddy field area	Land for vegetables, secondary	Land for industrial	Ponds, surface water

			crops	trees	
Total	**99,5**	**95,2**	**59,2**	**13,3**	**15,3**
By commune					
An Sinh ward	98,1	95,0	66,5	12,9	15,8
Tan Viet ward	100,0	96,0	77,5	25,0	12,5
Viet Dan ward	100,0	98,2	55,6	29,1	10,3
By income					
+ Group 1 (the poorest)	100,0	89,5	60,5	10,5	0,0
+ Group 2	100,0	95,6	72,3	19,2	16,4
+ Group 3	100,0	97,5	68,2	20,9	13,6
+ Group 4	100,0	98,1	69,2	20,2	17,5
+ Group 5 (the richest)	100,0	94,4	73,3	32,7	20,3

4.3.2.6. Clean water

Water source for domestic usage

The majority of surveyed households in the project area use tap-water (95 %) for bathing and daily activities, the usage of other water sources is low: there is no HHs use water from ponds, lakes, rivers; 1.4% use other water sources and 1.0% use well water.

In the rural areas, 91.5% of the water sources used for bathing and daily activities from sources such as wells, private water taps, public water and rainwater are considered to be hygienic.

Table 4.19. Percentage of HHs in the project communes using water sources for domestic usage (%)

	Private running water tap	**Public water**	**Wells**	**Water from ponds, lakes**	**Rainwater**	**Others**
Commune						
Total samples	**95,0**	**0,0**	**5,0**	**0,0**	**0,0**	**0,0**
By commune						
An Sinh ward	95,3	0,0	4,7	0,0	0,0	0,0
Tan Viet ward	92,0	0,0	8,0	0,0	0,0	0,0
Viet Dan ward	95,2	0,0	2,7	0,0	0,0	1,8
In term of income groups						
+ Group 1 (the poorest)	90,0	0,0	5,0	0,0	0,0	5,0
+ Group 2	90,2	0,0	9,8	0,0	0,0	0,0
+ Group 3	95,5	0,0	4,5	0,0	0,0	0,0
+ Group 4	93,9	0,0	6,1	0,0	0,0	-
+ Group 5 (the richest)	98,5	0,0	1,5	0,0	0,0	0,0

The survey data shows that 95% of people in the areas using domestic water from tap, which is transmissed from Khe Che lake into supply plant, through filtration system, then provide to end users. As a result, keeping water from being lost in the Khe Che reservoir is a very important for living.

Drinking water sources

Like water for washing and bathing, the drinking water of people in surveyed communes is mainly from tap at the rate of 98%, there is only 2% of people use water from well for drinking.

In consideration of the relatively clean water in rural areas, these sources include: running water, we water, storm water and water purchased, supply of drinking water is relatively assured to up to 98% of people in the project area. However, it must be acknowledged that people in the project area do not use water from ponds and lakes for drinking water.

It can be said that in the surveyed project areas, drinking and domestic water are not being met in terms of quantity and quality, thus keeping water during the water shortage seasons is very important affected to the people in the project area.

Table 4.20. Percentage of households using drinking water in the project areas (%)

Communes	Private running water tap	Public water	Wells	Water from ponds, lakes	Rainwater	Commercial water	Others
Total samples	**98,0**	**0,0**	**2,0**	**0,0**	**0,0**	**0,0**	**0,0**
By commune							
An Sinh ward	95,7	0,0	4,3	0,0	0,0	0,0	0,0
Tan Viet ward	97,5	0,0	2,5	0,0	0,0	0,0	2,5
Viet Dan ward	94,0	0,0	6,0	0,0	0,0	0,0	0,0
By income							
+ Group 1 (the poorest)	92,7	0,0	6,3	0,0	0,0	-	1,0
+ Group 2	97,2	0,0	2,8	0,0	0,0	-	0,0
+ Group 3	98,0	0,0	2,0	0,0	0,0	0,0	0,0
+ Group 4	98,8	0,0	1,2	0,0	0,0	0,0	-
+ Group 5 (the richest)	100,0	0,0	100	0,0	0,0	0,0	0,0

4.3.2.7. Sanitation

Figure 4.5 shows that up to 94.6% of households in the surveyed area have used sanitary toilets; including 66.1% of households with septic and semi-septic tanks, 28.5% of households with 2 compartment toilets. In addition, about 3.7% of households still use simple toilets, and 1.2% of households haven't had toilets. In parallel with the implementation of the project, it is necessary to promote greater awareness of people about hygiene to protect health.

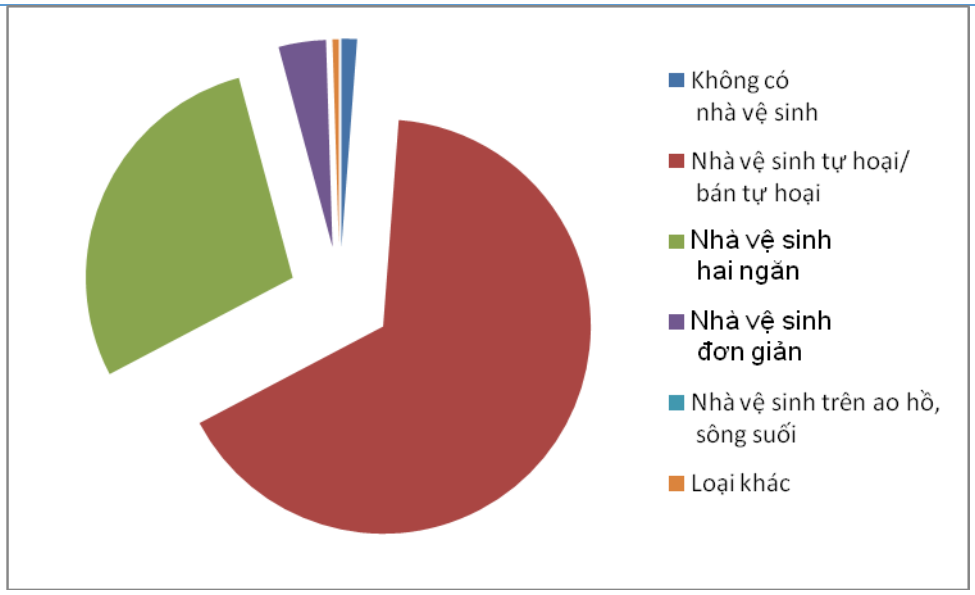

Figure 4.5. Kinds of toilets

Table 4.21. Types of toilets of surveyed households

	Without toilets	Sanitary toilets			Unsanitary toilets		
		Septic and semi-septic tanks	Two compart toilets	Total	Simple toilet	Discharge into ponds, lakes	Others
Total samples	**1,2**	**66,1**	**28,5**	**94,6**	**3,7**	**0,0**	**0,5**
By commune							
An Sinh ward	0,0	60,5	22,7	83,2	3,5	0,0	0,0
Tan Viet ward	1,0	65,5	25,5	91,0	5,0	0,0	3,0
Viet Dan ward	1,2	66,0	28,3	94,3	4,05	0,0	0,0
By income							
Group 1 (the poorest)	1,2	66,5	26,8	93,3	5,5	0,0	0,0
Group 2	1,0	79,7	14,4	94,1	4,9	0,0	0,0
Group 3	0,0	79,1	17,3	96,4	3,6	0,0	0,9
Group 4	0,0	86,8	10,9	97,7	2,3	0,0	1,0
Group 5 (the richest)	0,0	86,4	13,4	99,8	0,2	0,0	0,0

By income group, it is noteworthy that in the surveyed wards and communes, the proportion of households with toilets meeting standards is very high, accounting for more than 96.4%. The poorest group also has 93.3% of standard toilets. In contrast, the richest income group (group 5) has 99.8% meeting standards.

4.3.2.8. Income and Standards of Living of households

In the Project areas, the middle income group and above occupy a high rate (43.5% and 33.8% is) and especially the poverty rate in surveyed communes remains only of 2.5%.

Table 4.22. By income (%)

	By income					**Total**
	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	
Total samples	**2,5**	**2,1**	**43,5**	**33,8**	**18,1**	**100,0**
By commune						

An Sinh ward	0,0	1,8	45,0	28,2	25,0	100,0
Tan Viet ward	0,0	1,1	47,0	33,0	18,9	100,0
Viet Dan ward	2,5	5,0	35,0	45,5	12,0	100,0
By gender						
+ Male headed HH	2,5	2,0	44,5	30,9	20,1	100,0
+ Female headed HH	2,5	2,5	42,5	33,0	19,5	100,0

According to locality's self-evaluation, the standard of living is at average with the income group of average and higher level accounting for 90%.

In terms of ethnicity, at poverty level, there is not a big gap between the Kinh and ethnic people (0.5% and 5%, respectively).

Similarly, for gender of the heads of households, female-headed households have the same rate of poverty compared with male-headed households (2.5% versus 2.5%). This number shows the equal role between male and female group in creating income in the project area.

As a result, the Project will contribute to the improvement of the lives of women because they are affected and vulnerable, supporting strongly women in generating income and stable life, as well as poverty eradication.

4.3.2.9. A numner of livelihood and social security issues

a) Loans

It is a regular situation and popularity when communities in rural areas are often debts. One third of the interviewed households currently have a loan, accounting for 34.5% of total respondents. Regarding the scale of debt, up to 85.6% of households borrow only an amount of less than VND 60 million, and the rate of households with loans of more than VND 60 million is much lower only 9.4%. The loan is relatively low (≤ 60 million) because households do not dare to make a large-scale investment while their production and living conditions do not guarantee high profits for payment of loan and interest. Therefore, investing in irrigation infrastructure, agricultural production will make them feel safe. The HHs with the loans of more than VND 60 million mostly use for their business, majorly trading.

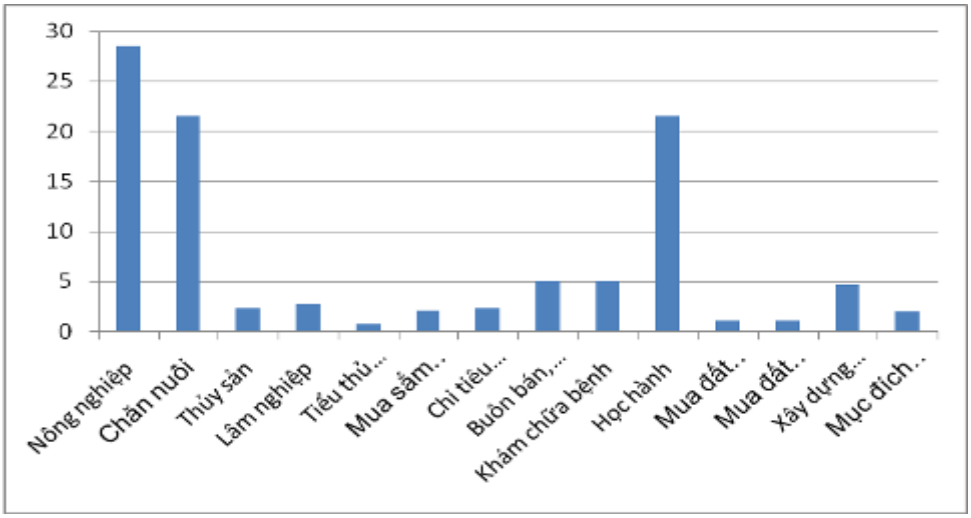

Figure 4.6. Purposes of loan

Figure 4.6 shows the different loan purposes of families. People use the loan to spend for education, livestock and agricultural production at a rate of over 20%. This indicates the top priorities and demands of local people in the project areas. Other purposes such as fisheries, forestry, industry, have a very low rate (<5%).

When considering the ratio of loan purpose social survey data shows that in the purpose of "investment loans for livestock and agricultural production" accounted for the highest percentage. This is easily explained by people still focus on production development, and life stabilization.

b) Social Security

It is likely that everyone will face and overcome risks or difficulties in a certain period of time in the life that need the help of other people (or organizations). The survey of difficulty/ risk that may require physical support, in the Figure 4.7, shows that people rely heavily on support from their siblings, parents, then from parents from both sides, children, government/ mass organization; and a small percentage of support from friends and neighbors of only 1-2%. This suggests that in addition to the support from parents, children; the unions and the government also play a significant part in helping people overcome difficulties in life and to develop production.

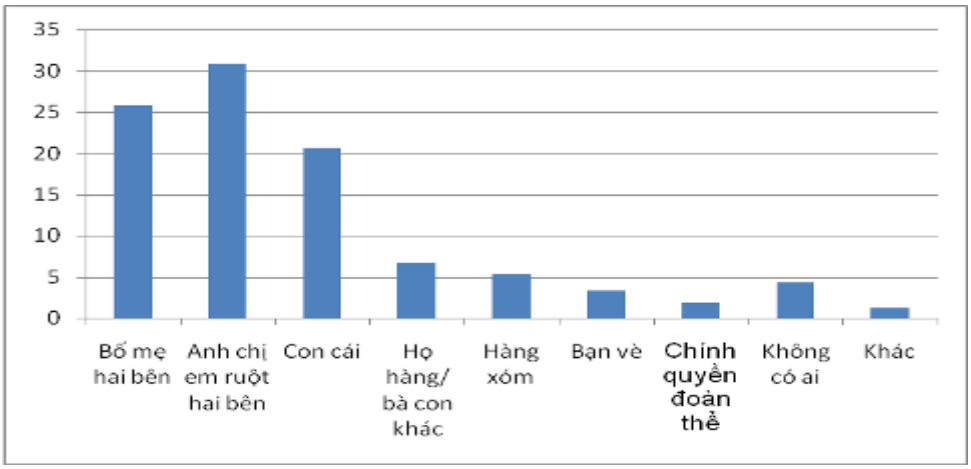

Figure 4.7. Physical support in difficulties

In terms of income group, the poor income group (group 1) receives significantly material support from governments/ organizations (31.6%), and then support from parents of the two sides (26. 3%) while the highest income group (group 5) receives the most significant support from their siblings only (28.0%).

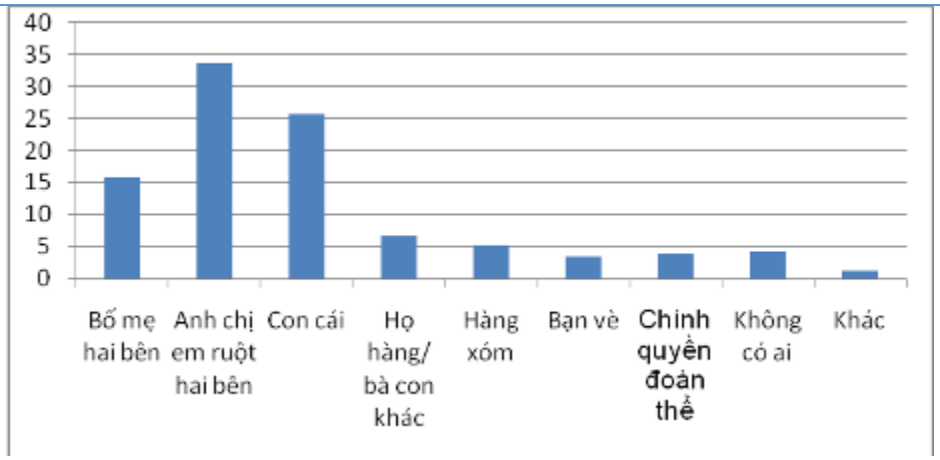

Figure 4.8. Rate of receiving moral support in difficulties

Figure 4.8 represents the results of the moral support in troubled time or in case of risks. Up to 95.7% of the respondents said that they always have someone whom to share with or receive moral support from when they face difficulties/ risks. Emotional support of people is mainly from their siblings, children, parents of the both sides; the rest of as low as 5% is from relatives, neighbors, government/ community and friends.

In terms of ethnicity, or income groups, although the indices are different but they have important role in emotional support to those siblings, children and parents in difficulty.

Thus, the above data suggests an important role in providing material support of governments / mass organizations to people in the poor income group, ethnic minorities, poor mountainous localities and people experiencing difficulties/ risks in the life. For social groups, other localities, the physical and emotional support are both from siblings, parents and children of two sides.

The data show that the majority of people in the project are now struggling, and highly need loans, accounting for 30.8%. The significant demand for people when the project is implemented shows that not all needs are reasonable and can be met, but it is a good suggestion for staffs and project implementing agencies to pay attention to concerns, worries of the people such as issues on resettlement, land, agriculture extension, new training, livelihood and vulnerable groups. From that, there should have suitable support and construction plans to help reduce negative impacts on daily life and livelihood of the people in general in the project areas.

4.3.2.10. Gender Issue

There are some gender issues in the scope of the sub-project.

i. **Labor and Labor division:** Most of women are involved in agricultural activities. Women in mountainous areas encounter severe time constraints having to work much longer hours than men especially in the areas of land cultivation, transportation, family care, housework, etc. Women can work 9-10 hours/day while men only work for 8 hours/day). The limitation of knowledge, access to

technology and use of traditional agriculture methods contribute to local people often facing high risks of bad crops, diseases for cattle and undernourishment.

ii. **Access to education:** All boys and girls have equal rights to go to school however the rate of attendance for girls is always lower than boys.

iii. **Women's Involvement in group activities:** In subproject area, most women are Kinh women. Women do not know how and are not trained and empowered to express their rights in front of the community. Therefore, they have few opinions in the community meeting.

iv. **Women's participant in local government system:** Through interviews with chairmen of commune PCs, it was recorded that women accounted for 35% within the Commune PC structure. No woman played a role as chairwoman of the An Sinh CPC. Most women do not play leadership positions that influence the decision-making process.

v. **Health:** Health conditions of women in An Sinh commune is not serious. However, not only women but also the community has the high potential risks of contracting diseases such as diarrhoea, skin allergies and other forms of infection.

Expected positive impacts on gender. The project when implemented will have a positive impact on the people in the project area in general and on women in particular. These effects are:

i. Creating new opportunities for economics, trade and services; creation of jobs to increase income for women, especially poor women and EM groups during project construction time, temporarily contributing to poverty alleviation in the project communes; and

ii. Providing opportunities to improve the status of women and enhance their participation in community activities through gender action plan.

Negative impacts on gender. Besides the positive impacts, the project may also impact negatively on women in particular and people in general in the area. The negative effect is the land acquisition that will affect the lives of families. However, the mitigation measures will be conducted through the compensation and resettlement plan. In addition, during construction, environmental pollution caused by dust, construction waste, noise may occur and affect people. These effects can be significantly reduced by the proposed mitigation measures

Measures to Minimize negative impacts. To mitigate the negative impacts to women in the project areas before and after the design, compensation and resettlement assistance, as well as supervision of construction projects, the project will enhance the dissemination of project information to the people in general and to women in particular to ensure that women will get maximum benefit from the advantageous conditions brought by the subproject.

Gender Action Plan: From the above analyses of gender, a gender action plan is needed to facilitate the full participation of women in the project construction stage,

providing new opportunities for women to boost their income, without increased burden on their lives, and contributing to the enhancement of women's role and status in the project area. The objectives of this plan include:

- The local contractors will employ at least 30% of female workers in maintenance, construction and repair works;
- For a similar type of work, female workers should be paid as much as male workers;
- Safety conditions must be equal to both men and women;
- The local contractors will not use child labor;
- The use of local labors is encouraged and the establishment of labor camps will be avoided;
- The Women's Group and Union will be consulted about the design of subprojects;
- Training on gender mainstreaming will be provided for national, provincial and local authorities (i.e. PMUs, and other stakeholders);
- Training and capacity building is provided for women to engage in public decision-making and sub-projects in a way that makes the most sense (i.e. training in participation, negotiation skills, marketing skills, mathematics and literacy);
- The involvement of women in project study tours is ensured.
- The agricultural extension services aimed at women are designed and delivered to women;
- The awareness enhancement campaign on HIV/AIDS will be launched before the start of civil works. PMU is responsible for monitoring and reporting of GAP key performance indicators, including the participation of women, target works and trainings, and HIV prevention campaigns;
- At least one woman shall be involved in the Supervision Board of a commune (about 1/3 of the members).

(For futher activities, please Appdendix B3: Gender action plan)

PART V: ENVIRONMENTAL AND SOCIAL IMPACTS ASSESEMENT (ESIA)

5.1. Sub-project environmental and social impacts screening

According to the Environmental and Social Screening results of the EIA mentioned in Appendix A6.2 and result of potential impact of environmental and social screening (in Appendix A6.4) of sub-project repairing and upgrading headworks of Khe Che reservoirs as follows:

Most of potential impact on environment and society mentioned in the sub-project has a low to average impact and overcoming and mitigation are able to deal with. According to this impact profile, the sub-project will have to prepare the following reports:

- The Environmental and social impact assessment report and appendixes
- Gender development plan
- Community health protection plan
- Communication plan to raise the awareness of the community
- Claim settlement procedure
- Dam safety report.
- Resettlement action plan (RAP) report.

Base on the SA in the 3 communes An Sinh, Tan Viet, Viet Dan with the participation from representatives from Commune People communes, (CPC) mass organization, beneficiaries, including some ethnic minority shows that, there is no difference in terms of needs among the ethnic minority groups and the Kinh people in the project areas because: i) there are only 2,8% of total households in the beneficiary are EM; ii) the EM households live scattered with the Kinh people for few decades and they almost have the same characteristic with the Kinh people in terms of social economic status and the opportunity to access services in the community.

The EMDP therefore is not necessary to prepare. However, in the process to prepare and implement subproject, we will consult deeply with the EM and CPC and provide solutions if there is any relevant requirements from EM on this subproject.

5.2. Positive impacts on environment and social of sub-project

The sub-project, when it is implemented, will bring back proactive impact on environment and social economics to the local community as follows:

5.2.1. Environmental impact

Repairing of headwork's item will contribute to regulating the flow of flood better and provide water resource in the dry season. As a result, humidity, underground water reserve will increase, flora and fauna living near water or under the water are created favourable condition for development to balance ecosystem of the region. Risks or

environment incidents caused by dam-breaking or overflowing will be overcome to resist to climate change.

5.2.2. Socio-economic impacts

a) Enhance the capacity of management and operation of irrigation system

Development strategy of irrigation sector by 2020 is to focus on irrigation development to support the transformation of agriculture and forestry structure, crop diversification, food security before the pressure of population growth, adverse changes on weather and the instability of the world and to solve water source for domestic activities, industry, fishery, tourism service; to maintain and improve the ecological environment, exploitation of hydro power. The main subjects of the strategy include: ensure water demands for the residents and economic sectors; To strengthen safety, prevention and adoption to minimize damages caused by natural disasters, floods; manage river basins well; properly exploit and use the water resources, sustainable development, prevention of pollution, depletion of water resources in main river basins and all the national basins. To enhance the capacity of water management from the central to local levels.

To attain the above aim, under the framework of the project, Ministry of Agriculture and Rural Development has been towards activities: Improve organizational models, complete management mechanism, especially for finance, mechanism of management and distribution of water subject to the maximum mobilization of the beneficiaries' participation; build standard system and assessment tools for performance of irrigation systems and institutions; Training and boost manager's qualifications and skills to meet requirements on exploitation of irrigation works in new context; invest advanced equipment and technical solutions to support management and exploitation of irrigation works ...

Results that are expected to achieve for the units, organizations and individuals in terms of improving the efficiency of management and exploitation of irrigation works include: be equipped with skills and advanced tools to improve operational efficiency of irrigation services and manage the water distribution; to have legal basis in management mechanisms and financial controls; to flexibly and fairly apply irrigation services among water users, WUOs and Hydraulic Works Management and Exploitation Companies (IMC); to enhance community participation in the management and distribution of water source; management and operation (O&M) activities are paid more attentions and properly invested to extend the actively irrigated area every year;

Dam Rehabilitation and Safety Improvement Project (DRaSIP/WB8) will be deployed to reinforce the safety of reservoir and support the Ministry of Agriculture and Rural Development, provincial management agencies within the scope of project construction, strategies for long-term rural development, taking into account the climate change scenarios, the realization of activities to implement the National Target Program

on minimize and adapt to climate change; Irrigation Development Strategy in 2020 with a vision to 2050; National Strategy for water supply and rural sanitation by 2020; Socio-economic Development of mountain areas by 2020; National Target on New Rural Construction; Agriculture, Farmers and Rural Areas Development Programs, ...

b) Maintain the irrigated area, smart agricultural productions to adapt with climate change:

The provinces under the scope of the project all are agricultural ones. To develop the agriculture in circumstance of being limited soil and water resources that are more and more decreasing in the quality and quantity as well as the current food crisis in the world, it becomes more urgently. Hence, it is needed to improve the efficiency of using land and water resource to serve agricultural production and multi-purpose development. This requires not only technical measures but also settlement of socio-economic – environment issues with direct and active participation of farmers into management and exploitation of irrigation system

At the moment, most of dam, irrigation works were invested from the decade 70 to 80 of the XX century, some larger irrigation systems were also constructed 10 years ago, therefore, half of irrigation systems and water drainage system are being degraded and/or operated under its capacity. This leads ineffective use and wastes water. Improvement of water output is a key to manage better water resource in agriculture;

MARD's guideline is to focus on complete investment of irrigation systems which are in progress because of lack of capital to improve Work's efficiency and better serve for production and bring back the highest economic efficiency and promote the effectiveness of the capital invested. Invest, consolidate, and modernize irrigation works in the orientation of service to reach the target: irrigation, water supply to serve aquaculture, power generation, domestic and industrial water supply; finalize infrastructure and enhance living standard in difficult areas. Upgrade and complete automatic irrigation system. In the scope of the project, investment result will help improve and upgrade dam and reservoir safety in 28 provinces and proactively serve irrigation for hundreds of hectares.

c) Increase the social welfare, social capital for the residents in the scope of project

The project will increase agricultural yield, improve living conditions, upgrade irrigation status, traffic conditions, change the habitat and the health status of the people in the project area, especially for women and ethnic minorities in the project area.

At present, due to the irrigation system has not completed and process of water management and distribution has not been flexible and prompt yet, leading to the conflicts among community groups on water source used for irrigation and drainage. Community groups at key areas or main channels have often many advantages to use water for irrigation comparing with the groups at remote areas or downstream facing many difficulties to access water sources. Community groups at the upstream release

wastes and animal carcasses along with the flows to gather at the downstream, causing environmental pollution. In the stage of investing the project with the purpose of upgrading the system, improving the setup mechanism and strengthening and organizing the use of water source in sync, encouraging the community to join the irrigation management and exerting the efficiency of capital investment to increase the social capital of communities/improve community relations in the irrigation activities.

d) Safety for reservoir and community

The repair and upgrade of Khe Che reservoir contribute to ensuring safety in downstream of reservoir and dam by proactively controlling flood and regulating lake: the downstream of Khe Che reservoir is composed of the communes An Sinh, Tan Viet, and Viet Dan in Dong Trieu district, Quang Ninh province. The safety ensurance oft the reservoir during its operations is essential.

5.3. Negative impacts on environment and social

5.3.1. The historical negative impacts and miligation action

Khe Che Reservoir was designed in 1986. In 1995-1998, the works was rehabilitated and improved with some works items under the head works system. Up to now, such works has been working for nearly 30 years.

During operation, some accidents happened:

1. In the period of 1996 – 1998, a part of spillway face was subject to cavity because the initial construction used some concrete and gravel exploited at the local area. In order to recover such condition, entire spillway face was re-plastered with 3-5cm thick concrete (concrete coating) by the management agency. However, some positions' above concrete coating has been blistered.

2. In the period of 200-2001 the works was subject to water penetration from the dam downstream. The selected recovery method at that time was to spray concrete and apply the roofing embankment.

5.3.2. Environmental and social impacts during the project preparation process

5.3.2.1. Activities

Main activities in the preparation process for construction of the sub-project include:

- Cut trees down (belonging to the occupied land area for forestry …).
- Clear the site to build building camps/tents.
- Gather the machines and equipment to the site.

5.3.2.2. Sources of impact

5.3.2.2.1. Source relating to waste

- **Source releasing solid waste**

- Skim the site and clear the vegetation cover.

- Cement covers, remaining construction materials, solid waste from worker's daily activities...

- **Source releasing liquid waste**

- Released grease for machine;
- Leaked petroleum from repairing, washing cars and equipment;
- Domestic waste water of workers during the preparation period.

- **Source emitting exhaust gas**

- Gather the vehicles, machine

5.3.2.2.2. Sources that not relate to waste

These sources affect to the physical and ecological environment such as: erosion, landslide, erosion of river, stream and lake banks; settlement at bottom of river and lake; transformation of environmental components, biological diversification.

5.3.2.3. Impacts on social

- **Impacts on socio-economy**

Any project must be considered the human factor to commence. It is the top issue needed to concern. Then, the suitable assessments are conducted to ensure their legal rights. Thus, in the preparation stage, environmental impact assessment task must specify the negative impacts to the living conditions of residents for finding out the remedies, reasonable mitigation. For this project, impact of socio-economic environment takes mainly place in the reservoir area.

The construction site is located upper the existing site of the works that are needed to repair, upgrade and extend the surrounding area for serving the building activities.

Required area for recovering the permanent site includes:

+ Forestry land area taken by excavating into the mountain:

$$S = 200m \times 20m = 4{,}000m^2$$

+ Unused land area at the downstream of the dam taken:

$$S = 480m \times 6.5m = 3{,}120m^2$$

+ Total land area taken: 7,120 m^2.

Occupied land area includes forestry land and unused land so it does not conduct the site clearance, immigration or have no effect on households around the project area.

Due to the renovation, rehabilitation, extension of spillway for the headwork of Khe Che reservoir, it will help reduce the flooding impact to the downstream and the project area that does not infringe on residential land and existing works under residents' management.

- Residential land: Not affected
- Garden land: Not affected.

- Land for production/ cultivated land: Not affected
- House/Work/Permanent Properties: Not affected
- House/Work/Temporary Properties: Not affected
- Crops: Not affected
- Affected land area for forestry: 4,000 m^2.
- Affected unused land area: 3,120 m^2

- *Impacts on safety of dismantling workers and communities:*

- Risk of electric shock during site clearance can cause fire and smoke, dust, hazardous debris, is dangerous for workers and residents.

- Material falling during dismantling process can cause accidents.

- Transportation of bulk materials can be easy to make accidents, especially for the section having the relatively high traffic density or being near schools.

- The process of demolition, site clearance, and excavation may reveal toxic substances that were previously buried or hazardous substances in new waste and can directly affect health of workers and residents.

- *Impacts on local traffic and infrastructure:*

The process of site clearance shall increase volume of vehicles (for solid waste transportation to dump site), leading to affect to infrastructure system and traffic safety.

Dam rehabilitation and safety improvement project, including: repair and reinforce the dam, extend the spillway, concrete the service road, renew the sewers, has not performed the land recovery. For sub-project for upgrading and repairing the headwork of Khe Che reservoir, damages from the loss of land for construction works is not serious because most of affected land is land of protection corridors for irrigation works, land for annual crops. The invested items have small scale, constructed far from the residential areas. According to a survey about the policy of compensation and resettlement, activities for compensation, support and resettlement here are conducted in favourable conditions because the project has invest to the public works that orient to serve the community. By the survey results, the residents are always in favour of investment projects to serve the community and be willing to hand over the site if requested. If receiving the requirements on land acquisition and resettlement, the locality shall apply the approved proposals within the scope of Resettlement Policy Framework (RPF), Ethnic Minority Development Framework (EMDF) of the project.

5.3.2.4. Impacts on environment

Impact on the water environment: The transportation of equipment and building materials to build construction camps for workers, etc. as well as solid waste and domestic waste water in this stage can flow with rainwater into the water, increasing the polluted water volume if not being handled properly.

Impact of air environment: During the preparation stage, any activity can also be likely to cause air pollution. The main pollutants are dust and exhaust gases released by trucks transporting materials and equipment to the project area.

Impact on soil environment: Waste arising from the living activities of workers who building camps will increase the load of pollutants for soil environment if not being handled well.

Noise Impacts on the residents: Noise source can be caused by a number of the following activities: the operations of tree cutting, demolition of existing works and transportation of the waste to dump sites. 02 110CV bulldozers, 03 1.6m^3 excavators, five 7-10 ton dump trucks will alternately operate on the site at various locations. In particular, the noise level corresponding to the distance of 1m from the devices as follows: 77-95 dBA for bulldozers, 72 to 82.5 dBA for excavators, and 82-94 dBA for trucks. The distance increases more 10m, the noise level decreases from 22 to 25%; for 50m, the noise level drops from 38 to 40%. However, the resonance of the noise can be created by operations of the vehicles at the same time.

According to QCVN 26:2010/BTNMT, the acceptable noise level in public sector settlements is from 50 to 70dBA (from 6h to 21h). So the noise only affects the local area with radius of 50m. The subjects affected by the noise can only be workers on the site. This impact ***can be controlled*** by the mitigation measures.

This stage does not require a large number of workers, vehicles, machinery yet so the impact is not significant.

Due to the small scope of the site and no site clearance, the preparation stage can be deployed quickly while impacts on the natural environment last in the short time at small level.

5.3.3. Impacts on environment and society in the period of sub-project construction

5.3.3.1. Activities

- Construct to extend the flood spillway.
- Construct to extend the flood spillway and concrete the dam surface, the management road.
- Construct the management house for flood prevention combining to work management.
- Construct the rescue road and overflow lines.
- Construct to renew 02 sewers through the stream with reinforced concrete M250

+ Tan Viet sewer with 4 doors: 4 x (6x3.5)m.
+ Ba Xa sewer with 2 doors: 4 x (6x3.5)m.

In the process of project construction, we can define the impacts on natural environment and socio-economy as follows:

Table 5.1. Impacts on environment and society in the process of sub-project construction

No.	Activities	Causes
1	Collection, restoration and maintenance of materials for construction	- Truck transporting materials, cement, sand, rock, etc create dust and exhaust gases. - Generate the noise from the loading and unloading of materials
2	Extension of spillway, excavation and hardness of road to the dam	- The construction process uses heavy machinery to dig rock and soil, concrete mixer to harden dam surface, roads to the dam. These machines can pollute the air, soil and water as being released dust, oil ... - Air is polluted by the use of building materials
3	Living activities of workers at the site	Living activities of about workers at the site cause the domestic solid waste, waste water in one day.
4	Completion, cleaning and return of the site, tents and yards	Wastes from the remaining materials after construction and domestic waste from the tents (Domestic activities of workers).

Although overall assessment of project impacts on residents is negligible, and environmental impacts are mainly positive, the works has been done in the process of construction within the areas affected by the sub-project within 2 drought seasons (from October to April), it will not cause the flood, or the flow to the area . According to preliminary assessment, construction location is not located in restricted or sensitive areas.

5.3.3.2. Sources of impacts

5.3.3.2.1. Source relating to waste

- **Source releasing solid waste**

- Domestic waste of workers at the site;
- Wastes from building materials at the site; soil and rock, cement cover,…
- Hazardous solid wastes.

- **Source releasing liquid waste**

- Domestic waste of workers at the site;
- Overflowing rainwater;
- Construction wastewater.

- **Source emitting exhaust gas**

- Dust generating from the materials transportation and loading and unloading (stone, sand, cement, steel,..);

- Dust and gases SO_2, NO_2, CO, THC emitted from mechanic vehicles for material transportation;
- Dust and exhaust gas from operations of machine at the site such as: bulldozer, excavator, compactor, truck …

5.3.3.2.2. Sources that not relate to waste

- Impacts from the noise and vibration;
- Other impacts: increasing of traffic density, number of workers, water cutting …

5.3.3.3 Impacts on social

1) Impacts on socio-economy

- Impacts on the social stability at the locality

Construction process of the sub-project mostly requires no water stop in the downstream because construction items are located above normal rising water level and at the downstream area, only construction of water intake is needed to stop water from 5-7 days. Still, construction of this water intake will be implemented during the time no activity of agricultural farming occurs, hence. Construction of the sub-project mostly causes no impact on agricultural cultivation downstream.

The appearance of the works will promote the best service development in the temporary period, increasing demand for foods in order to serve for the workers. However, the demand for foods from workers should not affect the balance of supply - demand of the region so much. The locality is able to fully meet these needs of the work in all manners.

During the process of construction, it requires to gather a number of workers from other places that may cause a conflict between the workers and local residents. So, a number of workers must comply with the provisions of the law on administration and population management.

- Impacts on safety of the workers and community:

During the transportation, rock and soil can be fallen on the road. If being collected and cleaned, it would harm to the beautiful looking, be dangerous for human and vehicles, increasing of the accident risks.

Road lines transporting the materials and construction equipment that are gathered at the site are primarily used as roads from National Highway 18 or Provincial Road 326 provinces (from Dong Trieu Town). Traffic activities on main roads are secured basically. In addition, the density of traffic on these roads and population density along the road are at the average level, severity of accidents is not high. Therefore, the operation of trucks will not create major problems on traffic accidents. However, the construction unit should still apply the measures to mitigate traffic accidents.

Subject to regulations, the trucks are allowed to carry overload (7 tonnes) and acceptable speed (30km/h) while on communal roads. The overloaded truck maybe cause damage for the traffic works, leading traffic accidents.

Domestic wastes from the tents without proper management causes local pollution such as unpleasant smell, attracting the vectors such as flies, mosquitoes, rats ... affecting to health of workers and the community.

2) Impacts on culture-society

If the project is implemented and exerted its effectiveness in the coming years such as sufficient water supply for production and improvement of channel surface, over a third of person joining to the survey have planned their production plans. This shows the potential impact of the project on production of the project area. Agricultural production will increase. Therefore, demand for planting more rice and crops is large but it may face to increasing of use of chemical fertilizers and pesticides, leading the risk of environment pollution. On the other hand, the increasing of rice yield will put more pressure on solving the problems after harvest such as processing, preservation as well as consumption in order for farmers to gain more benefits in the value chain of rice.

Social impact on the increasing and transformation of economic activities in conditions of supplying enough water for production demands maybe create more jobs, especially for groups of employees, reduce harvest time and contribute to poverty reduction. However, the project also has negative impacts such as land acquisition and resettlement, livelihood and business impacted by the relocation; conflicts on water use; increasing of use of fertilizers and pesticides; health risk; and impact of ethnic minorities. These impacts need to be considered and reduced the period of project implementation.

a) Impacts on the capability of management and operation of irrigation system

Dam Rehabilitation and Safety Improvement Project (DRaSIP) will be deployed to reinforce the safety of reservoirs and support the provincial management body in the project to build scenarios, long-term rural development strategy, to take into account to the climate change scenario, to realize activities for conducting National Target Program on mitigate and adapt to climate change; Irrigation Development Strategy in 2020, with a vision to 2050; National Strategy for water supply and rural sanitation by 2020; National Target on New Rural Construction; Agriculture, Farmers and Rural Areas Development Programs;...

b) Impact son resident's health

Investment for the project will mainly affect to the environment caused by material transportation and the noise of machinery ... in the construction process. In addition, workers moving from other areas to implement the items can also bring disease and different lifestyle that maybe break traditional and local regulations. The project management agency needs to take into account to risks on health such as

infectious diseases by sexual transmission, to organize the propaganda activities and closely monitor this works.

For socio-economic aspect, the sub-project will bring positive and long-term effects. The impacts are considered to be negligible and primarily happened within construction only.

c) Conflicts generating from water use and role of relevant parties

In the construction process, amount of water is certainly decreased, leading to disputes or dissatisfactions because of some households have got more favourable locations for water accessibility and someone have not been lucky like that. Therefore, it needs to make the advance commitment of the households through the meeting head of the village should be inform prior to occur the above situation.

Aim of the project is to increase the capacity of the local agencies in management and deployment of dam improvement, to encourage participation, to strengthen knowledge and understanding of management and to enhance the equal cooperation between the beneficiaries and management agencies and local authorities. This will support the residents and local communities to develop mechanisms of water resource management under the collective in order to avoid happening potential conflicts among the relevant parties and to minimize the impacts in short and long term. Specifically, it may appear conflicts between agricultural and hydraulic company (or local officials) and the water users for irrigation in case of the deviation of the water supply plan. Or it is the conflict between the water users, especially households living at the upstream and downstream of water source if water supply is interrupted or unfair.

5.3.3.4. Impacts on environment

5.3.3.4.1. Impacts on water environment

Impact on the water environment in the construction stage includes domestic waste water of workers on site, overflowing rainwater and wastewater from construction works, detailing:

a) Impacts from domestic waste water

Domestic wastewater of workers is a major cause affecting to water quality in the surrounding area. Domestic wastewater contains many impurities, easily decomposable organic matters, nutrients and bacteria so that it can lead to contamination of surface water and groundwater if not untreated. Domestic waste water is generated from the following sources: cooking, washing and normal hygiene of workers and officials.

Based on the pollution coefficient provided by Vietnam Environment & Sustainable Development Institute-VESDEC, the volume of pollutants per person daily released into environment is given in the following table:

Table 5.2. Load of pollutants in domestic waste-water

No.	Analysed parameters	Average pollution generated by one person per day (g/person/day)	Total maximum pollution load (kg/day)

1	BOD_5^{20}	45 – 54 (49.5)	10.8
2	COD	85 – 102 (93.5)	20.4
3	TS	170 – 220 (195)	44
4	SS	70 – 145 (107.5)	29
5	Oil	0 – 30 (15)	6
6	Total nitrogen	6 – 12 (9)	2.4
7	Organic nitrogen	2.4 – 4.8 (3.6)	0.96
8	NH_4^+	3.6 – 7.2 (5.4)	1.44
9	Total phosphorus	0.8 – 4 (2.4)	0.8
10	Total Coliform	$10^6 – 10^{10}$ (10^8) MNP/100ml	-

Source: Report of Vietnam Environmental Science and Development Institute - VESDEC, 2007

Domestic wastewater arises mainly from the living activities of workers in tents located in the area of the site. Basing on demand of water supply under standards of Ministry of Construction (TCXDVN 33-2006), amount of water required for one person to use daily is 100 litters/day, and amount of waste water is 80% (80 litters/person/day). According to the plan of construction and equipment installation in the 2nd drought season (starting from October until the end of April), a number of workers mobilized for the project is 50 persons/day, total amount of wastewater per day is:

100*80%*50 = **4 m^3/day**

Contents of main pollutants in the wastewater are predicted as follows:

Table 5.3. Predicted content of pollutants in domestic waste-water

No.	Pollutant	Load (g/person .day)	Average pollution load generated by 50 persons per day (kg/day)	Predicted content of pollutant (mg/l)	QCVN 14:2008/BTNMT	
					Column A x 1,2 mg/l)	Column B x 1,2 (mg/l)
1	BOD_5^{20}	49.5	2.465	**513**	36	60
2	COD	93.5	4.675	974	-	-
3	TSS	195	9.750	**2031**	60	120
4	SS	107.5	5.375	1120	600	1200
5	Oil	15	0.750	**156**	12	24
6	Total nitrogen	9	0.450	94	-	-
7	Organic nitrogen	3.6	0.180	38	-	-
8	NH_4^+	5.4	0.270	**56**	6	12
9	Total phosphorus	2.4	0.120	**25**	7.2	12
10	Total Coliform	10^8 MPN/ 100ml	$50*10^8$ MPN/100ml	**$10*10^8$** MPN/100ml	$3,6*10^3$ MPN/100ml	$6*10^3$ MPN/100ml

Concentrations of pollutants in domestic wastewater (in the case of not being handled) exceeds the largest allowable concentration of pollutants in domestic wastewater under the form of small-scale production of less than 500 people (hence coefficient K for the largest concentration, K = 1.2) in accordance with QCVN 14: 2008- Regulation

prescribed the permissible maximum value of pollution parameters in domestic wastewater as being discharged into the environment. Based on the prediction table, concentration of BOD, TSS, SS, grease is higher than 10 to 20 times; Nitrogen and phosphorus are higher than 5-10; coliform raises more than thousands of times comparing to standard level of Column A specified value C of maximum allowable pollution parameters in domestic wastewater as being discharged into the water source to be used for water supply. Because the project directly takes groundwater as a source treating fresh water, the water resource can be likely to adversely affect to groundwater quality if being untreated.

Comparing with Column B that regulates value C of the maximum allowable pollutants in domestic wastewater when being discharged into unused water sources for supplying the drinking water, this is surface water in irrigation channels for irrigation and aquaculture around the project area, the concentration of BOD, TSS, coliform, especially for nitrogen, phosphorus, are higher standard level from tens to thousands of times.

Thus, wastewater will make bad influence to drainage channels of the Project (the place directly receives waste water) if being untreated. The organic compounds are susceptible to decompose by microorganisms, reducing amount of oxygen in the water, affecting respiration of aquatic species. Nutrients such as nitrogen, phosphorus facilitate algae to grow, leading to eutrophication and loss of ecological balance at the receiving water area. To minimize the above impacts, the project manager will provide measures to reduce pollutants in domestic wastewater described in Chapter 6 before being discharged into environment.

b) Impacts from the overflowing rainwater

The work is built in the drought season (less rainfall) so the pollution from the overflowing rainwater is negligible.

c) Impact from construction waste water

Impacts on the water environment from construction activities can summarize as follows:

- The process of concrete mixture, sanitary and maintenance of machines will generate a certain amount of waste water, estimated about 0.5 m3/day (Tran Hieu Nhue, water supply - Science and Technics Publishing House, 1996) and is not much. The main contaminated compounds in wastewater are soil and sand classified into the kind of being less toxic and easy to settle, accumulating on the temporary sewer lines. Thus, penetration capacity of pollutants to surface water is at low levels.
- Activities such as excavation and embankment towards the mountain do not affect to domestic drainage systems, and potentially affect the turbidity of water in the lake.
- For the shallow aquifers, skimming and backfilling can make ground water artery to be exposed or create rainwater containing holes that shall be vulnerable from the penetration of polluted surface water and rainwater over a period of time.

Generally, contaminated surface water in the construction is unavoidable in direct or indirect manner but this impact lasts in temporary time. Basing on the extremely high self-cleaning ability of water, especially in the flooding season, water quality will gradually return to its original status after completing the construction activities.

5.3.3.4.2. Impacts on air environment

a) Impacts from the dust source

The operations for excavation, soil transportation, construction and expansion of spillway, etc ... and other works require a large number of trucks to transport materials and fuels in or out of the site. Moreover, the risk of waste spillage on the road maybe happen, causing the unsafely for traffic and sanitation and dust generation during the process of soil, sand transportation.

According to preliminary statistics, total volume of materials to be used for the works is about **18,000 tons.**

With that amount of material to be transported, a required number of trucks are about 3,600 times for transportation of material volume (estimated use of 5-ton trucks with diesel motor) over a period of 10 months (300 days).

Table 5.4. Vehicle flow for material transportation in the project region

Amount of transported materials (ton)	**Total (time of transportation)**	**time (day)**	**Flow (vehicle/day)**
16,000	3,600	300	12

Vehicles for transporting and moving the materials are dump trucks. These trucks release amount of dust, including dust from road surface, material spillage and the fuel combustion. According to quick assessment method of WHO, we can predict amount of dust generating from the transportation with the reference assumptions at locality as follows:

- Average speed: 35 km/h
- Average load: 5 tons/truck
- Average number of wheels: 6 pcs/truck
- Average distance: 5 km/time
- Working time: 8h/day

Table 5.5. Dust load in the process of extending the spillway and hardening the dam, road to the dam.

Source	**Coefficient *(1000km)***	**Generated amount of dust from one *(kg/1000km)***	**Generated average load *(kg/day)***	**Generated average load *(kg/h)***

Material transportation	3.7 × f	978.64	151.33	18.92

Source from WHO - Assessment of Sources of Air, Water, and Land Pollution - Vol 1 - Generva 1993.

Where:

f: Coefficient of secondary dust generating from operation of trucks on the road, calculated by the formula:

$$\mathbf{f = v.M^{0,7}.n^{0,5}}$$

- v: Average speed of truck: 35 (km/h).
- M: Average load of truck: 5(ton).
- n: Average number of wheels: 6 (pcs).

Load of pollutant E for whole distance:

$$E = 26.48 \times 1.000.000/(5 \times 1000 \times 3600) = 0,75 \text{ (mg/m.s)}.$$

To assess the impacts of dust in the process of site clearance, Sutton model for defining the pollutant content at a certain moment is applied to calculate in the form of:

$$C = \frac{0.8E\left\{\exp\left[\frac{-(z+h)^2}{2\delta_Z{}^2}\right] + \exp\left[\frac{-(z-h)^2}{2\delta_Z{}^2}\right]\right\}}{\delta_Z u}$$

Where:

- C: Content of dust in the air (mg/m^3).
- E: Load of pollutants from waste source (mg/m.s).
- z: Height of calculated point: 1(m).
- h: Height of road surface comparing to surrounding ground: 0,5 (m).
- u: Average wind speed in the area 1,5 (m/s).
- x: Coordinate of required point (m).
- δ_z: Coefficient of dust diffusion under z direction, defined by the following formula: $\delta_Z = 0.53x^{0.73}$

And x is distance along to wind direction from the required point to emission source (m), coefficient of pollutant diffusion is equal to:

Table 5.6. Dust diffusion coefficient in the atmosphere in the z direction

x	**5**	**10**	**15**	**20**	**25**	**30**
δ_z	1.716	2.846	3.826	4.721	5.556	6.347

Table 5.7. Dust content in atmosphere

Distance x (m)	**Attitude z (m)**						**QCVN 05:2013/BTNMT**
	0,5	**1**	**1,5**	**2**	**2,5**	**3**	
5	0.391	0.374	0.329	0.266	0.198	0.135	**0.3**

Distance x (m)	Attitude z (m)						QCVN 05:2013/BTNMT
	0,5	1	1,5	2	2,5	3	
10	0.236	0.232	0.222	0.205	0.184	0.160	**0.3**
20	0.142	0.141	0.139	0.135	0.130	0.124	**0.3**
50	0.073	0.073	0.072	0.072	0.071	0.070	**0.3**
100	0.044	0.044	0.044	0.044	0.044	0.043	**0.3**
150	0.033	0.033	0.033	0.033	0.033	0.032	**0.3**
200	0.026	0.026	0.026	0.026	0.026	0.026	**0.3**
250	0.023	0.023	0.022	0.022	0.022	0.022	**0.3**
300	0.020	0.020	0.020	0.020	0.020	0.020	**0.3**
500	0.014	0.014	0.014	0.014	0.014	0.014	**0.3**

During the period of transportation, vehicles operate continuously at high frequencies in the project area so it can create large amount of dust. Dust in the air will impede the vision, affecting health of workers and residents surrounding. Dust also affects to animals and plants. The leaves covered by dust layer can reduce the photosynthesis efficiency, affecting the growth and development of plants.

According to the above statistics, only at a distance of 5m in attitude of 0.5m, 1m, 1.5m, dust concentrations may exceed the allowable limits. In other distances, dust concentration is under the limit of QCVN 05:2009/BTNMT (0.3 mg/m3 for 1 hour). Subjects under these impacts are mainly residential zone within the scope of 5m comparing to roads.

b) Impacts from gases emission

The material trucks going out and in the Project area mainly consume gasoline and diesel oil. During operation of fuel combustion, amount of exhaust gases containing air pollutants such as dust, CO, CO2, SO2, NOx, hydrocarbons ... shall be released to environment.

The emitted level of pollutants depends on several factors such as air temperature, vehicle speed, distance, kinds of fuel and pollution control measures. According to the World Health Organization WHO, method forecasting the load of pollutants from diesel motors including:

Table 5.8. Emission coefficient derived from one vehicle

Items	Coefficient (kg/1000km)	Distance (km)	Time (minute)	Number of vehicle (in/out)	Emission (g/minute)
SO_2	4.15*S	5	15.5	1	0.007
NOx	14.4	5	15.5	1	4.645
CO	2.9	5	15.5	1	0.935
HC	0.8	5	15.5	1	0.258

S: Sulfur content in petroleum, S = 0.5%

Source from WHO: Assessment of Sources of Air, Water, and Land Pollution – Vol 1, Generva, 1993.

Table 5.9. Predicted exhaust gases corresponding to number of vehicles

Number of vehicle (time)	SO_2 (g/minute)	NOx (g/minute)	CO (g/minute)	HC (g/minute)
8	0.056	37.16	7.48	2.064

The scope of the impact of dust, toxic gases from the material trucks is local, mainly on the construction site.

Affect to vegetation cover along to the transport lines and agricultural ecosystem, especially for rice fields at the both sides of the roads because of being covered by the dust layer on the surface, leading to influence to photosynthesis and reduce the biological yield.

The operation of construction equipment will affect to the quality of ambient air environment because these vehicles consume gasoline or fuel oil, emitting exhaust gases from the combustion process such as dust, CO, SO2, NO2, total hydrocarbons. However, the impact is local, mainly affecting workers on the site at the mining area, auxiliary works, and storage area.

c) Impacts from the noise - vibration

All human activities, on-site equipment will generate the noise. The spreading level of noise depends on sound level and distance from noise source to the receiving environment. Noise affects worker's health in the site and residential zone.

Table 5.10. Maximum noise level (dBA) from the operations of means of transportation and mechanical equipment

No.	Type	Noise level corresponding to 1-m distance		Noise level corresponding to distance					
		Distance	TB	5m	10m	20m	50m	100m	200m
1	Truck	82-94	88	74.0	68.0	62.0	54.0	48	42
2	Concrete mixer	75-88	81.5	67.5	61.5	55.5	47.5	41.5	35.5
3	Digger	75-98	86.5	72.5	66.5	60.5	52.5	46.5	40.5
4	Excavator	75-86	80.5	66.5	60.5	54.5	46.5	40.5	34.5
5	Compressor	75-90	82.5	68.5	62.5	56.5	48.5	42.5	36.5
QCVN 26:2010/BTNMT: National Technical Regulation on Noise: 70dBA (from 6h-21h) and 55dBA (from 21h-6h)									

Source: Prof. Dr. Pham Ngoc Dang, Air Environment, Science and Technics Publishing House, Hanoi – 1997

Remark:

+ QCVN 26:2010/BTNMT: National Technical Regulation on Noise

Noise level that is higher than standard level will cause the impacts on health of workers as well as insomnia, fatigue, ennui. High noise level reduces labour performance, health of officials and workers in the manufacturing area. Exposure to intense noise for a long time will reduce the ability to hear, leading to occupational deafness. According to statistics from the Ministry of Health and Institute for Scientific and Technical Research on Labour Protection of Vietnam General Confederation of Labour, the noise adversely affects most parts of the human body. The impact of noise on the human body at different frequency ranges can be shown in the following table:

Table 5.11. Harm effects of noise at the high level for human health

Noise level (dBA)	Impact on the audiences
0	Hearing threshold
100	Initial to change heartbeat
110	Strongly stimulate the tympanic membrane
120	Threshold of pain
130 ÷ 135	Cause neuropathy, nausea, weaken touch and muscle
140	Cause ear pain, dementia, crazy
145	The maximum limit human can suffer the noise
150	Being broken tympanic membrane if hearing in long time
160	Being in danger if hearing in long time
190	Only hearing in a short time is also dangerous.

Source: National Institute of Labour Protection

In general, noise pollution takes place in local area, directly impacts to workers in the site. Basing on NTR 26:2010/BTNMT, the impact of noise from a distance of 10m onwards is under the acceptable level so the project does not remarkably influence to the surrounding area.

Vibration generating from the excavation and operation of equipment. These activities create vibration on the site, including:

- 8-ton mechanical hammer with closing force of about 48 KJ can create vibration of 12.9 mm/s at a distance of 10 m.
- Equipment for ramming the soil down with force of 30 KJ can create vibration of 4.3 mm/s at a distance of 10 m.
- Diesel hammer can create vibrations 7 mm/s at a distance of 10m.

Vibration at the high frequency will cause mental fatigue for the workers; Vibration from 5.0 mm/s or higher may adversely affect to the stability of the construction works. The vibrations arising from the operations of equipment on site affect within the

scope of the construction area only, workers on site at the distance of 15 m from the source.

5.3.3.4.3. Source generating the solid waste

a) Domestic solid waste

The site will contain about 50 workers/day. The mainly solid wastes from living activities are paper, plastic of all types, cigarette butts, bottle, beer cans. Estimated volume of domestic wastes is:

0,5 kg/person/day x 50 persons = 25 kg/day.

Despite of not being much, amount of the waste will contaminated land, water, air and landscape of the site and surrounding area if not being collected daily. Under the solar impacts and bacteria, the organic matters in the exposed wastes shall be decomposed to form anaerobic gases with the unpleasant smells from the biodegradation process, polluting the atmosphere because. On the rainy days, the rain will bring these organic matters to rivers and drains, leading to pollute surface water.

b) Solid wastes from work construction

Building activities: The solid wastes generated by the construction activities include rock and soil from the excavation for extending spillway, sand and gravel, ... surplus materials and spillage during construction such as broken bricks, broken roof plate, beams, formwork, cement cover, salvage ... Volume of solid waste depends on the construction process and mechanism of project management. However, the kinds of solid waste are still valuable in use so project manager will recover for reuse or sell to other units. As a result, this kind of solid waste cannot be released into external environment.

c) Source generating the hazardous wastes

Activities for repair and maintenance of machinery and vehicles: Releasing waste oil, grease and oil-contaminated materials (rags, oil sludge). The types of hazardous wastes are likely arisen from the construction stage and be mainly oil-contaminated waste. Generated amount of oil waste during construction depends on factors:

+ Number of vehicles and mechanical equipment on the site;
+ Amount of oil discharged from the mechanical vehicles;
+ Cycle of oil change and maintenance of machinery and equipment.

Office wastes: Depleted batteries and broken fluorescent bulbs which are hazardous wastes but does not create frequent source. It is difficult to estimate their number although we still need good management to avoid the negative impacts on environment.

Besides, there is also solid waste from the ill workers. Hazardous waste generates infrequently and does not cause significant impacts on environment.

5.3.3.5. Impacts on the biological environment

Construction items as embankments, drainage systems of Khe Che Lake in the flood season can potentially cause the instant flood, pollution of external environment, especially for hydrological environment that must receive large amounts of water, and soil environment of the surrounding residential area.

- ***Marine ecosystem***

Location of irrigation dam is former reservoirs (Khe Che lake), belonging to the low hilly of Red River delta. In this landscape, it has taken long time that natural environment here suffers more or less human impacts with various intensities. Under the impacts, most of the ecosystem seems to become secondary artificial eco-systems. These types of water area under the planned area of irrigation system are paddy fields, channels, ponds and lakes. The wetland types function to serve different purposes and suffer strong influence from human activities around them. In general, the construction of Khe Che dam causes the impacts on the ecosystem.

However, irrigation system operating in good conditions can improve environmental pollution. The analysis results of aquatic system at An Sinh commune and neighbour areas show the general features of aquatic system with Northeast delta in both qualitative and quantitative factors where there are no rare species under the protection.

- Prediction of ecological succession of the hydrology

In fact, relationship between the basin and water quality of the hydrology is the impacts of human activities on the basin for the water area. These activities often affecting to the water area include:

- Hydraulic morphology
- Hydrological regime
- Level of nutrients, organic pollutants
- Level of contamination by toxic matters in waste-water, sediment

Thus, we can say that socio-economic development will directly affect on the water quality of water area and eco-systems on the basin.

- ***Terrestrial ecosystem***

Area for constructing the irrigation dams as planned is low hills (forest plantation), rice fields and irrigation channels. Beyond is the village with the terrestrial ecosystems including garden, cultivated soils and several simple flora as crops, fauna including main cattle, poultry and some wild animals in rodent group (rats) and group of reptiles and amphibians (frogs, water snakes). Here we can see the rare animals and plants with high economic value under the protection. Basically, the construction of irrigation dam does not cause significant impacts to terrestrial flora and fauna in the surrounding area. However, it is necessary that it must control water level well during flooding. If not, the habitat maybe suffered the certain impacts, particularly residential areas.

For invertebrate groups under the soil- the group has a role in land reclamation and soil quality indicators, if environmental conditions change, the qualitative and quantitative structure of the group shall be changed. The impact of the external environment will occur in two ways: positive and negative. The impacts altering the landscape, narrowing area of residence, contaminating soil ... are negative for creatures and make loss of environmental stability. The population of animals will reduce, except for the increasing density of some specific species, leading to increase the competition and take the most advantage within the internal unstable populations that are constantly changing. All internal alteration is to aim to respond to the new living conditions of the environment until the external factors are improved corresponding to the development of groups and species. Then the environmental balance and stability are reset as original structure.

5.3.3.5. Assessment on impacts under the construction items

5.3.3.5.1. Upgrade and extension of flood spillway

- ***Parameters after repairing****:* Width of overflow threshold: 24m; Level of overflow threshold +23,68m;
- ***Operation of upgrade, repair and construction:***

- Extend the spillway towards the mountain (both sides), add 11m to total length of 170m.

- Structure of spillway body: reinforced concrete, bearing the pressure, hard frame put on the bedrock.

- Structure of supporting wall: reinforced concrete in monolithic shape, wall slope, supporting beam put on the bedrock.

- ***Assessment on impacts:***

Construction of extending the flood spillway takes over 7 months. Construction of the spillway will not affect water use for production activities because all the constructed parts are upper the normal water level so it should not temporarily cut the water supply in the entire construction process. Particularly, upgrading water sewer needs to cut water supply. However, the time for this item construction is very short (from 5-7 days), it will not affect the water demand of the downstream area if the construction is conducted at the suitable location.

Process of constructing the spillway can cause the erosion for dam body or surrounding areas. However, theses impacts are LOW and TEMPORARY due to:

i) Spillway construction is conducted in the drought season, low precipitation so it is extremely low or hardly any soil erosion.

ii) Construction positions are located upper the water level of lake or toward the downstream so it is hardly for land erosion.

Location: Khe Che reservoir, Flood spillway and Channel.

Duration: 7 months for constructing flood spillway and body of dam.

5.3.3.5.2. Maturing of concrete for dam surface and management road

- ***Parameters:***

- Dam surface: Length: 658m, Width: 4,2m.
- Management road: Line length: 139.56m, surface width: 5.0m..

- ***Operations of upgrade, repair, construction:***

- Dam surface: Structure: reinforced concrete M250 thickness of 20 cm.
- Management road: Structure: upper layer of foundation is ashlar and lower layer is aggregated ballast. Road surface is concreted M250, pavement width of 0,75m utilizing stone and soil from spillway construction.

- ***Assessment on impacts:***

Construction of management road can affect to local transportation as well as the risk of accidents.

- Increase the risks due to the increasing of the means at the construction site (the place of the excavation operations and equipment yard; waste is located on or next to roads, works ...) can be dangerous, especially at night when visibility is limited;
- To limit the ability of movement as well as access to social infrastructures such as schools, markets ...

However, theses impacts are LOW and TEMPORARY due to:

- Traffic volume is divided.
- The management line is currently land roads being less use by the residents, mainly lake management road. Therefore the capacity to obstruct traffic is very low;

A part of the scope of contractor's responsibility is to ensure the health and safety on construction sites for individuals and construction area is not allowed to create risks to the human safety. Thus, the contractor shall take measures to minimize the impacts in the construction process

Location: Management road in the project scope of Khe Che reservoir and spillway.

Duration: 7 months for constructing flood spillway and body of dam

5.3.3.4.3. Reconstruction of 2 underground sewers through the stream.

- ***Parameters after construction:***

Tan Viet sewer: 4 doors, dimension for each door (6x3.5m).

Ba Xa sewer: 2 doors, dimension for each door (6x3.5m).

- ***Operation of upgrade, repair and construction:***

Renew Tan Viet and Ba Xa sewer, structure: reinforced concrete M250.

- ***Assessment on impacts:***

Sewer construction has been predicted to commence within 2 months (in the drought season of 2nd year, avoid the seasonal time). The underground sewer is deactivating in this time.

Sewer construction shall affect to the water quality in the neighbour hydraulic system because of leaking petroleum from the dismantlement and installation.

However, theses impacts are LOW and TEMPORARY due to:

i) Construct the underground sewer to access water source is taken place in the drought season and ensured by the dikes if necessary. Therefore, water source shall be under the low impacts.

ii) Time for construction is widely informed to the residents for making the active plan in living activities and production

iii) Select the time of draining water, avoid the time of using water for the crops at the downstream.

Location: Tan Viet and Ba Xa Sewers

Duration: 2 months (in the drought season of 2nd year, avoid the time of serving the season).

5.3.4. Environmental and social impacts in the operational phrase

During the stage of operation and management, headwork Khe Che reservoir will take some positive effects on socio-economic environment of local region and contribute to improve the life quality of the residents and make sure that water source will be used for agricultural production activities.

5.3.4.1. Sources

In this stage, the source of the environmental impact can be some types of solid, liquid wastes from the residents having forestry land at the area higher than the water level of lake and beneficiaries. This is also a source affecting to environmental quality but the large or small impact depends on the number of households and used land area.

- Solid waste from residential zone and agricultural by-products;
- Solid waste from the use of fertilizers and pesticides in agricultural activities;
- Domestic waste-water, industrial wastewater;
- Change the work designs.

5.3.4.2. Subjects to be affected

5.3.4.2.1. Impacts on air environment and microclimate in this region

Repairing, upgrading the reservoir has affected to air environment at different stages with various levels. At this stage of preparation and site construction, air pollution is mainly caused by dust and exhaust gases from the preparation of construction site, roads, yards, warehouses, and material transport ... These impacts only takes place within

a small space and often create local and discontinuous pollution. When repairing the reservoir is completed and started again (operational stage), the impacts will change some meteorological factors in the region.

Reservoir foundation is characterized by tropical monsoon climate that creates river system under its impacts on large scale. The dry continental climate of this region is shown the best in the dry season. When the reservoir running back, it will contribute to change the microclimate.

So, impacts on air environment and microclimate within area of the project in the stage of management and operation are considered to be positive on wide scale. In order to quantitatively determine the above variations, activities of meteorological observation and regular study are required before and after the construction.

Thus, during the operation stage, the sub-project will increase water source in stable manner, ensuring the safety of the dam and downstream areas. The negative impact of the operational stage on air environment is hardly any.

5.3.4.2.2. Impacts on landscape

Landscape of the reservoir: After renovation and upgrade of the works, the landscape around the reservoir becomes more spacious and beautiful. Beautiful landscape combining with convenient traffic will attract many visitors and the tourism will increase local budget.

Improvement of the ecological environment: Area of construction site, lake area and flora, fauna at the upstream area and vegetation cover of the ecological environment here will be significantly transformed by trees planting, reforestation, eco-system recovery after completion of the work construction.

Main contents of the project:

- Upgrade and extend the flood spillway from 14m to 25m for reservoir safety and ensure drainage of flood at calculated frequency of 1%.
- Concrete dam surface with normal concrete M250-20cm to create favourable conditions for the combination of rescue activities and internal traffic and project management. Explore and handle the termite and potential threats.
- Concrete the section leading to dam surface with normal concrete M250-20cm for works of flood rescue and prevention, internal traffic and project management.
- Refresh the management house for combination of flood prevention and project management, usable area of 250m2, two-storey house with reinforced concrete frame.
- Build rescue road and support the construction of spillway line L = 480.0m, B = 6.50m.

So, newly renovated and constructed items shall create a new look for the reservoir that is going to be newer, more beautiful, modern and safer after being repaired, upgraded.

5.3.4.2.3. Impacts on water environment

- Impacts relating to waste-water

Most of waste-water source comes from the activities of officials and workers at the site. Number of officials and workers in the management team is estimated as follows:

Table 5.12. List of expected officials for management team

Management official	Technician	Operator for closing and opening valve in the tower	Total
1 (Concurrent member)	2	1	4

Basing on the above table, we can see that average amount of waste-water from the domestic activities of the manager and officials within the management house generate:

4*100 litters/day **= 400 litters/day**

However, the management house have designed the closed toilet system meeting the environmental standards so that domestic waste-water should be collected and processed in the septic tank before discharging into the receiving environment.

During the period of operation, petroleum from the valves in a tower can flow into Khe Che Lake but this leaking amount does not significantly affect the water quality as well as the surrounding environment.

- Others

After being upgrading, the operation of sub-project will increase the capacity to take water, leading to change the speed of flow, sediment transport and the current flow mode which can lead to soil erosion and sedimentation along the irrigation system.

5.3.4.2.4. Source generating solid wastes

Domestic solid waste includes: food, drinks and daily items at the average level:

0,5 kg/person/day x 4 persons = 2 kg/day

The waste amount is collected and gathered at right places in the station and periodically moved away by environmental sanitation company under the contract so that it should not pollute the environment.

Production waste: No waste in the production.

Hazardous waste: From the maintenance of machinery as petroleum rag. It can be reduced the pollution risks because of having its own collection area in processing station and waste treatment contract with environmental sanitation company.

5.3.4.2.5. Impacts without regard to wastes

- Noise, vibration

Noise and vibration derived from the operation area of the project mostly comes from the opening and closing of valves in the tower. Thus, it does not affect the residents because of small and infrequent noises. Moreover, the operational area of project is

located quite far from residential zone so it can be considered that sources of noise pollution and vibration are not significant.

- Erosion, landslide

In fact, landslide happened on the spillway of Khe Che reservoir in its history and 10 households living in the area must move. However, only when it is heavy rain, causing local floods and the pill way cannot promptly drain, this event will occur. Consequently, after extending the spillway from 14m up to 24m, the erosion will not happen.

Soil erosion can occur during operation of the project operation because amount of rainwater falls down from the mountains or flows from the scour holes to downstream. These impacts can be considered to be negligible because soil erosion rarely happens in this region.

- Termite destroying the dam body

When putting the works in operation, it probably appears termite nest. Nesting of termites will hollow body of the dam for long, causing water infiltration and reduce the intensity and functions of the dam.

5.3.4.2.6. Impacts on society

a) Impacts caused by reservoir sedimentation

Due to the steep terrain, capability of reservoir sedimentation will appear shortly after works are put into use. However, the process of sedimentation will occur in the long run, so, it can be monitored and controlled through the conversion of the reservoir upstream into protective forest to increase water storage capacity and minimize erosion and sedimentation. Operation phase is done in a long time, so if there is no action to control emissions source, it will also affect the reservoir.

b) Impacts caused by wastes from agricultural, forestry and fishery activities:

Along with the stability of the water resource and exploitation of water to serve agriculture and aquaculture activities of the people has also increased, at the same time, waste will be generated (containers and packages containing insecticides, fertilizers, etc), hazardous chemicals (pesticides) and aquaculture feed. This is a long-term waste source that should be controlled because the water resource in the reservoir is provided for multiple targets (irrigation, aquaculture). Without control measures, it will affect environmental quality in the region considerably.

5.3.5. Assessment on impact of risk and incidents

5.3.5.1. Preparation stage

The main risks of the Project arise from the delay of benefit performance the economy is sensitive for. The factors leading to delay the benefit performance includes delay in recruitment of project consultant and appointment of manager of the project, prolix administrative procedures relating to the contract conclusion and insensitive settlement on relocation.

The project has not made the land compensation for the residents so there is no difficulty on the site clearance and compensation.

Inappropriate capital distribution may result in the delay of the project. However, Quan Ninh Provincial People's Committee commit the capital distribution shall be alright due to the expense sharing between the city, district and commune authorities to ensure the sustainability of the Project.

5.3.5.2. Construction stage

- For community health: Require the contractor and construction unit to tightly check and supervise in order to prevent the sick infection for the community from all types of wastes generated in the living process of workers during work construction;
- For labour safety: Strictly comply with regulations on labour safety. Factors relating to environment, labour intensity, environmental pollution level all can cause the bad impacts on worker's health such as fatigue, dizziness. Installation, construction and material transportation, waste removal with highly operational intensity of trucks can lead to labour and traffic accidents in the region.
- Problems in the security order in the process of construction.

5.3.5.3 Operation stage

After being put in use, the project will not generate the polluted wastes, waste-water, exhaust gas and solid waste; negative impacts derive mainly from several small problems.

The dehydration risk of the reservoir: The reservoir water is lost due to seepage through the bank of the reservoir and the main dam, or percolation down to aquifers which cause reduction of water supply to more than 1,000 hectares of farmland downstream in the dry season. If amount of water lost is large, it would affect the ability to regulate water, causing water shortages for production, and economic damages. However, after the completion of the repair and reinforcement of the dam, water loss of Khe Che is considered negligible; flood overflow and the offtake are repaired, and upgraded to ensure that water seepage through the dam is limited to the maximum extent.

Risks to dam safety: dam break has a great impact on the hydrological regime of the area, affecting water, soil, aquatic ecosystems, water supply capacity of irrigated areas, agricultural production downstream. Especially, when the dam breaks, it has a major influence on the lives and assets of more than 3000 people in three communes downstream that is An Sinh, Tan Viet and Viet Dan. Overcoming the consequences of dam incident is very difficult and takes time, so, operation process must follow strictly the mitigation measures proposed in the report.

The reasons that cause the dam broken: (i) the largest flow and water level of construction flood are in excess of its largest level designed. (ii) The quality of backfilling material does not ensure quality standards. (iii) During the construction process, design altitude to deal with xiam-man flood has not yet been reached. (iv) Construction does not

follow design. (v) Problem of floodgate system (vi) the inaccurate of flood forecasting leads to operation of the reservoir untimely during flooding. (vii) Earthquakes. These causes should be settled by giving measures to overcome and minimize the impact on dam safety to protect downstream areas.

Impacts on sedimentation, erosion downstream

The reservoir is designed, constructed to ensure design flood frequency of 0.5% and inspection flood of 0.1%. The reservoir will be repaired and upgraded to ensure anti-flood frequency of 1%. Calculation results of flood regulation showed reservoir's spillway should be extended from 14m to 24m . This expansion will increase the capable of overflow drainage, water level in the reservoir will fall faster than that in the current status. Because flood water level in the lake has decreased rapidly, the time floodwaters deposited in the reservoir will decrease, resulting a reduced amount of reservoir sedimentation. Slower sedimentation of reservoirs would improve the life of the Work, reduce the cost of dredging the reservoir. However, the expansion of spillway also brings a larger amount over spillway that leads to the erosion downstream compared with the current situation.

The spillway of Khe Che, at the moment, is a free type, with the width B = 14m. During the flood season, when the water level in the reservoir is higher than normal water levels, the water will spilled over to downstream. After expansion, the width of spillway is 24m. With this new size, when occurring flood, the water rising level in the reservoir will be less than the current overflow; steady level of the reservoir will be higher, reducing the abnormal increase of water in each flood period. Ability to erode will be reduced due to extended water drainage time. However, the expansion of spillway will increase sedimentation and erosion downstream, especially the downstream area located right behind spillway

PART VI: MINIMIZATION MEASURES

6.1. No action alternative

a) Flood spillway:

The flood spillway has been rehabilitated and improved in 2000. However, it was only recovered and recovered with the spillway tail in a temporary manner.

Recently, due to adverse climate change, it is required to expand to ensure the flood discharge capacity affordable to cover the 2005 typical flood with flow rate of 370m^3/s, obtaining frequency of 1% (exceeding 1.5% against the design flood as calculated). At that time, Dong Trieu District People's Committee was urgent to alarm to evacuate 3000 local people at the reservoir downstream in 3 communes.

Figure 6.1. Earth diversion canal

Figure 6.2. Overflow weir

Figure 6.3. Earth diversion canal

Figure 6.4. Overflow weir

Figure 6.5. Dam body

Figure 6.6. Water slope

b) Backfilled dam surface

Khe Che dam surface is backfilled by mortar rock wall covered with quarry fines to protect the surface, the length of the dam is 658.00m; because of long-term usage and large frequency of travelling, the surface does not flush and appear potholes and bush tree along the roadside. One side of the surface is mortar stone wall, and the other is downstream face, the edge on the side of downstream and surface are also levelled by stone wall.

Figure 6.7. Broken protection wall at the dam head

c) Management road

The end of management road leading to the available dam face is the soil path. The works at such section has only one bridge to pass through the channel. After passing the dam face, such road section connects the service road along the reservoir bed. The pavement is subject to a series of potholes, not convenient for transport, especially flood control works.

Figure 6.8. Management road accessing dam face through soil path

d) Bridge via main channel

Because the bridge through the available channel is not conveniently arranged with the traffic direction in the management road, vehicles passing through the bridge often collide with bridge walls and barriers. The deck slab is narrow, about 3.0m width, causing difficulties for medium and heavy duty vehicles. The bridge is simple without slabs leading two bridge ends to leave the rough abutment, causing difficulties in transport.

Currently, the bridge wall is completely damaged due to collision with vehicles. The deck is not separated from the deck slabs to leave the bare concrete layer.

Figure 6.9. Bridge through the channel with damaged handrails and narrow deck

e) Water drainage system of downstream face

The dam has been repaired quite completely at the latest maintenance, the downstream face was remoulded, pastured for protection and drainage system is made of stone. However, a crater is left behind the water intake, so, this pit is often flooded after each rain, this cause the work's bad appearance.

Figure 6.10. Crater at the end of the water intake

f) Tower house of the water intake

The tower house is built with the main door system and wooden windows, at the moment, this door and window system had been damaged without warranty for usage, doors have been rotted and rain water is thrown inside the house.

Wall inside and outside the house painted with lime had been peeled off, wall painted and smeared ugly from tourists' visit

Downstream valve leaf used from 1990 up to now have been rusted and no longer operated.

Figure 6.11. The tower house for water

g) Management house

The house is built with flat roof, one storey, and spacious campus behind the water sewers at the downstream.

The current management house has 03 wooden doors and 03 side doors broken by the termite. The house is limited to use and needs to be replace.

The internal and external sides of wall and ceiling in covering with lime appear blister and mould.

Figure 6.12. Management house

In the past, some termite nests at the downstream face had appeared, despite that they are not popular, they are scattered over wide area, so, issues related termite settlement are also mentioned in the construction and investment project.

6.2. With project implementation alternative

a) Flood spillway

Expanding flood spillway, ensuring safety of reservoir:

- Distance of speed bumps: 1.54m

- Spillway structure: Load-bearing reinforced concrete structure with form of harden frame on base-rock

- Structure of injecting nozzle wall: Mass reinforced concrete structure with form of counterfort wall on base-rock.

b) Surface of soil dam

- Hardening dam surface by concrete, repairing cracks, breaks on breakwater.

- Structure of dam surface: structure of hard pavement, coated concrete M200 with 20 cm in thickness.

c) Management road

- Hardening concrete for management road.

- Structure of management road: The structure of management road is hard pavement structure, lower-layer foundation is made of rubble, upper-layer foundation is made of crushed aggregate, and pavement is coated by M200-20 cm concrete, road-side of 0.75m in width making use of waste soil and stone.

d) Salvage and rescue road in combination with spillway line construction

- Upgrading road surface.

- Road structure: The road foundation is paved by rubble, road base by grade 2 crushed aggregate, road-side by compacted soil and stone.

e) Rebuilding 02 undergrounds through spring: Tan Viet and Ba undergrounds

- Rebuilding 02 undergrounds through spring by M250 reinforced concrete structure on management road due to no capacity enough for flood discharge (designed calculation of flood discharge of 1%):

- The upstream and downstream of undergrounds are arranged to connect to natural spring bed by 2 stone lines with dimension of (0,5 x 1,0 x 2,0)m.

In general, the implementation of sub-projects will ensure the operation of the Khe Che reservoir, in particular:

- Ensuring safety for flood prevention of headworks complex of Khe Che reservoir;

- Creating stable irrigation source for about 1,000 ha of cultivated land, including 534 ha of rice;

- Ensuring the safety of more than 300 peoples in 3 downstream communes: An Sinh, Tan Viet and Viet Dan;

- Creating landscape, ecology for project area to serve for tourism;

- Contributting to economic growth of project area, development of aquaculture.

PART VII: ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

7.1. ESMP Objective

- Ensuring the compliance with regulations, laws, standards and guidelines applicable at the provincial and national level.
- Ensuring that resources are sufficiently allocated basing on project budget to carry out activities related to the ESMP.
- Ensuring that the environmental and social risks of TDA are managed appropriately.
- Responding to unforeseen and unidentified environmental issues in the environmental impact assessment by project.
- Feedback for the continued improvement of environmental performance.

7.2. Mitigation measures

7.2.1. Mitigation measres

7.2.1.1. Mitigation measures in preparation phase

a) Measures to minimize the environmental impacts of the sub-project in the preparation phase

Table 7.1. Measures to minimize the environmental impacts of the sub-project in the preparation phase

Potential impact	Mitigation measures	Effectiveness Advantage and disadvantages
Emissions of dust, gases	Equipping sprinkling vehicles, watering the road. Water spraying in the area of levelling and transport routes. Planning measures are needed, appropriate time transportation management, using the vehicle that meets the standards of emission, cloaking when moving to regrouping area.	The mitigation measures are feasible, simple, easy to implement, consistent with the ability of the contractor, and effective if being monitored closely and seriously. However, the impacts can only be reduced, not be completely overcome.
Noise creation	Maintenance works of machines and trucks should be in best state.	The mitigation measures are simple, easy to implement without technology or technical complexity. However, there must be a commitment of builders and project management board, shown on the construction contract. Noise impacts can only be minimized, not be completely overcome.
	The loud noise operation should be conducted over a period of working day	
Waste disposal (solid waste, domestic wastewater)	Solid Waste Bins	These measures are highly effective, feasible and easy to implement. However, there is a need of the participation in the form of a contract by the contractor's functional units for collection, disposal, and units that are responsible for handling waste oil. There should have a consistency between the construction contractors. There should be strict sanctions and close monitoring.
	Grease Waste Bins	
	Grease rag Bins	
	Mobile toilets	

b) *Measures to minimize the social impacts of the sub-project in the preparation phase*

Assessment and surveys show that the project of repairing and upgrading the reservoir of Khe Che in Quang Ninh will bring enormous immediate and long-term benefits to residents and communities in the project area in particular and Quang Ninh province in general. Specifically, the project will contribute to ensure the safety of reservoirs - an important factor for the development of irrigation for the mountainous areas especially in areas that have difficulty in water resources.

However, during the construction and after completion of the project, a number of negative factors may appear to affect people's lives and communities in the project area. The negative factors originate from the fundamental issues such as land acquisition and resettlement, career and business affected by displacement or conflict can occur on water use, the increase in the use of fertilizers, risks for health, etc.

The positive impacts by the project is overweight, meanwhile the negative effects are minor and can be overcome. The orientations to overcome and minimize the negative effects brought by the project will include the following activities:

- ***Consultation with stakeholders***:

In order to minimize the risks related to the negative effects that may arise and to establish communication channels, during project preparation, a number of consultations with the community have been done. Due to the fact that the project is involved in foreign loans, complaints on compensation are understandable because of the differences in the level of compensation and the compensation policy. Therefore, the province will have the documents to guide the implementation of the inventory, payments, replacement costs based on the framework of resettlement policy of the project that has been approved by the Prime Minister. PMU coordinates with local government to communicate widely in the community about the project investment objectives and policies of the project to help the community be aware of the requirements of increasing water use efficiency.

- ***Preparing resettlement policy framework:***

In order to avoid or minimize adverse impacts occurred due to land acquisition, compensation and resettlement, land donation should comply document OP 4:12. The project has established resettlement policy framework for consultation with the technical participation of the Ministry of Agriculture and Rural Development - CPO and the World Bank. The policy framework is to ensure that those affected are compensated and / or fully supported to ensure their rights. Resettlement Policy Framework describes the objectives, policy / regulations as well as rules and procedures that will be applied in the implementation of projects related to compensation assets and income, including measures to ensure that affected people affected or households can restore the lives of at least to that before the project. Resettlement Policy Framework proposes objectives, principles, criteria for entitlement, and forms of compensation, procedures of participation and consultation, and complaint resolution mechanism. The policy framework also

provides the steps to be followed when preparing and implementing resettlement action plans (RAP).

- ***Action plan for resettlement (RAP):***

Despite the best efforts to avoid land acquisition and resettlement of local people, the acquisition of land and other property of the people are inevitable. At the request of the World Bank, the project has established resettlement action plan for the projects in the fít round and a resettlement plan for the project will be made similarly for the second round. This plan reflects how the project will minimize the losses of those affected in the project, restoring their livelihood by the ways of compensation, support, and/or subsidizing them. The overall objective of the resettlement action plan is to ensure that all those affected are compensated at replacement cost of their losses and provide rehabilitation assistance measures so that they can restore their livelihood - at least the same level as before the project

7.2.1.2. Mitigation measures in construction phase

Table 7.2. The mitigation measures of social impacts in the construction phase

Potential impact	Mitigation measures	Effectiveness Advantage and disadvantages
(1) Risk of dam safety	+ Carry out all activities of upgrading during the dry season + Speed up the construction.	Highly effective and without technological or technical complexity and with low funding The mitigation measures will depend on the progress of implementation by project, experience and responsibilities of the construction units. Therefore, the commitment of the construction units is needed.
(2) Obstructing traffic and increasing the risk of traffic accidents and reducing the possibility of access to social services (schools, markets and health centres ...) in the sub-project area.	+ Installation of signs, lights in the construction area, applying traffic guidance; + Creating a temporary way for people to travel when necessary; + No gathering of the materials in front of the passage of people and other busy spots. + Installation of entry and exit signs on the field, in the densely populated areas that are near the sub-project area. + Notice of the construction plan for the community.	The mitigation measures are simple and easy to implement without technological or technical complexity. However, there must be a commitment by building contractors and investors, shown on the construction contract. Risks, accidents can be entirely preventable. However the impacts of obstructing traffic and access to social services can only be minimized but not be thoroughly overcome.
(3) Construction workers staying in the locality may	+ Consult local authorities about helping workers to rent houses instead of setting up camp with better advantages for the management of solid wastes. + Orient workers how to be exposed to the	These measures are workable and in the ability to perform by construction units. However, the effectiveness also depends on the consciousness by the

disturb the social and affect the lives of people	community and guide them to protect the health sanitation and prevention of infectious diseases. + Orient workers how to prevent infectious diseases such as HIV / AIDS and other social evils such as gambling, prostitution, theft .. + Workers are prohibited to exploit local resources.	workers and the responsibility of the construction units. Communities should be involved in the monitoring and detection of violations to sanctions. There must be a commitment between the construction units and stakeholders.
(4) Hazards to worker health and safety impacts to the project area	*Safety measures in the construction site:* + Appointing safety staff to implement safety measures at construction sites and training them in emergency aid + Provide adequate personal safety equipment for employees (such as helmets, gloves, safety belt etc.) and train them to use; + Install the tables of safety regulations in the field + Erect fencing around the construction site. *Reduce the risk in the material transport processes along the route:* + The speed limits along the route (road and dam management) and ensure compliance with each segment with residential areas and intersections. + The contractor should conduct meetings / inform regularly to local authorities and local people about the progress of construction and traffic safety to help them be aware of the risks to prevent. + Limit material transportation in the wet season and avoid overloading vehicles. + Timely repair damaged pavement. Implement measures to reduce dust as stated;	The above measures can be fully implemented and highly effective if they comply with the above provisions. However, it also depends largely on self-consciousness and observance of workers.
(5) The impacts arising from the temporary materials dump such as dust, noise and impacts on water quality	+ Store material along the route, dam or near the construction site to avoid congestion; + Store materials reasonably to avoid affecting vehicles and pedestrians passing through the construction area; + Erect fencing around the areas that contain the pits to prevent the entry of people and animals; + Make Reasonable compensation for the agricultural produce by local residents who are affected by gathering materials as well as the use of soil as a temporary materials dump;	These measures are highly effective, feasible and easy to implement without technological or technical complexity. These measures shall require implementation by construction units as well as the full assessment prior to construction. Therefore, there should be strict sanctioning and monitoring measures.
(6) Impacts around area of mines to exploit land, stone, sand such as dust, noise, safety,	At the rock and soil pits, the Contractor must comply with the environmental protection issues, including: - Construction plants and equipment must be periodically maintained during operation in accordance with the quality requirements. - Hazardous wastes such as engine oil and other chemicals must be strictly managed and kept at	The mitigation measures are simple easy to implement without technological or technical complexity. However, the contractor should prepare the conditions for construction such as machines, warehouse and yard prior to construction. There

pollution of soil and water by mining activities	the separated areas surrounding construction site to wait for competent authority for treatment. Workers must be provided with protection instruments when working in the borrowing site. - Exploitation area must be provided with fence, gate and protection station to prevent the penetration of unauthorized person and animals; - Water must be sprayed in the soil pit in dry days. - The Contractor must select the licensed suppliers to provide building materials.	should be coordination with the specialized units to ensure the disposal of waste. These measures will bring good results if the construction contractors and workers are aware or educated about environmental protection and monitored by the Owner.

Table 7.3. The mitigation measures of environmental impacts in the construction phase

Potential impact	Mitigation measures	Effectiveness Advantage and disadvantages
(1) Air pollution due to dust and other emissions (CO, NOx, SOx, etc)	Undertake the mitigation measures to minimize dust and air pollution, such as: + Use of construction serving vehicles that comply with emission standards under current regulations. + Covering trucks with tarpaulin during transport service + Ensuring vehicles and construction equipment are maintained in good condition. + In the dry season, vehicles loading with materials need to be watered when passing crowded residential areas, schools (within the area surrounding the project), camping areas in the rush hours (at least twice per day). + Regulation on speed limits should be prescribed and drivers are to know and comply with the regulations. + The contractor will perform the proposed construction plans, approved by the PMU to minimize the time clearance, construction and pits storage.	The mitigation measures are feasible, simple, easy to implement, consistent with the ability of the contractor, and effective if being monitored closely and seriously. However, the impacts can only be reduced, not be completely overcome.
(2) Water pollution, aquatic environment pollution due to waste, chemicals, effluent or contaminated land	+ Storing oil in a safe area, with concrete floors and roof to avoid rainwater and floodwater; + Ensuring the vehicles and construction equipment is maintained in good condition. + Use of mobile toilets in the process of construction. The mobile toilets comply with standards and are arranged in the area near worker camps. The number of mobile toilets: 02. + Regularly collecting and processing soil spillage to prevent clogging of canals and water resources in the region. + No chemical preparation is conducted close to water sources. + Do not wash tanks, shells containing materials.	The mitigation measures are simple, easy to implement without technology or technical complexity or machines. However, the contractor must prepare the conditions for warehouse and yard prior to construction. The contractor should coordinate with the specialized units to ensure the appropriate disposal of waste. Funding for these measures is needed. These measures will bring good results if the

	+ Do not leave waste from10 m down in the water sector.	construction contractors and workers are aware or educated about environmental protection and monitored by the Owner.
(3) Soil pollution by oil or other chemical spills or leaks.	+ Storing chemicals (oil, concrete chemical additives, etc.) for construction services in containers, boxes suitable for each type of chemicals in a safe areas with concrete floors and roofs to avoid rainwater and floodwater; + Ensuring vehicles and construction equipment is maintained in good condition. + The redundant and unused chemicals and petroleum must be wrapped carefully and transported to eligible warehouses. The containers of chemicals will not be reused, but separately collected and transported to specialized units to handle.	The mitigation measures are simple, easy to implement without technology or technical complexity, or machines. However, the contractor must prepare the conditions for warehouse and yard prior to construction. The contractor should coordinate with the specialized units to ensure the appropriate disposal of waste. Funding for these measures is needed. These measures will bring good results if the construction contractors and workers are aware or educated about environmental protection and monitored by the Owner.
(4) Rock, or dropped materials causing sedimentation in Khe Che Lake or channels, rice fields surrounding areas ... during clearance or excavation, backfilled and transportation of materials.	+ Avoid clearance activities in the rainy season, and the work is completed. The clean-up must be done before moving on to a new line. + Installation of sewer grates in the drainage ditch; + To dredge canals in the rainy season (if necessary) if sedimentation persists. + Clean and dredge soil, sand and rubble spilling from the vehicles down to paddy fields, canals ...	The mitigation measures are simple, easy to implement without technology or technical complexity. The mitigation measures will depend on the progress of implementation of the project, experience, and responsibilities of the construction unit. Therefore the commitment of the construction units is needed.
(5) Waste materials generated from construction activities on the site and the activities of workers	+ Local residents are prioritized in worker recruitment. + Regular cleaning of waste from the construction to the dumping area (including 01 disposal area) + Make the most amount of soil to dig up works during the construction (in the case that materials are qualified). + Putting the garbage container in the appropriate positions in the field and worker camps + For the hazardous waste (for example sludge,	These measures are highly effective, feasible and easy to implement. However, the participation in the form of a contract by the contractor and functional units for collection, disposal, and units that are responsible for handling waste oil is needed. There should be a consistency between the construction contractors. There should be strict sanctions and

	grease and other products relating to oil surplus, if any), installation of collection system and temporary storage around the site and then contact with the expertise units to handle. + Arranging waste rock and soil in the landfill in the construction project at the construction site. Size of landfill: 35x500m.	closely monitoring.
(6) Noise from construction equipment	+ The motor vehicles, construction equipment must be maintained periodically. + Select suitable locations to place the sources of loud noise: Some sources of noise such as concrete mixers, gathering yards ... must be located in areas away from residential areas, schools, clinics and Commune People's Committee office and workers' residential places. + Avoid performing construction activities near the residential areas during lunch or dinner time or after 8 p.m. + Regularly inform communities and local governments about construction plans by phone, loudspeaker, and documents or on the notice board of the Commune People's Committee.	The mitigation measures are simple, easy to implement without technological or technical complexity. However, there must be a commitment by builders and investors, shown on the construction contract. Noise impacts can only be minimized, not be thoroughly overcome.

7.2.1.3. Mitigation measures in operation phase

Table 7.4. The mitigation measures of social impacts in the operation phase

Potential impact	Mitigation measures	Effectiveness Advantage and disadvantages
(1) Emergency flood discharge: Flooding dam safety corridor; Increased risk of erosion and sedimentation downstream; affected production of people downstream	Prepare plans and training for local people to respond in case of emergency flood discharge; Promptly inform the people and the local authorities timely of flood discharge time, flood levels and the negative effects that may occur Prepare plans to evacuate and protect the property of people in downstream areas when necessary flood discharge	Easy to implement. But, there must be unity between the people and the authorities, particularly the reservoir management unit.
(2) Risk of water loss of reservoir: Affected ability to	Regular inspection and detection of incidents resulting in loss of water to notify the competent authority to handle Annually allocate funds for maintenance and repair of damage and incidents for headworks (dams, flood discharge spillway,	Easily done. However it depends on the proactive of management unit and qualifications of inspectors.

regulate water, causing water shortages for production, and economic damages.	the offtake)	
(3) Natural disaster risks causing the unsafe	+ Management Unit of Khe Che Reservoir should periodically check the safety of the Reservoir + Management unit coordinates closely with the CPC and the local people to promptly report the risks related to dam safety so that timely corrective measures are given +During the rainy and stormy seasons prone to unsafely, appoint staff to monitor regularly to ensure reasonable water regulation + For the flood discharge, flood mapping for downstream areas will be established. Inform people at least 01 days of the flood discharge plan (if necessary) to prevent and reduce damages and loss. + Construction of corridor Construction of safe corridor for flood discharge as needed on the basis of forecast scenarios of special influences due to dam failure.	Strict implementation of these measures will minimize the impact during the construction phases. This measure should also strictly abide by the principle of protection of irrigation works corridors of the people under the Ordinance on exploiting irrigation works.
(4) Regulatory reservoir to flood discharge in the case of large floods affecting downstream	- Management and operation units should promptly and accurately notify the flood discharge to people in the community to actively capture and response - At the moments of risky unsafely such as in the rainy season, those unit should appoint regular monitoring duty to ensure reasonable water regulation - People and the local government actively plan to cope with disaster risks	This measure is highly feasible. However, in order to accurately predict, there should be more monitoring systems for operating officers.

Table 7.5. The mitigation measures of environmental impacts in the operation phase

Potential impact	Mitigation measures	Effectiveness Advantage and disadvantages
A	**Mitigation measures of environmental impacts**	
(1) Domestic solid waste and hazardous waste (arising from the maintenance of machinery)	+ Arrange waste bins in the waste arising locations. + Limit dropping viscous oil in the maintenance of machinery. + Rent functional units to collect and handle in accordance with regulations.	Low investment and easy to implement with high effectiveness. However, it depends much on the consciousness of employees; therefore, there should be strict regulations.
(2) The impacts by	+ Use the toilet with waste water treatment tanks.	Easy to use and long-term in service

domestic wastewater by officials and employees at work		
(3) The impact of termites nest in the dam body	+ Regularly do surveys for early detection of termites. + Do not apply the means of digging to look for queen termite, but control termites by jet drilling technology in termite nests. + Study and apply management measures in operating procedures for each type of reservoir dam. + There should be solutions for comprehensive termite preventions in river dikes. + There should be solutions for comprehensive termite preventions in river dikes	Easily implemented and early detect termites nest in the dam body. However, the implementation also requires operating officers to regularly conduct surveys and tests to detect termite nest and risks from termites.
(4) Impacts caused by sedimentation: sedimentation and water pollution	Clean-up flora residue in the reservoir prior to water storage Planting protective forests upstream to increase water storage capacity and minimize erosion and sedimentation. Restrict exploitation activities on the slopes and the area of reservoir	Easy to implement
(5) Impacts caused by waste generated from agricultural, forestry and aquaculture activities	Collection of garbage (bottles, containers of pesticide, fertilizer), material waste immediately; avoid waste which is thrown away in disorder or collected for such a long time. Project owner shall coordinate with local governments to train people to use farming methods in terms of environmental safety; develop green – clean production in aquaculture and forestry.	Low investment, easy implementation, highly effective. However, it depends on knowledge and farming habits of farmers. Training classes of appropriate farming methods should be organized
B	**Measures to mitigate the social impact**	
(6) Emergency flood discharge: Flooding dam safety corridor; Increased risk of erosion and sedimentation downstream; affected production of people	Prepare plans and training for local people to respond in case of emergency flood discharge; Promptly inform the people and the local authorities timely of flood discharge time, flood levels and the negative effects that may occur Prepare plans to evacuate and protect the property of people in downstream areas when necessary flood discharge	Easy to implement. But, there must be unity between the people and the authorities, particularly the reservoir management unit.

downstream		
(7) Risk of water loss of reservoir: Affected ability to regulate water, causing water shortages for production, and economic damages.	Regular inspection and detection of incidents resulting in loss of water to notify the competent authority to handle Annually allocate funds for maintenance and repair of damage and incidents for headworks (dams, flood discharge spillway, the offtake)	Easily done. However it depends on the proactive of management unit and qualifications of inspectors.
(8) Natural disaster risks causing the unsafe	+ Management Unit of Khe Che Reservoir should periodically check the safety of the Reservoir + Management unit coordinates closely with the CPC and the local people to promptly report the risks related to dam safety so that timely corrective measures are given +During the rainy and stormy seasons prone to unsafely, appoint staff to monitor regularly to ensure reasonable water regulation + For the flood discharge, flood mapping for downstream areas will be established. Inform people at least 01 days of the flood discharge plan (if necessary) to prevent and reduce damages and loss. + Construction of corridor Construction of safe corridor for flood discharge as needed on the basis of forecast scenarios of special influences due to dam failure.	Strict implementation of these measures will minimize the impact during the construction phases. This measure should also strictly abide by the principle of protection of irrigation works corridors of the people under the Ordinance on exploiting irrigation works.
(9) Regulatory reservoir to flood discharge in the case of large floods affecting downstream	- Management and operation units should promptly and accurately notify the flood discharge to people in the community to actively capture and response - At the moments of risky unsafely such as in the rainy season, those unit should appoint regular monitoring duty to ensure reasonable water regulation - People and the local government actively plan to cope with disaster risks	This measure is highly feasible. However, in order to accurately predict, there should be more monitoring systems for operating officers.

7.2.2. Estimatecost of mitigation measures

Table 7.6. Estimatecost of mitigation measures

Sub-Project Phases	Sub-Project operations	Impacts on environment and society	Mitigation measures	Implementation budget (estimate)	Implementation responsibility
Preparation	Material transportation for temporary roads	- Increasing risks of traffic accidents. - Generating dust, noise and air pollution in transportation roads and at construction sites.	- Arranging the stockpile at the end of the monsoon direction - Spraying water on materials in the construction process generates dust: watering sand when transporting, watering before knocking down houses... - Cover trucks with tarpaulins if does not have or replace if tarpaulins are in bad condition - Spraying water to reduce dust during peak hours of transportation.	+ 1 mil/tarpulin x 30 = 30 mil. + Protective clothing : clothes, gloves, masks, glasses: estimate : 300000 VND/1 set * 50 = 15 mil.	Construction unit
	Gathering vehicles and machines	- Noise, dust, emissions and occupied premises	- Making relocation planning, gathering the right equipment to avoid affecting the daily life of residents		Construction unit
	Road construction	- Dust, noise and air pollution	- Prevent dust for individuals by using tools such as protective clothing and hats, masks, glasses - Water spray to reduce dust - Complying with regulations on environmental hygiene and safety		
	Camp building	- Dust and solid waste	- In addition to measures to reduce dust, trash bins should be fixed at site for waste collection	2 901 plastic bins: 800000/bin * 2 = 1,6 million	Construction unit
			TOTAL COST IN PREPARATION PHASE	**46,6 million**	
	Construction activities of work items	- Reduce the quality of air environment because of dust, emissions, noise and	- Do not use obsolete equipment, maintain machinery and vehicles every 6 months	15mil/time * once/1 year * 2 times =30 mil.	Construction unit

Sub-Project Phases	Sub-Project operations	Impacts on environment and society	Mitigation measures	Implementation budget (estimate)	Implementation responsibility
Construction		vibration	- Watering regularly on construction sites and along construction roads		
			− Cover the tarpaulin in the gathering yards of material, covering the truck with tarpaulins.		
		- Generating solid waste, soil spillage and hazardous waste (waste oil, grease rag) causing water, air and soil pollution.	- Remove, handle the amount of soil excavation and removal of weather on the ground	Estimate: 10 mil	Construction unit
			- At each construction sites, 02 50-litre waste bins are set for hazardous waste;	0,5 mil/bin x 02 = 1 mil.	Construction unit
			- Regular clean and collect spilled materials - Classify solid waste and throw in defined bins - Collect and process hazardous waste in accordance with regulations	Service cost for collection and treatment: 15 mil/year *1 year = 15 million.	Construction unit
		Runoff storm water, vehicle and facility washing water	- Use water economically - Build ditches to collect waste water from carwash, construction and rainwater into the pit.	15 million (estimate)	Construction unit Site workers
		- Impact on safety, working conditions and health of workers in the field.	- Arranging a reasonable schedule - Fully equip protective tools for workers - Training and upgrading capacity of labour safety and environmental protection prior to construction. (2 times during construction)	- Training on work safety: estimate 7 million * 2 = 14 million	Construction Unit
		- The problems of environmental disasters, storm, oil leak, fire ...	- Making plans for prevent storm, low pressure and cyclone - Communicate the preventing plans - Exercise.		Specialized unit

Sub-Project Phases	Sub-Project operations	Impacts on environment and society	Mitigation measures	Implementation budget (estimate)	Implementation responsibility
	Transportation of materials	- Air pollution due to noise, dust, emissions from transportation vehicles. - Impacts on the traffic infrastructure of the area - Increase the risks of traffic accidents for travellers	- Transport in the specified time frame - Carry with permitted load and cover vehicles with tarpaulin. Have 10 tarpaulins for vehicles that do not have or to replace the deteriorated one. - Follow the speed limit at sites	01 million/tarpaulin 10 tarpaulins= 10 million	Construction Unit
	Living, resting and eating of staff	- Generating waste	Hire 3 mobile toilets	5 million/toilet x 3= 15 million	Contract with the distribution units
		- Domestic waste	- 02 waste bins in the camp area - Clean regularly - Make contract with the local environment unit for transportation and treatment.	0,5 mil/bin x 02 bins x 01 camp = 1 million	Construction Unit
	Repair and return damaged transportation routes	- Protect the traffic roads in the project area	-Repairing, levelling, rehabilitation of damaged or poor quality roads,	Estimate 50 million	Construction Unit
			Total cost for the construction phase	**200 million**	
Operation	Revert construction areas: camps, landfill, mining land	- Generate solid waste	- Unmounts camps and signs. - Collect and sell. - Gather, removes machinery and construction equipment. - Revert the exploited areas.	Estimate 30 million	Construction Unit
	Management, operation, maintenance of dams, sluices, and overflow	Ensure the safety of the population, arable land, buildings, infrastructure	- Organize regular and periodic maintenance. - Detect, promptly handle encroachment, improper corridor use.	Cost for construction maintenance	PPMU
	Training to prevent incidents	- For checking purposes, timely detection, and rescue	- Organize training for response every year according to proposed programs by	Cost for operation	PPMU

Sub-Project Phases	Sub-Project operations	Impacts on environment and society	Mitigation measures	Implementation budget (estimate)	Implementation responsibility
		when occurring	the Department of Agriculture and Rural Development		
	Dredging canals	- Avoid sedimentation and water pollution, changes in hydrology because of narrow canals and rivers	- Flexible operation of drains; - Monitoring, tracking and detection of sedimentation and erosion; - Periodic dredging of canals to ensure flow and environment	Cost for operation	PPMU
	COST FOR OPERATION PHASE			**30,000,000**	
	TOTAL COST FOR CONSTRUCTION AND OPERATION PHASES (TT)			**237,600,000**	
	General management cost (take 15%)			35,640,000	
	Cost before tax			**273,240,000**	
	VAT			27,324,000	
	TOTAL COST FOR IMPLEMENTING ESMP			**300,564,000**	

Total estimate cost of mitigation measures: 300,564,000 Vietnamdong.

7.3. Environmental and Social Monitoring Plan (ESMoP)

7.3.1. Environmental Monitoring plan

7.3.1.1. Compliance monitoring

a) Compliance monitoring by PPMU

PMU will monitor the observance of security policy by the contractor during the construction phase. PMU will specify construction supervision consultant (CSC) to perform daily monitoring based on environment and society management plan (ESMP) and Environment and Society Monitoring Plan (ESMoP) that have been approved and pay attention to the minimization of the potential negative impacts caused by construction activities such as dust, noise, traffic obstruction caused by material transportation in the Sub-project area; The Outline (TOR) for construction supervision consultants. PMU will send environment staff and environment monitoring unit (provincial environment consultant) to track and monitor the implementation of security policy.

b) Supervision by Community

A Community Supervision Board was established under the "Decision No. 80/2005 / QD-CP dated 18/04/2005 by the Prime Minister on Regulations on investment Supervision." This Board has rights and responsibilities to supervise the construction activities, the negative impacts on the environment due to construction activities, the effective implementation of mitigation measures for potential negative impacts. In the case of environmental issues affecting the community, they will report with construction supervision consultant (CSC) and / or PMU by filling out the ballot of information about environmental safety.

7.3.1.2. Monitoring of environmental quality

- The local environmental management bodies such as: Department of Environment and Natural Resources of Quang Ninh, Dong Trieu Irrigation Company, Dong Trieu Agriculture Department, Dong Trieu Administrative Department shall have responsibilities to work with Project management Board and Construction Units by sending department or individual directly, in collaboration with agencies that monitor the quality of technical standards to monitor the observance of environmental legislation, which aims to restrict the causes of soil - water - air pollution to a minimum in the project area.

- Environmental Monitoring Program (location and monitoring indicators, methods and responsibilities of monitoring the impact of the sub-project to the environment and society in the following stages:

- During the construction phase: Under construction time (from start to finish).
- During the operation phase of the project management: 2 years.

a) Environmental supervision program for the construction phase

The tracking changes in environment quality and controlling the level of pollution caused by the project will be performed by the investor and in collaboration with other specialized bodies.

Table 7.7. Supervision of environment quality in construction phase

No.	Sample Type	Location	Frequency of monitoring	Monitoring objectives	Compared standards
I	Monitoring of waste sauces management				
1	Sources	Camps Landfill	Every 6 months	The volume of solid waste Number of toilets, tents, waste water treatment system Volume of hazardous waste Waste compositions;	
2	Waste management measures	Construction sites, camps Landfill	Every 3 months	Number of bins Invoices of collection services, transportation of hazardous waste.	
II	Monitoring of impacts on natural environment				
1	Gas	1. Construction area of flood overflow (KK01); 2. Construction of management road (KK02)	6 months/time 2 times/day	- Microclimate: temperature, humidity, wind speed - Noise LAeq - Suspended dust TSP - Respiration dust (PM10)- SO_2 - CO - NO_x	QCVN 05:2013/BTNMT National Technical Regulation on ambient air quality QCVN 26:2010 - National technical regulations on noise. QCVN 27:2010/BTNMT National regulations on vibration
2	Surface water	1. Surface water in the reservoir (NM01) 2. Surface water in front of water drain (NM02) 3. Water near the spillway (NM03)	Every 6 months	- pH - DO - TSS - COD - BOD_5 (20^0C) - NO_3^- (based on N) -NH_4+ (based on N) - PO_4^{3-} (based on P) - As	QCVN 08:2008/BTNMT - National Technical Regulations on surface water quality.

No.	Sample Type	Location	Frequency of monitoring	Monitoring objectives	Compared standards
				-Cl^- - Total oil, grease - Coliform	
3	Ground water	1. Household's wells in the construction site (NN01) 2.Wells of Khe Che reservoir management office (NN02)	Every 6 months	- Hardness (CaCO3) - TDS - Iron (Fe) - Lead (Pb) - Arsenic (As) - Chrome (Cr^{6+}) - Mangan (Mn) - NH^{4+} dependent on N	QCVN 09:2008/BTNMT - National Technical Regulations on ground water quality
3	Soil	1.Surround the temporary disposal area (MĐ 01)	Yearly	- Arsenic (As) - Cadimi (Cd) - Copper (Cu) - Lead (Pb) - Zinc (Zn)	QCVN 03:2008/BTNMT - National technical regulations on heavy metal content in soil.
4	Landslice, erosion	Spillway works	One time	Scale of landslide ; Degree of landslice	

b) The environmental and social supervision programme in the operational phase

During the operational management, contents of supervision include supervision of soil, water and impact on production and income of people.

Table 7.8. Supervision of the environmental quality in the operational phase

No.	Sample type	Location	Frequency	Objective	Compared standard
I	Supervision of impact on the natural environment				
2	Surface water	1. Lake water in front of water drain (NM04); 2. Lake water near ecology area (NM05)	Every 6 months	- pH - DO - TSS - COD - BOD_5 (20^0C) - NO_3^- (based on N) - PO_4^{3-} (based on P) - As - Total oils and grease - Coliform - The residues of plant protection products group Chlorine - The residues of plant protection products group Phosphate	QCVN 08:2008/BTNMT: National technical regulations on surface water quality
4	Landslic,	Downstream of the	During flood	Scale of landslide;	

	esoion	spillway	within 2 years after operation	The degree of landslice	
II	Supervision of impact on the society				
	Impact on the society	Benefited communes area	Every 6 months	Income, jobs, quantity of production, the average yield in a production, water supply schedule Complaints and claims of people	

7.3.2. Social Monitoring Plan

Social monitoring programme and requirements of social monitoring activities are presented in details in independent documents: Resettlement Action Plan.

Table 7.9. Social Monitoring Plan in construction phase

No.	Sample Type	Location	Frequency of monitoring	Monitoring objectives	Compared standards
I	Supervision of impact on the society				
	Impact on society	The downstream commune area	Every 6 months	Income, jobs, quantity of production, the average yield in a production, water supply schedule Complaints and claims of citizens	
II	Supervision of the environmental hygiene and safety				
1	The environmental hygiene	Construction site Camp site Material gathering area	Every 3 months	Quantity and condition of toilets Quantity, status of hygiene kits First aid kits Medical work Quantity of transfusion, infection Communication plan for public health	
2	The safety	Construction site Camp site Material gathering area Disposal area	Every 3 months	Work protection equipment Safety signs Quantity of accidents	

Table 7.10. Social Monitoring Plan in operational phase

No.	Sample type	Location	Frequency	Objective	Compared standard
	Impact on the	Benefited communes area	Every 6 months	Income, jobs, quantity of production, the average	

	society			yield in a production, water supply schedule Complaints and claims of people	

7.3.3. Estimated cost for Environmental and Social Monitoring

Table 7.11. Estimated cost for Environmental and Social Monitoring in the construction phase

No	Cost estimates	Unit	Quantity	Unit (VND)	Amount (VND)
I	**Salary of experts**				**336,000,000**
1	Team leader	Month	3	25,000,000	75,000,000
2	Environment experts	Month	3	18,000,000	54,000,000
3	Hydrological experts	Month	3	18,000,000	54,000,000
4	Ecological experts	Month	3	18,000,000	54,000,000
5	Community experts	Month	3	18,000,000	54,000,000
6	Support official (3 people x3 months	Month	9	5000000	45,000,000
II	**Monitoring impacts on natural environment**				**313,050,841**
1	Analysis of air samples		20	1,428,391	**28,567,820**
2	Analysis of surface water samples		36	4,824,392	**173,678,112**
3	Analysis of underground water samples		10	5,353,707	**53,537,070**
4	Analysis of soil samples		5	4,304,072	**21,520,360**
III	**Others**				**35,000,000**
1	Stationery	Period	5	2,000,000	**10,000,000**
2	Document printing	Period	5	4,000,000	**20,000,000**
3	Phone and internet	Period	5	1,000,000	**5,000,000**
IV	Salary-base management expenses (50%)				**168,000,000**
V	**Total (I+II+III+IV)**				**852,050,841**
VI	Pre-determined taxable income (6%*V)				**51,123,050**
VII	**VAT [10%*(V+VI)]**				**90,317,389**
	Total expenditure for monitoring (V+VI+VII)				**993,491,281**

7.3.4. Monitoring report requirement

Environmental and social monitoring report is conducted continuously during the subproject monitoring program and the effectiveness of monitoring of the proposed mitigation measures.

The requirements of social monitoring are detailed in documents related independent RAP.

Table 7.12. Reporting Requirements for ESMoP

Responsibilities	Type of Report	Report content	Frequency of report submission	Submitted to
Contractor	Report on Accident/incident	Gathering information about accident and incident	Within 24 hours from occurrence	Project Management Board, Construction

Responsibilities	Type of Report	Report content	Frequency of report submission	Submitted to
				Supervision Consultant
	Report on violation	Supply information about social and environmental management regulation breach	Within one week from occurrence	Project Management Board, Construction Supervision Consultant
	Report on revelation (when antiques are found)	Noting and reporting to the authority about the discovered relics and tombs…	Within 24 hours from discovery	Project Management Board, Supervision consultant and Tourism, Information and Culture department
	Report on implementation of ESMP	Report on solution to minimize the impact to society and environment	Monthly	Project Management Board
Construction Supervision Consultant	Report on implementation of solution to minimize the impact to society and environment	- Evaluating implementation of solution to minimize the impact to society and environment of contractors - Result of resolving incident and measures to overcome the shortcomings of previous reports	Monthly	Subproject Management Board
Independent Environmental Consultant	Report on independent supervision of social and environmental security	- Results of construction site investigation -Supervision results based on public -Summarising supervision results of construction supervision consultants -Environmental supervision results -Evaluation implementation results of ESMP and proposals	Every six months or every three months	Subproject Management Board and WB
Subproject Management Board	Report on environmental activities of	Implementation results of ESMP	Every six months	CPO and WB

Responsibilities	Type of Report	Report content	Frequency of report submission	Submitted to
	subproject			

7.4. ESMP Implementation Arrangement

7.4.1. Agencies and responsibilities

a) The responsibility of project owner/PPMU

PMU, representative of the IA, will be responsible for monitoring the overall project implementation, including environmental compliance of the project. PMU will have the final responsibility for ESMF implementation and environmental performance of the project during both the construction and operational phases. As the subproject owner, PPMU is responsible for implementation of the all the ESMP/ESMoP activities to be carried out under the project, including fostering effective coordination and cooperation between contractor, local authorities, and local communities during construction phase. PPMU will be assisted by the environmental staff, and CSC/or field engineer. Specifically the PPMU will closely coordinate with local authorities in the participation of the community during project preparation and implementation, monitor and supervise ESMP implementation including incorporation of ESMoP into the detailed technical designs and bidding and contractual documents, ensure that an environmental management system is set up and functions properly, be in charge of reporting on ESMP/ESMoP implementation to the IA and the World Bank.

b) Construction contractor

The construction contractors are responsible for implementing mitigation measures and the mitigation costs will be part of the contract. Take actions to mitigate all potential negative impacts in line with the objective described in the ESMP. In order to be effective in the implementation process, PMU will establish an Environmental Unit with at least two environmental staffs to help with the environmental aspects of the project, including ESMP at the working site, actively communicate with local residents and take actions to prevent disturbance during construction.

c) Construction Supervision Consultant (CSC) and/or Field Engineer

The CSC 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 EMP. The CSC shall engage sufficient number of qualified staff (e.g. Environmental Engineers) with adequate knowledge on environmental protection and construction project management to perform the required duties and to supervise the Contractor's performance

d) Independent Environmental Monitoring Consultant (IEMC)

IEMC will, under the contract scope, provide support to PMU to establish and operate an environmental management system, offers suggestions for adjusting and building capacity for relevant agencies during project implementation and monitor the Contractor's EMP implementation in both construction and operation stages. IEMC will

also be responsible to support PMU to prepare monitoring reports on EMP implementation. The IEMC shall have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the project.

e) Local community

The local community supervision Board has been established according to "Decision No.80/2005/QĐ-CP dated 18/04/2005 of Prime Minister on investment supervision statutes of community". The community supervision Board of commune has right and responsibility for supervising construction activities, negative impacts to environment caused by construction activities and guarantees the measures to minimize potential adverse impacts have been implemented effectively by contractor. In case of arising environmental problems that affect to community, they will report to scene Supervision Consultant and/or PPMU by filling in forms reflect information on environmental safety.

f) Responsibility of reservoir management and development agency

Take responsibility for maintenance and periodic supervision of project works and report to DoNRE.

g) Responsibility of CPO

CPO will guide PPMU staffs to carry out environmental and social management plan of subproject. Supervising the progress of subproject during construction time.

h) Province and District People's Committees (PPCs/DPCs), Provincial DONRE

Oversee implementation of subprojects under recommendations of DONRE and PPMU to ensure compliance of Government policy and regulations. DONRE is responsible for monitoring the compliance with the Government environmental requirements.

Table 7.13. Responsibilities of relevant organizations

Unit	Roles and responsibilities		
	Preparation of the subproject	**Implementation of the subproject**	**Operation of the subproject**
CPO	Guide Safety Policy Officer of Provincial Project Management Board (PMB) in the process of preparing reports on Checking and assessing the impacts on environment and society Review and give feedback to reports submitted by PPMUs.	Guide PPMUs officials on the implementation of environmental management plan during construction phase; Supervise progress during construction phase; Gather reports on environment in 6 months from PPMUs;	Guide PPMUs officials on the implementation of environmental management plan during the first year of operation; Supervise progress during the first year of operation; Gather reports on environment in 6 months from PPMUs;
PPC	n/a	The project owner has the highest responsibility for the environmental operations of the sub-project during construction;	The project owner has the highest responsibility for the environmental operations of the sub-project during the operation phase, including the implementation of Environment Management Plan (EMP) in the operation phase;
Department of Agriculture and rural Development / Project Management Unit	Hire consultants and have overall responsibility for the preparation work; Report on environmental impacts propose report for approval; Ensure staff are fully trained on environmental issues;	Responsible for implementing environmental management plan (EMP) in time prior to and during construction phase; Make sure the contract details and bidding documents including environmental requirements; Perform surveys and monitor environmental problems during construction; Coordinate environment monitoring reports to Central PMU;	Responsible for implementing environmental management plan (EMP) in time prior to and during the first year of operation; Perform surveys and monitor environmental problems during the first year of operation; Support the project owner to put environmental requirements into implementation procedures and maintenance.
District People's Committee		Supervise the Environment and Society Plan (EMP) via their internal monitoring system;	Supervise the Environment and Society Plan (EMP) via their internal monitoring system;
Community Supervision Board and members of local	Approve Commitment to Environmental Protection (CEPs) of the subprojects in	Participate in the environment monitoring activities under the laws of Vietnam and in accordance with the training sessions.	Participate in the environment monitoring activities under the laws of Vietnam and in accordance with the training sessions.

Unit	Roles and responsibilities		
	Preparation of the subproject	**Implementation of the subproject**	**Operation of the subproject**
community (CSBs [1])	accordance with the legal provisions of the Government of Vietnam; Participate in the consultation and identify and prepare the sub-projects; Have the ability to comment on the environmental assessment document after the document was introduced to;		
Construction Supervision Consultant	n/a	Undertake training courses on environmental monitoring for supervision counsellor Participate in environmental monitoring under the approved EMP in the impact assessment report on environment and society Prepare and submit monitoring reports to PPMUs	n/a

[1] CSBs, established under Decision 80/2005/QD-TTg on 18/04/2005 by Prime Minister on the Issuance of Regulations on Investment Community Supervision. Article 8, Decision 80/2006/NĐ-CP provides community with opportunities to obey, supervise the implementation and assessment of investment results in commune, including impacts on environment.

7.4.2. Assessment of existing environmental and social management practice and capacity for dam management

- **Dam management Organization**

Currently, Khe Che reservoir is managed by irrigation Dong Trieu Limited Company. However, due to management staffs with thin, unstable, , limited - level specialized, so the management of the reservoir does not comply with regulations on dam safety management.

There are 7 staffs working at Khe Che reservoir, including 4 women and 3 men. currently, there is no environmental staff.

- **Reservoir operation**

Khe Che Reservoir does not have the operating procedures regulating, annual water storage, floodgates of reservoir. The recording and storage of data during the operation does not complete.

Because of without operating procedure, the managers often operated in experience; leads to the risk of losing high dam safety.

- **Monitoring of dam and meteorological elements**

Khe Che Reservoir doesn't have monitoring station for meteorological elements (such as: rainfall, water level, flow, ...)

Dam of Khe Che Reservoir hasn't monitoring devices of subsidence, trans, the open level of valve, ... according to current regulations, has equipment of repellent monitoring but without using and data recording.

The lack of meteorological monitoring data and dam monitoring data lead to unpredictable flood situation; not track water levels in lake, flow through the drain discharge, overflow; not assessing the permeable dam is causing a high risk of unsafe dam.

- **The maintenance of dams**

Khe Che reservoir was built and put into operation since 1990, operating time of about 25 years. In the course of operation has undergone a number of upgrades repaired locally.

Face dam of Khe Che reservoir exalted by building stone walls, grit coated to protect the dam.

In the years 1995-1998, the headworks of Khe Che reservoir was upgraded some items belonging to clue system.

Flood overflow items had been repaired and upgraded in 2000, flood overflow was wrapped and redone the tail spill. The nature of the repair is temporary solution.

7.4.3. Building capacity and improves the knowledge on the environmental and social protection training / coaching programs

In order to enhance capacity and expertise of environment management for staff of the Project Management Unit as well as the other involved people, the Project Management Unit performs the following training:

- Raising the capacity for environmental management and environmental monitoring;
- Communication to raise awareness about environmental protection;
- Training for fire prevention and protection;
- Training on the regulations and environmental standards;
- Training on environmental health and safety measures, environmental safety;
- Training and raising awareness about dam safety;
- Training and raising awareness about the prevention of diseases;
- Training and raising awareness on gender equality;
- Training and raising awareness of ethnic minority development.

Table 7.14. Support programs to improve environment management capability and techniques

No	Training contents	Expenditure for performance (VNĐ)
1	Improve capability of environment management and supervision	2 classes x 2 million VND/class = VND 4 million VND
2	Disseminate information to raise awareness of environmental protection	3 classes x 2million VND/class = 6 million VND
3	Fire prevention and fighting	4 classes x 2 million VND/class = 8 million VND
4	Environment regulation and standards	4 classes x 2 million VND/class = 8 million VND
5	Environmental health and labour and environment safety	4 classes x 2 million VND/class = 8 million VND
6	Improve awareness of dam safety	3 classes x 2 million VND/class = 6 million VND
7	Raise awareness about prevention of communicable and infectious diseases	3 classes x 2 million VND/class = 6 million VND
8	Improve awareness of gender equality	3 classes x 2million VND/class = 6 million VND
Total		**52,000,000 VND**

7.5. Community development need Assessment

Community empowerment proposals are based on surveys, consultation and investigation of current socio-economic state of 3 communes (An Sinh, Tan Viet, Viet Dan) in the sub-project area in particular. Negative and positive impacts of sub-project are fully considered and discussed with local people.

As a typical area of sub-project with 70% of ethnic minority people whose main livelihoods are farming and forestry, during consultation process, the consultation agency have somehow grasped mainly demands of local people in the project area.

Regarding negative impacts of sub-project such as permanent and temporary land acquisition, water cut in the production season which affect daily lives of local people and ethnic minority group during project implementation, some demands of local people are summarized as follows:

1. Demand on Ethnic Minority development.
2. Demand on Gender development
3. Demand on enhancement of production improvement, joining in Encourage agriculture.
4. Demand on movement in structure employment.

It is easy to conclude that above demands closely relate to implementation of subproject. Therefore, with a demand, a proper action plan is indicated. Following by 4 demands, independent reports are also worked on such as Ethnic Minority Development Plan (EMDP) including action plan for EMDP; Resettlement Action Plan (RAP) including action plans for resettlement, movement in structure of employment for households being lost of landuse; a gender action plan is also discussed in the reports (See in attached reports for more details).

The improvement of the integrated crop management skills for local people in the region benefited by the project will be presented as follows:

ICM - Integrated Crop Management is considered a suitable measure that helps ensure the ecological stability and sustainability over a long-term period. It is a combination of two integrated management measures: IPM - Integrated Pest Management and INM - Integrated Nutrient Management.

When the sub-projects go in operation, organize workshops and training of IPM officials at commune and village levels in the sub-project area, with the following contents:

+ Distinguish the main and secondary pests
+ Identify the natural enemies of harmful pests and diseases for crops
+ Method of detecting harmful pests and diseases
+ Understand the impact of pesticides, appropriate use of pesticides
+ The pest control techniques according to the principles of IPM
+ Advanced farming techniques
+ Requirements to manage pesticide packaging after use

- The training program will combine theory and practice in the field. The content can be chosen according to thematic groups: farming, identifying and detecting methods for pests and their natural enemies, IPM techniques in manufacturing, etc.
- Target Training: The technical staffs of cooperatives, village leaders and members. The students will be trained to go back to the farmers in the project area, the implementation of the model
- The size of each class is from 30-45 students, organize classes in commune. Time Learning is in phases under the thematic training, each session can last 3-5 days of both theory and practice
- Lecturer: hiring experts from universities, research institutes, extension centres.

Additionally, the people would like to participate in observation and implementation of subproject, focusing on stage of land reclaim, compensation, support, levelling through social and political organizations in community. These community organizations have functions of observation of the feedback related to activities of the subproject in three phases (pre-construction, construction and operation). With the management and monitoring, these organization could significantly contribute in decision making processes during implementation of subproject, making it properly with local conditions.

PART VIII: PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

8.1. Public consultantation objectives

- To get the consent of the relevant agencies, local governments and communities in the sub- project implementation
- To share information about the scope of the project and its impact on the environment and society
- To increase the encourage of the participation in the community for determining the impacts of the sub-project
- To collect information about the requirement and the responsibility of the local resident and local authority on the proposing mitigation measures of the project owner, or to improve the mitigation measure in pre-construction phase or project design.

8.2. Social impact assessment consultantion

Based on the basic design, the Consultant in cooperation with PPMU staffs and cadastral officials of project communes make a list of households affected by the Project in each commune. On the basis of the list of AHs provided by the locality, the Consultant selects 100% of the total number of households affected and 10% of households not affected by the Project (including 100% of the households ten to relatively required the relocation) to be interviewed by questionnaire. Samples are selected to ensure gender ratio and ethnic minorities. In case of the number of Ahs of one sub-project is less than 20, all the Ahs will be interviewed.

The in-depth interviews and focus group discussions are selected from the survey and from those who provide key information at the provincial, district, communal levels and local people. Each discussion group consists of 6-8 people, 3 of which are female and ethnic.

At the project of Repair and upgrading for the safety of Khe Che reservoir in Quang Ninh province, the Consultant has carried out the following quantitative studies:

- In-depth interview 1 provincial leader of Project;
- In-depth interview 2 leaders of communal government;
- In-depth interview 1 female staff;
- Hold 03 group discussions with 25 representatives from affected households, in Ba Xa village, An Sinh commune, Dong Trieu district, Quang Ninh province.

8.3. Environment impact assessment consultantion

Public consultation and information dissemination are implemented in the ESIA and EIA preparation stage of sub-project. During detailed design, Investor is Project Management Unit of Irrigation construction 2 will consult with community and the authority in eight communes and 1 towns of sub-project area about "Repairing and upgrade Khe Che cluster works", inform them about the current state of the sub-project

and the measures will be deployed to minimize the potential negative impacts to the natural environment of the area. During the consultation, if necessary, management will review the design adjustments accordingly. Especially, investors will commit to implement measures to reduce the negative impact on the natural environment.

The objectives of the consultation: The contents of consultation: (i) Information about Project/sub-project (General information about the project, the scope, the components, the positive and negative effects and the minimization measures, the sub-project implementation plan. (ii) Discuss the historical risk/accident happened on the environment and society in the past from the construction. (iii) The key construction activities and operation issues. (iv) The potential impacts to the natural environment which is important in the construction phase and operation. (v) Mitigation measures, environmental management plans and social. (vi) Monitoring and observation (vii) Mechanism for settlement of complaint and claim.

Consultation programme:

+ Step 1: The owner inform to participant about projects and sub-projects.

+ Step 2: The environmental experts notify positive and negative impacts to environment due to sub-projects’ implementation.

+ Step 3: Obtaining advice from local authorities, people in the Project area who are benefited or not benefited.

The content of the consultation meetings with the relevant local authorities, direct consultation from officers and citizens of 8 communes and towns: During the public consultation on the current state of the environment, the environmental impact of the sub-project, the result is 100% of individuals, representative of households interviewed agrees with the implementation of sub-projects, wants contractors as well as investors to ensure the natural environment, social sector are not affected.

In order to prepare The environmental impacts assessment report, The environmental and social safety policy report for the sub-project, from 09/03/2015 to 13/03/2015, The sub-project Management Unit and environmental consultant divided into two groups to consult and survey in 8 communes and 1 town in the area of sub-project “Upgrading and repairing cluster headworks of Khe Che reservoir”.

Along with that, to facilitate the formulation of reports on safety policy on environment and society of the subproject, the Management Unit has sent a consultation form to relevant communities together with a summary of items as well as measures taken to mitigate the negative impacts to local residents and the People's Committee and Fatherland Front Committee of the communes of An Sinh, Viet Dan, Tan Viet. The minutes of community consultation show that these organizations totally agree with the implementation of sub-projects and submit proposals that when implementing the sub-projects, the relevant bodies and organizations at all levels manage and monitor on the basis of the contents of the reports that have been submitted.

Table 8.1. Summary of consultation process

No.	Date	Venue	No. of participants/women participants	Participant
1	The morning of 10/03/2015	Tan Viet commune People's Committee	25/6 people	- The owner representative -The environmental consultant - Communal Chairman - Cadastral officers, environmental officers, … -Chief of villages using directly water source from Khe Che reservoir.
2	The morning of 11/03/2015	An Sinh commune People's Committee	28/7 people	- The owner representative -The environmental consultant -Communal Chairman, vice chairman, Women Union representative - Cadastral officers, environmental officers - Chief of five villages using directly water source from Khe Che reservoir - Representative of 10 households affected by the construction.
3	The morning of 12/03/2015	Viet Dan commune People's Committee	27/6 people	- The owner representative -The environmental consultant - Communal Vice Chairman, Secretary - Cadastral officers, environmental officers... - Chief of five villages using directly water source from Khe Che reservoir - Representative of people using directly water source from Khe Che reservoir

Results of the public consultation and information dissemination of The Environmental and social impact assessment advisory unit, project management unit of Irrigation Project 2, the People's Committee, Fatherland Front Committee of the communes, towns in the sub-project area, with the following results:

- 100% of all participants agree to perform sub-project "Upgrading and repairing cluster headworks of Khe Che reservoir" because in fact Khe Che reservoir is one of the

largest lakes in Quang Ninh, the safety is very essential for the lake. There have been many floods throughout history put people in downstream areas in alarm situations.

- The people in the communes are agreeing with the detailed consultative meetings held by owner, helping people understand the sub-project correctly, and propose their comment in sub-project implementation may bring negative and positive effects;

- 100% of communes and towns have been advised clearly by environmental consultant about the measures that the investor will perform in the sub-project construction process to ensure there is no hazardous impact on the environment, nature as well as landscape of the area around the lake.

- Agree with the impacts on natural environment, society and minimization measures that environmental consultants have given.-

- In the sub-project area, there are many temples, shrines, An Sinh temples is a National recognized relic. Therefore, it is necessary to have construction measures to avoid adverse effects to these building.

Things that most local authorities and local people are concerned about, the risk of traffic accidents that may occur during construction but this impact is measured in small degree. However, local authorities and local people require contractors and investors to properly implement measures that given by environmental advisor to avoid traffic congestion and minimize the impact to public activities. Below is a summary of the feedback of citizens and local authorities in the meetings.

8.4. ESIA disclosure

The report of ESIA of the sub-project will be published in Vietnamese version on the website of the Ministry of Agriculture and Rural Development, CPO, People's Committee of Quang Ninh province. ESIA summary will be sent to the Department of Natural Resources and Environment of Quang Ninh, Dong Trieu District People's Committee, the CPC An Sinh, Tan Viet, Viet Dan to the community and interested organizations can access, monitor the plan of ESMP implement.

The report of ESIA of the sub-project in English will be published on Information Centre of the World Bank in Hanoi.

CONCLUSION, RECOMMENDATION AND COMMITMENT

1. Conclusion

ESIA report for "Repairing and upgrading headworks complex of Khe Che reservoir" has evaluated the positive and negative impact on the environment and society in the affected area (8 communes and 1 town in Dong Trieu district, in which the most and directly affected area is some villages of 3 communes: An Sinh, Tan Viet and Viet Dan). The report includes the following:

(1) Sub-project "***Repairing and upgrading headworks complex of Khe Che reservoir"*** brings a lot of benefits for local people as flood prevention, relocation reduction when flooding, avoiding landslide-overflow and ensuring water supply for agriculture production for people in the area.

(2) The process of preparation and execution of the work items to be carried out during the dry season, so the ecological environment (aquatic and terrestrial area) is not significantly affected or the flow of the water is not changed. Construction duration is short (about 14 months), modern machinery, repair area is far away from houses then it will not significantly impact on the lives of people (the impact on health and quality of life of 10 households in the planning area of the sub-project is also included because the construction activities are conducted during the day).

(3) Not many wastes are generated during the works is put into operation, therefore, socio-economic impacts are negligible. The current state of the environment is quite good, surface water and ground water are contaminated with micro-organisms only, land and air are not contaminated and works is not located in the crowded then negative impact from populated sources in the process of sub-project implementation (e.g. arising dust, emissions, noise, waste water, solid waste, ...) is only temporary and partial effects. In the operation phase, waste is not arise much then affects to the environment and society is negligible.

(4) The negative impact on the environment of the project can be completely overcome by the application of appropriate techniques and the feasibility to control pollution, such as collection and disposal of solid waste, domestic waste, domestic sewage, water spray to reduce dust ... By the technical measures which, combined with the management and proper operation of the technical facilities/construction equipment, the target environment that will meet the current criteria specified (Vietnamese Standard) and therefore, the negative impact of project activities on the environment is negligible.

(5) Combination with the technical measures to control environmental pollution, the project will also need strict management measures of environmental hygiene to minimize construction waste, domestic waste, and must implement of labour safety measures, prevention of fire, explosion and prevent incidents. Project management unit should usually associate with local to implement environmental protection work to ensure a stable life and production, sustainable regional development.

Livelihood resources of community and livelihoods of the people.

Status of uneven distribution of natural resources, physical capital, and financial capital in the social group is a factor affecting the economic development and social justice in the project area. It also influence and dominate livelihoods of households belonging to different social groups. Flexible and effective livelihoods of many households in vulnerable groups shows that in case of positive and consistent support, they have many opportunities to escape poverty and improve their living standards

Two main livelihood resources of the community in the project area are human resource and agricultural land. Repairing and improving safety of dam (WB8) will provide an opportunity to promote the advantages of the two aforementioned livelihood resources, expand agricultural production, create jobs, raise incomes and improve people.

2. Recommendation

Some recommendations after analysing and assessing the impacts of the sub-project of "Repair and upgrade clusters headworks of Khe Che Reservoir" are outlined as follows:

- To establish guideline documents for the operation procedures of Khe Che reservoir, water level monitoring, flood marks and take measures to manage, troubleshoot incidents if occur during the operation for operators.

- Implement measures to control pollution and environmental monitoring program as proposed in this ESIA report, to ensure that the output environmental indicators comply with current regulations.

- Periodic investigations and field surveys are needed to evaluate the performance of the project. Consult for wider audiences, focusing on the areas of the affected communes by this project.

- Strictly follow the regulations of the State of collecting, processing of waste sources, and the impacts on the environment in the operation phase of the project.

- Regularly conduct surveys of termites nest in the dam body for timely remedial measures.

- It is possible to consider the possibility of water supply (through treatment plants) in the near future to ensure a safe water supply and sanitation in rural areas.

- Local governments facilitate Investor to perform compensation and clearance. The District Division of environment and natural resources coordinates with the Department of Environment and Natural Resources of the province to observe annual environmental quality and have appropriate mitigation measures to ensure the quality of the living environment for people in the subproject.

- Overall, this project has great potential impacts on the development of agricultural production, and spreading effects on non-agricultural development, to improve incomes and living of the community in the project area. The project promotes

the efficient use of resources of the social groups. However, financial and physical resources of the project or other programs and projects still have many limitations and fail to meet the development goals and sustainable poverty reduction. Therefore, it is necessary to integrate a wide range of projects and programs of socio-economic development of the locality in order to integrate the resources for the implementation of this goal. For the community in the project area, the livelihood resources of social groups are still weak, lacking of financial capital for land cultivation, irrigation, manufacturing facilities, and human capacity .. . Therefore, the integration of programs and projects in the province increases the ability to effectively use the resources of the livelihood of the social groups in the community, especially the vulnerable groups. For example, in order to deal with uncertainty in food production, the development of irrigation systems is necessary but not sufficient so it needs to combine with the agricultural extension activities, disease prevention, application of engineering techniques, new technologies, post-harvest technology, agricultural insurance, credit, processing and consuming... These are the solutions to ensure the sustainability of agricultural production.

- That the human resources of the project area is still weak when being compared to other types of livelihood resources affects the cause of sustainable poverty reduction in short and long term. Improving human resources tasks are difficult and takes a long time. The other social resources have an important role in improving human resources. Therefore, in the project, there should be a program to improve the community resources, focusing on training activities associated with the main livelihood activities of the social groups and communities in each region.

- For the project, it is good to perform the sync works and put into use immediately, avoiding spreading or doing partially, which will lead to a decrease in the effectiveness of the project. On the other hand, attention should be paid to minimize the adverse impacts on economic activities, activities, transportation, and the environment during construction. Strengthen the management and monitoring of stakeholders, including residents of the project during the implementation process, especially monitoring the implementation of compensation, support and resettlement and rehabilitation of the affected people to ensure that all citizens benefit from the project. Therefore, the preparation of a resettlement policy framework, a framework on ethnic minority for the whole project and an Action Plan for resettlement for each subproject is needed.

3. Commitments of investors

Besides the benefit, when implementing the project as well as when the project is put into use there will be environmental issues, affecting the lives of people and the environment. Therefore, during the operation of the project, the investor commits to implement pollution control measures as follows:

3.1. Commitment to implement measures to reduce pollution in the construction phase:

The investor commit to implement measures to minimize the negative impacts of the construction phase, including

- Propose management measures to reduce pollution at the source
- Mitigate the negative impact caused by the transportation and construction machinery.
- Reduce pollution from domestic sewage and solid waste.
- Reduce pollution from construction waste..
- Reduce pollution by hazardous waste and deal with collective functional units.
- Implement risk management process and responding plan to deal effectively to environmental incidents may happen.
- Other minimization measures.

3.2. Commitment to implement measures to reduce pollution in the operation phase:

The investor commits to coordinate with operating management unit after the project completed to implement minimization measures of the negative impact in the construction phase, including:

- Establish annual reporting process and coordinate with the Department of Natural Resources and Environment.
- Monitoring the impact on society and public health in the area surrounding the project.
- Monitoring the situation of traffic safety on the line.

3.3. Commitment to comply with environmental standards and safety standards in construction

The investor commit to strictly implement the Environmental Protection Act 2005, the standards and regulations of the State of environmental protection in the construction activities, the provisions on environmental management and implementation of minimization measures, pollution control. Commitment to implement measures to protect the environment including:

- *Standards and regulations on water*

- QCVN 08:2008/BTNMT - National Technical Regulation on surface water quality.
- QCVN 09:2008/BTNMT - National Technical Regulation on ground water quality.
- QC 02:2009/BYT - National technical regulation on water quality.
- QCVN 14:2008/BTNMT - National technical regulation on the quality of domestic wastewater.

- *Standards and regulations on air*

- QCVN 05:2009 - National technical regulations on ambient air quality.

- QCVN 26:2010 - National technical regulations on noise.

- *Standards and regulations on soil, solid waste*

- QCVN 15:2008/BTNMT -National technical regulation on pesticide concentrations in soil.

- QCVN 03:2008/BTNMT - National technical regulations on heavy metal content in soil.

- QCVN 07:2009/BTNMT - National technical regulations for hazardous waste threshold.

- *Standards and regulations on noise and vibration*

- QCVN 26:2010/BTNMT - National technical regulations on noise.

- *Standard on labour hygiene:*

- Decision 3733/2002/QĐ-BYT of Ministry if Health dated 10/10/2002 on application 21 labour hygiene criteria.

- *Standards and regulations on safety in construction*

- TCVN 5308-1991, TCVN 4086-1995 and TCVN 4244-1986: Safe technique in construction.

- Decision 955/1998/QĐ-BLĐTBXH: regulations on occupational safety.

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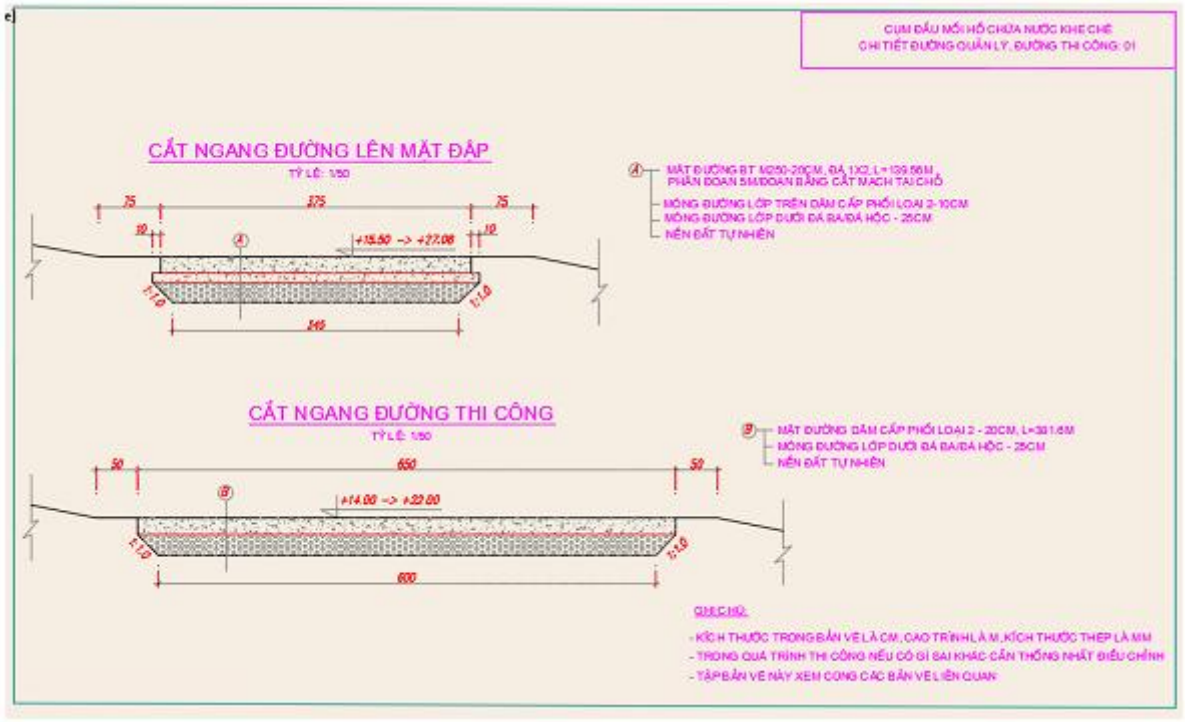
3. Report on the implementation of socio-economic development in Viet Dam commune
4. Planning map of new rural program in An Sinh commune
5. Assessment map on the Land Use Status in Viet Dan Commune
6. Description of “Repairing and upgrading head work clusters of Khe Che Reservoir”, The Company of Technology Consultancy and Transfer, University of Water Resources.
7. Monitoring Notes of Khe Che water environment.
8. Basic Design Version of “Repairing and upgrading head work clusters of Khe Che Reservoir”, The Company of Technology Consultancy and Transfer, University of Water Resources.
9. Report of the basic Design of Repairing and upgrading head work clusters of Khe Che Reservoir”, The Company of Technology Consultancy and Transfer, University of Water Resources.
10. Outline of Construction Drawings of Repairing and upgrading head work clusters of Khe Che Reservoir”, The Company of Technology Consultancy and Transfer, University of Water Resources.
11. Investment estimate of Repairing and upgrading head work clusters of Khe Che Reservoir”, The Company of Technology Consultancy and Transfer, University of Water Resources.
12. Main report of Repairing and upgrading head work clusters of Khe Che Reservoir”, The Company of Technology Consultancy and Transfer, University of Water Resources.

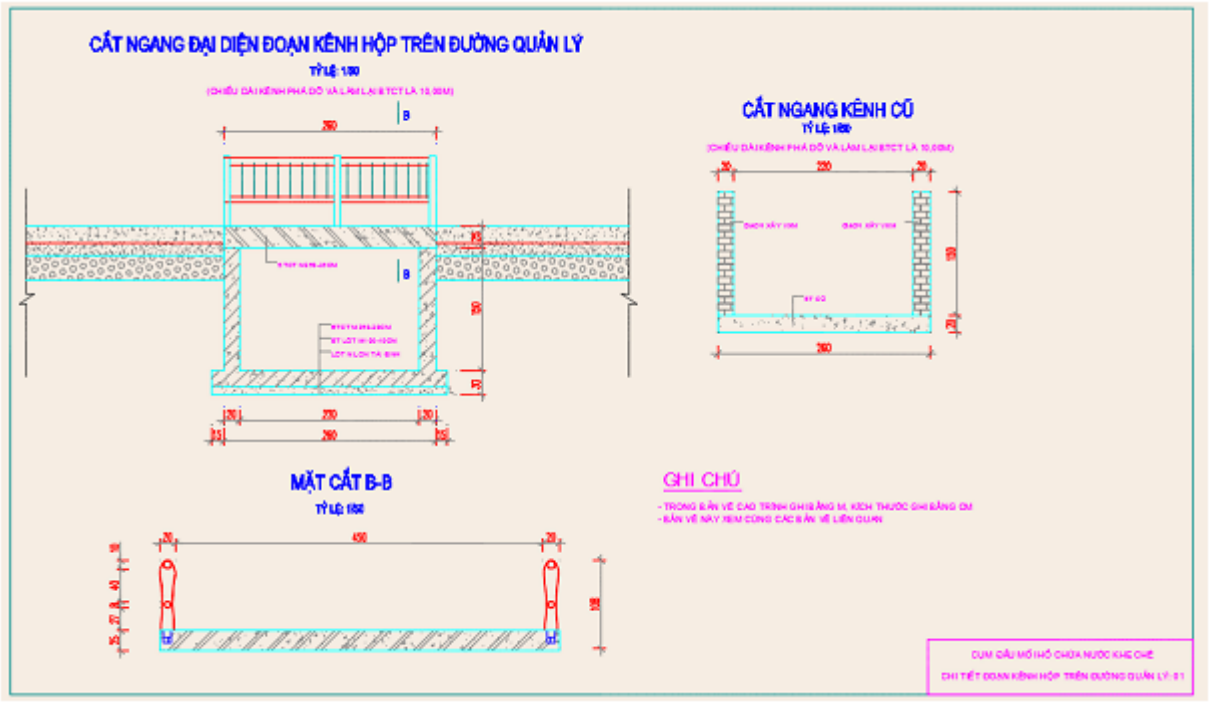
APPENDIX

APPENDIX A. ENVIRONMENT

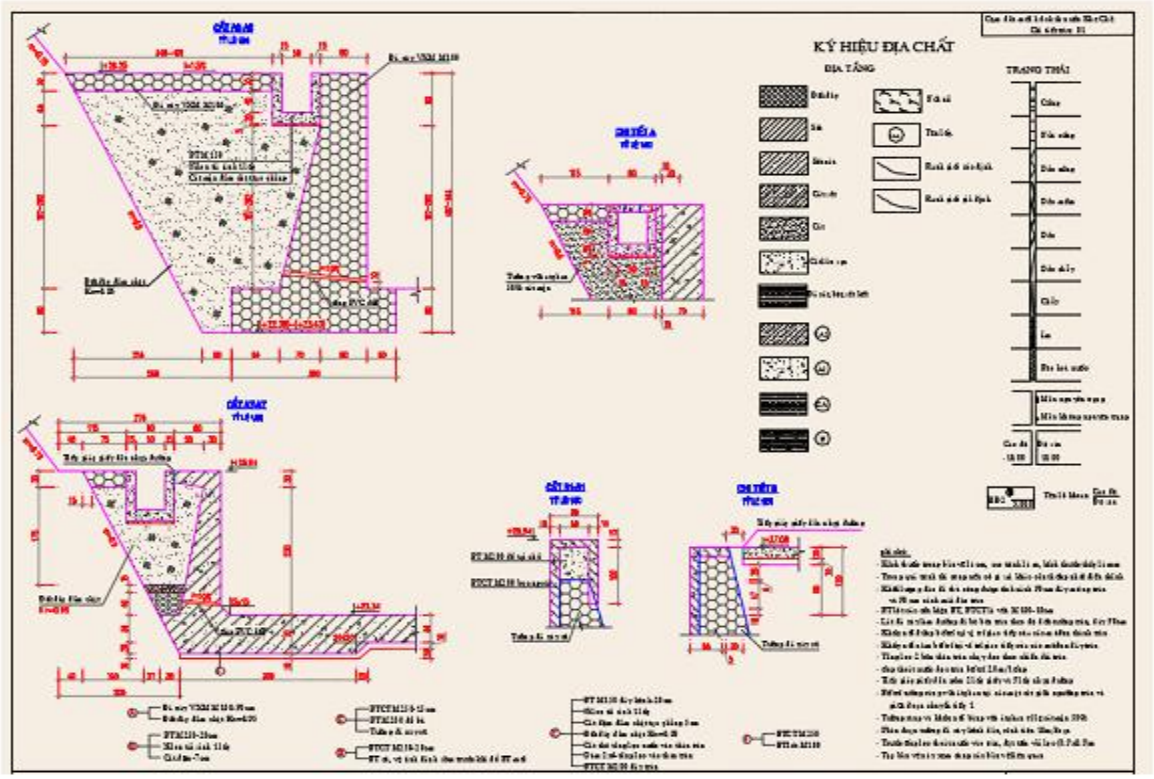
APPENDIX A1. DRAWING OF WORKS ITEMS



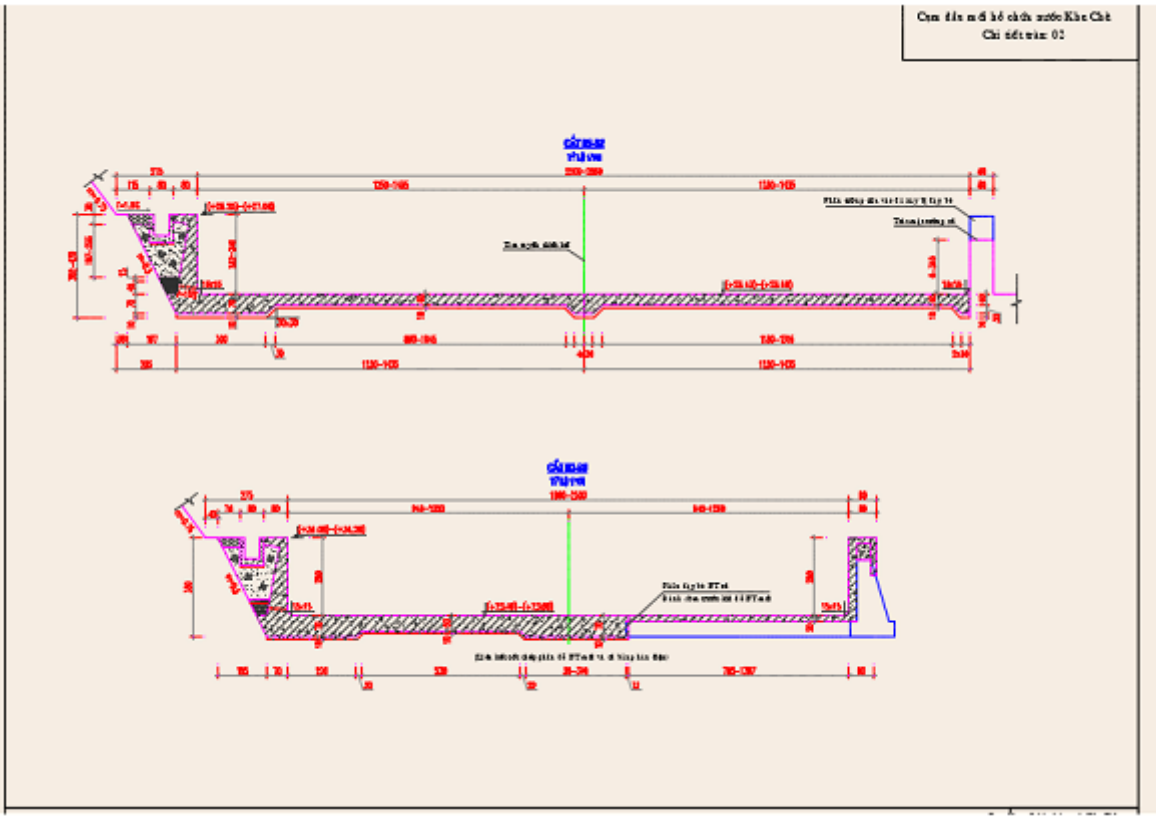
Construction Management Road



Channel on the management road



Details of spillway 1



Details of spillway 2

APPENDIX A2. POLICIES FRAMEWORK, INSTITUTIONS AND REGULATIONS OF VIETNAMESE GOVERNMENT TO ENVIRONMENTAL - SOCIAL ASSESSMENT

Legal framework on environment

- The Law on Environmental Protection (2014) No. 55/2014/QH13 on matters in relation with strategic environmental assessment, environmental impact assessment and commitment of environmental protection to development activities. Report on environmental impact assessment shall be implemented together with preparation of investment project (feasibility study report);

- The Decree No. 18/2015/ND-CP dated on 14 February 2015 on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plans;

- The Directives No. 26/CT-TTg dated 25 August 2014 of the Prime Minister on implementation of the Law on Environmental Protection;

- The Circular No. 01/2012/TT-BTNMT dated 16 March 2012 on setting-up, assessment, approval, inspection and certification of the implementation of detailed environmental protection project; setting-up and registration of simple environmental protection project;

- The Decree No. 29/2011/ND-CP dated 18 April 2011 stipulating strategic environment assessment, environmental impact assessment and commitment of environmental protection;

- The Circular No. 16/2009/TT-BTNMT dated 07 October 2009 of the Ministry of Natural Resources and Environment defining national technical regulations on environment, ambient air quality and a number of toxic substances in ambient air;

- The Decision No. 22/2006/QD-BTNMT dated 25 December 2006 of the Ministry of Natural Resources and Environment on the compulsory application of Vietnam's standards about the environment.

Legal framework on land use and land acquisition in investment project

- The Land Law No. 45/2013/QH13 approved by the National Assembly of the Socialist Republic of Vietnam on 29 November 2013.

- The Decree No. 43/2014/ND-Cp dated 15 May 2014 detailing a number of articles of the Land law in 2013.

- The Decree No. 44/2014/ND- CP, dated 15 May 2014 on land prices.

- The Decree No. 47/2014/ND-CP, dated 15 May 2014 on compensation, support and resettlement upon land acquisition by the State.

- The Decree No. 37/2014/ND-CP, dated 30 June 2014 on compensation, support and resettlement upon land acquisition by the State.

- The Circular No. 23/2014/TT-BTNMT dated 19 May 2014 stipulating the certificates of land use right, house ownership and other assets on land.

Legal framework on use, management and construction of investment projects

- The Law on Construction No. 50/2014/QH13 approved by the National Assembly of the Socialist Republic of Vietnam on 18 August 2014.

- The Decree No. 15/2013/ND-CP dated 06 February 2013 on quality management of construction works.

- The Decree No. 207/2013/ND-CP dated 11 December 2013 on amending, supplementing a number of articles of the Decree No. 48/2010/ND-CP dated 07 May 2010 of the Government on contracts in construction activities.

- The Decree No. 12/2009/ND-CP dated 10 February 2009 on management of investment projects on the construction of works.

Legal framework on integrated exploitation of water resources and protection of forest, cultural heritage and biodiversity

- The Law on Water resources approved by the National Assembly of the Socialist Republic of Vietnam on 21 June 2012.

- The Decree No. 42/2012/ND-CP dated 11 May 2012 of the Government on management and use of rice-farming land.

- The Decree No. 112/2008/ND-CP dated 20 October 2008 of the Government on management, protection and integrated exploitation of resources and environment of hydropower and irrigation reservoirs.

- The Decree No. 120/2008/ND-CP dated 01 December 2008of the Government on river basin management.

- The Decree No. 72/2007/ND-CP dated 07 May 2007 of the Government on dam safety management.

- The Decree No. 149/2004/ND-CP dated 27 July 2004 of the Government on the issuance of permits for water resource exploration, exploitation and use, or for discharge of wastewater into water source.

- The Law on Forest Protection and Development No. 29/2004/QH11 approved by the National Assembly of the Socialist Republic of Vietnam on 03 December 2004.

- The Decree No. 23/2006/ND-CP dated 03 March 2006 of the Government on the implementation of the Law on Forest Protection and Development.

- The Decision No. 57/QD-TTg dated 09 January 2012 of the Prime Minister on approval of the Forest Protection and Development Plan for the period 2011-2020.

- The Law on Cutural Heritage No. 28/2001/QH10 approved by the National Assembly of the Socialist Republic of Vietnam on 12 July 2001. Article 13 - The following are prohibited: The appropriation of cultural heritage for erroneous purposes;

Destruction or threatening to destroy cultural heritage; Illegal archaeological excavations; illegal construction or expropriation of land at historical-cultural sites or scenic landscapes.

- The Law on Biodiversity No. 28/2008/QH12 approved by the National Assembly of the Socialist Republic of Vietnam on 13 January 2008. Chapter III - Conservation and sustainable development of natural ecosystems and Chapter IV - Conservation and sustainable development of species.

National policies on dam safety

- The Decree No. 72/ND-CP dated 07 February 2007 on dam safety management;
- The Government's directions in the Document No. 21/CT-TTg dated 14 October 2013 on enhancement of safety management of reservoir;
- The Circular No. 33/2008/TT-BNN dated 04 February 2008 guiding the implementation of a number of articles of the Decree No.72/2007/ND-CP;
- The Circular No. 34/2010/TT-BCT of the Ministry of Industry and Trade dated 07 October 2010 on hydroelectric dam safety management.

Policies on resettlement

- Constitution of the Socialist Republic of Vietnam (1992) confirming the civil right on house ownership and protection.
- Constitution of the Socialist Republic of Vietnam (2013).
- The Land law No. 45/2013/QH13 on general administrative regulations of land. The Land law 2013 replaces previous versions in 1987 and 1993
- The Law on Complaints No. 02/2011/QH11 approved by the National Assembly of the Socialist Republic of Vietnam.
- The Decree No. 43/2014/ND-CP dated 15 May 2014 on the implementation of the Land law.
- The Decree No. 44/2014/ND-CP dated 15 May 2014 on land prices.
- The Decree No. 47/2014/ND-CP, dated 15 May 2014 on compensation and resettlement upon land acquisition by the State.
- The Decree No. 75/2012/ND-CP dated 03 October 2012 on the implementation of the Law on Complaints.
- The Decree No. 38/2013/ND-CP dated 23 April 2013 on management and utilization of official development assistance (ODA)
- The Decree No. 42/2012/ND-CP dated 11 May 2012 on management and use of rice-farming land
- The Circular No. 37/2014/TT-BTNMT, dated 30 June 2014 on compensation, support and resettlement upon land acquisition by the State.

- The Decision No. 1956/2009/QD-TTg dated 17 November 2009 of the Prime Minister approving the Master strategy on occupational training for rural laborers up to 2020.

- The Circular No. 36/2014/TT-BTNMT dated 30 June 2014 on land pricing method; construction works, adjustment to land price lists.

- The Decree No. 69/2009/ND-CP of the Government dated 13 August 2009 on additional regulations for land use planning, land prices, land recovery, compensation, support and resettlement.

- The Decision No. 52/2012/QD-TTg of the Prime Minister dated 16 November 2012 on the policy on support to employment and occupational training for laborerswhose agricultural land is recovered.

- According to the Quang Ninh Province People's Committee on performing next steps and completing the Action plan of resettlement under current regulations, making compensation and land clearance for the project. Quang Ninh Province's policies on preparation of the Action plan of resettlement are based on the following legal documents:

- The Decision No. 1766/2014 / QD-UBND dated 13 August 2014 promulgating regulations on compensation, support and resettlement upon land acquisition by the State under the Land law 2013 in Quang Ninh Province.

- The Decision No. 3566/2013/QD-UBND dated 26 December 2013 promulgating regulations on different land prices in 2014 applied in Quang Ninh Province.

- And some regulation documents related to compensation, support and resettlement of Quang Ninh Province.

Policies on gender

- The Law No. 73/2006/QH11 on gender equality approved bt the National Assembly on 29 November 2006;

- The Directives No. 07/2007/CT-TTg dated 3 May 2007 of the Government on implementation of the Law on Gender equality;

- The Decree No. 70/2008/ND-CP dated 4 June 2008 of the Government detailing the implementation of a number of articles of the Law on Gender equality;

- The Decree No. 55/2009/ND-CP dated 10 June 2009 of the Government on sanctioning of administrative violations of gender equality;

- The Decree No. 48/2009/ND-CP dated 19 May 2009 of the Government providing for measures to assure gender equality;

- The Circular No. 191/2009/TT-BTC dated 01 October 2009 of the Ministry of Finance guiding how to manage and spend budget for activities of gender equality and women's advancement;

- The Circular No. 07/2011/TT-BTP dated 31 March 31 2011 of the Ministry of Justice guiding the realization of gender equality in legal aid personnel and activities;

- The Decision No. 2351/QD-TTg dated 24 December 2010 of the Prime Minister on approval of the National strategy on gender equality in period of 2011 – 2020.

Policies on development of ethnic minority community

- The Decision No. 1956/2009/QD-TTg dated 17 November 2009 of the Prime Minister approving the Master strategy on occupational training for rural laborers up to 2020.

- The Decree No. 82/2010/ND-CP dated 20 July 2010 of the Government on teaching and learning of ethnic minority languages in schools.

- The Resolution No. 30a/2008/NQ-CP dated 27 December 2008 of the Government on support program for rapid and sustainable poverty reduction for 61 poorest districts.

- The Decision No. 74/2008/QD-TTg of the Prime Minister dated 9 June 2008 on support productive land and residential land for poor ethnic minority households in Mekong Delta area

- The Decree No. 60/2008/ND-CP dated 09 June 2008 of the Government on functions, tasks, powers and organizational structure of the Committee for Ethnic Minority Affairs.

- The Decision No. 06/2007/QD-UBDT dated 12 January 2007 of the Ethnic Minorities Committee on the strategy of media for the program 135-phase 2.

- The Decree No.70/2001/ND-CP: all documents registering family assets and land use rights must be in the names of both husband and wife.

Hunger eradication and poverty reduction

- The Decision No. 33/2007/QD-TTg dated 20 July 2007 of the Prime Minister on the policy of assistance to improve knowledge of laws as a program of 135, phase 2.

- The Circular No. 06 dated 20 September 2007 of the Ethnic Minorities Committee guidance on the assistance for services, improved livelihood of people, technical assistance for improving the knowledge on the laws according the Decision No. 112/2007/QD-TTg.

- The Decision No. 05/2007/QD-UBDT dated 06 September 2007 of the Ethnic Minorities Committee on its acceptance for three regions of ethnic minorities and mountainous areas based on development status.

Vietnamese standards and regulations on environmental protection

(i) Water environment:

- QCVN 08:2008/BTNMT - National technical regulation on surface water quality;
- QCVN 09:2008/BTNMT - National technical regulation on underground water quality;
- QCVN 14:2008/BTNMT - National technical regulation on domestic wastewater.
- QCVN 39:2011/BTNMT National technical regulation on Water Quality for irrigated agriculture.

(ii) Air atmosphere:

- QCVN 05:2013/BTNMT - National technical regulation on ambient air quality;
- QCVN 06:2008/BTNMT – National technical regulation on a number of toxic substances in ambient air.

(iii) Land environment

- QCVN 03: 2008/BTNMT - National technical regulation on the allowable limits of heavy metals in the soils;
- QCVN 04: 2008/BTNMT – National technical regulation on the pesticide residues in the soils;
- QCVN 43:2012/BTNMT - National technical regulation on sediment quality.

(iv) Solid waste management:

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

(v) Vibration and noise:

- QCVN 26:2010/BTNMT – National Technical Regulation on Noise;
- QCVN 27:2010/BTNMT – National Technical Regulation on Vibration.

Legal documents related to the project

- The Decision No. 02/2007/QD-BNN setting up the Water resources Investment and Construction Management unit No. 2 dated 18 January 2007;
- The Official Dispatch No. 7206/UBND-TM2 dated 18 December 2014 requesting the MARD to invest budget for repairing and upgrading reservoir safety in Quang Ninh Province, including Khe Che reservoir.

APPENDIX A3. ANALYSIS RESULTS NOTE

APPENDIX A3.1. ANALYSIS RESULTS OF QUALITY OF SURFACE WATER ENVIRONMENT

(Time: Morning 11 March 2015)

Criteria	Khe Che Lake Area						Water in underground sewers 1, An Sinh commune	Water in underground sewers 2, Tan Viet commune	Tan Viet Pump Station	Duc Chinh Drainage Ditch	Surface water at pump station, Viet Dan commune	Surface water at An Sinh commune	Binh Duong Pump Station	Thuy An Pump Commune	Trang An Drainage Ditch	QCVN 08: 2008/ BTNMT
	H1	H2	H3	H4	H5	H6	N1	N2	N3	N4	N5	N6	N7	N8	N9	B1
pH	7,1	7,2	7,2	7,3	7	7.3	1	7	7,1	7,2	6,9	7,4	7,15	7,2	7,1	**5 -9**
DO (mg/L)	4,7	6,2	6,6	5,4	5,2	5.8	6,2	6,6	4,5	4,2	5,1	6,1	3,8	4,1	5,1	**≥ 4**
Clorua (mg/L)	43	37	44	42	36	45										**600**
Hardness (mg/L)																**-**
TSS (mg/L)	13	14	17	17	7	7	13	**68**	45	24	18	26	43	21	36	**50**
TDS (mg/L)	89	135	96	107	72	81	43	83	76	51	47	61	91	73	65	**-**
COD (mg/L)	**31**	28	22	19	25	**34**	15	26	25	**34**	**44**	14	18	22	**31**	**30**
NH4-N (mg/L)	0,15	0,22	0,11	0,28	0,16	0,21	0,12	0,17	0,15	0,12	0,13	0,1	0,22	0,13	0,21	**0,5**
NO3-N (mg/L)	0,012	0,012	0,014	0,021	0,017	0,025	0,016	0,015	0,028	0,01	0,02	0,019	0,024	0,018	0,025	**0,04**
NO2-N (mg/L)	0,008	0,011	0,009	0,009	0,01	0,01	0,02	0,013	0,023	0,01	0,018	0,01	0,011	0,054	0,026	**10**
Coliform (MPN/100mL)	**1200**	**7900**	**14000**	**12000**	**2800**	**370**	**22000**	**5200**			**92000**	**22000**		**4900**		**7500**
E. Coli (MPN/100mL)	**173**	**617**	**3000**	**4000**	**KPH**	**0**	**2333**	**2333**			**2333**	**0**		**900**	**2000**	**100**

Note:

- QCVN 08-2008/BTNMT : National Technical Regulation on surface water;

- "-": Unspecified value.

APPENDIX A3.2. ANALYSIS RESULTS OF GROUND WATER AT 3 COMMUNES: AN SINH, VIET DAN, TAN VIET

(Time: Afternoon 11 March 2015)

Criteria	An Sinh	An Sinh	Tan Viet	Tan Viet	Viet Dan	Viet Dan	Viet Dan	QCVN 09:2008/ BTNMT
	NN1	NN2	NN3	NN4	NN5	NN6	NN7	
pH	6,8	6,9	6,8	7	7,1	6,9	6,9	**5,5 – 8,5**
DO (mg/L)	-	-	-	-	-	-	-	**-**
Clorua (mg/L)	-	-	-	-	-	-	-	**250**
Hardness (mg/L)	194	220	283	304	264	345	290	**500**
TSS (mg/L)	2	2	11	4	27	85	17	**1500**
TDS (mg/L)	-	-	-	-	-	-	-	**-**
COD (mg/L)	2	2	**6**	**5**	**7**	**5**	**6**	**4**
NH4-N (mg/L)	0,08	0,02	0,04	0,08	0,01	0,05	0,07	**0.1**
NO3-N (mg/L)	0,13	0,08	0,07	0,15	0,16	0,1	0,11	**1.0**
NO2-N (mg/L)	0,023	0,02	0,01	0,04	0,014	0,028	0,017	**15**
Tổng coliform (MPN/100mL)	**92000**	**310**	**400**	**1400**	**1400**	**610**	**450**	**3**
E. Coli (MPN/100mL)	**1600**	**KPH**	**200**	**100**	**110**	**317**	**68**	**KPH**

Note:

- QCVN 09-2008/BTNMT: National Technical Regulation on ground water;

- "-": Unspecified value.

APPENDIX A3.3. OBSERVATION RESULTS OF AIR SAMPLE

(Time: Morning 12 March 2015)

No.	Criteria	Unit	Result				QCVN 05:2013/ BTNMT	QCVN 26:2010/ BTNMT
			KK01	KK02	KK03	KK04		
1	Temperature	^{0}C	16	15	15	15	-	-
2	Humidity	%	88,5	86	87,5	86,5	-	-
3	Wind speed	m/s	1,2	1,3	0,8	1,1	-	-
4	Noise	dBA	46	52	51	53	-	**70**
5	Pressure	mmHg	742	741	746	745	-	-
6	SO_2	mg/m^3	0,1	0,1	0,19	0,06	**0,35**	-
7	CO	mg/m^3	2,4	3	4,7	3,7	**30**	-
8	NO_2	mg/m^3	0,09	0,1	0,08	0,08	**0,2**	-
9	Suspended dust	mg/m^3	0,05	0,05	0,09	0,11	**0,3**	-

Note:

- QCVN05:2013/BTNMT: National Technical Regulation on ambient air quality;

- QCVN 26:2010/BTNMT: National technical regulations on noise;

- "-": Unspecified value.

APPENDIX A3.4. OBSERVATION RESULTS OF SOIL QUALITY

(Time: Morning, 11 March 2015)

No	Criteria	Unit	Result			QCVN 03/2008/BTNMT
			Đ1	**Đ2**	**Đ3**	
1	Humidity	-	53.2	38.2	12.4	-
2	pH H_2O	-	5.8	5.9	5.1	-
3	pH KCl	-	5.5	5.7	4.7	-
4	Zn	mg/kg	105.7	92.7	70.5	200
5	As	mg/kg	1.2	1.2	0.7	12
6	Cd	mg/kg	0.2	0.8	0.2	2
7	Cu	mg/kg	30.2	32.5	22.6	50
8	Pb	mg/kg	58.2	42.5	25.1	70

APPENDIX A3.5. PHYTONPLANKTON DENSITY AT SURVAY AREA

(Time: 11 March 2015)

Survey station	Biodiversity Index (D)	Density (tb/l)					
		Total	Bacillariophyta	Cyanophyta	Chlorophyta	Pyrrophyta	Euglenophyta
T1	**2.54**	3910	1077	1587	1190		56
T2	**2.65**	4023	850	1587	1360	56	170
T3	**2.67**	3796	1133	1417	1020		226
T4	**2.56**	3683	1020	1360	1190		113
T5	**2.78**	3966	850	1643	1247	56	170
T6	**2.12**	3059	907	1133	793	56	170
T7	**2.73**	2203	560	1360	170		113
T8	**2.69**	2486	850	907	560	56	113
T9	**2.14**	2775	963	793	793	56	170
T10	**2.81**	2486	560	1473	340		113

APPENDIX A3.6. ZOOPLANKTON DENSITY AT SURVEY AREA

(Time: 11 March 2015)

Survey station	Biodiversity Index (D)	General density con/m^3 (%)	Copepoda con/m^3 (%)	Cladocera con/m^3 (%)	Rotatoria con/m^3 (%)
1	**0.72**	15,816	6,122 (38.71)	2,448 (15.48)	7,245 (45.81)
2	**0.92**	17,959	8,980 (50.0)	2,908 (16.19)	6,071 (33.81)
3	**1.15**	13,855	7052 (50.90)	2313 (1669)	4490 (32.41)
4	**1.94**	6,530	4,864 (74.47)	510 (781)	1156 (17.71)
5	**1.85**	3,333	2,540 (76.19)	204 (6.12)	590 (17.69)
6	**2.20**	1,451	1,088 (75.0)	136 (937)	227 (1.56)
7	**2.59**	2,268	1,610 (71.0)	272 (12.0)	385 (17.0)
8	**3.33**	67	39 (57.58)	24 (33.33)	6 (9.09)
9	**3.85**	49	24 (50.0)	10 (20.83)	14 (29.17)
10	**3.05**	98	61 (62.5)	12 (12.5)	24 (25.0)

APPENDIX A4. THE PUBLIC CONSULTATION DOCUMENTS

VIỆN THUỶ ĐIỆN VÀ NĂNG LƯỢNG TÁI TẠO
ĐƠN VỊ: TRUNG TÂM CÔNG TRÌNH THUỶ ĐIỆN

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh Phúc

An Sinh, Ngày 11 tháng 3 năm 2015

BIÊN BẢN LÀM VIỆC
THAM VẤN CỘNG ĐỒNG

Dự án: Sửa chữa và nâng cao an toàn đập WB8

Tiểu Dự án: Nâng cấp, sửa chữa cụm công trình đầu mối hồ Khe Chè

I. Thời gian, địa điểm làm việc

- Thời gian:
  Ngày 11/3/2015
- Địa điểm:
  UBND huyện xã An Sinh

II. Thành phần làm việc:

1. Đại diện nhóm cán bộ cơ quan địa phương
- Mạc Văn Nam: Phó Chủ tịch xã
- Phạm Trung Quang: Cán bộ địa chính xã
- Đại diện của các ban ngành đoàn thể xã
- Đại diện cho các hộ dân thuộc các thôn Tiêu Phú, Ba Xã, Bắc Dải

2. Đại diện nhóm cán bộ cơ quan
- Phạm Thị Thuần: cán bộ tư vấn
- Phùng Thị Ngọc Lan: Chuyên gia môi trường
- Nông Hải Hà: Đại diện chủ đầu tư
- Các cán bộ bà con

III. Nội dung làm việc:
- Trao đổi thông tin của tiểu dự án hồ Khe Chè
- Các cán bộ đưa ra thông tin liên quan
- Các trưởng thôn tham gia góp ý trong quá trình tiểu dự án
- Cán bộ tư vấn đề xuất các tác động và biện pháp giảm thiểu đến môi trường và xã hội

IV. Ý kiến đóng góp

Sau khi nghe chủ đầu tư và đơn vị tư vấn trình bày những tác động và biện pháp giảm thiểu của DA đến môi trường và sức khỏe người dân và chính quyền địa phương chấp nhận các biện pháp mà được đưa ra

- Mong DA sớm triển khai thực hiện để đảm bảo cuộc sống của người dân và địa phương

- Đồng ý với các đề xuất đưa ra

V. Kết luận

- Đồng ý thực hiện dự án

- Yêu cầu giữ nguyên Quy hoạch

- Yêu cầu đảm bảo đời sống nhân dân trong quá trình thực hiện

Cán bộ thực hiện

Phạm Thị Thuần

Đại diện

BNĐ XÃ AN SINH
PHÓ CHỦ TỊCH

Mạc Văn Nam

VIỆN THUỶ ĐIỆN VÀ NĂNG LƯỢNG TÁI TẠO
ĐƠN VỊ: TRUNG TÂM CÔNG TRÌNH THUỶ ĐIỆN

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh Phúc

DANH SÁCH THAM DỰ HỌP (TỜ.....)

Tên Dự án: Sửa Chữa, nâng cấp Cụm Công trình Đầu mối hồ Khe Chè

Nội dung họp: tham vấn về tiểu dự án "Nâng cấp và sửa chữa cụm đầu mối hồ Khe Chè"

Địa điểm họp: Hội trường UBND xã An Sinh

Thời gian: 11/05/2015

Ngày 11 tháng 5 năm 2015

STT	Họ và tên	Địa chỉ thường trú	Số tiền	Ký nhận
1	Nguyễn Phúc Lợi	(Trưởng Thôn Trúc phú)		[signature]
2	Phạm Văn Khánh	(Trưởng Thôn Bãi Dài)		[signature]
3	Lê Đình Nhiệm	(Trưởng Thôn Đông Dung)		[signature]
4	Phạm Duy Khiêm	(Chủ tịch UBND xã)		[signature]
5	Mạc Văn Nam	(phó chủ tịch UBND xã)		[signature]
6	Hoàng Xuân Nam	(chủ tịch UBMTTQ xã)		[signature]
7	Hoàng Văn Dũng	(Công chức Tài chính xã)		[signature]
8	Phạm Trung Quang	(Công chức Địa chính XD-MT		[signature]
9	Nguyễn Văn Thắng	(Công chức Địa chính XD-MT)		
10	Tống Duy Khải	Công chức Tư pháp		[signature]
11	Nguyễn Thị T. Hằng	Công chức Văn phòng		[signature]
12	Hồ Thị Hằng	Chủ tịch HND		[signature]
13	Phạm Thị Hồng Hạnh	Chủ tịch Hội phụ Nữ		[signature]
14	Cao Thanh Vũ	Bí Thư Đoàn Xã		[signature]
15	Đoàn Thị Hà	Công chức Tài chính Xã		[signature]
16	Phạm Khắc Toản	Chỉ huy trưởng Quân Sự		[signature]
17	Vũ Thị Hằng	công dân thôn Ba xã		[signature]
18	Vũ văn Thành	" " "		[signature]
19	Leo văn Thu	" " "		[signature]
20	TRần văn Nam	" " Nam "		[signature]
21	TRần Văn Tư	" " "		[signature]

VIỆN THUỶ ĐIỆN VÀ NĂNG LƯỢNG TÁI TẠO
ĐƠN VỊ: TRUNG TÂM CÔNG TRÌNH THUỶ ĐIỆN

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh Phúc

Tân Việt ,Ngày 10 tháng 03 năm 2015

BIÊN BẢN LÀM VIỆC
THAM VẤN CỘNG ĐỒNG

Dự án: Sửa chữa và nâng cao an toàn đập WB8

Tiểu Dự án: Sửa chữa và nâng cấp an toàn đập hồ Khe Chè

I. Thời gian, địa điểm làm việc

- Thời gian:

13h45, ngày 10/03/2015

- Địa điểm:

UBND xã Tân Việt

II. Thành phần làm việc:

1. Đại diện nhóm cán bộ cơ quan

Đại diện chủ đầu tư
Đại diện nhóm chuyên gia tư vấn
Đại diện UBND xã

2. Đại diện

Đại diện người dân địa phương
Chủ tịch xã; các cán bộ chuyên trách môi trường, thuỷ lợi địa chính

III. Nội dung làm việc:

Lý do tiến hành tham vấn cộng đồng
Giới thiệu dự án và hợp phần dự án
Nội dung tham vấn
Chủ đầu tư thông báo các hạng mục thực hiện
Đơn vị tư vấn đề xuất các tác động và biện pháp giảm thiểu đến MT-XH trong quá trình thi công
Lấy ý kiến người dân địa phương

IV. Ý kiến đóng góp

- Người dân ủng hộ việc thực hiện tiểu dự án.

- Mong chủ đầu tư, nhà thầu thực hiện đúng các phương án để giảm thiểu tác động đến môi trường xã hội.

- Sau khi nghe chủ đầu tư tư vấn đưa ra các biện pháp giảm thiểu, chính quyền địa phương hoàn toàn nhất trí.

V. Kết luận

- Đồng ý với việc thực hiện TDA.

- Đồng ý với các biện pháp giảm thiểu tác động môi trường xã hội mà tư vấn và chủ đầu tư đề xuất.

Cán bộ thực hiện

Phạm Thị Thuận

Đại diện

CHỦ TỊCH

Nguyễn Văn Khiêm

VIỆN THUỶ ĐIỆN VÀ NĂNG LƯỢNG TÁI TẠO
ĐƠN VỊ: TRUNG TÂM CÔNG TRÌNH THUỶ ĐIỆN

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh Phúc

DANH SÁCH THAM DỰ HỌP (TỜ.....)

Tên Dự án: Sửa chữa và nâng cao an toàn đập WB8

Nội dung họp: Tham vấn cộng đồng

Địa điểm họp: Hội trường Ủy Ban Nhân dân xã

Thời gian: 8h sáng

Ngày 10 tháng 3 năm 2015

STT	Họ và tên	Địa chỉ thường trú	Số tiền	Ký nhận
1	Phan Văn Quyết	phúc Đa - Tân Việt	30.000	
2	Nguyễn Hữu Khiêm	Tân Lập - Tân Việt	"	
3	Nguyễn Thị Nhã	phúc Đa - Tân Việt	"	
4	Nguyễn Văn Huy	phúc Đa - Tân Việt	"	
5	phạm Hữu Tiệp	phúc Đa - Tân Việt	"	
6	Lê Văn Hưng	phúc Đa - Tân Việt	"	
7	Lê Hồng Thêm	phúc Đa - Tân Việt	"	
8	phạm Văn Huynh	phúc Đa - Tân Việt	"	
9	Toàn Thị Hồng Bắc	Tân Lập - Tân Việt	"	
10	Toàn Thị Bích Liên	Tân Lập - Tân Việt	"	
11	Võ Thường Chuyên	Tân Lập - Tân Việt	"	
12	Nguyễn Văn Biên	Tân Lập - Tân Việt	"	
13	Nguyễn Xuân Hòa	Tân Lập - Tân Việt	"	
14	Toàn Thị Lương	Tân Lập - Tân Việt	"	
15	Nguyễn Văn Thắng	Tân Thành - Tân Việt	"	
16	Nguyễn Văn Dương	Tân Thành - Tân Việt	"	
17	Nguyễn Văn Nghiệp	Tân Thành - Tân Việt	"	
18	Hồ Thị Liên Thoa	Hồ Sao - Tân Việt	"	
19	Mạc Văn Thu	Hồ Sao - Tân Việt	"	
20	Hồ Văn Thăng	An Sinh	"	
21	phạm Thị Linh	Việt Dân	"	

VIỆN THUỶ ĐIỆN VÀ NĂNG LƯỢNG TÁI TẠO
ĐƠN VỊ: TRUNG TÂM CÔNG TRÌNH THUỶ ĐIỆN

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh Phúc

Việt Dân, Ngày 11 tháng 3 năm 2015

BIÊN BẢN LÀM VIỆC
THAM VẤN CỘNG ĐỒNG

Dự án: Sửa chữa và nâng cao an toàn đập

Tiểu Dự án: Sửa chữa, nâng cấp cụm công trình đầu mối Khe Chè

I. Thời gian, địa điểm làm việc

- Thời gian:

- Địa điểm: Nhà trường UBND xã Việt Dân

II. Thành phần làm việc:

1. Đại diện nhóm cán bộ cơ quan

- Chuyên gia Môi trường: Phạm Thị Ngọc Lan
- Chuyên gia Môi trường: Nguyễn Thị Hồng Thuỷ
- Chuyên gia Môi trường: Phạm Thị Huyền
- Cán bộ đại diện chủ đầu tư: Dương Mai Hà

2. Đại diện

- Chủ tịch xã: Phạm Đức Tiến
- Trưởng thôn các thôn
- Các hộ dân bị ảnh hưởng
- Bí thư Chi bộ: Hoàng Tiến Thắng

III. Nội dung làm việc:

- Trao đổi thông tin về Tiểu Dự án
- Tư vấn thông báo về các tác động có thể ảnh hưởng của việc thực hiện Dự án đến môi trường tự nhiên, xã hội
- Phó chủ tịch xã Phạm Đức Tiến thay phát biểu đồng ý với việc thực hiện TDA, mong chủ đầu tư thực hiện nhanh chóng hơn để người dân thực hiện công tác làm sản xuất

IV. Ý kiến đóng góp

- Ủng hộ cao việc thực hiện

- Sau khi nghe chủ đầu tư và đơn vị tư vấn trình bày những tác động môi trường của DA có thể xảy ra, thay mặt cho UBND xã Việt Dân đồng ý với việc thực hiện tiểu dự án, bên cạnh đó cũng đồng ý với các biện pháp đưa ra nhằm giảm thiểu tác động môi trường xã hội.

V. Kết luận

- Đồng ý với việc thực hiện Dự án

- Mong thực hiện sớm

- Đảm bảo vệ sinh môi trường trong quá trình thi công.

Cán bộ thực hiện	Đại diện
Phạm Thị Thuận	T/M UBND XÃ VIỆT DÂN PHÓ CHỦ TỊCH Phạm Đức Tiến

VIỆN THUỶ ĐIỆN VÀ NĂNG LƯỢNG TÁI TẠO
ĐƠN VỊ: TRUNG TÂM CÔNG TRÌNH THUỶ ĐIỆN

CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh Phúc

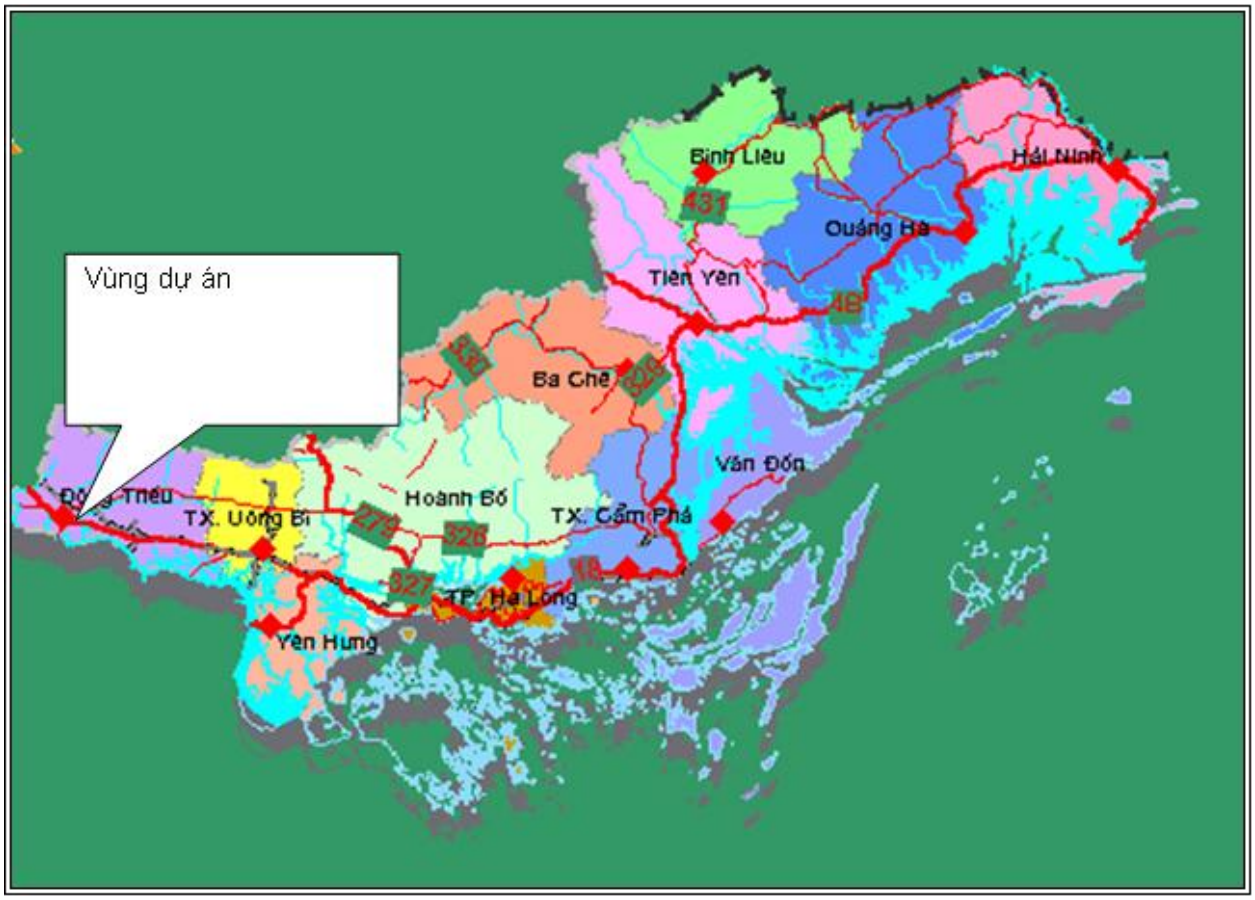
DANH SÁCH THAM DỰ HỌP (TỜ.....)

Tên Dự án: Sửa chữa và Nâng cao an toàn đập
Sửa chữa, nâng cấp cụm công trình đầu mối Khe Chè
Nội dung họp: Tham vấn cộng đồng các vấn đề môi trường xã hội
Địa điểm họp: Hội trường UBND xã Việt Dân
Thời gian: ...

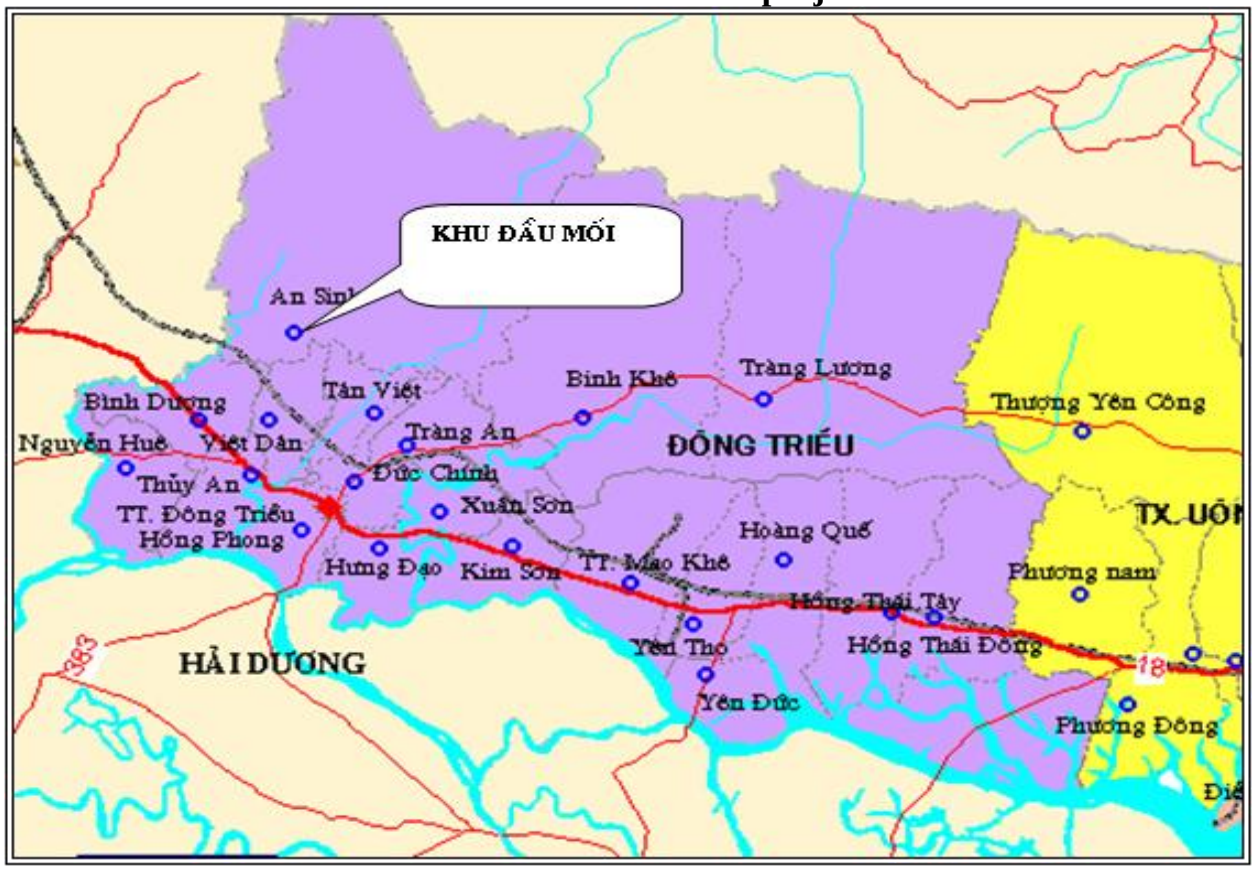
Ngày...... tháng.... năm 2015

STT	Họ và tên	Địa chỉ thường trú	Số tiền	Ký nhận
1	Hoàng Trọ Thắng	Thôn Tân Thành - Việt Dân	30000	[signature]
2	Nguyễn Văn Nam	Thôn Phúc Thị - Xã Tiến Dân		[signature]
3	Nguyễn Tiến ai	Khe Chè Việt Dân		[signature]
4	Nguyễn Thị Minh Lợi	Thôn Phúc Lợi - Việt Dân		[signature]
5	Hoàng thị Thủy	Thôn Khe Hạ - xã Việt Dân		[signature]
6	Bùi thị Hòa	Thôn Đồng Ý - VD		[signature]
7	Nguyễn Văn Sáu	Thôn Đồng Ý VD		[signature]
8	Nguyễn Chí Thân	Thôn An Làng - Việt Dân		[signature]
9	Hoàng văn Đông	BTCB Thôn Cầu Đaun		[signature]
10	Đỗ Thị Bốn	Trưởng Thôn Cầu Đaun		[signature]
11	Phạm văn Sách	BT CB thôn Tân Thành		[signature]
12	Nguyễn Văn Tuấn	Chủ tịch Hội chữ thập đỏ		[signature]
13	Đỗ Thị Tuyến	Hội viên CCB		[signature]
14	Nguyễn Văn Huy	CHT. QS xã		[signature]
15	Nguyễn Thị Nở	Hiệu trưởng Trường tiểu học		[signature]
16	Phạm Thanh Diu	Trưởng Thôn Chói Phúc		[signature]
17	Nguyễn Thanh Tùng	Trưởng thôn Khe Thượng		[signature]
18	Phạm Văn Hưng	Trưởng Ban CTMTT		[signature]
19	Đỗ Văn Trường	CN HTX DV nông nghiệp		[signature]
20	Ng Tiến Thọ	PT Khe Thượng		[signature]
21	Đỗ Mạnh Hùng	Khe Thượng - Việt Dân		[signature]

APPENDIX A5. MAPS



PLA5.1: Location of sub-project



PLA5.2: Location of headworks of Khe Che reservoir

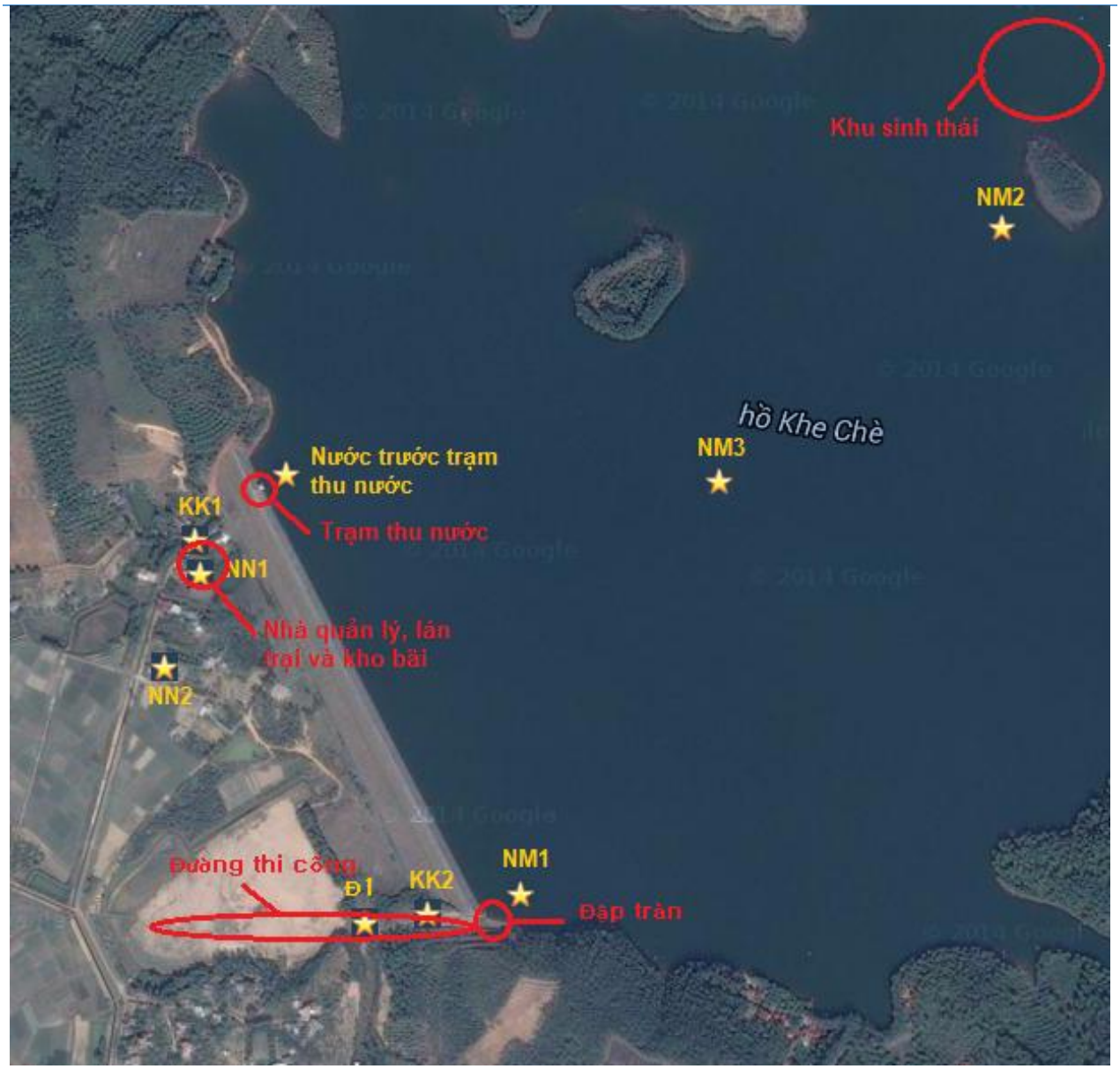
PLA5.3: The headworks of Khe Che Reservoir

PLA5.4: Location of monitoring sampling in sub-project

PLA5.5. Location of sampling around Khe Che reservoir area

PLA5.6: Location of sampling at An Sinh and Tan Viet commune – affected and benefited from sub-project

PLA5.7: Location of environment sampling at vicinity in the sub-project



PLA5.8. Location of environmental quality monitoring during the construction progress of sub-project

APPENDIX A6. ENVIRONMENTAL AND SOCIAL SCREENING FOR SUB-PROJECT

APPENDIX A6.1. ELIGIBILITY SCREENING

Screening Questions	Yes	No	Remarks, (If yes)
1. Does the proposed sub-project lead to an increase in the dam height and/or reservoir's design storage capacity?		No	
2. If the answer of the question 1 is yes, does the increase is not necessary from safety management perspective?			
3. Does the proposed sub-project encroach on a critical natural habitat, a protected area of natural habitat, a national park of nature or a nature reserve and would lead to temporary or permanent acquisition land in that habitat, park or reserve?		No	
4. Does the sub-project displace, disfigure or render inaccessible any structure or site of great cultural or historical value to the country, to an ethnic group or to the local community.		No	
5. Does the sub-project use land that is currently occupied or regularly used for natural forest areas, defensive forest or leads to a change in the land use of forest lands during project implementation?		No	

EPPENDIX A6.2. SCREENING AND ENVIRONMENTAL CATEGORIZATION

Screening Questions	Yes	No	Remarks
1. Does the subproject have the potential to cause significant adverse impacts to natural or critical natural habitats?			
Leads to loss or degradation of sensitive Natural Habitats such as: land and water areas where (i) the ecosystems' bio-logical communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions.		No	Impact on water and soil sources of the sub-project is not considerable (due to the increasing of emission such as solid wastes, domestic waste-water in the construction process of workers). At the place native species appear, the sub-project has not affect yet. At the place human activities have not significantly changed the basic eco-functions within the scope of project, the construction and operation processes have not changed this eco-system.
Leads to loss or degradation of Critical natural habitat, i.e., habitat that is legally protected, officially proposed for protection,		No	Within the area of Dong Trieu, there is reservation zone, sacred forests, rare and vulnerable species

Screening Questions	Yes	No	Remarks
or unprotected but of known high conservation value[2].			but endangered species so the sub-project has not lost or degraded the natural environment.
2. Does the subproject have the potential to cause significant adverse impacts to physical cultural resources?			
Leads to loss or degradation of physical cultural resources (PCR)[3].		No	The project has not exerted any impact on historical relics because locations of works are far from the historical relics, temples, churches and not violate the freedom of religion of the local residents.
Potentially results in a contravention of national legislation, or national obligations under relevant international environmental treaties and agreements, including the UNESCO World Heritage Convention or affect sites with known and important tourism or scientific interest.		No	Project for rehabilitating and upgrading the headwork of Khe Che reservoir totally matches with the national laws. An Sinh Commune – the area has under influence of Khe Che Lake – has An Sinh Vuong Tran Lieu temple and relics of tombs of Tran Kings with benefits of tourism. Khe Che Dam Rehabilitation and Safety Improvement Project has not involved to these relics that are far away from the headwork.
3. Does the subproject have the potential to cause significant adverse impacts on the lands and related natural resources used by ethnic minorities?			
Potentially result in impacts on lands or territories that are traditionally owned, or customarily used or occupied, and where access to natural resources is vital to the sustainability of cultures and livelihoods of minority peoples. Potentially impact the cultural and spiritual values attributed to such lands and resources or impact natural		No	Because the construction area of the sub-project has few people from ethnic minorities. All ethnic minorities immigrating in geographical areas is due to get marriage with the residents so the implementation of sub-projects do not affect to the land, their own

[2] Critical habitats include existing protected areas and areas officially proposed by governments as protected areas (e.g., reserves that meet the criteria of the World Conservation Union [IUCN] classifications, areas initially recognized as protected by traditional local communities (e.g., sacred groves), and sites that maintain conditions vital for the viability of these protected areas. Sites may include areas with known high suitability for bio-diversity conservation; and sites that are critical for rare, vulnerable, migratory, or endangered species.

[3] PCR is defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. They may be located in urban or rural settings, above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

Screening Questions	Yes	No	Remarks
resources management and the long-term sustainability of the affected resources.			tranditional territory, customs and have no access to natural resources which play an important for the sustainability of the culture and livelihood of ethnic minorities.
4. Does the subproject have the potential to cause significant adverse effects to populations subject to physical displacement?			
Leads to physical displacement of populations dependent upon lands or use of specific use of resources that would be difficult to replace or restore? Otherwise lead to difficult issues in the ability of the subproject to restore livelihoods?		No	The project on rehabilitating and improving the dam and reservoir safety includes repairing and strengthening the dam face and spillway, concreting the water intake without land recovery. Regarding the sub-project on rehabilitating and improving Khe Che Reservoir, An Sinh commune, Dong Trieu District, the damages caused by land used to construct works are negligible, it is ROW for irrigation works, agricultural land and works items with small scale with construction site far from the residential area.
5. Does the subproject entail the construction/rehabilitation of a large dam?			
Does the subproject require construction/rehabilitation of a dam that is: • 15 meters or more in height • between 10 and 15 meters in height with special design complexities--for example, an unusually large flood-handling requirement, location in a zone of high seismicity, foundations that are complex and difficult to prepare, or retention of toxic materials. • under 10 meters in height but expected to become large dams during the operation of the subproject?	**Yes**		This sub-project mainly aims to expand the spillway (expanding from 12m to 24m) to avoid discharging flood to downstream area. The spillway is characterized by available height of 14m, simple structure but it is expected to become a large dam during operation of the sub-project. In future, Khe Che reservoice shall serve agricultural irrigation activities in 8 communes and Dong Trieu town and ecotourism. Therefore, such works is considered to be a large dam. That is why as required in OP 4.37, an independent expert must be available to evaluate the dam safety
Does the operation of the subproject rely on the performance of: • an existing dam or a dam under construction (DUC); • power stations or water supply systems that draw directly from a reservoir	**Yes**		Operation of sub-project only depends on performance of available dam (providing irrigation water for agriculture and operating ecotourism services at the reservoir). No electric stations and

Screening Questions	Yes	No	Remarks
controlled by an existing dam or a DUC; • diversion dams or hydraulic structures downstream from an existing dam or a DUC, where failure of the upstream dam could cause extensive damage to or failure of the new World Bank-financed structure and irrigation or water supply projects that will depend on the storage and operation of an existing dam or a DUC for their supply of water and could not function if the dam failed.			water supply system to take water from the reservoir and dam is not guided or supported with downstream structure from one available dam. However, the works complex of Khe Che Reservoir does not require the assesment of group A but caution should be applied because the Bank has an extremly strict requirement to ensure the operation safety of available dam or dam to be built. The bank requires to inspect the dam or new dam, operation performance and O&M procedures; and recommends any repairs or safety measures; the previous evaluations are also re-conducted.
6. Does the subproject entail the chemical for soil treatment?			
Do the formulations of the products fall in World Health Organization classes IA and IB, or are there formulations of products in Class II?,	**Yes**		After the TDA is completed, the agricultural production conditions shall be improved (the irrigation canal system shall operate more efficiently); investing in the production activities to increase profits may increase use of fertilizers and pesticides; thereby increasing environmental pollution.
7. Does the subproject have the potential to cause irreversible impacts or impacts that are not easily mitigated?			
Leads to loss of aquifer recharge areas, affects the quality of water storage and catchments responsible for potable water supply to major population centers.		**No**	The subproject shall not affect the water storage location that is responsible for supplying drinking watercho các trung tâm dân
Leads to any impacts such that the duration of the impacts is relatively permanent, affects an extensive geographic area or impacts have a high intensity.		**No**	Widening the spillway shall not cause any impact that is considered to be long-term and affect the widespread geographical area or impact at high intensity for 3 communes (An Sinh, Tan Viet and Viet Dan Commune)
8. Does the subproject have the potential to result in a broad diversity of significant adverse impacts?			
Multiple sites in different locations affected each of which could cause significant losses of habitat, resources, land or deterioration of the quality of resources.		**No**	Widening the spillway shall be performed by excavating in the mountainous region on the spillway's left shoulder. However,

Screening Questions	Yes	No	Remarks
			this excavation shall not lose living environment, natural resources, land or quality reduce the natural resource quality at a significant level.
Potential, significant adverse impacts likely to extend beyond the sites or facilities for the physical works.		**No**	The subproject not only causes significantly potential and adverse effects but also widen their effects out of the project of construction work.
Transboundary impacts (other than minor alterations to an ongoing waterway activity).		**No**	Widening the spillway of Khe Che resevoir only impacts three main communes (An Sinh, Tan Viet and Viet Dan) and adjacent area which belongs to Dong Trieu district.
Need for new access roads, tunnels, canals, power transmission corridors, pipelines, or borrow and disposal areas in currently undeveloped areas.		**No**	Because the workers and material yard are located in the management house area, the workers may use power and water with the management house. Machines may be transported through inter-commune road and soil road to the dam. Therefore, service road, tunnel, canal, power transmission corridor, new pipeline are not required for performing the project.
Interruption of migratory patterns of wildlife, animal herds or pastoralists, nomads or semi-nomads.		**No**	The sub-project site is not located in the area where there are activities of grazing animals, immigrants, semi residents and does not impact wild aminal's immigration cycles.
9. Is the subproject unprecedented?			
Unprecedented at the national level?		**No**	There are many dam rehabilitation and safety improvement sub-projects conducted in the entire country.
Unprecedented at the provincial level?	**Yes**		This is the first sub-project conducted at Quang Ninh with the purpose of upgrading and repairing the reservoir safety.
10. Is the project highly contentious and likely to attract the attention of NGOs or civil society nationally or internationally?			
Considered risky or likely to have highly controversial aspects.		**No**	Conducting the sub-project is not considered as risk or potentials with the controversial issue.
Likely to lead to protests or people wanting to demonstrate or prevent its construction.		**No**	The sub-project receives the support of local people and authorities (that is expressed

Screening Questions	Yes	No	Remarks
			through the community consultation process in the project area).

EPPENDIX A6.3. ADDITIONAL REQUIREMENTS AND SUGGESTED TOOLS

Does the sub-project entail these environmental impacts?	Yes	No	If Yes, Requirements
Encroachment on historical/cultural areas		No	
Use of explosive and hazardous chemicals		No	
Use of sites where, in the past, there were accidents incurred due to landmines or explosive materials remaining from the war		No	
Construction that could cause significant disturbance to the transportation, traffic routes, or waterway transport?		No	
Increase flood levels to downstream and reservoir sedimentation		No	
Acquisition (temporarily or permanently) of land (public or private) for its development	Yes		RAP is required
Use land that is currently occupied or regularly used for productive purposes (e.g., gardening, farming, pasture, fishing locations, forests)	Yes		RAP is required
Displacement of individuals, families or businesses		No	
Temporary or permanent loss of crops, fruit trees or household infrastructure		No	
Involuntary restriction of access by people to legally designated parks and protected areas		No	
Ethnic minority groups are living within the boundaries of, or nearby, the subproject.		No	
Members of these ethnic minority groups in the area potentially could benefit or be harmed from the project.		No	
Involve the construction of a large dam (i.e. higher than 15m or more than 3M cubic meter reservoir capacity)?	Yes		DSR is mandatory
Depend on water supplied from an existing dam or weir or a dam under construction?		No	

EPPENDIX A6.4. LEVELS OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS TO BE ADDRESSED

	Does the subproject entail these environmental impacts?	No	Low	Medium	High	Not known	Remarks
1.	Encroachment on historical/cultural areas	No					Headwork of Khe Che reservoir locates far away from the historial/cultural area (An Sinh Vuong Tran Lieu Temple and tomb

							of Trang Kings at An Sinh Commune)
2.	Encroachment on an ecosystem (e.g. natural habitat sensitive or protected area, national park, nature reserve etc....).	No					At Dong Trieu District, there is no sensitive natural habitat, reservation zone, conversation park, national park so the sub-project has not affected to the eco-system.
3.	Disfiguration of landscape and increased waste generation		✓				During the period of project construction and performance, there are 50 workers to frequently extend the spillway everyday so it emits (domestic solid waste, waste water). Moreover, the machines for the project also causes the emissions (petroleum and emission). However, the emission level from the workers and machines serving the works is predicted at low level.
4.	Removal of vegetation cover or cutting down of trees during clearance for construction		✓				Extending the spillway onward the mountain maybe cut the trees here when constructing.
5.	Change of surface water quality or water flows (e.g. Increase water turbidity due to run- off, waste water from camp sites and erosion, and construction waste) or long-term.		✓				The sub-project is constructed during 2 drought seasons, the construction process does not require water cutting, so the impact from the flow is not considerable. Waste water, solid waste from the tent zone (living activities of workers) can affect to water surface quality.
6.	Increased dust level or add pollutants to the air during construction			✓			Machines increase the emission amount of dust into the atmostphere during the construction. Because machines are reused so the level of emissions can cause the remarkable impacts on the rest of fresh-air environment.

7.	Increased noise and/or vibration			✓			The level of noise and vibration is usually increasing on daytime mainly when the machines for digging, transporting, filling at the end of dam and probes for finding and handling the termite are starting to operate.
8.	Resettlement of households? If yes, how many households?	✓					Sub-project does not require households relocation
9.	Use of resettlement site that is environmentally and/or culturally sensitive	✓					The sub-project has not selected the location that is sensitive about environment and culture to relocate.
10.	Risk of disease dissemination from construction workers to the local peoples (and vice versa)?		✓				At the site of the sub-project, there are about 20 workers living here to implement the works everyday during 2 drought seasons as well as share the common water source with the localities so it can create the water-born diseases.
11.	Potential for conflict between construction workers and local peoples (and vice versa)?		✓				The workers living in the tents shall have less conflicts with the localities. However, it still happens during the living activities (go to market, entertain …)
12.	Use of explosive and hazardous chemicals	✓					No blasting activities in the construction and no usage of harmful chemicals in the termite process.
13.	Use of sites where, in the past, there were accidents incurred due to landmines or explosive materials remaining from the war	✓					According to the survey, the area under the sub-project has no explosive materials left since the war time.
14.	Construction that could cause disturbance to the transportation, traffic routes, or waterway transport?			✓			The land locates 7 km far from the work site, adjacent to communal asphalt road and building materials are transported from Dong Trieu Town so the waterway can be messed during the construction. Construction process has not caused any difficulties for

							waterway.
15.	Construction that could cause any damage to the existing local roads, bridges or other rural infrastructures?		✓				Road in the area of Dong Trieu District is concreted, enduring the quite huge loads. However, there are some sections of earth road and old road on the line of machine transportation so they can be damaged by activities of the sub-project
16.	Soil excavation during subproject's construction so as to cause soil erosion		✓				Rock and soil being taken away from the moutains can cause the increasing of soil erosion in this area.
17.	Need to open new, temporary or permanent, access roads?	✓					Not require to newly open the temporary service roads. Line for temporary construction is performed right at the headwork of Khe Che reservoir.
18.	Separation or fragmentation of habitats of flora and fauna?	✓					The sub-project has just upgraded and extended the spillway so there is no division or diffusion into habitats of fauna and flora.
19	Long-term impacts on air quality	✓					The reused machines and tools can produce the dust into the atmosphere during the construction of spillway. However, the conditions of air pollution has not lasted for long, the self-cleaning ability reduces the air pollution in the future. Therefore, the sub-project just affects to the air quality in the temporary period.
20.	Accident risks for workers and community during construction phase		✓				This is the work for dam rehabilitation and safety improvement project so normal risks for the workers is mainly from usage of machines or accidents relating to water. For the localities, accident risks rarely happens to them because the area for constructing the sub-project is located

							far from the residential zone (only 10 households under the scope).
21.	Use of hazardous or toxic materials and generation of hazardous wastes		✓				Machines and materials for construction all are buiding materials, petroleum so the harm wasted is reduced to emit. In the process of living, the workers can release some harm wastes such the pathogens in their excrement (if that worker is sick or infected) or use several harm chemicals (detergent …).
22	Risks to safety and human health		✓				Generally, performance of dam rehabilitation and safety improvement project has just caused the low risks for human safety and health because of: -Discharging exhaust gas, dust and noise during 2 drought seasons. -Releasing the petroleum that can follow with the flow into the reservoir via the irrigation systems. -Emitting the wastes from the workers, affecting to the water source (excrement, waste-water …).
Does the subproject entail land acquisition or restriction of access to resources?							
23	Acquisition (temporarily or permanently) of land (public or private) for its development		✓				-Affected land area for forestry: 4,000 m^2. -Affected unused land area: 3,120 m^2.
24.	Use land that is currently occupied or regularly used for productive purposes (e.g., gardening, farming, pasture, fishing locations, forests)	✓					The sub-project has not utilized the land that is under the ownership or used for production purposes (for gardening, farming, grazing, fishing or covering the land with trees).
25..	Displacement of individuals, families or businesses	✓					
26.	Temporary or permanent loss of crops, fruit trees or household infrastructure	✓					There is no land for planting the rice or crops, fruit trees at all in the region of the sub-project. In case of relocating 10 households to another place, the sub-project

							shall not utilize the infrastructure of such land lots.
27.	Involuntary restriction of access by people to legally designated parks and protected areas	✓					-
Are ethnic minority peoples present in the subproject area?							
28	Ethnic minority groups are living within the boundaries of, or nearby, the subproject.	✓					Only some groups of ethnic minorities have got marriage with the residents within or near to the scope of the sub-project so these impacts are not remarkably.
29.	Members of these ethnic minority groups in the area potentially could benefit or be harmed from the project.	✓					In the scope of sub-project implementation, only several persons belonging to ethnic minorities (because of getting marriage with the residents) have not been under the influence of the sub-project
Does the subproject entail construction of or depend upon a dam?							
30.	Involve the construction of a large dam?		✓				Dam's height is 14m with the spillway of being extended to 24m and being in use. Dam of Khe Che reservoir can serve for activities of agriculture and aquaculture on the large scale.
31.	Depend on water supplied from an existing dam or weir or a dam under construction?	✓					Water in Khe Che reservoir does not depend on amount of water supplied from some dam or existing dam or under-constructing dam.

APPENDIX A7. PICTURES OF SUB-PROJECT

APPENDIX A7.1. PICTURES OF THE CURRENT STATUS OF THE PROJECT

Khe Che Lake

Spill and abutment of absorption

Scour hole after spilling

Khe Che reservoir dam

Termite nest in the dam body

Road to the dam

Management office

Households affected Area

APPENDIX A7.2. PHOTOS OF FIELD SURVEY AND PUBLIC CONSULTATION

Consultation in Tan Viet commune

Consultation at People’s committee of Tan Viet commune

Consultation at People’s committee of Viet Dan commune

Consultation in Binh Duong Commune

Working with Khe Che lake Management and Exploitation Co.,Ltd, in Dong Trieu, Quang Ninh

Working with management officer of Khe Che lake

APPENDIX A7.3. PHOTOS OF SAMPLING

Water sampling in Khe Che reservoir

Water sampling in Khe Che reservoir

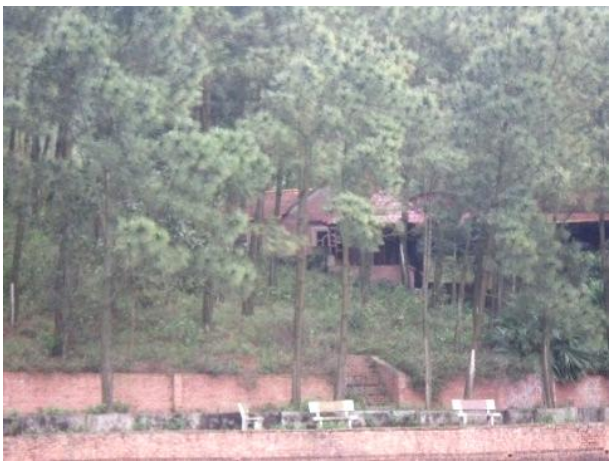
Water sampling in Khe Che reservoir

Water sampling at suntion tank of pump station in Tan Viet commune

Water sampling at a trench in An Sinh commune (near Khe Che reservoir)

Soil sampling at the field in Viet Dan commune

Coordiator measuring of location for sampling



An Sinh commune habitat

APPENDIX B. SOCIAL

APPENDIX B1. PUBLIC HEALTH INTERVENTION PLAN

1. The necessity of the construction of puplic health management plan

The activities of the subproject will generate impacts on the surroundings quality: air, water and soil environment, in addition it may arise disease. All these factors will affect directly 50 workers. The consequence of these effects lead to increase occupational accidents, traffic accidents, diseases related to respiratory and intestinal system and eyes.

There are 50 workers will directly contact with sources of pollution and disease from the activities of the project, although subproject have had measures to limit pollution such as dust, emissions, wastewater and epidemics, but there are potential impacts that we do not see immediately, so need to take measures for early detection of disease and sources of disease. The plan indicates the measures to minimize and prevent those impacts.

2. Objective

To control and prevent diseases, raise awareness of the people and the workers to protect health yourself; help people access fully medical services. Organize regularly medical examination to detect early disease due to impacts of the subproject; to build treatment plans for incidents related to diseases, occupational accidents and traffic.

3. Measure and content of public health management

- To train and raise awareness, prevent impacts on health
- Organize regularly medical examination for workers and people in the subproject region
- Build plan to minimize the impact on public health
- Build plan to prevent and treat diseases

4. Role and responsibility of agencies, organizations and individuals

Department of Agriculture and Rural Development (DARD)/ Project Management Unit (PMU):

- DARD and PMU are responsible for building materials about public health safety training.
- Coordinate all levels of authorities in An Sinh, Tan Viet, Viet Dan commune (local authorities, Fatherland Front, Women's Union, Farmers' Union, Youth Union, hamlet representative) organize propagandic activities about health safety.

Department of Health, Quang Ninh Preventive Medicine Center

- To train and raise awareness for all basic levels, contractors and residents about prevention measures and treatments of diseases;
- Check the medical examination process;
- To direct promptly when epidemics appear, resolving incidents related to public health.

People's Committee, Social Organizations

- To direct, guide and organize the health safety work; to coordinate closely with contractor, Department of Health and Preventive Medicine Center when epidemics appear.

Health Station: To prepare the medical examination plan and guide water pollution treatment, epidemic prevention and treatment.

5. Implementation Schedule

Public Health Management Plan implemented at 3 stages of the subproject and extended 6 months at operation stage.

Table B2-1. Implementation Schedule of "Public Health Management Plan"

No	Measure	Content	Responsible unit	Cost	Time
1	To train and raise awareness, prevent impacts on health	-Identify the impact of air and water environment, food safety. -Preventable measures (using a comforter when entering the affected area, treat water pollution by alum and chloramine B) -Cleaning household sector, ranch house	-Department of Agriculture and Rural Development (DARD) -Project Management Unit (PMU) - Dong Trieu district Preventive Medicine Center - Health Station at commune/ ward - Contractor	15.000.000 millions	2 stages in the early and the mid-stage of the project

No	Measure	Content	Responsible unit	Cost	Time
2	- Organize regularly medical examination for workers and people in the subproject region	- Check the health of workers 3 months/ time, residents in the affected areas 6 months / time - The diseases related to respiratory system, intestinal tract, eyes - To consult the affected people during examination - Advise or handle when the detection of abnormalities related to the impact of subproject (timely notify to the authorities and functional units)	- Department of Agriculture and Rural Development (DARD) - Project Management Unit (PMU) - Dong Trieu district Preventive Medicine Center -Health Station at commune/ ward - Contractor	Budget of Dong Trieu district	3 months/ time from the start of construction to 6th month
3	- Build plan to minimize the impact on public health	- Medical staffs at commune/ ward monitor regularly the implementation of the mitigation measures of construction units. - To treat timely occupational accidents and	- Department of Agriculture and Rural Development - Project Management Unit (PMU) - Budget of Dong Trieu district Preventive	Budget of Budget of Dong Trieu district and contractor	Continuously during the construction time

No	Measure	Content	Responsible unit	Cost	Time
		traffic - To vaccinate completely children, pregnant woman	Medicine Center -Health Station at commune/ ward - Contractor -Women's Union -Fatherland Front		
4	Build plan to prevent and treat epidemic	- To spray fly and mosquito-spray in the project area with the frequency of 3 months/ time. - To guide the water sanitation; use chloramine B for pretreatment of wastewater on work site and households. - When appearing epidemic, we need localize epidemic, isolate infectious objects and spray chloramine B to disinfect.	- Department of Agriculture and Rural Development (DARD) - Project Management Unit (PMU) - Dong Trieu district Preventive Medicine Center -Health Station at commune/ ward - Contractor -Women's Union -Fatherland Front	Budget of Quang Ninh province (Department of Health) and contractor	Continuously during the construction time (18 months)

APPENDIX B2. PUBLIC CONSULTATION, PARTICIPATION AND COMMUNICATION STRATEGY

1. The necessity of the construction of communication plan

The subproject "Repairing and upgrading headworks complex of Khe Che reservoir" cause impacts: (i) positive impacts: ensure safely for 3000 peoples in the downstream area, ensure stability source of domestic water supply for more than 1000ha of cultivated land, including 534 ha of rice ; (ii) negative impacts: acquire forest land, affect economy and public health, impact on gender equality…

The communication and public consultation plan is done throughout from the establishment of the investment project to the project operation. This helps local communities and managers to understand and visualize the entire impacts (positive, negative) to provide mitigation measures the impact on the natural environment and society, especially vulnerable objects include children, the elderly, women and sensitive ecosystem.

Information from communication and public consultation plan help managers, local authorities, monitoring unit to give decisions quickly or change timely decisions or plans during the project implementation.

2. Objective

To publish information about sub-project and provide all materials on the action plan to government at various levels, social organizations, unions and resident in sub-project areas. To consult local communities and organizations for the plan will be made for each stage of the project. The feedback helps the investors and the management level to improve plans to meet practical needs prior to the implementation of the action plan.

3. Contents

- Information on the subproject and policies of interest will be disseminated to people by Project Management Unit (PMU);
- Environmental and Social Management Plan: (i) the PMU and consultancy units provide information of impacts and mitigation measures; (ii) To consult the local authorities and social organizations, unions, people around the project area.
- Resettlement Action Plan: Provides information about land acquisition, resettlement, compensation cost apply framework and support policies of the subproject and the provisions of Quang Ninh Province and government at various levels, affected people
- Gender Action Plan: provides information about gender equality for the local authorities and social organizations, unions, people around the project area.
- Public Health Management Plan: provides information on the solutions, disease prevention plan, medical examination periodically.
- Social security, traffic safety, social evils: provide information about law, legal education for workers, people around the subproject area.

- Dam Safety: disseminate plans when occurring dam safety incidents in the construction process and the rainy season.

- Operate mining and flood discharge: provide information and detailed plans for the flood discharge to people around the project area and downstream area; make protection plan for the people, the buildings in downstream of the dam.

4. Forms of communication, community consultation

In order to organize the effective communication activities, need understand the basic elements of the communication process and public relations of them.

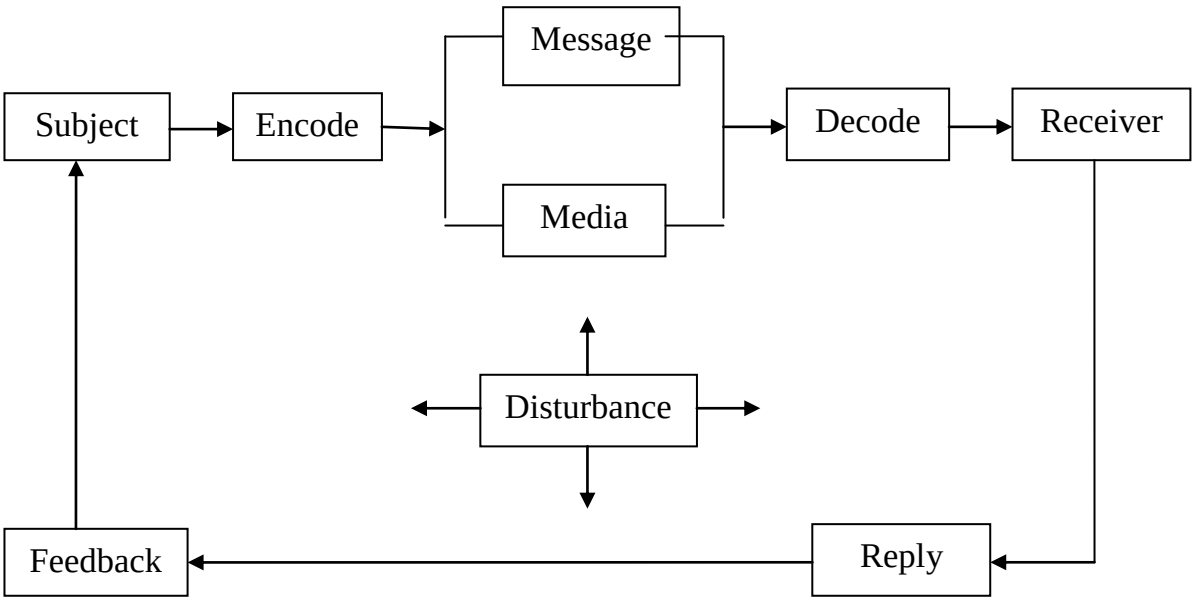


Diagram B2-1: The elements of the communication process

- Organize meetings to disseminate information for local authorities, social organizations, unions, people of the subproject region (An Sinh, Tan Viet, Viet Dan communes);

- Through the mass media, basis loudspeakers, commune and village boards.

- Issue brochures, consultative questionnaires to local authorities, unions, people of the subproject area;

- Through the activities of organizations and clubs;

- Training;

- Other media and information forms.

5. Role and responsibility of agencies, organizations and individuals

Department of Agriculture and Rural Development represents Quang Ninh province people's committee is an investor, and Project Management Unit for investment and construction in Agriculture and Rural development of Quang Ninh province is the project implementation unit.

Department of Agriculture and Rural Development (DARD)/ Project Management Unit (PMU):

- DARD and PMU are responsible for building materials about communication plan and participatory public consultation.

- Coordinate government at various levels in An Sinh, Viet Dan, Tan Viet commune (local authorities, Fatherland Front, Women's Union, Farmers' Union, Youth Union, hamlet representative) organize propaganda activities for this plan.

People's Committee, Social Organizations

- To direct, guide and organize the propaganda activities and disseminate contents of communication, participatory public consultation.

- Direct news agencies, local propaganda agencies to spend the appropriate time for disseminating plans and the impact of the subproject.

Land Clearance Committee

- Provide information about land acquisition, resettlement, compensation cost apply framework and support policies of the subproject and the provisions of Quang Ninh Province and government at various levels, the affected people.

Health Station: disseminate information on the disease prevention plan, medical examination periodically, solutions when having epidemic.

6. Implementation Schedule

The communication plan and participatory public consultation implemented under stages of the subproject; to provide completely information for local people and government at various levels.

Table B2-1. Implementation Schedule of "Communication Plan, Consultation with Community Participation"

No	Stage	Content	Form	Responsible unit	Receptive unit	Note
1	Preparation	Disseminate information, consult the authorities about subproject: scale, type of investment, the main works, incidence, benefits of the subproject.	Organize meeting at government at various levels, mass organizations.	DARD and PMU	Quang Ninh Province People's Committee, Department of Planning and Investment, Department of Finance, Department of Natural Resources and Environmen, Dong Trieu district People's Committee, Government of An Sinh, Tan Viet, Viet Dan communes.	
		Disseminate information about policies, compensation plan, the draft of resettlement action plan.	Meetings, leaflets, consultation votes at all government levels, the affected households around the subproject area.	PMU coordinate with design consultancy unit, resettlement action plan consultancy unit.	Dong Trieu district People's Committee, An Sinh, Tan Viet, Viet Dan communes, Women's Union, Fatherland Front, Farmers' Union, Cadastral Division of communes.	Perform 2 times: to prepare and present a draft of resettlement action plan
		Disseminate information about project, present the draft of ESIA and ESMP reports, gender plan, public health,	Meetings, leaflets, consultation votes at all government levels, the affected households around the subproject area	PMU coordinate with design consultancy unit, ESIA consultancy unit	Dong Trieu district People's Committee, An Sinh, Tan Viet, Viet Dan communes, Women's Union,	Perform 2 times: to prepare and present a draft of

No	Stage	Content	Form	Responsible unit	Receptive unit	Note
		communication etc.			Fatherland Front, Farmers' Union, Cadastral Division of communes.	resettlement action plan.
		Compensation and resettlement	Organize meetings to disseminate information about measure, counting, compensation plan, post information in noticeboard of commune/ precinct and village/ urban groups.	PMU coordinate with Compensation, Assistance and Resettlement Board	An Sinh, Tan Viet, Viet Dan commune People's Committee, Women's Union, Fatherland Front, Farmers' Union, Cadastral Division of communes.	Implement according to Resettlement Action Plan report.
No	**Stage**	**Content**	**Form**	**Responsible unit**	**Receptive unit**	**Note**
2	**Construction and Operation**	Gender Action Plan	Meetings, leaflets, basic broadcasting, consultation votes at government at various levels, the affected households around the subproject area	PMU and Social Supervising Consultant	An Sinh, Tan Viet, Viet Dan commune People's Committees, Women's Union, Fatherland Front, Farmers' Union, Cadastral Division of communes.	Implement in 3 phases of the subproject.
		Public Health Management Plan				
		Social Management Plan				
		Environmental Management Plan		PMU and Environmental Supervising Consultant	DONRE, An Sinh, Tan Viet, Viet Dan commune People's Committees, Women's Union, Fatherland Front, Farmers' Union, Health Station, Cadastral Division of	Implement in 3 phases of the subproject

No	Stage	Content	Form	Responsible unit	Receptive unit	Note
					communes.	
		Public order and social evils		PMU and contractor	An Sinh, Tan Viet, Viet Dan commune People’s Committees, Women's Union, Fatherland Front, Farmers’ Union, Health Station, Cadastral Division and Police of communes.	
		Traffic Safety and Fire Prevention and Extinction				Construction Stage.

Monitoring Assessment: PMU make a monitoring report of communication plan and participatory public consultation to control communication content, synthesize feedback from the Supervising Consultant Unit, local government, social organizations, unions and citizens to supplement or amend policies and measures of the management plan to suit each stage of the subproject.

7. Implementation Cost

The implementation cost of this plan is integrated with other plans (communication content and methods will be acquired and build by other plans. Social Management Plan chairs other plans related to social issue. Cost of this phase focuses primarily for broadcasting and organizations, the expected cost is 52,000 million (fifty two million VND) in 18 months.

APPENDIX B3. GENDER ACTION PLAN

(Summary and Details of plan can be referred to GAP report of subproject)

From the above analysis of gender, a gender action plan is needed to facilitate the full participation of women in the construction phase of the project, providing new opportunities for women to increase their income, but does not increase the burden on their lives, and contribute to increasing the role and status of women in the project area. The objectives of this plan are:

i) Local contractors will use at least 30% of female workers in the maintenance, construction and repair;

ii) For a similar type of work, female workers should be paid as male workers;

iii) The safety conditions must be equal for both men and women;

iv) The local contractor will not use child labor;

v) To encourage the use of local labor and avoid building labor camps;

vi) The women and women's Union will be consulted in the design of subprojects;

vii) Training on gender mainstreaming for the national, provincial and local authorities (ie the PMU, and other stakeholders);

viii) Training and capacity building for women's participation in the decision of the community and sub-projects implemented in a way that makes the most sense (ie training on participation and negotiation skills , marketing skills and training in mathematics and literacy;

ix) Ensure the participation of women in the study tour of the project

x) The agricultural extension services aimed at women are designed and delivered to women.

xi) The campaign to increase awareness about HIV/AIDS will be launched before the start of civil works. PMU is responsible for monitoring and reporting of key performance indicators gender action plan, including the participation of women, objective jobs and training, and the campaign to prevent HIV pandemic.

xii) At least one woman shall be representative of cummune in Commual Supervision Board (about 1/3 of the members)

Gender Action Plan of the Project

Result of the project	**Works and Indicators**	**Responsibility**	**Time**
Output 1: Increasing	The contractor will have to prioritize the use of unskilled	PMU/Project consulting coordinator will be	During construction phase

Result of the project	Works and Indicators	Responsibility	Time
dam safety, improving irrigation	labor (through subcontracting); must be at least 30% of the total labor force is unskilled in the locality; Of the 30% local labor, giving priority to female workers less skilled; Labour men and women will receive the same wages for the same type of job; The Contractor shall not employ children; These people want to work for the project will write their names on the list of villages/hamlets. Officer and the Head of the village and commune will provide this list to the contractor, the contractor will be selected on a priority basis poor and vulnerable households.	responsible for ensuring that these terms will be specified in the contract; communal officers will submit a list of contractors who want to work for the project The commual officers shall be responsible for ensuring the achievement of its objectives. Women Union is also responsible for ensuring that women in commune are employed to projects.	
Output 2: Strengthened capacity for people to take advantage of the subproject	At least 30% of women participates in the agricultural extension session	Provincial Project Management Unit Officer, District officer, Commual officer	During construction phase
Output 3: Raising awareness about the potential social evils for those vulnerable, especially women and ethnic minorities	Programme on HIV/AIDS and human trafficking. Risk mitigation programs based on community. Information about risk mitigation will be transferred to the communes and villages affected by the project using a participatory approach with a focus on the poor and vulnerable households (eg ethnic minority groups, households headed by women, households with elderly and disabled people); The documents and information must match the language, culture and gender, especially must be translated into many languages of ethnic depending on the	Provincial and commual Women Union shall be responsible for organizing and implementing the program (training and preparing materials) in collaboration with the communal and district healthcare center. WU of village shall promote and disseminate information Commune health centers, the district will have to support Women Union. Project consulting coordinator will provide domestic and international experts on gender and ethnic minorities.	Monthly, prior to and during the construction of project

Result of the project	Works and Indicators	Responsibility	Time
	region; Women Union, representatives of the HIV/AIDS center and commune will train social communicators for each commune/village in the project area. The program will be implemented at the commune and village by two propagators (village chief and one member of Women Union). The program will be implemented in the villages and in the fair by distributing of materials on project and program using loudspeakers.	Gender and ethnic minority experts will review the existing literature, supplement the necessity for program.	
	The risk reduction in construction process: PMU and contractors will coordinate closely with the health services in communes and districts to implement programs to raise awareness, education, prevention, diagnosis and treatment for workers; All programs and documents are built with integration of gender issues, including vulnerability and needs of men and women. Contractors will: - Implement programs to raise awareness for workers and communities including information, education, communication refers to the problem of HIV infection and guidelines of the precautions. - Free consultation and encouragement employees to do HIV test to ensure that all of them know about your health - Supports access health services and encourage people living with HIV to admit they have HIV - Supply of medical equipment	PMU Contractors Local health center Communal officers Women Union will coordinate to create greater synergy in the prevention of HIV	During construction phase

Result of the project	Works and Indicators	Responsibility	Time
	(free condom) for workers in the camps;		
Project management	- The guidelines on gender, development and training will be provided to the PMU staff, local organizations and contractors. All capacity development activities will include targets for women's participation and EM. Project performance consultant PMU in the design and initial implementation	- Project implementation consultancy - PPMU	During the process of design and initial implementation

APPENDIX B4. SYSTEM OF COMPLAINT SOLVING

Complaints relating to any matter of the project will be resolved through negotiations aimed at achieving consensus. The complaint will be passed through three stages before it can be submitted to court. Enforcement agencies will pay all administrative fees, related to legal complaints handling.

The resolution of complaints of the project will comply with Article 138 of the Land Law 2003; Article 28 of the Law of the Complaint; Article 63, 64 of Decree 84/2007/ND - CP; Clause 2 of Article 40 of Decree 69/2009 and regulation on complaints of Decree 75/2012/ND-CP dated 20/11/2012. Under Clause 2, Article 138 of the Land Law 2003 and 2013:

(i) Where the appeal with administrative decisions, administrative actions on land managed by the Chairman of the People's Committees of districts, towns and provincial cities where the first settlement of complaints, complaint does not agree with the decisions they have the right to sue at the People's Court or further appeal to the Chairman of the People's Committees of provinces and centrally-run cities. In the case of a complaint to the Chairman of the People's Committees of provinces and central cities, the decision of the President of the People's Committees of provinces and central cities is final.

(ii) In case of complaints against administrative decisions, administrative actions on land managed by the Chairman of the People's Committees of provinces and central cities solve first, the complainants disagree with the decision resolved, and they may initiate proceedings at people court.

(iii) The time limit for lodging an administrative decision, the administrative actions of Land Management is thirty (30) days after receiving the administrative decision or administrative decision acknowledgement. Within 45 days from the date of receiving the resolving decision of the first complaint, if the complainant disagrees, he/she has the right to appeal to the state authorized agencies or sue at the People's Court.

In complaints handling: Article 14 in the Law of Complaint: Rights and obligations of the first solver of complaints:

(i) The first complaint solver must:

a) Request the complainant, related agencies, organizations and individuals to supply information, documents and evidence within 07 days of the request as a basis for resolving complaints;

b) Decide to apply, cancel the emergency measures as defined in Article 35 of this Law;

(ii) The first complaint solver have the following obligations:

a) Receive the complaint and notice in writing to the complainant, agency, organization, or individual has the right to appeal and the state inspection agencies at the same level of acceptance on resolving complaints decision administrative, administrative actions;

b) Resolve complaints against administrative decisions, administrative actions when the complainant requires;

c) Organize a dialogue with the complainant, the complaint and related agencies, organizations and individuals;

d) Decide to resolve a complaint and be responsible before the law forresolving complaints, complaints of agencies, organizations and individuals concerned shall be notified settlement results to agencies, organizations and individuals in accordance with law;

e) Provide information, documents and evidence relating to the complainant when the complainant requests to provide records of complaints resolved when dealing with second complaint or request the court.

(iii) The compensation for the first complaint, the compensation for damage caused by administrative decisions, administrative actions must comply with the State law of responsibility.

(iv) The first complaint solver exercises the rights and obligations prescribed by law.

Disclosure of Decision on resolving complaints: Article 12 of Decree No.75/2012/ND-CP dated October 3th, 2012 of the Government detailing the implementation of some articles of the Law on Complaints

(i) Within 15 days from the date of the decision to settle complaints, who have jurisdiction to resolve the second complaint shall publish the decision to settle complaints in one of the forms specified in paragraph 2 Article 41 of the Law on Complaints.

(ii) In the case announcement at the meeting, the participants shall include the decision of resolving a complaint, complainants or their representatives, who complained and agencies, individuals concerned. Before conducting public meeting, the authorised person must notify to agencies, organizations and individuals involved 3 days before publication.

(iii) Notification of decisions to settle complaints on the mass media is done on television, radio, print and electronic media. The athorised person shall choose one of the mass media to inform. In the case of the bodies competent to resolve

complaints had portal or website, the decision must be made publicly available on electronic communications or electronic portal. Hits publicized on the radio: at least 02 times; on TV: at least 02 times; in the press: at least 02 times, while publishing electronic media, on the portal e-mail or website are at least 15 days after notification.

(iv) In case of listing at the office or citizen reception office of agencies, organizations have settlement of complaint; listing time is at least 15 days from the date of listing.

The stages of resolving complaints of the project include four steps:

(i) **First stage, People's Committee of Commune**:

The affected households may appeal to any members of the CPC, possibly through the village head or directly to the CPC in writen form. The mission of the CPC officials or village heads are to notify all the complaints to people's committee. The CPC will meet personally with the affected families and within 10 days will have to sign the appeal decision. Secretary of the committee is responsible for compiling and keeping documentation of all complaints that the Committee handles. The duration of the initial complaint does not exceed 30 days from the date of signing the appeal decision; for complicated cases, the prescribed time limit may be extended but may not exceed 45 days from the date of receipt of the complaint. In the remote areas, the time limit for resolving the complaint is no later than 45 days from the date of acceptance; for complicated cases, the time limit may be extended but not exceeding 60 days from the date of acceptance (Article 28, Law 02 // 2011 / QH13 dated 11/11/2011). If the first complaint is not resolved or from the date that the complainant receives the decision of the first complaint, if he/she does not agree with the decisions, they have the rights to sue a second complaint to The People's Court or District People's Committee.

(ii) **Second stage, People's Committee of District**:

According to Article 63 of Decree 84/2007 / ND - CP by the Government: the procedures for resolving complaints against administrative decisions, administrative acts of the President of the People's Committees at district level: (i) Within no more than ninety (90) days from the date that the Chairman of the district People's Committee issues an administrative decision or administrative acts in land management that is described in the Article 162 of Decree No. 181/2004 / ND - CP and if the involved people disagree with administrative decisions or administrative acts, they may sue a complaint to the district People's Committee (ii) the President of the district People's Committee is responsible to settle the complaint within 30 days from the date of signing the appealling decision. In remote areas, the time limit for appeal is 45 days from the date of acceptance; for

complicated cases, the time limit for settling complaints may take longer, but not later than 60 days from the date of acceptance. (iii) The settlement decision of the President of the district People's Committee shall be published and sent to the complainant and other involved people. (iv) Within forty-five days (45) days from receipt of the decisions of the president of the district People's Committee, if the complainant disagrees with the decision, they may sue the People's Court or appeal to the Provincial People's Committee. The time limit for appeal may be longer, but not more than 60 days from the date of receipt of the decision to settle complaints for complex cases. In remote areas, time of appeal is not later than 60 days from the date of acceptance, for complicated cases, the time limit for appeal may be longer, but not more than 70 days from the date of handling (Article 37, Law on Complaints No. 02/2011 / QH13 November 11, 2011). (v) The agency that receives a complaint shall record the case in book of resolving complaints.

(iii) **Third stage, People's Committee of Province**:

The procedures of resolving complaints against administrative decisions, administrative acts of the President of the Provincial People's Committee: (i) Within thirty (30) days (or 45 days for complicated cases) or within 45 days for remote areas (or 60 days for complex cases), since the president of the provincial People's Committee has decided to administrative acts administrative action in land management according to Article 162 of Decree No. 181/2004 / ND - CP, if the people who have relevant rights and obligations disagree with administrative decisions, administrative acts, they may submit a complaint to the Provincial People's Committee.

(ii) the President of the provincial People's Committees is responsible for resolving the complaint within the time limit prescribed by the Law on Complaints and denunciations. (iii) The decision to settle complaints by Provincial People's Committees shall be publicized and sent to the complainant and other involved people. (iv) Within forty-five (45) days from the date of receiving the decisions of the President of the Provincial People's Committee, if the complainant disagrees with the decisions, they may sue at the People's Court. The time limit for appeal may be longer but not more than 60 days from the date of acceptance for complicated cases. In remote areas, time of appeal is not later than 60 days from the date of acceptance; for complicated cases, the time limit for appeal may be longer, but not more than 70 days from the date of handling. (v) The agency that receives a complaint shall record in the book of resolving complaints

Final stage, court's arbitration: Within forty-five (45) days from the date of receiving the decision of the provincial People's Committee Chairman that the complainant is not satisfied with the decision that they may solve the petitioner's Court citizens (Article 64 of Decree 84.2007/ND-CP). While the complaint has not been solved, the decisions on land acquisition must be implemented. In the case of the authorities conclude the land

acquisition is unlawful, it must be stopped; the authorities issued land acquisition decisions have to cancel the decision and compensate for damage caused by land acquisition decisions (if any). Where the authorities have jurisdiction over complaints concluded the land acquisition is lawful, who have land acquired must abide by the decision. Within 30 days of trial of expropriation cases, the compensation, resettlement assistance will be paid to the affected households by amount specified by the Court. If the Court concludes that the land acquisition is legal, the person whose land acquisition must comply with the decision (Article 54 of Decree 84/2007/ND-CP).

APPENDIX B5. DESCRIPTION OF IMPELMENTATION PREPARATION INCLUDING ORGANISING, INSTITUTION, SUPERVISION AND EVALUATION

APPENDIX B5.1. IMPLEMENTATION OF EVALUATING REPORT

Responsibilities	Type of Report	Report content	Frequency of report submission	Receipent
Contractor	Report on Accident/incident	Gathering information about accident and incident	Within 24 hours from occurance	Project Managment Board, Construtction Supervision Consultant
	Report on violation	Supply information about social and environmental management regulation breach	Within one week from occurance	Project Managment Board, Construtction Supervision Consultant
	Report on revelation	Noting and reporting to the authority about the discovered relics and tombs…	Within 24 hours from discovery	Project Managment Board, Supervision consultant and Tourism, Information and Culture department
	Report on implementation of ESMP	Report on solution to minimize the impact to society and environment	Monthly	Project Managment Board
Construction Supervision Consultant	Report on implementation of solution to minimize the impact to society	- Evaluating implementation of solution to minimize the impact to society and environment of contractors - Result of resolving incident and measures	Monthly	Subproject Managment Board

Responsibilities	Type of Report	Report content	Frequency of report submission	Receipent
	and environment	to overcome the shortcomings of previous reports		
Independent Environmental Consultant	Report on independent supervision of social and environmental security	- Results of construction site investigation -Supervision results based on public -Summarising supervision results of construction superivion consultants -Environmental supervision results -Evaluationg mplementation results of ESMP and proposals	Every six months or every three months	Subproject Managment Board and WB
Subproject Managment Board	Report on environmental activities of subproject	Implementation results of ESMP	Every six months	CPO and WB

APPENDIX B5.2. RESPONSIBILITY OF RELATED PARTIES

Unit	Roles and Responsibilities		
	Subproject preparation	**Subproject implementation**	**Subproject operation**
CPO	Guiding for Safety Policy Officer of Provincial Project Management Unit (PMU) in the process of preparing reports on Inspection of assessment the impact of social environment Reviewing and giving advice for the report submitted by provincial PMB	Guiding Provincial PMB on implementation of environmental management plan during construction; Supervising construction progress; Gathering half-year reports on environment from Provincial PMB;	Guiding for Safety Policy Officer of provincial PMB on implementation of environmental management plan in the first year of operation; Supervising first year operation progress; Gathering reports on environment from Provincial PMB;
Provincial People's Committee	N/A	The project owner is the highest responsible for the environmental activities of the sub-project during construction;	The project owner is responsible for environmental activities in the operational phase, including implementation of the environmental management plan (EMP) in the operational phase;
Provincial Department of Agriculture and Rural Development/Subproject Management Unit	Hiring consultants and being responsible for the preparation of reports on evaluating the social environmental impact and obtaining approval; Ensuring full training on environmental issues for officers;	Being responsible for implementation of environmental management plan before and during construction; Ensuring contracts' details and tendering document including environemental requirements; Investigating and supervising environmental issues during construction; Coordinating environmental supervision report with	Being responsible for implementation of environmental management plan during the first year of operation; Investigating and supervising environmental issues during the first year of operation; Supporting project owner to propose environment requirements into operation procedures and works

Unit	Roles and Responsibilities		
	Subproject preparation	**Subproject implementation**	**Subproject operation**
		National PMB;	maintenance;
District People's Committee	Approving Commitment to Environmental Protection of subproject under Vietnam's regulations;	Supervising environmental management plan by their own system of internal supervision;	Supervising environmental management plan by their own system of internal supervision;
Community monitoring committee and members of the local community (CSBs [4])	Joining in consultancy activities and preparing subprojects; Giving advice on environmental assessment documents after they're introduced.	Joining the environmental supervision activities under the laws of Vietnam and in the training sessions	Joining the environmental supervision activities under the laws of Vietnam and in the training sessions
Construction Supervision Consultant	N/A	Undertaking training courses on environmental for supervision counselor; Joining environmental supervision under the approved EMP in the impact assessment report on the social environment; Preparing and submitting supervision reports to PPMUs	N/A

[4] CSBs is established in accordance with Decision No.80/2005/QD-TTg dated 18/04/2005 of Prime Minister on issuance of Public Monitoring Investment Regulation. Article 8 of Decree No.80/2006/NĐ-CP provides community opportunities to inspect the compliance, implement supervision and investment effect assessment in communes, including the environment impact.