**DAK LAK PEOPLE'S COMMITTEE**
**DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT**

**DAM REHABILITATION AND SAFETY IMPROVEMENT PROJECT (WB8)**

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

**SUBPROJECT: DAK LAK DAM REHABILITATION AND SAFETY IMPROVEMENT PHASE 1**

**Dak Lak, 2019**

**The Investment and Development for Resouces and Environment. JSC**
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**SUBPROJECT: DAK LAK DAM REHABILITATION AND SAFETY IMPROVEMENT PHASE 1**

| REPRESENTATIVE OF PROJECT OWNER | REPRESENTATIVE OF CONSULTANT |
|---|---|

**Dak Lak, 2019**

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# ABBREVIATIONS

| | |
|---|---|
| BOD | Biochemical Oxygen Demand |
| CPMU | Commune Project Management Unit |
| CSC | Construction Supervision Consultant |
| DARD | Department of Agriculture and Rural Development |
| DO | Dissolved Oxygen |
| DONRE | Department of Natural Resources and Environment |
| EIA | Environmental Impact Assessment |
| ECOP | Environmental Codes of Practice |
| EMDP | Ethnic Minority Development Plan |
| ESMP | Environmental Social Management Plan |
| ESMF | Environmental and Social Management Framework |
| ES | Environmental Supervisor |
| IPM | Integrated pest management |
| MARD | Ministry of Agriculture and Rural Development |
| OP | Operational Policy of the WB |
| PPMU | Provincial Project Management Unit |
| QCVN | National Technical Regulation |
| RAP | Resettlement Action Plan |
| RPF | Resettlement Policy Framework |
| TCVN | National environmental standard |
| TOR | Terms of Reference |
| WB | World Bank |

# EXECUTIVE SUMMARY

***Background.*** The Government of Vietnam loan from the World Bank for the "*Dam Rehabilitation and Safety Improvement*" Project to invest in improving the safety of dams and related works to ensure safety of people and socio-economic infrastructure of downstream community pursuant to Decree No. 114/2018/ND-CP dated September 04, 2018 on dam and reservoir safety management in Vietnam.

Currently, Dak Lak province has more than 550 hydraulic works, including 599 reservoirs. More than 50% of the hydraulic works in the province were invested and exploiting from 30-40 years ago. Therefore, some dams have seepage through dam body, intake structure is damaged, the spillway is not reinforced, flood drainage capacity is not guaranteed, there are potential risks of incidents and insecurity for downstream areas in the rainy season.

In order to take initiative in supplying irrigation water for agricultural cultivation for 1949 ha in Krong Pak, Krong Nang, Krong Buk, M'Drak, Ea Kar district and Buon Ho town and to repair, solidify dam body, reservoir construction items to ensure safety and convenience in operation, "*Dam Rehabilitation and Safety Improvement subproject - Dak Lak Province*" is proposed to be implemented..

***Overview of the Subproject.*** The Subproject's construction items include 10 reservoirs in Hoa Tien, Ea Yong, Dlie Ya, Phu Xuan, Cu Pong, Cu Bao, Ea Drong, Ea Rieng, and Ea Kmut communes. The objective is to support the implementation of the reservoir safety program through solidification and rehabilitation of priority dams, strengthening the management capacity and safe operation of the dams and to protect the downstream population and socio-economic infrastructure.

*Specific objectives:*

a) To secure the safety of reservoirs and key works.

b) To improve the efficiency of irrigation works in service of intensive cultivation, increase productivity and quality of products, develop specialized areas of high yielding and high economic value, maximize potential of agricultural land in the region.

c) To reduce water loss, to ensure the water demand for people's life, the development of local industries, and socio-economic development in the subproject area in particular and Dak Lak province in general.

d) To create natural landscapes, improve the ecological environment, promote tourism development in the region.

*Construction items:*

a) Repairing, upgrading earth dams, reinforcing dam crest, repairing upstream/downstream slope, repairing drainage systems and injecting waterproofing;

b) Repair, replace, build new offtake structure depending on the level of damage;

c) Solidified and renewed to improve flood drainage capacity, can expand spillway;

d) Management road: Depending on the current state of each reservoir, the construction of concrete pavement structures shall be built according to rural road standards.

***Preparation of ESIA***. The Subproject is designed and implemented in accordance with the Environmental and Social Management Framework (ESMF) of DRSIP project, which is approved by the World Bank and in line with the current laws of Vietnam. The purpose of ESIA is to identify the importance of environmental and social issues in the decision-making process by assessing environmental and social consequences of the proposed research before undertaking the project activities. Early identification and characterization of important environmental and social impacts will help communities and governments assess potential environmental and social impacts of the proposed subproject and apply mitigation measures to minimize the risk of such effects. The activities during the preparation, construction and operation of the Subproject are analyzed, evaluated and proposed to prevent and minimize impacts on environment and living of local residents. The results from screening 10/10 reservoirs meet the project criteria and the Subproject is classified as category B in terms of environment. It also triggers 05 safeguard policies, including OP/BP 4.01 (Environmental Assessment), OP 4.09 (Pest Management), OP/BP 4.37 (Safety of Dams), OP/BP 4.10 (Indigenous Peoples) and OP/BP 4.12 (Involuntary Resettlement).

***Environmental impacts and mitigation measures:*** Subproject impacts are both positive and negative

a) Positive impacts: 10 reservoirs at risk of unsafety will be rehabilitated and upgraded by work rehabilitation methods such as: rehabilitation of the dam cross section, treating the seepage via dam body and base, calculating and inspecting the discharge capacity of the spillway. ... to strengthen the ability of dam safety management and operation, to protect the inhabitants and infrastructure, society and economy at the downstream. At the same time, the reservoir rehabilitation contributes to the improvement of livelihoods and life quality for the inhabitants in the project area and promote socioeconomic development by promoting the effectiveness of investment in rural infrastructure, accessing and applying scientific and technical advances in agriculture, mitigating the loss of cultivation land, enhancing intensive cultivation and diversification in agriculture; providing stable employment opportunities for inhabitants, contributing to the sustainable poverty reduction, giving people better access to services such as health, education, markets, cultural exchanges, beliefs, etc…
b) Negative impacts in the pre-construction and construction phases: Potential negative impacts include acquisition of land. The survey results showed that the implementation of subproject items will permanently acquire 5,870 m2 of land (4,860m2 land for perennial crops, 230m2 annual crop land, 500 m2 residential land, 280 m2 aquaculture land) for construction works around the dam site. The subproject will acquire 189,200 $m^2$ of public land for workers accommodation and engineering material yards. This temporary land acquisition will not affect any household because the subproject only takes unused public land areas managed by CPCs and will return this land after completion of the project. 16

households will be affected by the subproject. The total number of severely affected households is 01 household, which has to ressetlle.. Impacts associated with construction activities include noise and vibration, air pollution due to dust and emissions, water and soil pollution due to dumping, social conflicts by workers migrating from other places to work, clean up vegetation, affected traffic, loss of income, risk of accidents. In addition to the general impacts, there are some specific impacts on reservoirs due to the transportation of materials. Structures under the subproject do not allow the water level to be lowered. The construction of downstream slopes, upstream spillway and renovation of the intake structure (if any) are done at the time when the water level in the reservoir is the lowest, so the construction does not have construction flow. Therefore, the subproject does not cutoff water for construction. The level of negative impacts is assessed as low to average.

c) Negative impacts in the operation phase: Potential negative impacts during the operation phase include: drowning risk because the reservoir is the area where inhabitants often come and go; there may be a volume of domestic waste including solid waste and sewage due to daily activities of the reservoir operators; water for downstream inhabitants may be cut off for a short time that directly affects their agricultural activities and livelihoods due to rehabilitation and maintenance activities; and can cause floods, damage to property, crops and lives at the downstream side due to emergency flood discharge and dam broken. However, the degree of potential negative impacts during this period is considered to be low due to the small volume of waste from operator's daily activities, the period of rehabilitation and maintenance is short, and because the characteristics of the sub-project is to improve dam safety.
d) Proposed mitigation measures for negative impacts during the preparation and construction phases: Land acquisition will be minimized through RAP while construction related impacts will be mitigated through application of ECOP and site-specific mitigation measure.
e) Proposed mitigation measures for negative impacts during the operation phase: Installing warning signs and propagating the risk of drowning to local people; limiting activities that can generate solid waste and wastewater, collecting and transporting solid waste to the treatment site, gathering wastewater into sedimentation tanks before discharging into the environment. People should be informed about any annual rehabilitation and maintenance plan. And such rehabilitation and maintenance activities should be conducted in a short period of time and at the time the demand for water is lowest. Emergency flood discharge and dam burst will be mitigated by the "Dam Safety Report".”.

***Institutional arrangement:*** The CPMU recruits and hires independent monitoring consultants and project support consultants to conduct independent monitoring and regular supports of project activities. They will assess the compliance with the safeguard policies and the implementation of the tools in practice. There are Environmental and Social Management

Plan/Environment Code of Practice (ECOP), Resettlement Policy Framework/Resettlement Action Plan, Ethnic Minority Development Plan, and Gender Action Plan.

For this Subproject, the PPMU is responsible for the implementation and monitoring of implementation of recommendations from the ESMP, ensuring that tenders and contracts include environmental covenants for Contractors' compliance. The Contractors will carry out construction activities and comply with environmental covenants in the contracts. The Contractor's environmental and social management plan (CESMP) is prepared and submitted for the PPMU's review and approval and sent to relevant units and disseminated to the community in accordance with the law of Vietnam before the Contractor commence the construction activities. The PPMU and its Consultants will monitor the compliance with the mitigation measures agreed with the Contractors. In addition, the Contractors' compliance will be closely monitored by the Department of Natural Resources and Environment of Dak Lak province, local authorities and local people.

***Capacity building:*** During the implementation process, PPMU receives support from CPMU on the World Bank's environmental safeguard policy. PPMU safeguard staff has been trained by CPMU in coordination with World Bank experts on compliance with environmental and social safeguard policies of the project, including OP 4. 01 (Environmental Assessment), General Guidelines for Environment, Health and Safety (EHS) of IFC, OP 4.04 (Natural Habitats), OP 4.09 (Pest Management), OP 4.10 (Indigenous Peoples), OP 4.11 (Physical Cultural Resources), OP 4.12 (Involuntary Resettlement) ... During the implementation of the subproject, training on environmental safeguard policies for the Consultant Construction Supervisor (CSC) and contractor EHS staff are carried out regularly to update them on relevant information. For PPMU, during the implementation of the subproject, the subproject will regularly receive support from CPMU's independent monitoring consultant and project implementation support consultant on the management of dam safety risk issues and supervision of the implementation of the Environmental and Social Management Plan (ESMP).

***Cost estimation for CESMP implementation:*** The costs estimated for the CESMP implementation include monitoring, implementation of mitigation measures and capacity building. The cost of implementing mitigation measures will be included in the construction cost.

| No. | Activities | Cost (VND) |
|---|---|---|
| 1 | Monitoring the CESMP implementation | 686,633,000 |
| 2 | Capacity building | 315,000,000 |
| | **Total** | **1,001,633,000** |

***The Grievance Redress Mechanism (GRM):*** Complaints related to the Subproject will be resolved by negotiations to reach consensus with locally-affected people. Complaints will be resolved through three stages before submission to court pursuant to the provisions of the Law on Complaints in 2011. The PPMU will pay all administrative and legal fees related to the receipt of complaints as it is included in the subproject budget

***Community consultation:*** Many different methods and techniques have been used to conduct community consultations, including a) community meetings, b) household surveys, c) focus group discussions, field monitoring and key informant interviews. The use of these methods and techniques is to improve the reliability and effectiveness of feedbacks from the subproject stakeholders, especially the locally-affected people and to ensure that (i) the affected households receive full information about the Subproject; and (ii) all affected households are involved in the free and informed consultation process during the preparation and implementation process. The first 9 consultation meetings were conducted in each commune of the sub-project in February and March 2018 with the participation of 25 to 30 AHs in each consultation. After the draft of the Environmental and Social Impact Assessment has been completed, Management board of dam rehabilitation and safety improvement subproject in Dak Lak province has sent a letter of consultation to the Commune People's Committees to hold the second consultation meeting in April and May 2018 with the same participants for the first time to consult local authorities, mass organizations and local communities on the draft Report on environmental and social impact. Furthermore, consultations will be conducted throughout the construction period to address issues related to assessing environmental and social impacts in a timely manner

***Information disclosure.*** In compliance with OP 4.01 policy and the World Bank's policy on access to information, since the preparation phase of the subproject, the information has been transmitted through mass media to the community. The PPMU disseminated and consulted the community in February & March, 2018 and sent information to local organizations. The draft ESIA in Vietnamese was sent to the CPCs for dissemination and consultation in April & May, 2018. Expectedly in August 2019, the final ESIA will be disclosed on the project website in Viernamese and the WB external website in English and at the subproject sitesaccessible to locally-affected people and local NGOs prior to subproject apparaisal.

***Conclusion.*** The Subproject: "*Dam Rehabilitation and Safety Improvement*" of Dak Lak province may cause negative impacts in the implementation phases, however, due to the small size of construction works, short-term impacts, limit in small area, impacts are negligible, therefore mitigation measures that are appropriate to the natural, socio-economic and management and construction conditions in the localities were proposed.

The management and environmental and social plans are set up to ensure that the subproject implementation complies with environmental, social, health and safety requirements in accordance with World Bank's safeguard policy requirements and current relevant laws of the Government of Vietnam. Monitoring and compliance with environmental and social management plans help local authorities, people and NGOs with regular update on the process of the subproject implementation. Construction supervision consultant will support PPMU to regularly monitor the subproject's environmental and social compliance and report monthly to PPMU. On that basis, PPMU will report compliance with the ESMP to the CPMU, WB and relevant agencies periodically.

# CHAPTER 1. GENERAL INTRODUCTION

Vietnam is one of the nations that own largest networks of dams and hydraulic infrastructure in the world, including 7,000 dams of different types and sizes. More than 750 dams are able to be classified as large dams (over 15m high or between 5 and 15m wide with the water reservoir storage in excess of 3,000,000 $m^3$). The number of small dams (less than 15m with the water reservoir storage lower than 3,000,000 $m^3$) is estimated to be over 6,000, which are mainly earth dams. Of the total 4,000,000 ha of agricultural land, more than 3,000,000 ha are irrigated by 6,648 dams.

Many small-medium reservoirs were built in 1960s with limited technical surveys, designs and construction in addition to limited and slow operation and maintenance. As a consequence, many have been degraded, unsafe and failed to meet the international safety standards. In addition, increasing risks of unstable hydrology due to climate change and massive upstream development make reservoirs at risks of subsidence of major structures, permeability to main dams and/or subsidiary dams/surrounding water-intake works, deformation of upstream/downstream slopes, spillway incidents etc.

Awareness of the importance of infrastructure for the country's sustainable economic growth, the Government launched a multi-sector program in 2003, including the "*Dam Rehabilitation and Safety Improvement Project"*(DRSIP) financed by the World Bank, which supports dam safety and reservoirs and operational safety to downstream populations and socio-economic infrastructure that are at risk, ensures the downstream integrated development planning and strengthens institutional coordination and future development and safe operation of reservoirs.

The Ministry of Agriculture and Rural Development (MARD) is responsible for the implementation and management of the entire project. The Provinces repair and upgrade dams under Component 1 and MARD will coordinate activities with the Ministry of Industry and Trade (MOIT) and MONRE under Component 2. The CPMU (under MARD) is responsible for coordinating and monitoring the entire project. The repair and preparation of dam safety plans, including protection and commissioning, are centered on provincial government. The Provincial People's Committee (PPC), the Department of Agriculture and Rural Development (DARD) are the managers at the provincial level. The PPMU is responsible for managing and supervising the works with the support from the CPMU.

The selection of rehabilitation dams by the Project was based on unified criteria, probability and severity of incidents and risks to human and socio-economic infrastructure, paying importance of economic benefits in the poverty and inequality framework. The assessment criteria for dam safety include: (i) dam incident probability (structural risk that is based on height and capacity); (ii) impact of dam incident on downstream people; (iii) impact of dam incident on downstream infrastructure, (iv) context of poverty and impact, (v) areas of ethnic minorities; and (vi) the readiness.

The Project is implemented in 34 provinces in the North, Central and Highlands. There are about 450 selected dams. The project components include:

- Component 1: Dam Safety Rehabilitation (Expected cost is *US$ 412 million, of which*

*IDA's funding is US$ 388.5 million*)

- Component 2: Dam Safety Management and Planning (Expected cost is *US$ 20 million, of which IDA's funding is US$ 17 million*)
- Component 3: Project Management Support (Expected cost is *US$ 11 million, of which IDA's funding is US$ 9.5 million*)

In the second year, the Project will support the repair and solidification of related infrastructure and dams. About 90% of the proposed dams are earth dams which are less than 15m high and their design capacity are less than 3 million $m^3$. The Project does not invest in completely changing existing structure or new construction or expansion of main structure but focuses on repairing and re-shaping structure of main dams, secondary dams, strengthening upstream slope by concrete and stones, reinforcing or expanding spillways to increase drainage capacity, repair or rehabilitation of existing intake culverts, replacement of hydraulic system at sluice gates (intake culverts) and spillway gate, drilling for waterproofing of the main dam bodies, upgrading service roads.

The Project will be implemented for 6 years, 08/7/2016 - 30/6/2022. With regard to the environmental safeguards, the ESMF of the Project was approved by the Bank in 2015. The Environmental and Social Impact Assessment (ESIA) for the next years of the subprojects will be prepared following the project progress and greements between the CPMU, the PPMU and the World Bank.

In Dak Lak province, the Dam Rehabilitation and Safety Improvement Subproject is to ensure the safety of the reservoirs through the repair and rehabilitation of 10 dams and strengthening management capacity and safe operation of dams to protect inhabitants and socio-economic infrastructure in 09 communes in Krong Pak district, Krong Nang district, Krong Buk district, M'Drak district, Ea Kar district, and Buon Ho town.

## 1.1 Approaches and methodologies

The Environmental and Social Impact Assessment (ESIA) is implemented in accordance with the World Bank's regulations and the Law on Environmental Protection and other laws and regulations of the Government of Vietnam. The purpose of the ESIA is to identify the importance of environmental and social issues in the decision-making process by assessing environmental and social consequences of the proposed research before undertaking the project activities. Early identification and characterization of important environmental and social impacts will help communities and governments assess potential environmental and social impacts of the proposed subproject and apply mitigation measures to minimize the risk of such effects.

### *1.1.1 Methodology for social impact assessment*

The objectives of the social assessment (SA), in parallel with the environmental assessment of the Subproject, include: First, it examines potential impacts of the subproject–positive and negative–on the basis of planned subproject activities. Second, it finds from the design of measures addressing potential adverse impact and proposing community development activities

that are relevant to the project development objectives. For identified adverse impacts, consultation with local people, governmental agencies, project stakeholders, etc., were carried out to ensure that affected people will be appropriately compensated and supported in a manner that their socioeconomic activities will be promptly and fully restored to the pre-project level, at least, and that their livelihoods will not be worse off, in the long run, as a result of the subprojects.

A part of the social assessment is ethnic minority (EM) peoples who are living in the subproject area and are confirmed by the EM screening (WB's OP 4.10). The consultations with them were carried out in a free, prior, and informed manner to confirm supports for affected EM peoples when there is the subproject implementation. The EM screening was conducted based on WB's OP 4.10 and implemented within the social assessment scope and area corresponding to the scope of the environmental assessment (according to OP 4.01).

A gender analysis in the subproject area was also done as part of the SA to understand gender features in the subproject area to enable gender mainstreaming to gender equality improvement and to enhance further development effectiveness of the subprojects and the Project as a whole. Depending on the magnitude of the identified potential project impacts and the project development objectives, a gender action plan and a gender monitoring plan were prepared.

To ensure that any potential impacts can be identified during the project preparation, the SA was conducted through series of consultations with the stakeholders. A particular focus was the households which are potentially affected (both positively and adversely) by the Subproject. The assessment techniques 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.

### *1.1.2 Methodology for environmental impact assessment*

During the ESIA survey and reporting, the Consultant Agency used a combination of the following methods.

**(a) Rapid assessment method**

The Rapid Assessment Method was issued by the World Health Organization in 1993. The basis of this method is based on the nature of material, technology, rules of processes in nature and experience to quantify pollutant discharge load.

In Vietnam, it has been introduced and applied in many ESIA studies, which performs relatively accurately the calculation of pollutant discharge under limited conditions of instrumentation and analysis. In this report, the pollution factors set by WHO are used to estimate the load and concentration of pollutants being generated during the construction and operation phase of the project, and assess the impact on the environment quantitatively and qualitatively.

**(b) The method of building impact matrix**

Establishing correlation between impact of each project activity on each issue and environmental component as shown on the impact matrix, which is basic for the focus on detailed contents of impact study.

**(c) Comparative method**

The comparison method is to evaluate the environmental quality, effluent discharge quality, pollutant discharge load... on the basis of comparison with the relevant environmental standards and regulations of MoNRE and MOH as well as related research and experiment topics.

**(d) Description of environmental system**

Identifying subproject components that affect the environment and identifying in full effluents, related environmental issues for detailed assessment.

**(e) Enumerating method**

It is used extensively (since the National Environmental Protection Agency (NEPA) has been established in some countries) and yields positive results thank to its advantages as mentioned above such as clear approach and systematic supply during system analysis and evaluation. There are two main construction items: A descriptive list of the environmental components to be studied along with measurement, forecasting and evaluation, a simple list of environmental components which are likely affected to be studied.

**(f) System analysis method**

This method is quite popular in the environment assessment. The advantage of this approach is the comprehensive assessment of impacts, which is very useful in identifying impacts and sources of waste. It is based on the assessment of waste sources, impacted objects, environmental components, etc., as the elements in a system have close relationship with each other, thereby, we can identify, analyze, and evaluate impacts.

**(g) Community consultation method**

This method is used during interviews with local leaders and local people to gather necessary information for the Subproject's ESIA preparation, introduction of benefits and possible negative impacts of the Subproject on the environment and the life. Based on that, we can aggregate feedback and aspirations of local people.

On the other hand, we can directly interview local officials and local people on socio-economic development, farming practices and environmental sanitation.

**(h) Method of reference, collecting and analysis of information and data**

This method aims at identifying and evaluating natural and socio-economic conditions in the subproject area through data and information collected from different sources like statistical yearbook, socio-economic report, current status of environment and related research works.

**(i) Field survey method**

Field survey is required when carrying out the assessment of social and environmental impacts to determine the current status of the subproject area, related objects and to select sampling locations, survey of status of water supply, drainage, electricity supply etc.

The consulting agency carried out topographical and geological surveys and collected hydro-meteorological data for design in accordance with the current standards of Vietnam. These survey results are used to assess the natural conditions in the subproject area.

**(j) Expert panel method**

Based on the knowledge and experience of environmental science of environmental impact assessment experts of the Consultancy Agency and other scientific research agencies.

**(k) Method of sampling and analysis in laboratory**

Sampling and analysis of environmental components (soil, water, air) is indispensable in identifying and assessing the status of baseline environment quality in the subproject area.

After field survey, the sampling and analysis program will be developed with the main contents as sampling locations, measurement and analysis parameters, manpower, equipment and tools in need, implementation time, sample preservation plan, analysis plan etc.

For Dak Lak subproject, the Consultant coordinated with the Environmental Monitoring Agency to monitor, take and analyze samples of air, water and soil in 10 reservoirs to assess the current quality of environment components. The sampling, analysis and preservation are in accordance with the concerned current standards of Vietnam.

**1.2 Preparation of ESIA report**

*Subproject management agency*

Department of Agriculture and Rural Development of Dak Lak province

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**Table 1. List of experts**

| No. | Name | Speciality | Task/position |
|---|---|---|---|
| 1 | Van Thi Ngoc Lan | Social Specialist | Team leader/coordinating the preparation of report |
| 2 | Bui Dinh Hieu | Environment Specialist | Team deputy leader/Field survey; environmental impact assessment |

| No. | Name | Speciality | Task/position |
|---|---|---|---|
| 3 | Ha Thuc Dung | Social Specialist | Community consultation; social impact assessment; preparation of resettlement plan. |
| 4 | Vu Trong Bang | Hydrologist/Irrigation Specialist | Field survey; environmental/hydrological impact assessment |
| 5 | Pham Trung Kien | Environment Specialist | Field survey; assessment of environmental impacts |
| 6 | Nguyen Ngoc Anh | Gender Specialist | Community consultation; Assessment of social impacts related to ethnic minorities gender |
| 7 | Nguyen Thi Hue | Ethnic Minority Specialist | Community consultation; Assessment of social impacts related to ethnic minorities |
| 8 | Le Thi Ngoc | Ecological Environment Specialist | Field survey; assessment of environmental impacts, biodiversity |

# CHAPTER 2. SUBPROJECT DESCRIPTION

The *Dam Rehabilitation and Safety Improvement Subproject* in Dak Lak province is being implemented in 9 communes:Krong Pak, Krong Nang, Krong Buk, M'Drak, Ea Kar district, and Buon Ho town. The infrastructure of 10 reservoirs, which were mostly built and exploiting since 30 to 40 years ago, have seriously deteriorated; most dam slopes have been soaked and in landslide, drains, intake-culverts, spillways are broken and management roads are damaged, which are in need of repair and upgrading to ensure the safety and operation of reservoirs.

## 2.1 Objectives of the Subproject

1) To secure the safety of reservoirs and key works.
2) To improve the efficiency of hydraulic works in service of intensive cultivation, increase productivity and quality of products, develop specialized areas of high yielding and high economic value, maximize potential of agricultural land in the region.
3) To reduce water loss, to ensure the water demand for people's life, the development of local industries, and socio-economic development in the subproject area in particular and Dak Lak province in general.
4) To create natural landscapes, improve the ecological environment, promote tourism development in the region.

## 2.2 Location of subproject

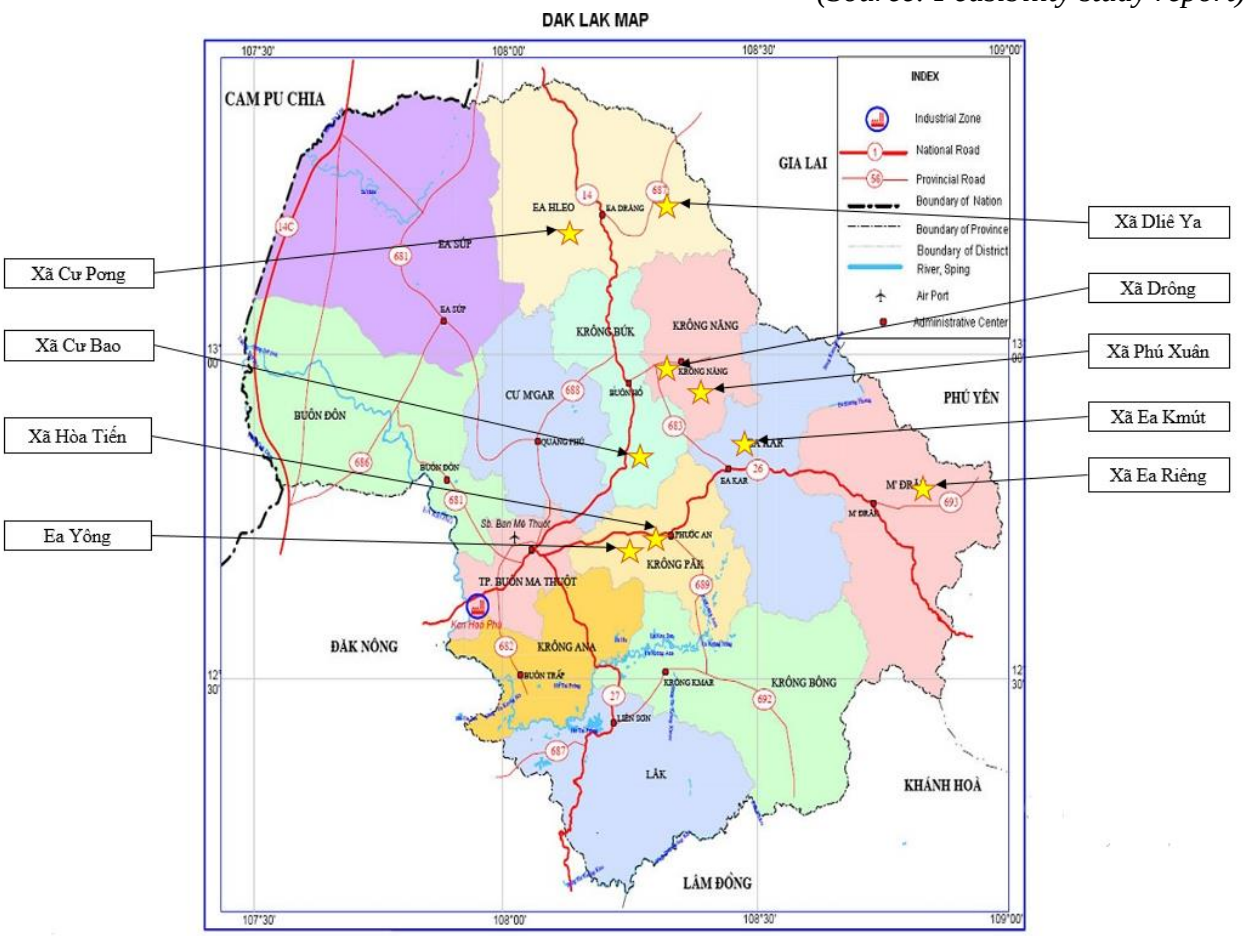
10 upgraded and repaired reservoirs of the subproject are located in 9 communes of 06 district/towns in Dak Lak province (Table 2):

**Table 2. Location for subproject implementation**

| No. | Name of reservoirs | Location of the project (VN2000) | | Level of works | H/W (m/ million m3) | Construction site |
|---|---|---|---|---|---|---|
| 1 | Ea Uy | X= 1401905 | Y= 479934 | III | 18/8.3 | Hoa Tien commune, Krong Pak district |
| 2 | Buon Dung II | X= 1400825 | Y= 474324 | III | 8.7/0.53 | Ea Yong commune, Krong Pak district |
| 3 | Ea Blong Thuong | X = 1449686 | Y = 484420 | III | 13.1/0.34 | Dlie Ya commune, Krong Nang district |
| 4 | Ea Kmien 3 | X = 1424053 | Y = 489343 | IV | 8.5/0.4 | Phu Xuan commune, Krong Nang district |
| 5 | Ea Bro 2 | X = 1443681 | Y = 463398 | III | 8.5/0.4 | Cu Pong commune, Krong Buk district |
| 6 | Ea Nao Dar | X = 1414200 | Y = 470913 | III | 9/0.25 | Cu Bao Commune, Buon Ho Town |
| 7 | Ea Ngach | X = 1426560 | Y = 482134 | III | 11/0.22 | Ea Drong Commune, Buon Ho Town |
| 8 | C19 (Doi 12) | X= 1411732 | Y= 533302 | IV | 14/0.78 | Ea Rieng commune, M'Drak district |

| No. | Name of reservoirs | Location of the project (VN2000) | | Level of works | H/W (m/ million m3) | Construction site |
|---|---|---|---|---|---|---|
| 9 | 725 (C32) | X= 1411339 | Y= 532250 | III | 10.1/0.49 | Ea Rieng commune, M'Drak district |
| 10 | Doi 11 | X = 1414238 | Y = 491995 | IV | 7.7/0.68 | Ea Kmut commune, Ea Kar district |

*(Source: Feasibility study report)*



## 2.3 Status of construction works and construction items

**Table 3 . Summary of current status of reservoirs and construction items of the subproject**

| Location | Current status | Work item | Status images |
|---|---|---|---|
| **1) Ea Uy reservoir**<br>in Hoa Tien commune, Krong Pak district | The work was built in 1980 to provide irrigation water for 207.3 ha of two-crop rice area, 344ha of coffee area and 6.45 ha of secondary crop area of Hoa Tien commune. Catchment area is 34.43 $km^2$, with net capacity of 3.76 million $m^3$ corresponding to the reservoir surface area of about 1.08$km^2$.<br><br>Homogeneous earth dam, 850mlong , 6m-width dam crest as rural road had degraded and unsafe risk. In the middle of the dam and the two shouders, there is leakage flow through the dam body and foundation, seepage streaks appear from dam downstream to downstream dam abutment, increasing the instability factors for downstream slope.<br><br>The entire entrance, the old overflow threshold and the first 15m slope of the flood discharge spillway have not been protected | ***a, Earth dam***<br><br><u>Dam crest</u>: : Width of dam crest B = 6m (equivalent to the current crest width); dam surface has a structure in sync with the road through the dam: The structure of the surface layer is 18cm-thick M300 cement concrete, the lower layer is crushed aggregates type 1, thickness of 150mm, the curb of the downstream edge is M200 concrete; in upstream, breakwater is made of M200 reinforced concrete with a height of 0.7m, a wall thickness of 0.4m<br><br><u>Upstream dam slope</u>: The section of the dam slope from the elevation of 483.80m up to the dam crest, with the slope coefficient m = 3.0 is reinforced by the poured-in-place M200 concrete slabs, the slab has dimension (3.0x3.0) and 10cm thickness, contains drainage holes, underneath lining cement paper against water loss of cement mortar, followed by macadam, filtered sand layer with thickness of 15cm each layer.<br><br><u>Downstream dam slope</u>: The downstream face is removed 0.5m on average, processed termites, reinforced for erosion by planting grass inside the drainage ditch made of crushed stone, the slope coefficient according to the new design is m = 2.75; 3.0. Backfill the hollow of the downstream face and make dam structure at the elevation of |  <br>  |

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| | and are strongly eroded, many locations are eroded deep into the shore, currently the old overflow threshold has been peeled and broken in many locations, annually management units often have to repair to ensure irrigation water.<br><br>In the rear slope, many mortared stoneworks have been degenerated on mortar circuits, with landslide in many locations<br><br>The two sides of the panel wall are completely eroded embankment, completely inert concrete due to surface water, water infiltrated from upstream.<br><br>Regarding the intake culvert, the working bridge surface is made of reinforced concrete slab, working bridge railing at the upstream of the steel shape culvert is currently severely rusty, does not ensure safety in the management and operation process, especially during the rainy season. The valves of the upstream culvert cannot be closed, the screw machines and worm screw are severely rusted. The downstream | 479.50 m, width of B = 3m (corresponding to the current dam mechanism). Drainage downstream of rock pile + drainage attic at downstream: rock piles with peak elevation of + 474m, width of 3m, rock pile length within range of old stream terrace and stream bed. Attic elevation for drainage of + 477.50.<br><br>Seepage treatment: Grouting for seepage treatment for dam body and dam foundation. Grouting for seepage treatment is conducted at the existing dam centerline; Depth of grouting from normal water level elevation to seepage bed with permeability flow of unit q <0.05 l/ minutes.m.m<br><br>***b, Flood discharge spillway*** Replacement the old spillway with a new spillway. The new spillway is located at the old spillway location. The threshold elevation = normal water level + 484.80m; width Btr = 45.0m; Structure by reinforced concrete M200; Beyond the spillway, there is a combination of traffic bridge to serve people's life and management, operation with capacity of 6 tons/ axis;<br><br>Water Slope: length L = 50.0m; i = 0.04; width Bd = 15.0m, structure by reinforced concrete M200;<br><br>Energy dissipater: By spray nozzle, structure by reinforced concrete M200;<br><br>Downstream channel: Maintain the existing downstream discharge channel<br><br>***c, Culverts for water supply*** The culvert is placed |  |

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| | stilling well has been damaged, valve gate and steel lining concrete surface has been rotted, completely damaged; The damper stilling well structure is often clogged due to branches, dry trees and floating objects in the reservoir, making management and operation difficult. | on the left abutment of the dam, 5.0m from the old sewer centerline to the left, the entire culvert body is placed on the clay soil layer. Threshold elevation of sewer + 476.00m. Length of sewer L = 102.60m. The culvert is designed with 02 sections, the front section is made of reinforced concrete M200, with BxH = (1,0x1,5) m; The rear section is made of steel pipe D1000, 8mm thick, outer covered with M300 reinforced concrete. Pressure-controlled culvert, open and close by downstream cone valve. The culvert tower has repair valves.<br>***d, Traffic road.*** The basic route follows the direction of the old road, only aligning locally the positions to ensure technical factors, ensure traffic safety visibility of curves with narrow corners and connecting with two dam crests. | |

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| **2) Buon Dung II reservoir**<br>in Ea Yong commune, Krong Pak district | Buon Dung 2 reservoir is built in 1992 to provide irrigation water for about 100ha of coffee area around the reservoir and downstream area. Catchment area of 6.8km$^2$, net capacity of 0.47 million m$^3$.<br><br>The upstream slope of the dam is not reinforced, so it is broken by waves. The dam surface has uneven height. At downstream of the dam, there is not drainage device, affecting the safety of earth dams in the long term. There is no bridge over flood discharge spillway. There are no culverts to drain water through the dam, which does not guarantee bottom discharge and provide irrigation water for downstream areas.<br><br>The project does not have sluices through the dam, so when the downstream needs water, it cannot regulate water, sedimentation and reduce the net capacity of the reservoir. | ***a, Earth dam***<br><br><u>Dam crest:</u> Heightening, embankment with soil. Designed crest elevation = 525.20m; elevation of breakwater = 525.70m, dam crest length L = 264.0m, dam crest width Bd = 6.0m, top crest surface is made of M300 reinforced concrete with thickness of 18cm. The edge of dam crest is reinforced with a concrete curb of M200.<br><br><u>Upstream slope:</u> Protect upstream slope with cast-in-place concrete slabs with dimension (3x5) 10cm thick, below are filtered sand and macadam layers, 15cm thick. Lay out from the dam crest to the elevation of the dead water level is 518,700m.<br><br>Upstream slope mt = 3.0. Decompose the upstream slope at the erosion position and re-embank by hand with an average peeling thickness of 0.3m. Lay out 10cm thick reinforced concrete slabs M200 from the top of the dam down to the height of 517.70m and pave stone in the frame of reinforced concrete M200 size 5x5m from + 517.7 or less to protect the upstream face, arrange 4 drainage holes with pipes PVC D34. Arrange a filter layer upstream of the upstream face with a 15cm thick gravel layer, and a 15cm thick layer of filtered sand below<br><br><u>Downstream slope</u>: Downstream slope $m_h$ = 2.75. Maintain the current status of lower slope, make drainage ditches and plant grass on the entire slope for protection. Downstream slope drainage uses a |  <br>  |

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| | | roof type combined with a drainage pile. The height of roof peak is +520.00m down to the height of the top of prismatic rock pile of + 518.00m. Treatment of termites and insects in current dam body.<br>***b, Flood discharge spillway:***<br>Break down the current flood spillway. New construction on the current route, 2.3m from the line centerline to the current spillway centerline to the right. Choosing the free flowing form with a cross-section of Cerizer Ophicerok. Spillway is divided into the following sections: Entrance, overflow threshold, water slope, stilling basin and channel leading to the stream. Drainage basin is drained to the bottom of the stream. On the spillway, there is a bridge passing over with width of 6.0m, loading 7 tons to serve construction as well as local traffic combination later. Free spillway with spillway threshold of 21m in arc shape, 14.8m from the top of the dam.<br>***c, Culverts for water supply***<br>Round culvert with D400mm diameter with outer steel pipe coated with reinforced concrete M300, regulated by 01 downstream cone valve and arranged 01 downstream repair valve. |  |
| **3) Ea Blong Thuong reservoir** | The project was built in the 1980s in order to irrigate 85.3 hectares of coffee area and secondary crop | ***a, Main dam***<br><u>Dam crest:</u> Width B = 5m; the dam surface has a uniform structure with the road passing through the dam: Dam slope structure is reinforced with stone | |

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| In Dlie Ya commune, Krong Nang district | area of inhabitants along the reservoir and downstream of the project. Catchment area: 2.40 $km^2$, net capacity: $0.2x10^6$ $m^3$.<br><br>The upstream slope has not been reinforced with reinforced concrete, slopes with overgrown grass, it is difficult to observe the dam cracks and seepage, there is no downstream drainage for seepage treatment on the dam body.<br><br>Under the effect of the wave, currently the dam has been eroded, causing instability. The downstream dam has a steep slope, due to lack of attention and protection, the seedlings and weeds are growing with the average height h = (3 ÷ 4) m. There is no occurrence of seepage, in the middle part of the downstream dam slope, there is no drainage device.<br><br>Spillway is made by soil, free flow, no bridge traffic overflow. The entire entrance, overflow threshold and the beginning of the unpaved slope and water slope have been eroded, eroded deep | concrete 1x2M300, arranged with wave walls and bundles of downstream seams with concrete M200.<br><br><u>Upstream reinforcement:</u> Slope coefficient m = 3.0, slope is reinforced with cast-in-place reinforced concrete M200 with (3.0x3.0)m size 10cm thick with drainage holes. Beneath the drainage holes is a layer of gravel, sand filter with a thickness of 15cm each layer.<br><br><u>Downstream slope</u>: In downstream slope, handle termites, reinforce to control erosion by planting grass, reinforce concrete drainage ditches, new slope coefficient according to design m = 2.75. Fill up the structure of the downstream drainage slope foot by applying the downstream drainage slope, the height of the slope top of ▼ 494.50m, the length of the slope drainage is in the range of the old stream bed and terrace.<br><br>***b, Spillway:***<br><br>Spillway is in free form. The threshold elevation = normal water level +498.20m; width Btr = 12m; The spillway is made of M200 stone concrete with 1x2 size, the bed is lined by M100 stone mortar with 4x6 size 10cm thick.<br><br>The section is narrowed after the length of 6.95m, the width is 12.0 -: - 4.6m, the cross section is rectangular, the structure is made of M200 stone reinforced concrete with 1x2 size, the bed is lined by M100 stone cement mortar with 4x6 10cm thick, the bed slope is 8.20%. |  <br>  |

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| | into the shore, all the above mentioned problems are at risk of insecurity for the project, life people's participation in traffic through the spillway and limiting the flood drainage capacity of the spillway.<br>The project does not have a water intake therefore, the area of rice and crops downstream does not have water for irrigation. | The rectangular traffic bridge is 5.0m long, 4.6m wide. The traffic bridge is made of M200 stone reinforced concrete with 1x2 size, the bed is lined by M100 stone cement mortar with 4x6 size 10cm thick, the bed slope is 8.20%.<br>The water slope is 45.0m long, 4.60m wide, its cross section is rectangular, the structure is made of M200 stone reinforced concrete with 1x2 size, the bed is lined by M100 stone cement mortar with 4x6 size 10cm thick, the bed slope is 8.20%.<br>The section in front of the stilling basin is 9.0m long, 4.6 -: - 6.6m wide, its cross section is rectangular and is made of M200 stone reinforced concrete with 1x2 size, the bed is lined by M100 stone cement mortar with 4x6 size 10cm thick, the bed has the shape of a curve according to the coordinates of the falling water.<br>The stilling basin is 12.0m long, 6.60m wide, the cross section is rectangular, the structure is made of M.200 stone reinforced concrete with size 1x2, the bed is lined by M100 stone cement mortar with 4x6 size 10cm thick, the depth of stilling basin is d = 1.50m.<br>Back yard is 10m long, the cross section is trapezoidal , the slope is m = 1.0, the bed part is 6.60m wide, 2.0m high, the structure is made of M200 stone reinforced concrete with 1x2 size, 30cm thick. The bed is lined by M100 stone cement mortar with4x6 size 10cm thick, bed slope |  |

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| | | is 0,1%.<br>Overpass bridge is made of M300 stone reinforced concrete with 1x2 sizefor non-motorizedvehicles, the width of the bridge is 3.00m (not including the work drawing), the bridge length is 5.40m.<br>Left spillway bank is poured with stone concrete M200 with size 1x2 10cm thick, average width from 2.25m to 3.00m to drain the hillside, andcombine with transport<br>***c, Culverts for water supply***<br>Culvert is made of steel pipe ϕ400mm 7mm thick, length (Fabricated at the factory), each segment is9.80m long and connected by field welding method, pipe pressure test is conducted before installing, the pipe shell is waterproofed and covered with asphalt reinforced concrete M.200 with 1x2 size, pipe joint is made of waterproofing joints with gaskets combining copper joints<br>The channel to the entrance of the culvert is 33.20m long by earth channel, trapezoidal section, slope m = 1.0. Channel bed elevation is 493.30m.<br>Elevation of the front yard is 493.30m, the length is 3.0m, trapezoidal section is 1.2m wide, 1.5m high. M.200 stone concrete structure with 1x2 size, the bed is lined by stone cement mortar M.100 with 4x6 size10cm thick.<br>The elevation of the entrance door is 493.30m, the length of the entrance is 4.5m, the rectangle section | |

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| | | is 0.8m wide, 1.5 -:- 2.7m high. 1x2 M.200 stone concrete structure, the bed is lined by stone cement mortar M.100 with 4x6 size 10cm thick.<br><br>Elevation of culvert threshold is 493.50m, length of culvert body is 32.18m, steel pipe structure ϕ8mm is 400mm thick, its outside is wrapped with reinforced concrete M.200 with 1x2 size, bed is lined by M.100 stone cement mortar with 4x6 size 10cm thick. Arrange 02 waterproofing walls which are made of M.200 stone concrete with 1x2 size along the culvert body.<br><br>Elevation of culvert outlet is 493.18m, stilling basin is 4.4m long, its cross section is 1.2m wide, 1.85m high. The structure is made of M.200 stone concrete with 1x2 size , the bed is lined by M.100 cement mortar with 4x6 size 10cm thick, digging depth d = 0.5m.<br><br>Following the energy dissipator is a backyard of 10m long, narrowing from 1.2m to 0.4m wide, gradually lowering from 1.0m to 0.5m, the structure is made of M.200 stone reinforced concrete with 1x2 size 15cm thick, The bed is lined by M.100 stone cement mortar with 4x6 size 10cm thick ,the bed slope is 0.1%.<br><br>The canal adjacent to backyard of the sewer is 30m long with rectangular section, size bxh = (0.4x0,5) m,. The structure is made of M.200 stone reinforced concrete structure with 1x2 size 15cm thick, the bed is lined by M.100 stone cement mortar with 4x6 size 10cm thick, the bed slope is | |

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| | | 0.1%.<br>The working bridge which is made of M.200 stone reinforced concrete with 1x2 size to operate and open and close the valve. The Collapsible valve system include flat valve size bxh = (0.65x0.7) m, valve frame, actuator and V5.0 open switch and 1 disk valve in the downstream. In addition, it is arranged to step up to the top and lower slope of useful stone concrete structure of 0.19 million m3. The upstream slope has not been reinforced, so it has been severely eroded. There is a shelter on the upper slope. The dam downstream has a steep slope, there is no 1x2 M.200 design to facilitate the operation of the sluice gate. | |
| **4) Ea Kmien 3 reservoir**<br>In Phu Xuan commune, Krong Nang district | The project was built in 1990s, serving irrigation for 80ha of coffee and crops of people in Phu Xuan commune, Krong Nang district. Catchment area is 2.85km$^2$, the capacity is under water drainage.<br>Safety corridors of dams are strongly encroached (people planted pepper trees, coffee ... on the flank sides, 50m from the foot of the dam, people have dug ponds). Before 2014, there was almost no flood drainage system, which was caused by the | ***a, Earth dam***<br><u>Dam crest</u>: Covering the top of the dam to upstream to reach a minimum width of 6 m according to traffic demand, reinforce the crest: Reinforced with 18cm thick concrete M300, below is 15cm thick macadam layer .<br><u>Upstream dam slope</u>: m = 2.75, reinforced with M200 cast-in-place reinforced concrete with 300x300x10cm size from the elevation of the dam crest down to elevation of + 531.00m. From elevation 531.00m or less, reinforced with thick paving stone 30cm placed in the frame of reinforced concrete M200 size 5x5m, the bottom layer is nylon layer and the lined reverse filter layer and sand filter is 15cm thick. |  |

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| | overflow of land which was occupied or landslided by people. By 2014 the government has built a flood spill on the existing overflow background. Due to limited funding, only construction of inlets, traffic bridges and overflowing roads will be built.<br><br>The project does not have a water intake, so it is very difficult to provide irrigation water for the downstream area. | Downstream dam slope: m = 2.50, build drainage ditches and plant protecting grass. The downstream slope drain is attic type, with the elevation of 530.31m. It is made of 30cm anhydrous stone structure which is placed on the back filter layer of macadam and 15cm filter sand. Length of attic drainage is within the range of old beds and springs. The toe of the dam is arranged with concrete drains.<br><br>***b, Spillway:*** Maintain the current state of the spillway, the entrance and exit sections, bringing the spillway threshold to upstream, removing the regulating valve at the bridge of spillway, connecting the part after the threshold to the entrance. Spillway structure for construction road is made of concrete, reinforced concrete M200. Energy dissipation is the stilling basin at the end of the water slope.<br><br>***c, Culverts for water supply:*** Construction of sluice gates with the following parameters: 5mm thick D400 steel pipe encased in M300 reinforced concrete and tapered valve layout for regulating downstream. Inlet and outlet are made of concrete and reinforced concrete M200.<br><br>***d, Road under management:*** Harden the section from the management road (linking the inter-commune asphalt road) to the dam surface with a length of 120.0m; Width of floor 6.0m; Width of face 5.0m. The road surface is made of M300 stone cement concrete with 1x2 size 18cm thick. |  <br>  |

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| **5) Ea Bro II reservoir**<br>Cu Pong commune, Krong Buk district | Ea Bo II reservoir in Cu Pong commune was built in 1988 to irrigate about 300 ha and 15 ha of surface water for aquaculture. Catchment area is 4.8km$^2$with net capacity of 0.48 million m$^3$.<br>The dam surface has uneven height. At downstream of the dam, there is not drainage device, affecting the safety of earth dams in the long term. Flooding by land, there is no traffic bridge spillway. At present, spillway has been seriously eroded in the stilling section, the downstream channel section.<br>The project does not have a water intake. Operating road: on the right abutment, there is no road, the left abutment of the earth road is narrow, protruding and difficult to walk. | ***a, Earth dam***<br>Dam crest: Field dams are earthy clay γktk = 1.36 T / m$^3$. Elevation of the crest of the designed dam = 580.0m, elevation of the top of the wave wall = 580.50m, the crest length of the dam L = 152.0m, the crest of the dam crest $B_e$ = 5.0m the top surface is concrete concrete M300 #. The edge of dam crest is reinforced with a concrete bundle of M200#. Planting grass to protect the lower slope, apply the downstream slope to waterproof the dam body.<br>Upstream dam slope: $m_t$ = 3.0. Ground leveling with flat slope coefficient m = 3.0 and reinforced with M200 cast-in-place reinforced concrete with (3.0x3.0) size 10cm thick with drainage holes on the ground of filtered macadam sand reverse. The underlayment of reinforced concrete sheet protects the upstream slope with macadam layer 15cm thick, the bottom layer is 15cm thick sand layer placed on the ground.<br>Downstream dam slope: $m_h$ = 2.75. Remove the soil to cover the lower slope and plant grass on the whole slope to protect. Arrangement of drainage ditch between the toe and the hill abutment, the drainage ditch is built from M75# stone cement mortar with25cm thick. Downstream face drainage uses a slope attic type combined with a drainage pile. Elevation of attic peak = 574.00m down to elevation of prismatic rock pile = 573.00m.<br>***b, Spillway:*** |  <br>  |

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| | | The location of the route will be perpendicular to the dam site and should be placed on the right abutment of the earth dam. Solidly constructed semi-circular form of Spherical Spheres, 2x4 M150 in situ cast and concreted structures with traffic and management using H13 bridge loads. Spillway threshold elevation is 577.80 m. Spillway water column Htr = 1.00 m. Spillway discharge Qtr = 46.45 $m^3$/S. Width of spillway threshold $B_p$ = 24.2 m. The entry section is 2.0 m long and 24.2 m wide. The spillway threshold is 1.5 m long, 24.0 m wide. The water slope is 92.0 m long with M150 concrete with 2x4 size, the bed slope I = 7%, the wide bottom is 20 m narrowing to 10.0 m. The transition section between the water governor and the stilling basin is 5.0 m long, the wide bottom extends gradually from 10.0 m to 14.0 m. Energy dissipator is 18.0 m long, 14.0 m wide, slope m = 0. The back yard is 30.0 m long, 14.0 m wide and 2.0 m high, the trapezoidal slope is m = 1.0. The bridge crossing spillway is designed with M200 stone reinforced concrete with 1x2 size for rudimentary vehicles, the width of the bridge is 5m (excluding handrail), the bridge length is 14.0 m, there is a pin in the middle. The total length of the overlay section is 148.5 m<br><br>***c, Culverts for water supply*** The length of 36.0m is made of an external 8mmmm thick 8mm steel pipe wrapped with M300 reinforced concrete. Elevation of entrance gate is 573.20 m, length of front yard is 8.5m, width is 0.8m, height is 2.5m, |  |

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| | | slope is m = 0. Stone concrete structure 1x2 M150. The elevation of the exit gate is 573.16 m, the length of the back yard is 5.0 m, the width of the bottom is narrowed from 1.0m - 0.5m, slope m = 0. The exit gate is built from M200 stone concrete structure with 1x2 size. Stilling basin is 5.0m long, 1.0m wide, 2.6 m high, slope m = 0. The stilling basin is built from M150 stone concrete with 1x2 size. The length of culvert body is 36.0 m, the structure is made of 600mm steel pipe, 8mm thick, the bottom is lined by M150 stone concrete 1x2 size. Regulated by D600 downstream valve and arranged a repair valve downstream. Downstream canal is 80m long with discharge of Qtk = 0.06 m3 / s, is responsible for irrigating the coffee area downstream of the work and return the basic flow to the old stream. The canal has a rectangular section with canal bed B = 0.5m, canal height H = 0.5m, slope m = 0, soil channel structure. In order to facilitate the process of construction, transport for production, increasing steadily and sustainably for the canal banks, the right bank of the canal is arranged with a 3 m wide road surface. The level of upper and lower slopes is convenient for the operation of the culvert.<br>***d, Operating road in combination with rescue*** Renovate construction roads and rescue and rescue on both sides of the dam about 300m long. The road surface is made of M200 stone cement concrete with 1x2 size 18cm thick. | |

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| **6) Ea Nao Dar reservoir**<br>in Cu Bao commune, Buon Ho town | Ea Nao Dar Irrigation Project was built in 1988 to irrigate 70ha of rice and coffee. Catchment area is 3.4km$^2$ with net capacity of 0.22 million m$^3$.<br>The dam is 194m long, the dam crest is 4m wide, eroded; upstream slope has not been reinforced, eroded and eroded; downstream slope has been planted with grass, built drains and has no downstream drainage equipment.<br>Sewers for water supply: Drain is still good, is operating normally.<br>Spillage of land, two-side left-over land slopes have been eroded, narrowing the aperture when flooding in the flood season can not be discharged completely very dangerous, unsafe to the earth dam, the downstream side is also severely eroded, which will affect earth dams. | ***a, Earth dam***<br>Dam crest: Earth dam is 194m long, dam surface is B = 4.0m; elevation of the dam crest + 660.8m. Dam surface structure: the bottom layer of stone slab of 4x6 M50 mortar is 10cm thick, the upper layer is made of M300 stone concrete with 1x2 size 18cm thick.Atthe upstream and downstream peaks of the dam, the crest edge is built by concrete M200.<br>Upstream dam slope: slope coefficient m = 3.0; reinforced with M200 cast-in-place reinforced concrete slabs with 10cm thick, the size cross section of (3.0x3.0m); The filtered layer below the ground is a 15cm thick layer of sand, the upper layer is 1x2 stone with a thickness of 15cm.<br>Downstream dam slope: slope coefficient m = 2.75; plant grass on the dam slope to protect, build drainage ditches between the dam slope and hillside by M100 stone. Drainage equipment after dam use rock pile and attic drainage type below is the filter layer including15cm thick gravel stone, 15cm thick sand; The height of the drainage device is 655.5m.<br>***b, Spillway:*** Spillway width is B = 26.0m; The entry section has a slope of 8%, after the entrance is a 8% water slope and the following part of the slope is the section of the stilling basin. Spillway is built from M200 reinforced concrete, the bed is lined by M100 stone mortar with 4x6 size. |  <br>  |

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| **7) Ea Ngach reservoir**<br>In Ea Drong commune,<br>Buon Ho town | Ea Ngach irrigation project was built in 1986 with the task of supplying irrigation water for 105ha of coffee, 20ha of two-crop rice, and secondary crop area of inhabitants along the reservoir and downstream of the project. Catchment area is 12 km $^2$with net capacit of: $0.21x10^6$ $m^3$.<br>The dam is 311.82m long, the dam crest is 3.5 - 4.5m wide, currently combining traffic; The structure of the dam slope is graded soil, the surface of the dam surface varies from 589.66m | ***a, Earth dam*** Width of dam crest $B_e$= 5m<br><u>Dam crest:</u> The dam crest is made of cement concrete stone 1x2 M300 20cm thick, the bottom lining is separated by asphalt impregnated oil paper, curb of downstream seams with concrete M200, 0.2m high.<br><u>Upstream dam slope</u>: Slope coefficient m = 2.75 is reinforced with reinforced concrete sheet M200 in place, sheet size (3.0x3.0), 10cm thick, with drainage holes below is nylon layer, filter layer, sand filter with a thickness of 15cm each.<br><u>Downstream dam slope</u>: Downstream slope is removed from downstream mud layer, termite nest is treated, reinforced against erosion by grass planting, drainage ditches are made of concrete combined with slope covering. Fill up the dam toe. |  |

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| | to 590.03m, does not guarantee the design elevation. No seawalls. The upstream slope has not been reinforced and has been eroded, the convex surface does not guarantee the dam slope coefficient. The downstream slope is unevenly eroded, the surface is convex, protruding, the average coefficient of m = 2.60 to m = 2.75 and the downstream drainage is not yet available.<br><br>Flood spillway has the form of free overflow, 15m wide, the entire entrance, the old overflow threshold and the unsecured protection ramp are now heavily eroded, many locations are eroded deeply from 1.0 - 2.0m. No bridge traffic overflow. Many risks cause unsafe for people in the rainy and stormy season. The work has a sewer drain but the garbage net has been completely damaged. Operating road has length of 50m, width of 5m designed according to rural road standards. | Drainage downstream use rock pile and attic drainage type, elevation of rock pile is ▼ 583.00m, the width is 2.0m, length of rock pile is within range of old beds and springs, peak elevation of slope is ▼585.00m.<br><br>***b, Spillway:*** Free flowing , Ophixerop threshold, , energy dissipator is stilling basin; have traffic bridge crossing spillway; the spillway is builft from M200 and M300 reinforced concrete.<br><br>***c, Culverts for water supply*** The sewer route is arranged on the left abutment of the dam. The culvert is made of cast iron pipe ϕ300mm. Flow with pressure which is regulated by downstream disc valve to supply irrigation water for the area downstream of the work. |  <br>  |

| Location | Current status | Work item | Status images |
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| **8) C19 Reservoir**<br>In Ea Rieng commune, M'Drak district | The project was built in 1973 with the task of supplying irrigation water for about 170ha of coffee area around the reservoir and 30 ha of rice in the downstream area. Catchment area is 5.72 $km^2$ withnet capacity of 0.33 million $m^3$.<br>Embankment dams with basalt soil, dam crest of 147m long, dam slope wide (3.5 - 4.5) m, high dam Hmax = 8.0m, elevation of dam crest ranges from elevation (460.35) ÷ 460.89) m; the upstream slope is broken, with the average coefficient of m = 2.75; The downstream slope has a slope coefficient of m = 2.75, planting protective grass, without drainage system; The dam surface has an uneven height. At downstream of the dam, there is not drainage device, affecting the safety of earth dams in the long term.<br>Semi-permanent flood discharge with construction stone: Located on the left abutment of the dam, the spillway has a width of Btr = 10.0m, the threshold elevation of | ***a, Earth dam***<br>Dam crest: Width B = 5.0m; the dam surface has a uniform structure with the road passing through the dam: M300 # concrete surface layer structure. Upstream edge is made of M200 concrete wall with a height of 0.5m. The edge of dam crest is reinforced with a concrete bundle of M200 #.<br>Upstream dam slope: Ground leveling with flat slope coefficient m = 2.75 and reinforced with reinforced concrete sheet M200 in place, sheet size (3.0x3.0) 10cm thick with drainage holes on the ground of reverse filtered macadam sand with thickness of 15cm.<br>Downstream dam slope: The downstream slope retains the current status m = 2.75, planting grass to compensate for the concave and concrete drainage ditches. Drainage downstream of the reverse filter layer in the form of slope cladding m = 2.75 from the elevation of 456.00m or less in the area of the old bed and terrace.<br>***b, Spillway:***<br>The section of the door in front of the spillway is 5m long, the width is narrowed from 45.0-28m, the spillway is built from M150# stone concrete with(2x4) size, 20cm thick, the bottom is lined by M100# stone concrete with (4x6) size10cm thick .<br>Spillway threshold is 3.3m long, 28.0m wide, it is built from M200 reinforced concrete covered with |  <br>  |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | 459.00m. Overpass bridge has aperture B = 1.2m. The traffic is very limited. At present, the spillway has been broken and temporarily repaired in 2015, the downstream canal has not been reinforced and has deep erosion with a place of nearly 2m.<br><br>The project does not have sluices through the dam, so when downstream needs water, it cannot regulate water. | M150 stone concrete with 2x4 size, the bottom is lined by M100# stone concrete with (4x6) size 10cm thick.<br><br>The first slope section follows from the threshold of 16.50 m long, width narrowing from 23.00m to 5.0m, slope i = 5.0%. The slope sections 2,3,4 and 5 after the first slope are 35.0m long, of which 6m length passes over the bridge crossing spillway, the width is 6m, the slope i = 5%. Slope is built of M200 # stone reinforced concrete with (1x2) size, the bottom is lined by M100# stone concrete with (4x6) size 10cm thick.<br><br>The continuous falling water section after the slope number 5 is 7.0m in length, extending gradually from 5.0m to 10.0m. Stilling basin is 10.0m wide, 13.0 long.The stilling basin is built of M200# stone concrete with (1x2) size, the bottom is lined by M100# stone reinforced concrete with (4x6) size, 10cm thick.<br><br>It is necessary to reinforce the canal behind stilling basin with a length of 20m , width of 10.0m, height of 3.5m with a trapezoidal cross-section, slope coefficient m = 1.00, arrange 100 gabions of anhydrous paving stones with dimensions (2x1x0.5) m / gabion and connect soil channel to the stream.<br><br>It is intended to arrange traffic bridges crossing spillway with a width of 5.0m, length of 5.0 m . It is built of M200# and M300# stone reinforced concrete with (1x2) size . The bridge will serve |  |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | | tasks for construction, project management and later intra-regional traffic combined with H13 bridge load.<br><br>Arrange back wall and bottom drainage holes to reduce pressure infiltration on the walls and bottom with a distance of a = 2.0m with the wall and a = 2.0m with the bottom plate from behind the threshold to the end of the stilling basin. | |
| **9) 725 Reservoir**<br><br>In Ea Rieng commune, M'Drak district | The reservoir was built before 1975, providing irrigation for about 95 hectares of coffee and 05 hectares of wet rice. Catchment area is 1.25km$^2$ with net capacity of 0.22 million m$^3$.<br><br>Embankment dams is made of basalt soil, dam crest is 140m long, dam slope is 5.0m wide, the height of dam Hmax = 12.2m, elevation of dam elevation is from (475,360 ÷ 476,530) m; upstream slope m = 2.75 is not reinforced and protected; The downstream slope has a slope coefficient of m = 2.75, there is no drainage system. At present the large diameter trees are growing on the | ***a, Earth dam*** Relocate the centerline of earth dam to downstream which is 5m above the current centerline.<br><br>Dam crest: Homogeneous dam is made of clay. Designed crest elevation = 476,800m; elevation of breakwater = 477,300m, dam crest length L = 144.0m, dam crest width Bd = 5.0m, top crest surface is made of M250# concrete. The edge of dam crest is reinforced with a concrete bundle of M200 #. The dam surface is 5m wide, the structure is made of M250 #stone concrete with (1x2) size-20cm thick. Arrange breakwater in the upstream, and shielding shores in the downstream. They are built of M250 #stone reinforced concrete with (1x2) size.<br><br>Upstream dam slope: $m_t$ = 3.25, upstream dam is at elevation of 471.00m, width of 3m, under slope coefficient mdc = 3.25, deep removal of soil layer at the toe of upstream dam into stable soil layer 2b, |  |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | downstream slope. Seepage occurs in the dam body and foundation from the dam base with the permeability length of about 70m, the permeability elevation is approximately (465-468) m.<br><br>Spillway is built of construction stone, lying on the right abutment of the dam. Spillway has B $width_p$ = 4.0m, there is There is no bridge crossing spillway. At present, the spillway has been completely damaged, the water flows freely through the threshold of spillway and cause the erosion pit. | fill up upstream slope by clayey soil $k_{tk}$ = 1.357T / $m^3$. Arrange upstream covered yard by heavy clay.<br><br>Paving M200 # stone steel mesh concrete D8 a = 20 stones with (1x2) size 10cm thick from the top of the dam down to the height of 465.800m to protect the upstream slope, arrange 4 drainage holes with PVC pipe D34 with filter floor which is filter sand and filter cloth on each slab on upstream slope.<br><br>Downstream dam slope: $m_h$ = 2.75. Removing organic soil and roots on the downstream slope and leveling to complete the downstream slope according to the design slope coefficient. Planting grass for the entire slope for protection. Arranging drainage ditch between the toe and the hill abutment. The drainage ditch is built of stone cement mortar M75 # with 25cm thick. Downstream slope drainage uses rock pile and attic drainage type . Elevation of attic peak = 469.500m , the elevation of the top of the prismatic rock pile = 467.500m.<br><br>Downstream slope drainage use attic type combined with prismatic drainage pile. Elevation of attic peak = 469.500m , the elevation of the top of the prismatic rock pile = 467.500m<br><br>Treating termites and insects existing dam body<br><br>***b, Spillway:***<br><br>Free flow, cross section is practical. Width $B_p$ = 17.5m, $H_p$ = 1.28m, threshold elevation = elevation |  <br>  |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | | of normal rising water level = 474.600m.<br>The section of the entrance in front of the spillway threshold is 1.7m long, 15.92m wide, it is built of M200# stone concrete with (1x2) size 20cm thick, the bottom is lined by M100# stone concrete with (4x6) size10cm thick.<br>Spillway threshold is 3.3m long, Btr = 17.5m wide, arc shape, it is built of M200# and M150# stone concrete with (1x2) size, the bottom is lined by M100# stone concrete with (4x6) size 10cm thick.<br>The first slope segment is connected to the toe of threshhold, the first slope is 9m long, its width is narrowed from 10.1m to 46.0m, slope i = 5.0%, its wall built of M200# stone reinforced concrete with (1x2) size, the bottom is built of M200# stone reinforced concrete with (1x2) size40cm thick and lined by, M100# stone concree with (4x6) size 10cm thick.<br>The second slope segment which is after the first slope is bridge crossinspillway, the second slope is 10.0m long, 4m wide, the slope is i = 5%, the structure is made of M200# stone reinforced concrete with (1x2) size, the bottom structure is built of M200# stone reinforced concrete with (1x2) size40cm thick and lined by M100# stone concrete with (4x6) size 10cm thick.<br>The third slope is 20m long, divided into 2 compartments with a width of 4.0m, slope i = 10.0%. Slope water is built of M200# stone | |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | | reinforced concrete with (1x2) size, the bottom structure is built of M200# stone reinforced concrete with (1x2) size40cm thick and lined by M100# stone concrete with (4x6) size 10cm thick.<br><br>The continuous falling water section after the third slope is 10.0m long, it widenes gradually from 4.0m to 7.0m and built of M200# stone reinforced concrete wih (1x2) size 50cm thick, its bottom is lined by M100# stone concrete with (4x6) size 10cm thick.<br><br>The stilling basin is 7.0m wide , 12.0 m long,its wall structure is built of M200# stone reinforced concrete with (1x2) size, the bottom structure is made of M200# stone reinforced concrete with (1x2) size 50cm thick, the bottom is lined by stone concrete with (4x6) size 10cm thick.<br><br>It is necessary to reinforce the canal after stilling basin, the canal is 22m long, 7m wide, 3m high, its cross section is trapezoidal, slope coefficient m = 1.0, arrange anhydrous paving stones with dimensions (2x1x0.5) m / gabion and connect soil channel to the stream.<br><br>It is intended to arrange traffic bridges crossing bridge with a width of 5.0m, a length of 6.0m. The bridge is built of M200# and M250#stone reinforced concrete with (1x2) size. The bridge is to serve the construction, project management and later internal traffic combined (if any), with a bridge load of 7 tons. | |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | | Arranging wall drainage holes and bottom drainage holes to reduce pressure infiltration on the walls and bottom with a distance of a = 2.50m with walls and a = 2.0m with the bottom plate from the threshold to the end of the stilling basin.<br>***c, Culverts for water supply***<br>Culvert is made of 5mm thick rolled steel pipe and covered by M200# reinforced concrete, the culvert diameter is D400mm, regulating culvert with open D400mm flat valves in the upstream. Regulated by open and close machine V5.0 placed above the working bridge.<br>The size of entrance is (bxh) = (2.7x0.8) m and the entrance is built of M200# stone concrete with (1x2) size, the bottom is lined by M100# stone concrete with (4x6) size - 10cm thick.<br>Culvert body is 57.60m long, slope i = 0.010, it is built of M200# stone reinforced concrete with (1x2) size, the bottom is lined by M100# stone concrete with (4x6) size 10cm thick.<br>Working bridge: L = 24.83m long, 1.5m wide. It is built of M200# reinforced concrete with (1x2) size 10cm, arranging guardrail which is made of steel pipe D49. The bridge is placed on 4 reinforced concrete pillars with the structure of M200 # (1x2). | |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| **10) Doi 11 reservoir**<br>Ea Kmut commune, Ea Kar district | Doi 11 reservoir has been put into use since 1986, with the purposes of irrigating 107ha of two-crop rice area, 124ha of coffee and secondary crop area of inhabitants along the reservoir and downstream of the project. Catchment area: 16.2 $km^2$, Net capacity: 0.47 million $m^3$<br><br>The earth dam is 848.3m long, the dam crest is 4.0m wide, combining traffic; Dam structure is graded soil, elevation of dam surface varies from 479.58m to 480.50m, does not guarantee the design elevation. The breakwater wall connecting the traffic between the two dam ends is not available and some sections are damaged; The upstream slope is reinforced with hard rock but has been eroded; Downstream slope collapses, average coefficient of slope m = 2.60 to m = 2.75 and downstream drainage is not yet available.<br><br>Spillway: The entire entrance, the old spillway threshold and the unsecured protection slope are | ***a, Main dam***<br><br><u>Dam crest:</u> Width B = 4m; the dam surface has a homogeneous structure with the road passing through the dam: The surface of ground layer is concrete M300 stone 1x2, 18cm thick, curb of downstream edge is made of M200 concrete, the upstream side is arranged with concrete wall M200 with a height of 0.77m, a wall thickness of 0.2m (according to the existing situation).<br><br><u>Upstream dam slope</u>:<br><br>The coefficient of slope m = 2.75 is reinforced with cast-in-place reinforced concrete sheet M200, with sheet size (3.0x3.0) and 10cm thick There are drainage holes on the upstream slope, below is gravel layer, sand filter with a thickness of 15cm each.<br><br><u>Downstream dam slope</u>: clear the downstream mud layer, handles termites, reinforces erosion by planting grass, concrete drainage ditches, the new slope coefficient according to the new design m = 2.75. Fill up for structure base. Drainage downstream use rock pile and attic drainage type, rock pile elevation is ▼ 474.70m with the width of 1.5m, length of stone pile is in the center of the river bed and old terrace.<br><br>***b, Spillway:***<br><br>The threshold elevation = normal rising water level = +477.90m; width Btr = 40m; it is built of M200 |  <br>  |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | now heavily eroded, many locations are eroded deep into the shore from 1.0 - 2.0m. No bridge traffic overflow. Upgrade, repair, do not extend overflow. BxH = 40x1,19m, $Q_{tk}$ = 104.27$m^3$/S.<br><br>The garbage net of the culvert has been completely damaged, not safe in the management and operation process, especially in the rainy season. | stone concrete with 1x2 size, the bed is lined by M50 stone mortar with 4x6 size 8cm thick. The narrow section after the threshold is 20.13 m long, 40 -:- 15m wide. Its cross section isrectangular, the narrow section is built of M200 stone reinforced concrete with 1x2 size, the bottom is lined by M.50 stone cement mortar with 4x6 size 8cm thick, bottom slope is 4.0%.<br><br>The section of traffic bridge is 5.0m long, 15.0m wide, rectangular section, structure made of reinforced concrete 1x2 M.200, the bottom is lined by M.50 stone cement mortar with 4x6 size 8cm thick, bottom slope is 4.0%.<br><br>The water slope is 40.0m long, 15.0m wide, the cross section is rectangular, the structure is made of reinforced concrete 1x2 M.200, the bottom is lined by M50 stone cement mortar with 4x6 size8cm thick, the bottom slope is 4.0%.<br><br>The section connecting to the stilling basin is 5.50m long, 15.0m wide, rectangular section, structure made of reinforced concrete 1x2 M.200, the bottom is lined by M50 stone cement mortar with 4x6 size 8cm thick. The bottom has the shape of a curve according to the coordinates of the falling water.<br><br>The section of the stilling basin is 15.0m long, 15m wide, rectangular section, it is built of M200 stone reinforced concrete with 1x2 size, the bottom is lined by M50 stone cement mortar with 4x6 csize 8cm thick, digging depth d = 1.0m. |  |

| Location | Current status | Work item | Status images |
|---|---|---|---|
| | | The back yard is 10m long, the section is trapezoidal with m = 1.0, the bottom width is 15.0m, the height is 2.6m, the structure is made of reinforced concrete 1x2 M.200, 40cm thick, the bottom is lined by M50 stone cement mortar with 4x6 size 8cm thick, the bed slope is 0.1%.<br>The bridge crossing spillway is built of M300 stone reinforced concrete with 1x2 size and use for rudimentary vehicles, the width of the bridge is 3.4m, the bridge length is 15.8m.<br>The spillway must be concreted with 1x2 M.200 concrete stone with thickness of 10cm, average width of 5m to drain the hillside combined with repair and transport. | |

## 2.4 The quantiy of earth work and machinery mobilization

### *2.4.1 Sources of engineering materials*

Subproject material suppliers are entities approved by local competent authorities. The locations and distance to the construction site are showed in the following table

**Table 4. Distance for material transportation**

| Reservoir | Engineering materials | Location and distance | Transport road |
|---|---|---|---|
| Buon Dung 2 | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Phuoc An town (12 ~ 25km)<br>Buon Ma Thuot city (40km)<br>Quarry of Hoa Tien commune, Krong Pak district (25km) | QL26, inter-village and inter-commune roads. |
| Ea Uy | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Phuoc An town, Krong Pac district (25km)<br>Ngoc Vi quarries (6km) | QL26, DT9, inter-village and inter-commune roads. |
| Ea Blong Thuong | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Krong Nang district (35km)<br>Krong Nang town or Buon Ma Thuot city (35km)<br>Cu Kpo quarries (30km)<br>Giang Son quarries in Krong Bong district (102km) | QL14, QL27, QL29, inter-village and inter-commune roads. |
| Ea Kmien 3 | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Phu Xuan commune, Krong Nang district (25km) | QL29, inter-village and inter-commune roads. |
| Ea Bro II | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Buon Ma Thuot city and commune center of Krong Buk district (45km)<br>Ha Lan quarries (15km)<br>Giang Son quarries in Krong Bong district (25km) | QL27, QL14, inter-village and inter-commune roads. |
| Ea Nao Dar | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Construction materials agents in Cu Pao commune (8km)<br>Quarry of Viet Ha Thong Nhat Ward - Buon Ho town (30km)<br>Giang Son quarries in Krong Bong district (25km) | QL27, QL14, inter-village and inter-commune roads. |
| Ea Ngach | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Ea Drong commune, Buon Ho town (35km)<br>Cu Kpo quarries (18km) | QL19, inter-village and inter-commune roads. |

| Reservoir | Engineering materials | Location and distance | Transport road |
|---|---|---|---|
| C19 | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | M'Drak town (10km)<br>Buon Ma Thuot city (55km)<br>Deo Lak quarries (30km)<br>Giang Son quarries in Krong Bong district (8km) | QL19C, QL26, DT9, inter-village and inter-commune roads. |
| 725 | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | M'Drak town (10km)<br>Buon Ma Thuot city (55km)<br>Deo Lak quarries (30km)<br>Giang Son quarries in Krong Bong district (8km) | QL19C, QL26, DT9, inter-village and inter-commune roads. |
| Doi 11 | Engineering materials of all kinds, concrete types, steel, stone, gravel of all kinds, sand, cement, wood, fuel. | Ea Kar town, Ea Kar district (2,5 ~ 12 km)<br>Son Ha quarries located in Cu Jang commune (22km)<br>Giang Son quarries in Krong Bong district (90km) | QL26, DT9, inter-village and inter-commune roads. |

### *2.4.2. Mobilization of vehicles and machinery for construction*

The number of vehicles and machinery being mobilized to serve the subproject items depends on the construction progress of different items and the construction time on site. In order to meet the construction progress and to complete the volume of works, based on the terrain of the site, the nature of work and the sources of material supply, it is estimated to arrange the main equipment for embankment and dam construction like truck 10T pay-load, concrete vibrator, concrete compaction machines, compactor, soil compactor 9T, bulldozers 110CV, and excavators 1.25$m^3$. Equipment and machinery for road construction, management and installation of monitoring systems include: Water Bowser Truck 5$m^3$, concrete vibrator, concrete compaction machines, bulldozers 110CV and concrete mixer 250L, 500L and generator. The details are in the table below.

**Table 5. List of machinery and equipment for construction**

| No. | Type of equipment | Quantity (unit) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Buon Dung II Reservoir** | **Ea Uy Reservoir** | **Doi 11 Reservoir** | **725 Reservoir** | **C19 Reservoir** | **Ea Nao Dar Reservoir** | **Ea Ngach Reservoir** | **Ea Bro II Reservoir** | **Ea Blong Thuong Reservoir** | **Ea Kmien 3 Reservoir** |
| 1 | Concrete mixer 250L, 500L | 8 | 10 | 6 | 7 | 7 | 8 | 10 | 3 | 2 | 4 |
| 2 | Concrete vibrator | 34 | 42 | 25 | 29 | 29 | 30 | 42 | 13 | 8 | 20 |
| 3 | Concrete compaction machines | 11 | 14 | 8 | 10 | 10 | 10 | 14 | 4 | 3 | 4 |
| 4 | Compactor | 8 | 10 | 6 | 7 | 7 | 8 | 10 | 3 | 2 | 6 |
| 5 | Soil compactor 9T | 8 | 10 | 6 | 7 | 7 | 8 | 10 | 3 | 2 | 4 |
| 6 | bulldozers 110CV | 4 | 5 | 3 | 40 | 40 | 4 | 5 | 2 | 1 | 2 |
| 7 | Excavators 1,25m3 | 8 | 10 | 6 | 7 | 7 | 8 | 10 | 3 | 2 | 4 |
| 8 | Truck 10T | 29 | 36 | 22 | 25 | 25 | 26 | 36 | 11 | 7 | 13 |
| 9 | Water Bowser Truck | 8 | 10 | 6 | 7 | 7 | 8 | 10 | 3 | 2 | 3 |
| 10 | Generator | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

*Source: Report on the total investment of the subproject, 2018*

### *2.4.3. Material quantity*

The construction quantiy of 10 reservoirs is shown in the table below:

**Table 6. Summary of construction material volume**

| No. | Material | Unit | Items | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Buon Dung II Reservoir** | **Ea Uy Reservoir** | **Doi 11 Reservoir** | **725 Reservoir** | **C19 Reservoir** | **Ea Nao Dar Reservoir** | **Ea Ngach Reservoir** | **Ea Bro II Reservoir** | **Ea Blong Thuong Reservoir** | **Ea Kmien 3 Reservoir** |
| 1 | Bricks | Ton | 286.44 | 458.30 | 409.2 | 1023.00 | 507.41 | 491.04 | 585.16 | 351.09 | 572.88 | 401.02 |
| 2 | Concrete | Ton | 405.44 | 648.70 | 579.2 | 1448.00 | 718.21 | 695.04 | 828.26 | 496.95 | 810.88 | 567.62 |
| 3 | Steel | m3 | 7.81 | 12.50 | 11.16 | 27.90 | 13.84 | 13.39 | 15.96 | 9.58 | 15.624 | 10.94 |
| 4 | Stone | m3 | 367.44 | 587.91 | 524.92 | 1312.30 | 650.90 | 629.90 | 750.64 | 450.38 | 734.89 | 514.42 |
| 5 | Macadam | m3 | 462.11 | 739.38 | 660.16 | 1650.40 | 818.60 | 792.19 | 944.03 | 566.42 | 924.22 | 646.96 |
| 6 | Sand | m3 | 409.36 | 654.98 | 584.8 | 1462.00 | 725.15 | 701.76 | 836.26 | 501.76 | 818.72 | 573.10 |
| 7 | Cement | m3 | 136.11 | 217.77 | 194.44 | 486.10 | 241.11 | 233.33 | 278.05 | 166.83 | 272.22 | 190.55 |
| 8 | Wood | Ton | 10.72 | 17.16 | 15.32 | 38.30 | 19.00 | 18.38 | 21.91 | 13.14 | 21.448 | 15.01 |
| 9 | Fuel | m3 | 12457.26 | 19931.61 | 17796.08 | 44490.20 | 22067.14 | 21355.30 | 25448.39 | 15269.04 | 24914.51 | 17440.16 |

*Source: Report on the total investment of the subproject, 2018*

## 2.5 Auxiliary items

### *2.5.1 Electricity and water for construction and living*

Near the main construction area, there is a national electricity grid crossing through. In order to use this power source, it is necessary to apply for a connection point to use. In the case of no wiring procedures, the construction unit should prepare backup generators.

Water used during the construction period includes water for construction, for domestic use, for fire prevention ... Domestic water is exploited from groundwater wells in the area, with water purification tank to ensure hygiene. Water for construction, especially water for concrete mixing is water from reservoirs, rivers and streams that is pumped into storage tanks for use.

### *2.5.2 Demand for workers' houses and camps*

The demand for construction workers at the subproject projects at peak time is up to 300 people for 10 projects (mainly managers and skilled workers, for simple work items, subproject hire local workers, about 20 personnels on a structure). Most of the construction sites are quite convenient to gather materials as well as to set up workers' camps. The material yards is located near the camping area to protect assets, it is also a temporary shelter for rain and sun. The construction sites are equipped with the portable toilets that meet the requirements of QCVN 01: 2011 / BYT on hygienic latrine standards.; Individual activities are carried out in the workers' camp area.

### *2.5.3 Landfill, borrow pits*

The landfills are located in the commune planning points, which are permitted by local authorities, households, and PPMU. The locations are suitable and convenient for transportation, minimizing impacts on environment and people's life.

The locations of the borrow pits for the Subproject are approved and licensed by the People's Committee of Dak Lak province. Soil materials in the construction items are exploited in the available mines according to the planning of the province, meeting the conditions to safety and environmental protection

Specific locations are showed in the following table

**Table 7. Locations of landfill, borrow pits**

| No. | Location | Landfill | Borrow pits | Appendices |
|---|---|---|---|---|
| 1 | Buon Dung II, reservoir Ea Yong commune | About 60m on the left of the reservoir. Landfill area is about 0.2ha. The total expected dumping volume is 3258 tons with a height of dumping soil of 0.8m. | Land for embankment is exploited on the spot, borrow pit is on the left hill of the reservoir. Transport distance is about 300 to 500m. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 2 | Ea Uy reservoir, Hoa Tien commune | On the right of the dam, in front and behind the reservoir, about 60-70m from the reservoir. Landfill area is about 6.2ha. The total expected dumping volume is 78222 tons with a height of dumping soil of 0.6m. | To make use of excavated soil to fill and exploit land at the borrow pit on the right of the dam. Transport distance is about 1.2km. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 3 | Doi 11 reservoir, Ea Kmut commune | About 120m on the right of the reservoir. Landfill area is about 1.5ha. The total expected dumping volume is 21359 tons with a height of dumping soil of 0.7m. | The embankment soil is exploited on the hillsides in the upstream of Ea Kar reservoir. Transport distance is about 1.5km. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 4 | 725 reservoir, Ea Rieng commune | About 90m away from the reservoir in the southwest. Landfill area is about 0.5ha. The total expected dumping volume is 25044 tons with a height of dumping soil of 2.4m.. | The 725 reservoir exploit soil on the left hill of the dam. Transport distance is about 250m. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 5 | C19 reservoir, Ea Rieng commune | About 130m away from the reservoir in the east. Landfill area is about 0.15ha. The total expected dumping volume is 7033 tons with a height of dumping soil of 2.2m. | Exploit soil on the right hill of the dam. Transport distance is about 400m. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 6 | Ea Nao Dar reservoir, Cu Bao commune | About 65m away from the reservoir in the northest. Landfill area is about 0.5ha. The total expected | The soil is exploited on the left of the dam with the area of 2500m2 and the exploitation volume of | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction |

| No. | Location | Landfill | Borrow pits | Appendices |
|---|---|---|---|---|
| | | dumping volume is 5689 tons with a height of dumping soil of 0.5m. | 2500m3. Transport distance is about 100m. | items are exploited at available borrow pits according to the planning of the PPC |
| 7 | Ea Ngach reservoir, Ea Drong commune | About 90m away from the reservoir in the west. Landfill area is about 2.4ha. The total expected dumping volume is 19177 tons with a height of dumping soil of 0.4m. | The embankment soil is exploited on the hillsides in the upstream of Ea Ngach reservoir. Transport distance is about 500m. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 8 | Ea Bro II reservoir, Cu Pong commune | About 110m away from the reservoir in the Southwest. Landfill area is about 0.5ha. The total expected dumping volume is 19540 tons with a height of dumping soil of 1.9m. | Land for dams is exploited on the spot, borrow pit is on the left hill of the reservoir. Transport distance is about 200-300m. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 9 | Ea Blong Thuong reservoir, Dlie Ya commune | About 80m away from the reservoir in the Southeast. Landfill area is about 0.8ha. The total expected dumping volume is 7636 tons with a height of dumping soil of 0.5m. Diện tích bãi thải khoảng 0,8ha. | Soil for embankment is taken at the hillside on the left side of the reservoir upstream. Transport distance is about 500m. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |
| 10 | Ea Kmien 3 reservoir, Phu Xuan commune | About 95m away from the reservoir in the North. Landfill area is about 1.0ha. The total expected dumping volume is 608 tons with a height of dumping soil of 0.03m. | Soil for embankment is exploited in the borrow pit in the lake. Reserves and quality of mines is ensured. Transport distance is about 200m. | Borrow pit is within the scope of the project and under the management of the reservoir's owner. Soil for embankment in construction items are exploited at available borrow pits according to the planning of the PPC |

**Ecological characteristics of borrow pits and landfill**: The borrow pits and landfill of the subproject are vacant land areas within the scope of management of the reservoir's owner. There is no valuable plants and animals that need to be protected.

### *2.5.4 Construction road*

**Table 8. The current status of roads of the reservoirs under the subproject**

| No. | Reservoirs | Current status of traffic road |
|---|---|---|
| 1 | Buon Dung II, reservoir Ea Yong commune | The project is located 500m from the inter-village road. At present, the road runs through the dam crest connecting the inter-commune road, with length of about 120m. The route is located on the side of the flood discharge spillway, during construction, this route is used to transport equipment, supplies, fuel, and embankment soil. |
| 2 | Ea Uy reservoir, Hoa Tien commune | The traffic and management road passing through the dam crest and connecting to the main traffic axis in Hoa Tien commune, currently as the earth road with convex road surface, many potholes, swamps, erosion in the rainy season, causing difficult traffic. Horizontal drainage, longitudinal drainage systems are not available.<br>The left shoulder of dam The management road section connects the existing asphalt road to the left shoulder of dam , about 286.6m long, currently the earth road, the width of the road surface is from 6.0 to7.0m.<br>The right shoulder of dam The existing rural road section connects to the right shoulder of crest, about 150m long, now is earth road, the width of the road is from 6.0-7.0m. |
| 3 | Doi 11 reservoir, Ea Kmut commune | The project is located in the area where infrastructure is available, only 600m from inter-village and inter-commune roads and there are earth roads to enter the project. |
| 4 | 725 reservoir, Ea Rieng commune | The project is located in an area with infrastructure, 500m from the inter-village road and a earth road to the project. Currently the inter-village road runs through the crest connecting the inter-commune road, the length of the road is about 110m of earth road. |
| 5 | C19 reservoir, Ea Rieng commune | The project is located in an area with infrastructure, 2000m away from inter-village and inter-commune roads and earth roads for construction, water for construction works from the reservoir is available. |
| 6 | Ea Nao Dar reservoir, Cu Bao commune | The road section at the top of the dam on the left and the head of the dam must be about 212m as a earth road, 3-3.5m wide, now degraded |
| 7 | Ea Ngach reservoir, Ea Drong commune | The project is located in an area with infrastructure, 500m from the main traffic road, inter-village and inter-commune roads are asphalt and earth roads. |
| 8 | Ea Bro II reservoir, Cu Pong commune | The project is located in an area with infrastructure, 2,000 m away from inter-village and inter-commune roads and has a earth road to the project. |
| 9 | Ea Blong Thuong reservoir, Dlie Ya commune | The project is located in the area where infrastructure is available, away from the inter-village and inter-communal roads are asphalt and earth roads. |

| | | |
|---|---|---|
| 10 | Ea Kmien 3 reservoir, Phu Xuan commune | Earth roads connecting with inter-commune roads and degraded rural roads, with irregular subsidence, seedlings and weeds growing densely. |

### 2.6 Pre-construction activities

Prior to the construction, there are some works like surveying topography, hydrology, meteorological conditions, geological drilling, land acquisition land marking, demining. Besides, in the subproject scope, it also includes demolition of structure and vegetation clearing of affected households that have affected trees and crops. Waste from vegetation clearing will be collected and transported to the communal dump sites by affected households.

Designing the Subproject to provide the options that take into account scenarios, risks of climate change on the performance of the construction items of the Subproject. The study on the climate factor change is presented in the section: the recent status of the subproject area, as a basis for selecting optimal design options. The recent impact of climate change in the region is mainly relating to the precipitation that results in floods, landslides and droughts.

### 2.7 Material transportation plan

Construction materials will be transported to site about 1 week before the starting of the construction. Construction materials will be implemented at certain periods of time to avoid negative impacts on agricultural activities and the daily life of local residents. Workers, machines and materials are estimated in the sections above.

### 2.8 Operational and maintenance activities

*Periodic dam safety monitoring:* Once the reservoirs have been filled with water and the dams started exploiting, the dam-owners are responsible for the dam safety monitoring. This assignment is carried out by qualified independent experts who did not participate in the investigation, survey, design, construction or operation of the dams. After the dams regularly operate, the monitoring stages are kept periodically, including the safety inspections prior and after flood seasons every year in accordance with the Government Decree No. 72/2007/ND-CP on dam safety management.

Upon completion of the works, the operation of the dams will be the responsibility of the dam owners and the responsibility of the PPMU will end.

*The reservoir and valve operation procedure:* A dam-owner must develop a reservoir water regulation procedure to regulate the storage and discharge of water in normal and emergency conditions of dam and reservoir to submit to authorized state management agency for approval and organize the implementation of the process. The dam owners must prepare and submit documents on operational procedure of valves and each work (hereafter referred to as protocolof operation) to the authorities for promulgation according to their competence. Other operations should be addressed pursuant to the Government's Decree No.114/2018/ND-CP on dam safety management.

### 2.9 Dam Safety Plan

A dam safety report (DSR) will be prepared for the Subproject. The objectives of the DSR are to present, analyse and make recommendations on: a) all conditions that may affect the safety of the dams and its associated facilities; b) impacts of the dam or substructure breaking or unable to work due to harsh natural conditions, human errors or structural faults; and c) the institutional framework (at the present time and in the future) necessary to avoid or minimize adverse conditions for the safety of the dams.

After the completion of the review at the subproject screening stage, the CPMU of MARD should provide a DSR for each subproject which is identified during the project implementation stage and sent to the international dam safety (PoE) and the World Bank for review. The report must include findings and recommendations for any related safety issues and necessary actions to be taken. The dam safety measures should be integrated into the design, construction and operation of the reservoirs.

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

- Review of the geological documents and material sources, with the attention to potential adverse effects that may occur by the predictable geological features. Assessment of unforeseen conditions and counter measures to address the safety and operation of the dams and the works.
- Assessment of the suitability of the types of dams and spillways, the response of the dam design. They include the proposed measures for soil treatment, excavation, load characteristics of selected substrate, permeability and pressure exertion control measures. The safety point of view for any abnormalities or omissions and measures to be taken will be paid attention to.
- Assessment of the stability, strength analysis and safety factors in normal conditions, abnormal and extreme load conditions for soil dams and concrete dams, spillway structure and drainage works, including the determination of geological impact criteria.
- Consideration of the factors of like reservoir stability, landslide formation, waves, and wave effects on dam stability.
- Consideration of the hydrological calculation method that determines the design flood of the project, reservoirs and spillway size; review of the designs of the spillways, e.g. the flow conditions and the energy dissipaters; assessment of the discharge capacity of the spillways corresponding to all design flood indicators that dams will not be damaged.
- Considerations for the water intake and discharge works, including hydraulic designs, emergency dewatering capacity and sedimentation process in the reservoirs.
- Assessment of the design of the spillways and out-door controls, including the selection of the number and types of outlets and valves, lifting equipment and other controlling mechanisms. Particular attention should be given to back-up systems to operate spillways which have gates and draining facilities in the event of operational and power failure.

- Review of the design of the flow diversion works, construction progress, hydrology and the risk factors associated with the flow diversion during the flow construction and filling process at the beginning stage of the reservoir water accumulation.
- Consideration of the suitability of the instrumentation, especially those instruments or markers which are required in the prediction of serious hazards or dam breakage.
- Consideration of the operation and maintenance procedures and the emergency response plan of the dam owners, including the assessment of sub-project operation and maintenance factors relating to dam safety and operators' capacity assessment to be able to perform the maintenance and inspections of the safety of the dams.

*Review and assessment of dam safety risks:* In addition to ensuring the dam's structure safety, the project will assess potential risks of the dams to the population and the environment in downstreams, including the related works. Dam breakage may not occur but if it happens consequences will be serious. Regarding this content, during the project preparation, as part of the DSR or environmental and social management plan, the subProject Owners should conduct assessing potential risks to the downstream population. For large dams with high-risks, it need to acquire comprehensive data during the preparation process, including topographic survey and downstream land use to simulate a flood in downstream area and dam and breakdown under different conditions/scenarios to serve the preparation of the emergency response plans. Collecting data from upstream dams and/or watershed activities may also be necessary for some dams. Planning and implementing capacity building programs for the subprojects with pilot activities to promote active participation of local communities should be considered. Communities around the dams can participate in daily monitoring to protect the dams from external destructors and they can join in simple maintenance tasks. A community participatory model in dam safety activities should be considered. Sedimentation and contamination of upstream water may be a serious problem for some river basins. The dam owners must commit to allocate funds for appropriate dam operation and management and to periodically survey dam safety.

**2.10 Time and cost of implementation**

Total investment: VND 192,633,589,000

Construction duration: 24 months

Signing construction contract and starting construction: 08/2019

Completion of construction: 08/2021

# CHAPTER 3. LEGAL, ADMINISTRATIVE AND POLICY FRAMEWORK

## 3.1 Vietnam Regulations

❖ ***Laws***

- Law on Environmental Protection No.55/2014/QH13 promugated by the National Assembly of Vietnam on 23/06/2014 and effective since July 2015. This Law provides the regulations on environmental protection activities, policies, measures, resources, rights, obligations and responsibilities of agencies, organizations, households and individuals in the environmental protection.
- Land Law No.45/2013/QH13 approved by the National Assembly of Vietnam on November 29, 2013, regulating the land ownership regime, powers and responsibilities of the State which is the representative of the land ownership of the whole people and unifies the management and use regime of land, rights and obligations of land-users in respect of land within the territory of the Socialist Republic of Vietnam.
- Law on Natural Disaster Prevention No.33/2013/QH13 approved by the National Assembly of Vietnam on June 19, 2013, regulating the natural disaster prevention and control, rights and obligations of agencies, organizations and household, individuals participating in the natural disaster prevention and control, state management and resources to ensure the prevention and control of natural calamities.
- Law on Water Resources No.17/2012/QH13 promugatedby the National Assembly of Vietnam on 21 June 2012 on management, protection, exploitation and use of water resources, prevention and mitigation of damages caused by water in the territory of the Socialist Republic of Vietnam.
- Law on Biological Diversity No.20/2008/QH12 promugated by the National Assembly of Vietnam on 13 November 2008 on conservation and sustainable development of biodiversity, rights and obligations of organizations, households and individuals in the conservation and sustainable development of biodiversity.
- Forestry Law No. 16/2017 / QH14 promugated by the National Assembly of Vietnam dated on November 15, 2017, stipulate management, protection, development and use of forests, along with processing and trade of forest products.
- Law on Construction No.50/2014/QH13 promugated by National Assembly, Session VII, on June 18, 2014;
- Law on Road Traffic No.23/2008/QH12 promugated on 13/11/2008;
- Law on Complaint No.02/2011/QH13 promugated on 11/11/2011;
- Law on Cultural Heritage No.10/VBHN-VPQH promugated on 23/07/2013;
- Law on Labor Safety and Health No.84/2015/QH13 promugated on 25/06/2015;
- Law on Dykes No.79/2006/QH11 promugated on November 29, 2006;

- Law on Irrigation No.08/2017/QH14 was approved by the National Assembly on 19/06/2017;
- Law on Plant Protection and Quarantine No.41/2013/QH13 promugated on 25/11/2013.

❖ ***Decrees***

- Decree No.38/2015/ND-CP dated 24/04/2015 of the Government on waste management and waste material.
- Decree No.18/2015/ND-CP dated 14/02/2015 of the Government on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan.
- Decree No.44/2014/ND-CP dated May 15, 2014 of the Government on land prices.
- Decree No.47/2014/ND-CP dated May 15, 2014 of the Government providing for compensation, support and resettlement when the State recovers land.
- Decree No.155/2016/ND-CP dated 18/11/2016 of the Government, providing for the sanctioning of administrative violations in the field of environmental protection.
- Decree No.25/2013/ND-CP dated March 29, 2013 of the Government on environmental protection charges for wastewater.
- Decree No.67/2012/ND-CP of the Government, amending and supplementing a number of articles of the Government's Decree No.143/2003/ND-CP of November 28, 2003, detailing the implementation of Article of the Ordinance on the exploitation and protection of irrigation works.
- Decree No.113/2010/ND-CP dated 03/12/2010 of the Government on the determination of damage to the environment.
- Decree No.112/2008/ND-CP dated October 20, 2008 of the Government on management, protection and integrated exploitation of natural resources and environment of hydropower and reservoirs;
- Decree No.120/2008/ND-CP dated 01/12/2008 of the Government on river basin management;
- Decree No. 114/2018/ND-CP dated September 04, 2018 on dam and reservoir safety management.

❖ ***Circulars***

- Circular No.27/2015/TT-BTNMT dated 19/05/2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan.
- Circular No.36/2014/TT-BTNMT dated 30/06/2014 of the Ministry of Natural Resources and Environment, detailing methods of land valuation; building and adjusting the land price table, specific land prices and land pricing consultancy.
- Circular No.37/2014/TT-BTNMT dated 30/06/2014 of the Ministry of Natural Resources and Environment, providing detailed regulations on compensation, support and resettlement when the State recovers land.

- Circular No.30/2014/TT-BTNMT on land allocation, land lease, change of land use purpose, land acquisition.
- Circular No.36/2015/TT-BTNMT dated 30/06/2015 of the Ministry of Natural Resources and Environment on the management of hazardous waste.
- Circular No.22/2010/TT-BXD of the Ministry of Construction on labor safety in construction of works.
- Circular No.19/2011/BYT-TT dated 06/06/2011 of the Ministry of Health, guiding the management of labor hygiene, health of workers and occupational diseases.
- Circular No.13/2007/TT-BXD dated 31/12/2007, guiding a number of articles of Government's Decree No.59/2007/ND-CP dated April 9, 2007 on solid waste management.
- Circular No.34/2010/TT-BCT dated 07 October 2010 of the Ministry of Industry and Trade, regulating the dam safety management of hydropower projects.

❖ ***Decisions***

- Decision No.52/2012/QD-TTg dated 16/11/2012 of the Prime Minister on the policy to support job creation and vocational training for laborers whose agricultural land is acquired.
- Decision No.3733/2002/QD-BYT dated 10/10/2002, issuing 21 labor sanitation standards, 05 principles and 07 labor sanitation criteria.
- Government Directive in Document No.21/CT-TTg dated 14 October 2013 on strengthening the management of reservoir safety.

❖ ***Applicable standards***

- QCVN 01: 2009/BYT: National technical regulation on drinking water quality.
- QCVN 02: 2009/BYT: National technical regulation on domestic water quality.
- QCVN 08-MT: 2015/BTNMT: National technical regulation on surface water quality;
- QCVN 09-MT 2015/BTNMT: National technical regulation on groundwater quality.
- QCVN 14: 2008/BTNMT: National technical regulation on domestic wastewater.
- QCVN 40: 2011/BTNMT: National technical regulation on industrial wastewater quality.
- .
- QCVN 38: 2011/BTNMT: National technical regulation on surface water quality to protect aquatic life.
- QCVN 03-MT: 2015/BTNTM: National technical regulation on limit of some heavy metals in soil.
- QCVN 15: 2008/BTNMT: National technical regulation on pesticide residues in the soil.
- QCVN 43: 2012/BTNMT: National technical regulation on sediment quality.
- QCVN 05:2013/BTNMT: National technical regulation on Ambient Air Quality.
- QCVN 06: 2009/BTNMT: National technical regulation on hazardous substances in ambient air.
- QCVN 26: 2010/BTNMT: National technical regulation on noise.

- QCVN 27: 2010/BTNMT: National technical regulation on vibration.
- QCVN 07: 2009/BTNM: National technical regulation on hazardous waste thresholds.
- QCVN 18: 2014/BXD: National technical regulation on construction safety.
- QCVN 04 - 05:2012/BNNPTNT: National technical regulation on hydraulic structures – The basic stipulation for design.
- Other relevant technical standards and regulations.

❖ ***Legal documents provided by the project owner***

- Decision No. 3091 / QD-UBND dated November 12, 2008 of Dak Lak Provincial People's Committee on detailed irrigation planning of river and stream basins in Ea Kar district;
- Decision No. 3092 / QD-UBND dated November 12, 2008 of Dak Lak Provincial People's Committee on detailed irrigation planning of river and stream basins in Krong Pak district;
- Decision No. 3086 / QD-UBND dated November 12, 2008 of Dak Lak Provincial People's Committee on detailed irrigation planning of river and stream basins in Krong Nang district;
- Decision No. 3473 / QD-UBND dated 30/12/2010 of the People's Committee of Dak Lak Province on approving the provincial irrigation development plan for the period of 2010-2015 and orientation to 2020;
- Decision No. 2893 / QD-BNN-KHCN dated November 30, 2015 of the Ministry of Agriculture and Rural Development on approving the "Environmental and Social Management Framework on Project WB8 on Dam Rehabilitation and Safety Improvement" .
- Decision No. 4638/ QD-BNN-HTQT dated November 9, 2015 of the Ministry of Agriculture and Rural Development approving the feasibility study report of the project "Dam Rehabilitation and Safety Improvement" (WB8) funded by the World Bank.

❖ ***Compliance with the environmental and social impact assessment***

The Subproject's environmental and social impact assessment will be carried out in accordance with the World Bank and the Government's environmental assessment procedures. In particular, it will be subject to the environmental and social management framework of the project that the WB reviewed and approved. Social and environmental screening will be conducted for each subproject to determine the appropriate size and type of the environmental assessment. Based on that, TOR will be prepared for environmental and social impact assessments in accordance with the subproject scope and the potential impacts expected from the subproject implementation. Environmental and social screening will be conducted by World Bank safety policy experts. The TOR for the environmental and social impact assessments will also be reviewed and approved by the World Bank Safety Policy Specialists prior to the implementation of the environmental and social impact assessments. In the process of the environmental and social impact assessment, consultations with affected people and local NGOs should be conducted. ESIA will be publicly

available at the place of the subproject implementation in Vietnamese language so that affected people and local NGOs can easily access and the English version will be available on the WB's website before the evaluation of the subproject.

## 3.2 The World Bank's safeguard policies

The objective of these policies is to prevent and minimize impacts to people and natural environment in the development process. The safeguard policies provide basis for stakeholders' participation in the project designs and act as an important tool for building ownership among local people.

The effectiveness and development of the WB's projects and programs has been increasing significantly as a result of attention to these policies. The World Bank's safeguard policies are available on the website at http://web.worldbank.org, where the environmental protection policies are published.

### *3.2.1 Project level*

The Project's environmental and social screening has been in accordance with OP 4.01 and indicated that the World Bank's Safeguard Policies on Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Indigenous Peoples (OP/BOP 4.10), Involuntary Resettlement (OP/BP 4.12), Safety of Dams (OP/BP 4.37), Projects on International Waterways (OP/BP 7.50), Pest Management (OP 4.09) and Physical Cultural Resources (OP/BP 4.11) will be applied to this Project. According to the environmental screening, the Project is classified as Category A. In addition, it needs to comply with the World Bank's requirements for public consultation and dissemination.

### *3.2.2 Subproject level*

*Environmental safeguard policies*

OP/BP 4.01 Environmental assessment

OP 4.09 Pest Management

OP/BP 4.37 Saefty of Dams

*Social safeguard policies*

OP/BP 4.10 Indigenous Peoples

OP/BP 4.12 Involuntary resettlement

**(a) OP/BP 4.01 Environmental Assessment**

This policy is going throughout the process of identifying, preventing and mitigating environmental and social potential negative impacts associated with the World Bank 's lending activities. In the work of the World Bank, the purpose of the environmental assessment is to improve decision making, ensure that the project options are being reviewed and sustainable and that the community to be likely affected must be consulted. The Borrower is responsible for environmental assessment (EA) and the World Bank advises the Borrower at their request. The

borrowing projects are proposed in four categories, depending on locations, sensitivity, scales of the projects, nature and extent of potential environmental impacts, including A, B, C and FI.

This Subproject activates OP 4.01 as it relates to the construction and operation that will have social environment potential negative impacts. Based on the results of the environmental screening, the Subproject is classified B in terms of environment. As defined in OP 4.01 and the Government's environmental assessment regulations, this ESIA is prepared for the Subproject to meet the requirements of the Government's regulations and the World Bank's safeguard policies. Upon appraisal, the ESIA of this Subproject will be publicly disclosed to the local people in the project area to ensure that affected people and local NGOs can access it easily and it will be disclosed through the World Bank website.

**(b) OP 4.09 Pest management**

The purpose of the pest management policy is to minimize and manage environmental and health risks associated with the use of pesticides, to promote and support safe, effective and environmentally-friendly pest management. The purchase of pesticides in a WB-financed project must be assessed for the nature and extent of risks involved, taking into account the proposed and intended use. For pest management affecting one of the two sectors of agriculture or public health, WB supports a strategy to promote the use of biological control methods and reduce reliance synthetic chemical pesticides. In Bank-financed projects, the borrower addresses pest management issues in the context of the project's environmental assessment. In appraising a project that will involve pest management, the Bank will assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. This subproject activate the policy because of the use of insecticides in termite treatment in dam bodies.

**(c) OP/BP 4.37 Safety of Dams**

This policy is enabled for the whole project because of the safe operation of dams related to the socio-economic development and environment. When borrowing from the World Bank for construction of new dams, a borrower must proposed a dam safety policy based on opinions of experienced and responsible experts in charge of design and construction supervision and that borrower, by way of the dam safety measures, will implement them throughout the project cycle. This policy also applies to the rehabilitation and improvement of existing dams, which affect the performance of a project. In this case, the dam safety assessment should be undertaken and additional dam safety measures should be proposed. OP 4.37 recommends that, in an appropriate circumstance, WB staff will discuss necessary measures with clients to strengthen institutional, legal and regulatory framework for dam safety programs of that countries.

**(d) OP/BP 4.12 Involuntary resettlement**

The Involuntary Resettlement Policy is to address long-term difficulties, poverty and environmental impacts on affected people during a resettlement process. OP 4.12 applies to regardless of whether an affected person is relocated or not. The WB describes all processes and results of "involuntary resettlement" or simply resettlement, even when affected people are not required to relocate. The resettlement is involuntary when the Government has the right to requisition of land or other assets, and when the affected people have no choice to maintain their current livelihood.

This policy is applied because this Subproject has effects on involuntary or temporary involuntary land acquisition and loss of affected land-related structures and assets for the construction of the Subproject. After appraisal, the Subproject prepared and disseminated a resettlement policy framework and a resettlement plan. The Resettlement Policy Framework and the Resettlement Plan includes measures to ensure that displaced persons (i) are informed of resettlement options; (ii) consulted and selected alternative resettlement options; and (iii) compensated and supported for livelihood restoration.

**(e) OP 4.10 Indigenous peoples**

This policy definition is that ethnic minorities can be defined in particular geographical areas by the presence of varying degrees of the following characteristics:

- Identifying themselves as members of a distinct indigenous culture group and being recognized for this feature by others.
- Living closely in identity geographic or territorial habitats that they were hesitated from their ancestors in the project areas and close to the nature of such habitats and territories.
- Their cultural, economic, social or political institutions are traditionally different from those of the majority of cultures and societies.
- Native languages are often different from official languages of such region or country.

The obligatory conditions for approving an investment project: OP 4.10 requires a borrower to undertake consultations and disclosures of information with ethnic minorities that are possibly affected and to establish a broad community support model for its subprojects and objectives. A project financed by WB shall include the calculations to (a) avoid potential negative impacts on ethnic minority communities; or (b) when avoiding is not feasible, measures should be proposed to minimize, mitigate, or compensate for impacts.

This policy is applied because the ethnic minority communities in the 9 communes in the area have benefited from the subproject.

**(f) WBG EHS Guidelines**

The Environment, Health and Safety Guideline (EHS) by a World Bank Group (WBG)/International Finance Corporation (IFC) was introduced in 2008. This is an important guideline on environmental, health and safety protection in industrial development and other projects. It set out the goals to be achieved and measures to be taken to deliver the best results at reasonable costs. This Guideline can be found at the website ***http://www.ifc.org*****.**

**(g) World Bank's policy on Access to Information**

In addition to the environmental safeguard policies to promote the transparency and the accountability, WB issued the Information Access Policy relating to proposed safeguard measures. It sets out the policy to support borrowers' decision-making by allowing them accessing information relating to social and environmental aspects of such projects at the website in native language, which is easy to understand and intuitive. The WB ensures that relevant environmental and social protection documents related to such projects as well as the preparation procedures related to subprojects are introduced timely prior to the appraisal. The World Bank's

information access policy requires disclosure of information in both English and Vietnamese languages and meets the World Bank's standards.

**Table 9. Summary of environmental assessment process of WB & Vietnam Government**

| The stages in the environmental assessment process | WB (OP/BP 4.01 on Environmental Assessment) | Vietnam (Decree No. 18/2015/ND-CP, Circular No.27/2015/TT-BTNMT) |
|---|---|---|
| **Screening** | - List of categories (A, B, C, FI)<br>- It is not mandatory for each specific case to classify, apply safety policy and determine environmental assessment tool (EA).<br>- The World Bank will classify a proposed project into one of four categories including A, B, C, or FI depending on category, location, sensitivity and scale of the project and the nature, the importance of its potential environmental impacts.<br>- Category A: Requirement for full environmental impact assessment. In some cases, the social and environment management framework is required, too.<br>- Category B: ESIA, social and environment management framework or social and environment management plan is required. In most cases, social and environment management framework and/or social and environment management plan are required.<br>- Category C: no EA action.<br>- Category FI: social and environment management framework is the most commonly tool. In the case of a number of sub-projects that have been identified before the appraisal, the FI will prepare specific tools based on the frameworks, e.g. the ESIA or social and environment management plan. | - Categories: I, II, III and IV of Decree No. 18/2015/ND-CP.<br>- Rules, regulations in Appendix I, II and III - List of projects requiring submission of SEA and EIA report for approval.<br>- All projects are not listed.<br>- Generally, the Project Owners classify their projects based on the classification as stated in Decree No.18/2015/ND-CP and consulted with the Department of Natural Resources and Environment (DONRE) or Vietnam Environment Administration (DONRE). VEA) to categorize and require EA report such as:<br>• Projects fall into Appendixes: I, II, III: SEA or EIA are required.<br>• Projects fall into Appendix IV: no EIA and EPP are required.<br>• Projects fall into Appendixes: I, II, III and IV: EPP is required. |
| **Environmental assessment tool** | - Depending on the project impacts, a range of tools are used to meet the World Bank's requirements, including: environmental and social management framework; specific environmental assessment; environmental and social management plan; regional and sectoral EA; risk or hazard assessment; Environmental audit. The World Bank provides general guidelines for | - The EA tools like SEA, EIA or EPP are identified based on Appendixes: I, II, III and IV of Decree No.18/2015/ND-CP. |

| The stages in the environmental assessment process | WB (OP/BP 4.01 on Environmental Assessment) | Vietnam (Decree No. 18/2015/ND-CP, Circular No.27/2015/TT-BTNMT) |
|---|---|---|
| | implementing each tool. | |
| **Scope of environmental assessment** | - The World Bank helps the borrower to draft the TOR for EA and to determine the EA scope, procedures, timetable and outline of a EA report.<br>- A A-category project require ESIA TOR and the determination of scope and consultation will be necessary to prepare the TOR for environmental assessment report. | - TOR for EA is not required.<br>- Normally, after consultation with the local DoNRE or the Environmental Department (VEA) about the type of EA, Project Owner will prepare an EA report. |
| **Community consultation** | - During the EA, the Borrower must consult with affected groups and local NGOs on the environmental aspects of the project and focus their views.<br>- For a A-category project, the Borrower shall consult these groups at least twice: (a) immediately after the environmental inspection and before the EA TOR completion; and (b) once a draft EA report has been prepared. In addition, the Borrower will consult with these groups throughout the project implementation process as needed to address issues related to EA that affect them.<br>- For a B-category project, there should be at least one community consultation meeting.<br>- For meaningful consultations, the Borrower provides relevant project documents in a timely manner prior to the consultation in a form and language that the group can understand and be accessible to.<br>- The minutes of the public meeting are included in the report. | - Project owner is responsible for consulting with the People's Committee of the commune, ward or township (hereinafter referred to as the commune) where project is being implemented, consulting with with organizations or communities directly affected by project; Research and receive objective opinions and requests from relevant agencies to minimize project negative impacts on the natural environment, biodiversity and public health.<br>- Commune People's Committees where a project is implemented and organized and directly affects will be consulted. Project owner is responsible for submitting the EIA report to the commune-level people's committees where the project is implemented and organized and directly affects, together with a written request for comment. Within 15 working days from the date on which a EIA report is received, the commune-level people's committees and organizations under the direct impact of the project are obliged to submit their responses if they do not approve the project.<br>- The community consultation is carried out in the form of community meetings co-chaired by the Project Owner and the commune people's committees where the project is implemented together with the participation of the community like |

| The stages in the environmental assessment process | WB (OP/BP 4.01 on Environmental Assessment) | Vietnam (Decree No. 18/2015/ND-CP, Circular No.27/2015/TT-BTNMT) |
|---|---|---|
| | | Vietnam Fatherland Front, socio-political organizations, socio-professional organizations, population quarters, villages/hamlets. All opinions of participants in the meetings must be fully and truthfully presented in the minutes of the meeting. |
| **Public information** | - Before the World Bank conducts a project appraisal, EA report must be made public in a way that is easily accessible to project-affected groups and local NGOs. When the World Bank officially receives report, the World Bank will publish the report in English to the public via its website. | - After EIA report is approved, the Project Owner is responsible for preparing, approving and publicly displaying EMP at the local Commune People's Committee office, in consultation with the community for people's information, inspection, monitoring. (Article 16 of Decree No.18/2015/ND-CP). |
| **Independent environmental specialist** | - For a A-category project, the Borrower retains independent EA specialist who have no contact with the project to implement EA.<br>- For a high-risk A-category project or a project with multi-dimensional environmental concerns, the Borrower will also hire a consultative group of independent environmental specialists with international qualifications to advise on the project aspects relating to EA.<br>- Specialists/consultancy companies will be selected through bidding under the close supervision of the World Bank. | - This content is not regulated in Vietnamese policy.<br>- The Project Owner shall implement or hire a consulting unit which satisfies the conditions specified in Clause 1, Article 13 of Decree No.18/2015 to make EIA report. Project Owner or consultancy companies must fully meet the following conditions: (i) Staff responsible for EIA must have at least BA degree and EIA consultancy certificate; (ii) specialized staff involved in the project must have university or higher degrees; (iii) have laboratory and testing equipment certified for measuring, sampling, processing and analyzing environmental samples for the environmental impact assessment of the project; In the absence of a laboratory, the calibration equipment must meets the requirements and there must be contract with qualified unit. |
| **EA review/approval process** | - The WB reviews EA's findings and recommendations to determine if it provides sufficient grounds for the Bank to process the project. When Borrower has completed all or part of the environmental assessment before the Bank participates in a project, the Bank will consider the environmental assessment to ensure its consistency with this policy. The Bank | - The Ministry of Natural Resources and Environment appraise and approve EIA reports of the projects specified in Appendix III to this Decree, excluding the projects relating to defense and security contents.<br>- The Ministries or the ministerial-level agencies shall appraise and approve EIA reports on projects under their competence |

| The stages in the environmental assessment process | WB (OP/BP 4.01 on Environmental Assessment) | Vietnam (Decree No. 18/2015/ND-CP, Circular No.27/2015/TT-BTNMT) |
|---|---|---|
| | may, where appropriate, request additional environmental assessments, including public consultation and disclosure. | for investment approval, except for projects listed in Appendix III to this Decree;<br>- The Provincial People's Committees conduct appraisal and approval of EIA reports for projects in their provinces, except the projects mentioned above.<br>- The appraisal will take place at least 45 working days at the MoNRE level and 30 working days at the DoNRE level and 5 working days at the district level after receipt of full Environmental Impact Assessment or full EPP. |
| **The number and language of the EA/EIA to be evaluated** | - Number of copies are not specified.<br>- Language requirements: English and Vietnamese. EA reports in Vietnamese are required for domestic disclosure and must be in English for publication on the World Bank's website. | - Project Owner must submit at least 07 environmental impact assessment reports (depending on number of appraisal committee members) and 01 feasibility study or technical report of a proposed project. |
| **Content of EA report** | - For a A-category project, the content of a EA report is in line with Appendix B of OP4.01.<br>- The EA scope for a B-category project may vary depending on each project, but the EA's scope is narrower than that of a A-category project. An environmental and social management plan is an integral part of an EA category A (regardless of other tools to be used). EA for a B-category project may also be an environmental and social management plan with the content set out in Appendix C of OP 4.01. | - The content of a EA report must be in line with Circular No.27/2015/TT-BTNMT. |
| **Monitoring EA** | - During the project implementation, the World Bank will supervise the implementation of the environmental aspects on the basis of environmental regulations and the Borrower arranges reports of the agreement in the Loan Agreement and in other project documents to determine if the compliance of the Borrower's Environmental Procedures (mainly with EMP) is satisfactory. If the compliance is not satisfactory, the World Bank will discuss with the Borrower to | - The local DoNRE is entrusted monitoring the environmental compliance of the projects.<br>- At the end of the project construction phases, the Environmental Management Agency will coordinate with the Construction Management Agency to monitor the compliance of the environmental management activities stated in the EAs. |

| The stages in the environmental assessment process | WB (OP/BP 4.01 on Environmental Assessment) | Vietnam (Decree No. 18/2015/ND-CP, Circular No.27/2015/TT-BTNMT) |
|---|---|---|
| | ensure the compliance, if necessary. | |

# CHAPTER 4. NATURAL CONDITIONS, SOCIO-ECONOMIC CONDITIONS AND ENVIRONMENTAL STATUS

## 4.1. Natural conditions

### *4.1.1 Geographical location*

Dak Lak province is located in the center of the Central Highlands, the watershed of the Serepok river system and part of Ba river, within the geographic coordinates from 107º28'57" to 108o59'37"º59'37" East longitude and 12º9'45" to 13º25'06" North latitude, with average height of 400 - 800 meters above sea level, 1,410 km from Hanoi and 350 km from Ho Chi Minh City. It borders on Gia Lai province in the North, Phu Yen and Khanh Hoa in the East, Lam Dong and Dak Nong in the South, Cambodia in the West. Dak Lak has an area of 13,125.37 km2. Dak Lak province has 15 district-level administrative units, including 1 city, 1 town and 13 districts. There are 184 communal administrative units, including 152 communes, 20 wards and 12 towns.

Krong Pak district is located in the East of Dak Lak province, along both sides of National Highway 26, from km 12 to km 50, the center of the district is 30 km from Buon Ma Thuot city center and has a natural area of 62,581 ha. Krong Pac District Located on National Highway 26, about 160 km from Nha Trang City - Khanh Hoa Province, about 30 km from Buon Ma Thuot Airport.

Ea Kar district is located 52 km from Buon Ma Thuot city along Highway 26 to Khanh Hoa which is the Eastern gateway connecting Dak Lak province to the Central provinces, especially Phu Yen and Khanh Hoa.

M'Drak district is located to the East of Dak Lak province, 100 km from the provincial administrative center (Buon Ma Thuot City). The district has National Highway 26 running through connecting Buon Ma Thuot city with Nha Trang city in Khanh Hoa province; Provincial Road 13 route connects with Song Hinh district, Phu Yen province; Dong Truong Son road (D35) connects Gia Lai province and Krong Bong district.

Buon Ho town is located in the Northeast of Dak Lak province, 42 km from Buon Ma Thuot city. With this geographical position, it is convenient for the town to access to the economic - urban - national - international corridor through National Road 14 and Phu Yen - Dak Lak route connecting the national border gate (Dak Rue and Dak Per) and national highways connecting with seaports and urban centers, cities such as Pleiku city (150 km), Kon Tum (230 km), Da Nang city to the North and Dak Nong and Binh Phuoc, Binh Duong and Ho Chi Minh City (350 km) to the South through National Highway 14; It is easy to connect to Nha Trang coastal city via National Highway 26 (following the route of the provincial road of Buon Ho - Krong Nang and intersection with Highway 26 in Ea Kar town), about 50 km from Buon Ma Thuot international Airport.

Krong Buk district is located in the Northeast of Dak Lak province, 60 km from the center of Buon Ma Thuot city along Highway 14. Located in the Northern gateway of the province, bordering Buon Ho town, on National Highway 14, connecting Krong Buk district with Buon Ma Thuot city and Pleiku city; It is about 60 km from Buon Ma Thuot airport, convenient exchange with the Central Highlands, Central Coastal area and the whole country.

Krong Nang is a district located in Northeastern Dak Lak province, 50 km from Buon Ma Thuot city center along National Highway 29 and Highway 14. The district center has National Highway 29 and provincial road 3 (Krong Nang - EaKar).

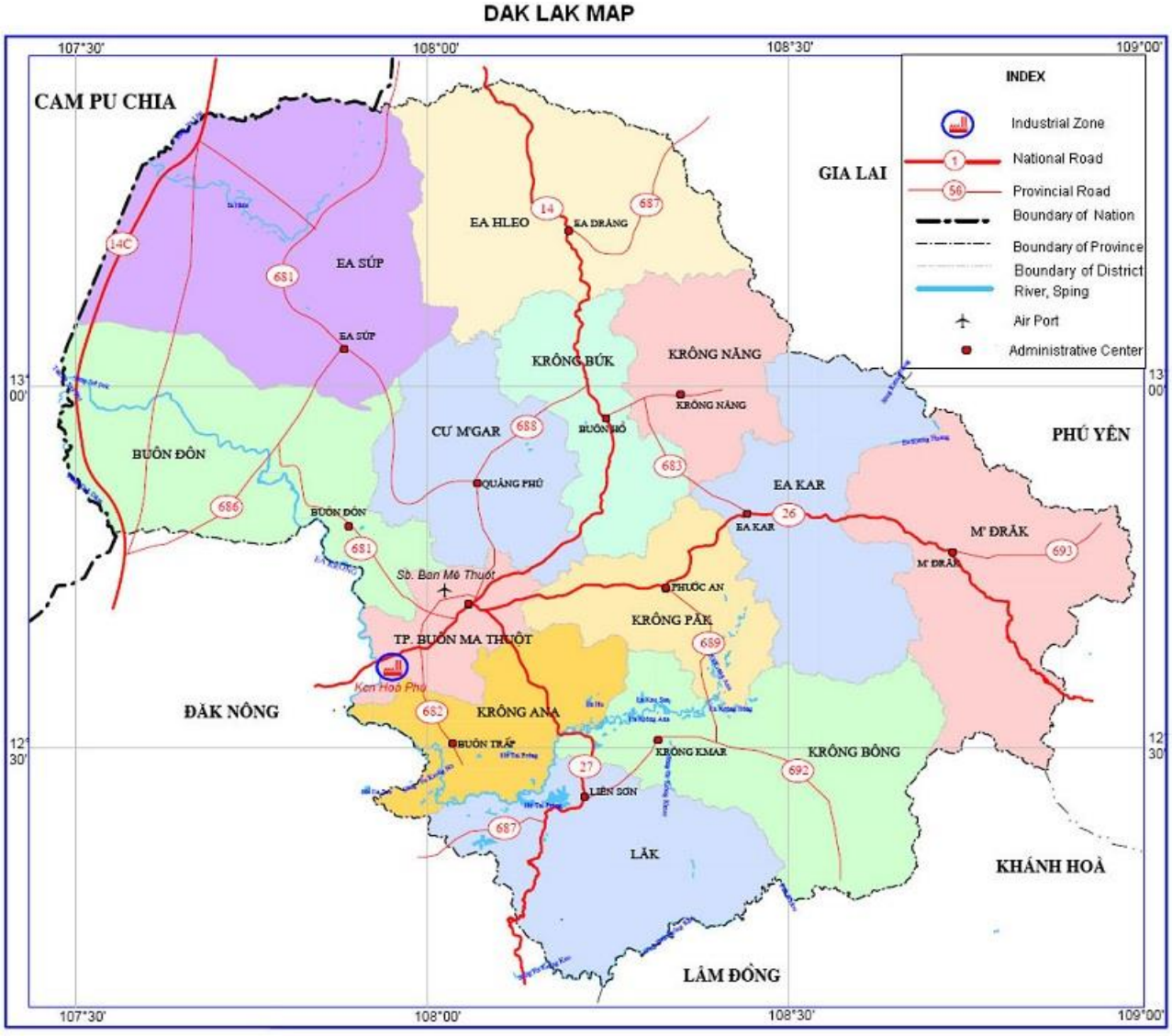



**Figure 2. Administrative map of Dak Lak province**

### *4.1.2 Climate conditions*

Due to the geographical position and terrain, the climate in Dak Lak is under the influence of the monsoon tropical climate and the nature of the cool plateau climate. But the most affected is still

the West Truong Son climate, which is the average temperature is not high, the rainy season is much less sunny due to the influence of the Southwest monsoon, the winter is less rainy. The Eastern and Northeastern regions of M'Drak, Ea Kar and Krong Nang districts are intermediate climates, influenced by the West and East Truong Son climate. The average temperature, rainfall and air humidity are from 22-28.3$^{o}$C, 1443-1958mm and 78-83%. In general, the weather is divided into two distinct seasons, the rainy season from May to October with the prevailing Southwest wind, the months with the highest rainfall are August, August, rainfall accounts for 80-90%. annual rainfall. In the Eastern region, it is influenced by the East Truong Son, so the rainy season lasts longer and until November. The dry season is from November to April of the following year, during this season, the humidity decreases, the Northeast wind blows strongly, high evaporation rate, causing severe drought.

### *4.1.3. Topography*

Dak Lak province has terrain elevation ranging from 400 m - 800 m above sea level. The main slope direction is lower from the Southeast to the Northwest with 4 main terrain categorys: Mountain terrain; Buon Ma Thuot - M'Drak plateau terrain; Buon Don - Ea Sup Semi-plateau terrain and Krong Pac-Lak lowland area terrain.

### *4.1.4. Hydrological conditions*

**(a) Surface water:**

Surface water includes water from the main stream branch and small streams in the upstream of the dam site. The small stream branches in the reservoir bed are all oriented to supply water for the main stream and in the Northwest - Southeast direction. In the dry season, the surface flow often observe only in the main stream with a fairly abundant flow, in the rainy season the flow will be much larger.

Ea Nao Dar irrigation project in Cu Bao commune, Buon Ho town is built on stream branch in the basin of Ea Kang stream branch - Cu Bao commune - Buon Ho Town - Dak Lak Province. The terrain features are steep, severely divided, the rainfall is relatively high but concentrated mainly in the rainy season, so the stream flow also fluctuates strongly around year. The flow in the rainy season (flood season) accounts for over 86% of total annual flow.

**(b) Underground water:**

The groundwater aquifer is located in quaternary sediments that rae distributed along rivers and streams beds. The groundwater level is predicted to be located at a depth of 15-20m. In general, rock and soil in the area have low permeability, lower water reserves are recharge mainly from surface and rain waterl.

For Doi 725 reservoir in M'Drak district, the study area is located in the basin of the Ba river system via the Krong Hnang river branch, with length of 129km, this is the source of water for production and living for Ea Lai, Krong Jing, Cu Prao and Ea Pil communes. Therefore, in the reservoirs in the area in general, in Ea Rieng commune in particular, the underground water source in the area is also very abundant, in particular in recent years of severe drought, the

reservoirs have not dried up under the normal water level. This is also a water source for the reservoir.

**Table 10. Hydrogeological characteristics of reservoir basins under subproject I**

| No. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Parameters | | Basin area | Name of main stream | Length of main river | Total length of tributaries | Slope of river bed | Slope | Flow |
| Unit | | $Km^2$ | | Km | Km | ‰ | ‰ | $m^3/s$ |
| Value | **Ea Uy Thuong reservoir** | 34.4 | Ea Ly | 10.6 | 0 | 6.93 | | 1.2 |
| | **Buon Dung II reservoir** | 6.8 | Da | 3 | 0 | 8 | 45 | 0.6 |
| | **Ea Blong Thuong reservoir** | 2.4 | | 1.8 | 3 | 8 | 25 | 0.37 |
| | **Ea Kmien 3 reservoir** | 2.85 | | 1.8 | 0 | 10 | 30 | 0.98 |
| | **Ea Bro 2 reservoir** | 4.8 | | 3.2 | 1.2 | 14 | 130 | 0.6 |
| | **Ea Nao Dar reservoir** | 3.4 | Ea Kang | 1.2 | 0 | 7 | 50 | 0.8 |
| | **Ea Ngach reservoir** | 12 | | 7.3 | 2 | 15 | 80 | 0.1 |
| | **C19** | 5.72 | | 3.7 | 0.8 | 7 | 60 | 0.1 |
| | **Reservoir 725** | 1.25 | | 1.6 | 0 | 12 | 55 | 0.05 |
| | **Doi 11** | 16.2 | | 4.5 | 3 | 7 | 30 | 0.2 |

*Source: Report on total investment of the subproject, 2018*

### *4.1.5. Biodiversity*

**(a) Terrestrial fauna and flora system**

- Fauna: According to the environmental and social screening of the subproject, in the subproject area, there is no presence of endangered species that need to be protected. The fauna in the subproject area is mainly a number of small mammals, birds, some reptiles that reside in the fields of coffee, frogs, snakes living in bushes, paddy-rice growing areas.
- Flora: According to survey and survey data of the Center for Environmental Monitoring and Analysis implemented in July 2018 in the project area, typical vegetation is shown in the table below

**Table 11. Typical vegetation at the construction site**

| Name of reservoir | Typical vegetation at the construction site | | | | |
|---|---|---|---|---|---|
| | Rice | Coffee | Vegetables | Rubber | Pepper |
| Ea Uy reservoir | ✓ | ✓ | ✓ | | ✓ |
| Buon Dung II reservoir | ✓ | ✓ | ✓ | | ✓ |
| Ea Nao Dar reservoir | ✓ | ✓ | ✓ | ✓ | ✓ |
| Reservoir 725 | ✓ | ✓ | ✓ | | |
| Doi 11 reservoir | ✓ | ✓ | ✓ | | |
| Ea Blong Thuong reservoir | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ea Kmien 3 reservoir | ✓ | ✓ | ✓ | | ✓ |
| C19 reservoir | ✓ | ✓ | ✓ | | |
| Ea Bro II reservoir | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ea Ngach reservoir | ✓ | ✓ | ✓ | | ✓ |

Dak Lak is the central province of the Central Highlands with an area of fertile red basalt soil suitable for coffee and some other crops.

Major crops in the subproject area include food crops (rice, maize, sweet potato and cassava); short-term industrial plants (soybean, groundnut, sugarcane ...); vegetables, beans and spices; and industrial crops (coffee, tea ...). Coffee and pepper accounts for a large proportion.

However, agricultural production in the subproject area has a low starting point, outdated production methods, low application of science and technology, lack of water for production, thus low productivity of crops and life People still faccing many difficulties.

**(b) Aquatic ecosystem**

The aquatic system in the area is quite diverse including:

- Fish species: stream fish, fish tong ...
- Phytoplankton: The composition consists of species representing water bodies of rivers, lakes, flowing streams such as green algae and filamentous blue algae.
- Zooplankton: In the area there are a number of typical zooplankton species belonging to the groups of rotatoria, crustaceans, larvae, insects ...
- Invertebrates: There are typical families like snails, mussels, shrimp, crabs ...

The flora and fauna in the subproject area is likely to be affected by the construction activities of the subproject as well as being ecologically sensitive and will require specific mitigation measures. for these ecosystems.

**4.2 Impact of natural disasters and climate change with Dak Lak province**

Located in the tropical monsoon area, the annual rainfall is quite high from 1.00 - 2,000 mm, creating the flow of the Serepok river system and the tributaries of Ba River. With a high density of rivers, streams and diverse terrain, Dak Lak is one of the provinces with great potential in irrigation and hydropower, convenient for economic and social development. However, due to

the characteristics of climate, topography and natural geography, Dak Lak is one of the provinces affected by many different types of natural disasters. Some types of natural disasters often occur every year such as: Droughts, floods, flash floods, floods, heavy rains, landslides, cyclones, lightning, hail. In addition, there are also some other natural disasters such as cold weather, strong wind, unseasonal rain, etc. Especially in recent years with global climate change, the natural disaster situation in the whole country in general and Dak Lak province in particular, the situation is more complicated and serious, affecting the life and economy of the people in the province. According to the summary data, the value of damage caused by natural disasters in the province for 12 years (2005 - 2017) is VND 14,271,384 billion, of which flood damage is 4,319,769 billion VND (accounting for 30.27%), drought damage is over VND 9,884.491 billion (accounting for 69.26%), damage from other natural disasters is VND 67,124 billion (0.47%). From the above statistics, it is shown that the damage caused by drought is very heavy, greatly affecting the lives of people in the province.

According to the provincial natural disaster prevention and search and rescue plan for the period of 2018-2020 in Dak Lak province, the disaster situation in the subproject districts is reflected in the following table:

**Table 12. Types of natural disasters affecting project districts**

| Type of natural disasters | Focus point | | | | | |
|---|---|---|---|---|---|---|
| | **Krong Pak District** | **Ea Kar District** | **M'Drak District** | **Buon Ho Town** | **Krong Buk District** | **Krong Nang District** |
| Influence of storms and tropical depressions | | x | x | | | x |
| Heavy rains, floods, flash floods | x | x | | | | |
| Landslides, land subsidence due to flood or flow | | | x | | x | x |
| Cyclone, lightning, hail | | x | x | | x | x |
| Hot sunshine, drought | x | x | x | x | x | x |

### 4.3. Current status of surrounding environment quality

The status of the baseline environment is reflected by the parameters of soil, water and air quality measured in site and analyzed in laboratory. These are the basis for assessing environment impacts during the construction and operation of the reservoirs. This is the necessary condition for controlling and mitigating effects of dam construction and operation and dam safety.

The environmental status in the subproject area is assessed by two main methods:

- The environment rapid measurement method using field measuring devices.
- The laboratory analytical method (ISO 17025: 2005).

Due to the mountainous topography, 10 reservoirs are located in valleys and surrounded by cultivation and agriculture hills and forests. The Consultant undertook site observations and sampling at subproject sites. Specifically, there are 30 air samples, 20 surface water samples, 20 groundwater samples, and 16 soil samples. (Details of the location of sampling points are shown in Appendix 5).

### *4.3.1. Water Environment*

**(a) Quality of surface water in the project area**

Monitoring is carried out in 10 reservoirs, 2 representative samples of surface water in the upstream and the spillway of the reservoir are taken in each area. Parameters of surface water quality monitoring in the subproject area include pH, TSS, DO, $BOD_5$, COD, $NH_4^+$, $NO_3^-$, $NO_2^-$, $PO_4^{3-}$, Pb, Cu, Fe, Total grease, E.coli, and Coliform. The analytical results showed that surface water quality in the project is within the limit of column B1 according to QCVN 08-MT:2015/BTNMT National technical regulation on surface water quality (Specific results are shown in Appendix 5). Sample analysis showed that the quality of surface water at the sampling sites is not significantly affected by the farmer's livelihood activities but could still be used for irrigation or other purposes.

**(b) Quality of ground water in the project area**

Monitoring and sampling for ground water quality analysis in the construction area of 10 reservoirs, 2 ground water samples of households living around the reservoir and below the dam body are collected in each area. Analytical samples are taken at an average depth of 18m to 40m. Monitoring parameters include: pH, Hardness, TDS, $NO_2^-$, $NO_3^-$, $NH_4^+$, $SO_4^{2-}$, As, Cd, Fe, Pb, and Coliform. Analysis of well water samples in the residental area near the project area showed that the ground water quality in the project area is very good. The analytical values are within the range of the QCVN 09-MT: 2015-BTNMT National technical regulation on ground water quality (Specific results are shown in Appendix 5). This will be very advantage for the construction unit to exploit and use this water source for domestic use for workers.

### *4.3.2. Current status of air environment and noise*

Carry out sampling at the dam site, the roads on the left and right side of the dam. Monitoring parameters include: Temperature, humidity, wind speed, noise (Leq), Dust (TSP), $NO_2$, $SO_2$, CO, $NH_3$, $H_2S$. Through the measurement and analysis of air environment indicators, the air environment quality in the subproject area is relatively good, the recorded values are within the allowable limits of QCVN 05: 2013 / BTNMT National technical regulation on ambient air quality, QCVN 26: 2010 / BTNMT National technical regulation on noise, and QCVN 06: 2009 / BTNMT National technical regulation on hazardous substances in ambient air (Specific results

are shown in Appendix 5). The 10 reservoirs area have cool climatic conditions, production forest, and well-developed shrubs.

#### *4.3.3. Current status of sediment*

Conduct sediment sampling at the upstream, dam area and in the reservoir. Monitoring parameters include: As, Cd, Cu, Pb, Zn, Hg, and Cr. Analysis results of sediment samples in the project area showed that all the analyzed values are within the range of QCVN 43: 2012 / BTNMT National technical regulation on sediment quality (Specific results are shown in Appendix 5). From the results of the analysis, the quality of sediment is relatively good, not affected by the activities of residents and production.

### 4.4. Socio-economic conditions in the subproject implementation area

The subproject is implemented in 9 communes of 7 districts with similar natural and socio-economic conditions; Agricultural production activities are mainly pepper, coffee and growing crops. In addition, some localities actively rotate crops, increase crops to grow vegetables and fruits to increase income. The subproject area is a common residence of many ethnic minorities, each with its own cultural beauty. Ethnic minorities residing in the subproject area can be mentioned as Thai, Muong, Dao, Xo Dang, Hmong ... but the majority is composed of Ede, M'Nong and Tay, Nung people. They often connect and exchange, although in different localities and above all, together, they preserve cultural values that are deeply embedded in the soul. The most evident thing is the well-organized festivals, keeping the heritage spirit.

**(a) Infrastructure**

**(a.1). Water supply**

On the use of water by households, the use of water by households is divided according to the following indicators: Water used for drinking, water used for bathing / washing and water used for production. The results of quantitative and qualitative surveys show that households in the subproject area mainly use groundwater (drilled wells) for eating / drinking / bathing / washing or generally for domestic use. There are very few households using clean water from the state's clean water supply system and using water from rivers and canals and irrigation systems for producing water. Thus, lack of water will profoundly affect the living and livelihoods of residents in the area. Having enough water from the irrigation system as well as the natural canal system will contribute to enriching the groundwater, which is the main water source for people's daily life.

**(a.2). Transportation**

Currently the province has 10,858.86 km of roads, of which: National highway is 359.37 km including: Highway 14C, Highway 27, Highway 29 and there are 62 bridges on 3 national highways with a length of 2,237.58 m; 11 Provincial roads with a length of 352.3 Km, level-IV Provincial roads in mountainous area with 02 lanes, the rate of asphalt reaches 95.17% on the provincial roads with 71 bridges with a length of 1,503.3m ; Ea H'leo - Ea Sup inter-district road with a length of 46km; there is 751 km of urban road, concentrated in Buon Ma Thuot city, Buon

Ho town and district towns; District roads have a length of 1,343.82 km, usually roads of grade IV and V in mountainous areas, the rate of asphalt is 84%, including 67 bridges with a length of 937.8m. Popular routes of national highways and provincial roads are not flooded during the flood season but are facing with mostly landslides, rock on both sides of the road, subsidence of the roadbed due to rain, causing traffic congestion and difficulties in evacuation and rescue work in storms and floods. In the project area, there is an inter-commune road which has been reinforced for transportation. The commune road network of the districts has a length of 3,220.07 km and a village road network has total length of 4,079.32 km. Along with the specialized road system of farms and forestry farms with a total length of about 675 km, mainly earth roads.

**(a.3). Irrigation infrastructure**

The tertiary irrigation system of the communes in the subproject area includes a system of canals, siphons of irrigation pumping stations, water-regulating works ... which have been reinforced, upgraded, renovated and completed and reasonably arranged in order to effectively exploit water sources from dams in the area to serve agricultural and forestry production (rice, coffee, pepper, fruit trees, ...). Many areas of production land after changing plant structure have been invested by local authorities and households to modernize the irrigation system, apply automatic irrigation technology, save water and apply advanced cultivation procedures and methods. In the context of shortage of water sources due to climate change, the sub-project communes are continuing to mobilize capital sources to invest in upgrading intra-field canals, repairing pumping stations and water regulation works, build irrigation management process according to the Irrigation Law (2017), ... to increase water use efficiency and promote the capacity of the works after being upgraded and repaired.

**(a.4). Waste treatment**

Commune waste in the subproject area is stored in various facilities to avoid leakage and drop during transportation to disposal sites. Any types of solid waste (such as mop, rags contaminated by lubricant, chemical, solvent; chemical packing; powder waste; waste electronic boards, etc.) shall be contained in PE bag, cloth cover or container. Lubricants, solvents, chemicals will be contained in plastic or iron containers. Dump trucks are checked to ensure that there is no mixing between types of waste during transport. If the waste is not mixed, the sorting team will compare to the Waste Management Protocol to determine the type of waste and unloading it from the vehicle. If the wastes are mixed, the sorting team conducts preliminary classification. After sorting, non-hazardous and hazardous waste shall be stored in accordance with the prescribed area in order to be disposed of properly according to the burning or sanitary landfill plan. Up to now, Dak Lak province has 17 public service units operating in the field of collection, transportation and treatment of domestic solid waste. For hazardous waste in the subproject area, these wastes will be transported to Buon Ho Treatment Plant (3.81 ha) and Ea Kar District Treatment Plant (2 ha) for treatment. These two treatment plants have a capacity of 150 tons/ day and 100 tons/ day respectively. The districts, towns and cities in the subproject area all have solid waste collection, transportation and treatment services in the form of socialization.

These service units are basically equipped with specialized facilities and equipment through the state budget, development support fund, environmental non-business funds and capital sources of enterprises for the environmental protection.

**(a.5). Current status of electricity supply**

The communes in the subproject area all have electricity grid systems, which all meet the criteria of the new rural construction. The households living scattered and not far from residential areas should connecting to local electricity network to by their owned budget.

**(b) Tangible, intangible cultural assets.** There are no cultural or archaeological sites in the construction area of the sub-project. Thus, the impact of the project on tangible and intangible cultural assets is absent..

**(c) Gender equality and the role of women.** The position of women in the area is increasingly promoted, each commune have a Women's Union. Government and mass organizations are also concerned about the positon and role of women in governmental organizations and socio-political organizations. The VWU plays an important role, actively participates in many propaganda and economic development activities in the region. Officials and members of the association actively participate in production activities, social activities and raising awareness. However, because of the mountainous area, traveling difficulties, the awareness of ethnic minority people is still limited. Promoting the role of the Association has not been diverse, sometimes interrupted. In addition, the Association is facing many difficulties due to budget not meet the current reality. Regarding gender roles and responsibilities, in addition to participating in most agricultural activities, women in the area also have to take care of their children and their families according to Vietnamese tradition.

**(d) Security.** Security is maintained and well implemented, the situation of political security, social order and safety in the locality is maintained stable, no incident occurred unexpectedly. Not to form hot spots of political security, no complaints petition over crowded, complicated cases, urgent people. Residence management is often directed. Town / commune / ward police regularly check staying temporarily and temporarily absent of residence in order to ensure the security situation in the locality. Workers and engineers from other locations will be registered for temporary residence in the locality to ensure good security, avoid disorder and disturb the lives of local people.

**(e) The use of fertilizers and pesticides.** The amount of pesticides used in the subproject area is on the downward trend as local people are moving to use stronger varieties that are able to effectively prevent common diseases such as rice blast disease, leaf rolls, leaf blades, stem borer, brown plant hopper, etc. The average amount of pesticides used in the sub-communes is about 1.7kg/ha. The amount of fertilizer used in the subproject area is sufficient to meet the nutritional

requirements of the temporary extension program. The main fertilizers used include Urea, Lactose Supe, Potassium Chloride, which is 280kg/ha, 550kg/ha, 150kg/ha, respectively.

**Taable 13. Use of Fertilizer and Plant protector chemica**

| No. | Reservoirs | Irrigated area in a year (ha) | Use of Fertilizer and Plant protector chemical | | | |
|---|---|---|---|---|---|---|
| | | | Urea (ton) | Superphosphate (ton) | Kali Clorua (ton) | Plant protection chemicals (kg) |
| 1 | Ea Uy | 557.75 | 156.17 | 306.76 | 83.66 | 948.18 |
| 2 | Buon Dung II | 100 | 28.00 | 55.00 | 15.00 | 170.00 |
| 3 | Ea Blong thuong | 85.3 | 23.88 | 46.92 | 12.80 | 145.01 |
| 4 | Ea Kmien 3 | 80 | 22.40 | 44.00 | 12.00 | 136.00 |
| 5 | Ea Bro 2 | 300 | 84.00 | 165.00 | 45.00 | 510.00 |
| 6 | Ea Nao Dar | 70 | 19.60 | 38.50 | 10.50 | 119.00 |
| 7 | Ea Nghach | 125 | 35.00 | 68.75 | 18.75 | 212.50 |
| 8 | C19 | 200 | 56.00 | 110.00 | 30.00 | 340.00 |
| 9 | 725 | 100 | 28.00 | 55.00 | 15.00 | 170.00 |
| 10 | Doi 11 | 231 | 64.68 | 127.05 | 34.65 | 392.70 |

**(f) Education.** The facilities have been invested and the school is clean and beautiful, ensuring good teaching and learning activities. However, there is still a case of pupils dropping out due to family's lack of attention, difficult family circumstances and difficult travel conditions..

The population, education & labour structure and economic structure of the communes in the project area are shown in the table below.:

**Table 14. Population, Education & Labour Structure**

| No. | Location | Population | | Education | | | | | | Labour Structure (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Kindergarten | | Primary school | | Secondary school | | | |
| | | Number of HHs (HH) | Number of people (person) | Number of pupils (person) | Number of teachers (person) | Number of pupils (person) | Number of teachers (person) | Number of pupils (person) | Number of teachers (person) | The working age (*16-60*) | The age dependency (*<16 and >60*) |
| 1 | Ea Yong Commune Krong Pac District | 3902 | 19204 | 655 | 49 | 2725 | 125 | 1640 | 137 | 60.4 | 39.6 |
| 2 | Hoa Tien Commune Krong Pac District | 1749 | 8650 | 281 | 21 | 682 | 49 | 646 | 46 | 66.2 | 33.8 |
| 3 | Ea Kmut Commune Ea Kar District | 3034 | 13096 | 610 | 29 | 615 | 87 | 806 | 48 | 62.2 | 37.8 |
| 4 | Ea Rieng Commune M'Drak District | 1736 | 6846 | 250 | 15 | 498 | 31 | 545 | 30 | 55.2 | 44.8 |
| 5 | Cu Bao Commune Buon Ho Town | 2658 | 12384 | 869 | 48 | 1356 | 83 | 803 | 63 | 44.9 | 55.1 |
| 6 | Ea Drong Commune Buon Ho Town | 2471 | 11597 | 651 | 52 | 826 | 58 | 577 | 39 | 54.2 | 45.8 |
| 7 | Cu Pong Commune Krong Buk District | 2441 | 10728 | 436 | 23 | 1164 | 66 | 559 | 31 | 74.9 | 25.1 |
| 8 | Dlie Ya Commune Krong Nang District | 3482 | 14960 | 932 | 54 | 1792 | 96 | 957 | 51 | 63.4 | 36.6 |
| 9 | Phu Xuan Commune Krong Nang District | 3959 | 18017 | 320 | 33 | 1651 | 133 | 1107 | 91 | 55.9 | 44.1 |

*Source: Socio-economic report of subproject communes*

**Table 15. The economic structure**

| No. | Location | The economic structure (%) | | |
|---|---|---|---|---|
| | | Agriculture, Forestry and fishery | Trade and Services | Handicraft, Construction |
| 1 | Ea Yong Commune Krong Pac District | 70 | 24.7 | 5.3 |
| 2 | Hoa Tien Commune Krong Pac District | 70.5 | 24.6 | 4.9 |
| 3 | Ea Kmut Commune Ea Kar District | 65 | 28.2 | 6.8 |
| 4 | Ea Rieng Commune M'Drak District | 85.9 | 13.2 | 0.9 |
| 5 | Cu Bao Commune Buon Ho Town | 88 | 10.9 | 11 |
| 6 | Ea Drong Commune Buon Ho Town | 90 | 8.8 | 1.2 |
| 7 | Cu Pong Commune Krong Buk District | 89.7 | 1.4 | 8.9 |
| 8 | Dlie Ya Commune Krong Nang District | 77.5 | 11 | 11.5 |
| 9 | Phu Xuan Commune Krong Nang District | 93 | 3.8 | 3.2 |

*Source: Socio-economic report of subproject communes*

**Table 16. Socio-economic conditions in the 09 subproject communes**

| Location | Economic condition | Social condition |
|---|---|---|
| 1, Ea Yong Commune Krong Pac District | The main economic sector in the commune is agriculture, industry - construction sector has not been develop. The total social income of the commune in 2017 reached VND 709 billion, of which the agriculture sector accounted for 68% (559.76 billion VND), industry - handicraft accounted for 7% and trade and services accounted for the proportion of 25%. The total area of annual crops is 1142 ha. Per capita income reached 32 million VND/person/year. The number of employees in the working age is 10,315 (accounting | The natural area of Ea Yong commune is about 57.5 km2. Ea Yong commune has 21 villages and hamlets. The population of the commune is 19,253 people/4,000 households, of which 9313 people/840 households are the ethnic minorities (accounting for 48%). Ethnic minorities in the commune include the Ede, Tay and Nung. The number of poor households in the commune in 2017 is 495 households/2,275 people (accounting for 13.2%). The total number of near-poor households is 140 households/659 people, (accounting for 3.7%). Poor ethnic minority households are 347 households accounting for 70% of the poor households in the |

| Location | Economic condition | Social condition |
|---|---|---|
| | for 53.6% of the total population in the whole commune). | commune. Commune education has done a good campaign to bring children to school (100%). The commune has achieved the standard of preschool universalization for children, illiteracy eradication, universaling primary, secondary education at the right age. In terms of health, Ea Yong commune meets the national criteria for health. The proportion of people participating in health insurance forms reaches 87.8%. In terms of infrastructure, the commune has been invested in concreting 15.8 km long of roads. 3,366 households/4,000 households use hygienic water according to national standards. The commune's electricity system meets the standard and 100% of households use electricity regularly ensuring production and daily life needs. |
| 2, Hoa Tien Commune Krong Pac District | Agriculture and forestry account for 70.5%, trade and services account for 28.2%, construction - handicraft account for 4.9%. The total crops area in the commune is 2,038.03ha. Total cattle and poultry are 69,414. The aquaculture area in the commune is 20ha. Per capita income reaches 30 million VND/person/year. The number of employees in the working age accounts for 66.2% of the commune's population. | Hoa Tien commune is located in the south of Krong Pac district, with a natural area of about 21.2 km2. The population of the commune in 2017 is 1749 households with 8650 people, the number of poor households is 171 households (accounting for 9.8% and mainly Kinh people), the number of near-poor households is 22 households. The commune has 01 junior high schools, 02 primary schools and 01 kindergartens. School facilities in the commune ensure teaching and learning. The commune meets the standards of universalizing primary, secondary education at the right age and the national health standard for stage 1. The proportion of people participating in health insurance forms reaches 86.6%. Inter-village and inter-commune roads are concretized. The commune's electricity system meets the national standard and 100% of households use electricity regularly and safely from sources. The proportion of people using clean water reaches 83.63%. |

| Location | Economic condition | Social condition |
|---|---|---|
| 3, Ea Kmut Commune Ea Kar District | Total income in 2017 of the commune reached nearly 350 billion VND, of which agriculture accounted for 65.2%, followed by the service sector accounted for 12.4%, industry accounted for 6.6% and other income accounted for 15.8%. For agricultural production in the commune, local people raise cattle (buffaloes, cows, goats and pigs with an estimated number of 26,000), poultry (300,000), and grow long-term industrial crops such as coffee (1010 ha with produce), pepper (146 ha), cashew (160 ha), cocoa (26 ha), fruit trees (30 ha), vegetables, fruit food (240 ha) and other food crops such as rice (mainly), corn, cassava (1845 ha with an output of nearly 10,500 tons). The total number of people of working age is 8,104 people, of which 8,052 labourers participate in economic activities. The average income per capita in the commune is 30 million VND /person/year. | Ea Kmut commune has a natural area of about 31.32 km2, including 15 villages and hamlets. The commune population is 13,096 people / 3,034 households and are mainly Kinh people (2,771 households / 11,988 people). Ethnic minority people living in the commune include Ede people (175 households / 747 people) and Tay (86 households / 355 persons), accounting for 8.4% of the commune population. The number of poor and near-poor households in the commune in 2017 were 142 households (account for 4.7%) and 130 households (accounting for 4.3%), respectively. In which, poor ethnic minority households were 85 households, accounting for 60% of the poor households in the commune. In term of education, there are 07 schools in the commune. The rate of students going to school is 99%. The commune has well implemented the universalization of primary and secondary education. In term of health, Ea Kmut commune meets the national criteria for health. The proportion of people participating in health insurance forms reaches 86.5%. In term of infrastructure, the commune has upgraded, repaired and expanded rural roads, and developed a canal system. 85.49% of households use clean water and 100% clean water meets national standards. The commune's electricity system meets standards and 100% of households use electricity regularly and safely from sources. |
| 4, Ea Rieng Commune M'Drak District | Agricultural production is still the main sector of the commune, in particular, the agricultural sector accounts for 85.9%, the service sector accounts for 13.2%, the industry sector accounts for 0.9%. For agricultural production in the commune, local people raise cattle (buffaloes, cows, goats and pigs with an estimated number of 14,000), poultry (70,000), and grow long-term industrial crops such as coffee (681ha), pepper (35 ha), rubber (393 ha), fruit trees (20 ha), legumes and fruits (200 ha) and other food crops | Ea Rieng Commune has a natural area of 34.45 km2, including 20 villages and villages. The population of the commune is 6,836 people / 1,723 households and are mainly Kinh people (accounting for 99.5%). The number of poor and near-poor households in the commune in 2017 were 115 households/385 people (account for 4.7%) and 211 households/976 people (account for 12.63%), respectively. In terms of education, school facilities are invested, schools are solidified with adequate equipment and tools for teaching and learning. The commune has well implemented the universalization of primary and secondary education. The |

| Location | Economic condition | Social condition |
|---|---|---|
| | such as rice, corn, and wheat (1845 ha with a yield of nearly 5,500 tons). The total number of people of working age is 3,773 people, accounting for 55.2% of the commune's population. The average income per capita in the commune is 30 million VND /person/year. | proportion of people participating in health insurance forms reaches 88.5%. The percentage of children under 5 years old with stunting malnutrition (height according to age) accounts for 15% (9.2% lower than the criteria). In terms of infrastructure, the commune has upgraded, repaired and expanded rural roads including inter-commune, inter-village and intra-village roads. 89% of households use clean water and 100% clean water meets national standards. The commune's electricity system meets standard and 100% of households use electricity regularly and safely from sources. |
| 5, Cu Bao Commune Buon Ho Town | Agricultural and forestry production activities are still the main economic sector in the commune. The total production value of all industries in 2017 reached 347.24 billion VND. In which, agriculture, forestry and fishery reached 276 billion VND (account for 80%), industry and handicrafts reached 3.44 billion VND, trade and service reached 61.8 billion VND (industry, trade and services account for 20%). Coffee is a key tree in the economic structure of the commune, the existing area of coffee is 1888.89 ha, the output of 2.6 tons/ha. The total area of pepper is 192 ha, the output reaches 3 tons/ha. The total area of the rubber is 1,226.5 ha. The total number of cows, pigs are 2,132 and 1,850, respectively. Aquaculture area is 20.75 ha. Per capita income reaches VND 20 million /person/year. Employees in the working age group account for 45% (5,564 people) of the total population in the whole commune. | Cu Bao commune has a natural area of about 44.16 km2 and includes 18 villages. The commune population is 12,364 people/2,658 households, there are 5,488 people/1,112 EM households accounting for 44%. Ethnic minorities in the commune include Ede ethnic people (5,436 people/1,103 households ), Tay ethnic people (23 persons/6 households), and some other ethnic groups with few people. The number of poor and near-poor households in the commune in 2017 was 224 households (accounting for 8.42%) and 149 households (accouting for 5.6%), respectively. In term of education, there are 04 out of 7 schools meeting national standards in the commune. The commune has well implemented the mobilization of the whole population to bring children to school. The commune has achieved the standard of preschool universalization for children, illiteracy eradication and universalising primary, secondary education at the right age. In term of health, the commune has well performed the work of medical examination and treatment for the people. The rate of stunting in children accounts for 14%. The proportion of people participating in health insurance reaches 86.4%. In term of infrastructure, all 2,658 households use water from dug wells, deep wells, and drilled wells with a rate of 100%. The commune's electricity system meets standard and 100% of households use electricity regularly and safely from sources. |

| Location | Economic condition | Social condition |
|---|---|---|
| 6, Ea Drong Commune Buon Ho Town | Agricultural and forestry production is the main economic sector in the commune, accounting for 90% of the economic structure, trade and services account for 10%. The total production value of sectors in 2017 reached 207.5 billion VND, of which agriculture and forestry reached 180 billion VND, trade and service reached 28 billion VND and other sectors reached 7.5 billion VND. Coffee and corn are key crops in the economic structure of the commune with a cultivated area of 5315 ha (90% of the total cultivated area), the production is estimated at 22,122 tons (18,000 tons of corn and 4,122 tons of coffee). The total number of cows, pigs and poultry are 1,090, 2,625, and 23,885, respectively. Per capita income reachesVND 19 million /person/year. The number of employees in the working-age group accounts for 54% (6,280 people) of the total population in the whole commune. | Ea Drong Commune is a commune of Region 2 in Buon Ho Town. The total natural area is 48.01 km2, the population of commune is 11,597 people/2471 households distributing in 21 villages and hamlets. There are 14 hamlets with native ethnic minorities (Ede), accounting for over 70% and the rests are Kinh ethnic people and other ethnic minorities coming from other provinces. The number of poor and near-poor households in the commune in 2017 was 370 households/1,552 people (15.5%) and 260 household /1,115 people (10.5%), respectively. In terms of education, the facilities at the schools in the commune have been repaired and supplemented. The commune has well implemented the campaign to mobilize children to go to school. In general, the quality of education at all levels has increased. In term of health, the commune maintains the national health standard. Village and hamlet health network has been strengthened. There is no epidemic in the commune and national health programs are implemented on schedule. The rate of stunting in children accounts for 16.2%. The proportion of people participating in health insurance reaches 91.5%. In term of infrastructure, the rate of people using clean water is 90%. The commune's electricity system meets standard and 100% of households use electricity regularly and safely from sources. |
| 7, Cu Pong Commune Krong Buk District | Agricultural and forestry production activities are still the main economic sector in the commune. The total production value of all industries in 2017 is 277.76 billion VND. Agriculture and forestry account for 89.7%, industry-handicrafts account for 8.9%, trade - services account for 1.4%. Coffee is the main tree in the economic structure of the commune, the existing area is 3597.7 ha and the output is 7182 tons. The total area of pepper is 217 ha, rubber is 213 ha. The total number of cattle and poultry in the area is still low. | The natural area of Cu Pong commune is about 74.63 km2. The commune population is 10,728 people/2,441 households, of which 7,747 people are ethnic minorities accounting for 72%. The Ede ethnic group accounts for the majority (1,477 households / 7,499 people). The number of poor households in the commune in 2017 is 292 households (accounting for 11.95% of the total population) and most of them are the ethnic minorities. The number of near-poor households is 48 households (1.97%). In term of education, the commune meets the standards of preschool universalization for children, illiteracy eradication, universalizing |

| Location | Economic condition | Social condition |
|---|---|---|
| | Specifically, there are 1,700 cattle and 15,000 poultry. Per capita income reaches 23 million VND/person/year. The number of workers in the working age group accounts for 74.9% (8,040 people) on the total population in the whole commune. | primary, secondary school education at the right age. In term of health, the commune has well performed the work of medical examination and treatment for the people and achieved the National Criteria for Health. The proportion of people participating in health insurance reaches 93.4%. In terms of infrastructure, all 2,441 households use water from dug wells, deep wells, and drilled wells with a rate of 100%. The commune's electricity system meets standard and 100% of households use electricity regularly and safely from sources. |
| 8, Dlie Ya Commune Krong Nang District | In recent years, although the industry - construction and trade - service sectors have developed, the agricultural and forestry production is still the main economic sector in the commune. The total production value of all industries in 2017 reached 561,532 million VND. In which: agriculture reached 435,151.6 million VND, accounting for 77.5%; handicraft, construction reached 61,523.4 million VND, accounting for 11%; The service sector reached VND 64,857 million, accounting for 11.5%. The total cultivated area in the whole commune is 6.920 ha. The total area of perennial industrial crops is 4,849 ha. The total number of cattle in the commune is 2,381. Aquaculture area of the commune is about 75 ha. The average production value per capita is 37 million VND/person/year, reaching the plan target. The rate of trained workers reached 19.3%. The number of employees in the working age group accounts for 63.43% of the total population in the whole commune. | The natural area of Dlie Ya commune is about 86.25 km2. Dlie Ya commune includes 18 villages. The population of the commune is 15,202 people/3,510 households, of which 7,302 people/1,530 households are ethnic minorities (accounting for 36.1%). Ethnic minorities in the commune include Ede (729 households/3,646 people) and Tay, Nung, Thai, Muong, etc. (801 households/3,656 people). The number of poor households in the commune in 2017 is 288 households (accounting for 8.27%). Near-poor households are 303 households (accounting for 8.7%). In term of education, the commune meets the standards of preschool universalization for children, eliminating illiteracy. The universalizing primary and secondary education at the right 100% and 98%, respectively. In term of health, the commune has well performed medical examination and treatment for the people. The commune continuously maintains the criteria for meeting the national standards of health. The rate of malnourished children under 5 years old decreased to 14%. The proportion of people participating in health insurance was 89.35%. The proportion of people using clean water is 97.5%. The rate of villages and hamlets having electricity for daily life is 100%. |
| 9, Phu Xuan Commune Krong Nang District | Agricultural and forestry production activities are still the main economic sector in the commune. The total production value of the commune reaches VND 341 billion. In which: | Phu Xuan commune natural area is about 45.12 km2 and located in the east of Krong Nang district, including 32 villages and hamlets. The population of the commune is 18,123 people/3993 households. Ethnic |

| Location | Economic condition | Social condition |
|---|---|---|
| | forestry and fishery sector reaches 204.9 billion VND, accounting for 60%; industry and construction reaches 61,470 billion VND, accounting for 18%; Service trade reaches 75,130 billion VND, accounting for 22%. The total cultivated area in the whole commune is 4,785 / 4,530 ha. Annual crops: 1999 ha / 1744ha. Perennial plants: 2,786 ha / 2,786 ha. In which, Coffee: 2,365.9 ha / 2529 ha, total output reaches 7,097 tons. The total number of cattle in the commune is 5,610. Aquaculture area of the commune is about 250 ha. The average production value per capita is 35 million VND /person/year. The number of employees in the working age group accounts for 55.9% of the total population in the commune. | minorities in the commune include Thai, Tay and Nung. The number of poor households in the commune in 2017 is 96 households/3993 households (accounting for 2.4% of the total population of the commune), the number of near-poor households is 14 households (0.35%). In term of education, the commune has achieved the standard of preschool universalization for children, illiteracy eradication and universaling primary education at the right age. In term of health, the commune performs well the medical examination and treatment for the people. The commune continuously maintains the criteria to meet national standards of health. The rate of malnourished children is 220/1274, accounting for 16.3%. The proportion of people participating in different types of health insurance reaches 86.7%. In terms of infrastructure, the commune repair and upgrade 2 sewer overflow systems for Buon Ku and Ea Kmien 3. The rate of people using clean water reaches 96.35%. The rate of households having electricity for a living reaches 100%. |

*Source: Socio-economic report of subproject communes*

### 4.5 Sensitive and specific works

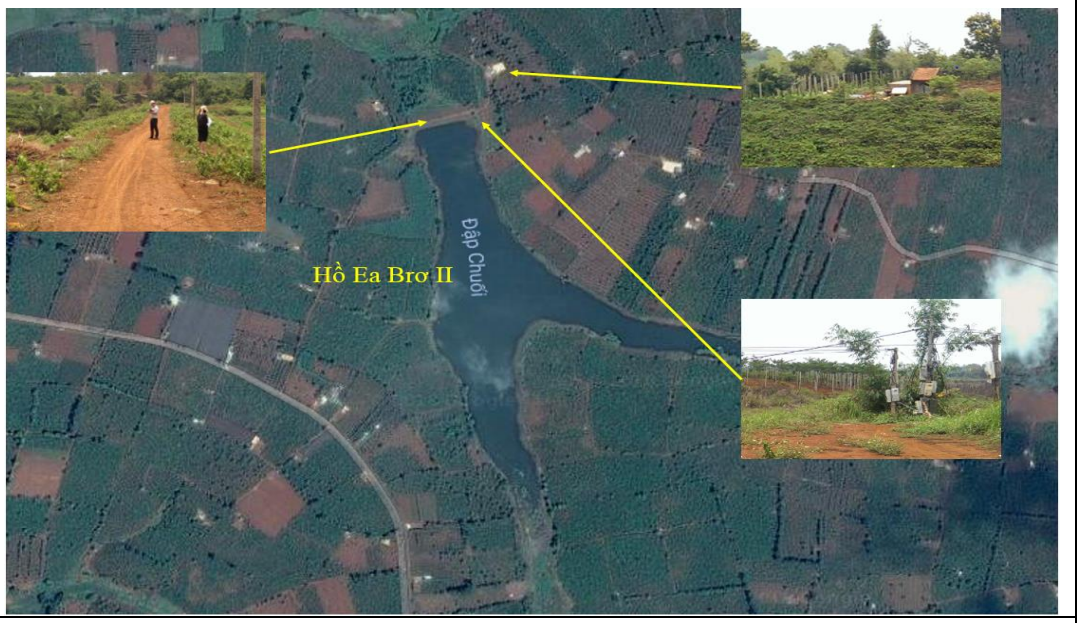
The Subproject is implemented in 9 communes in 7 districts of Dak Lak province. The subproject deployment in large-scale will not cause impact on the environment and local people's activities. The sensitive works to be noted during the construction of reservoirs are presented in the table below.

**Table 17. The status of sensitive works**

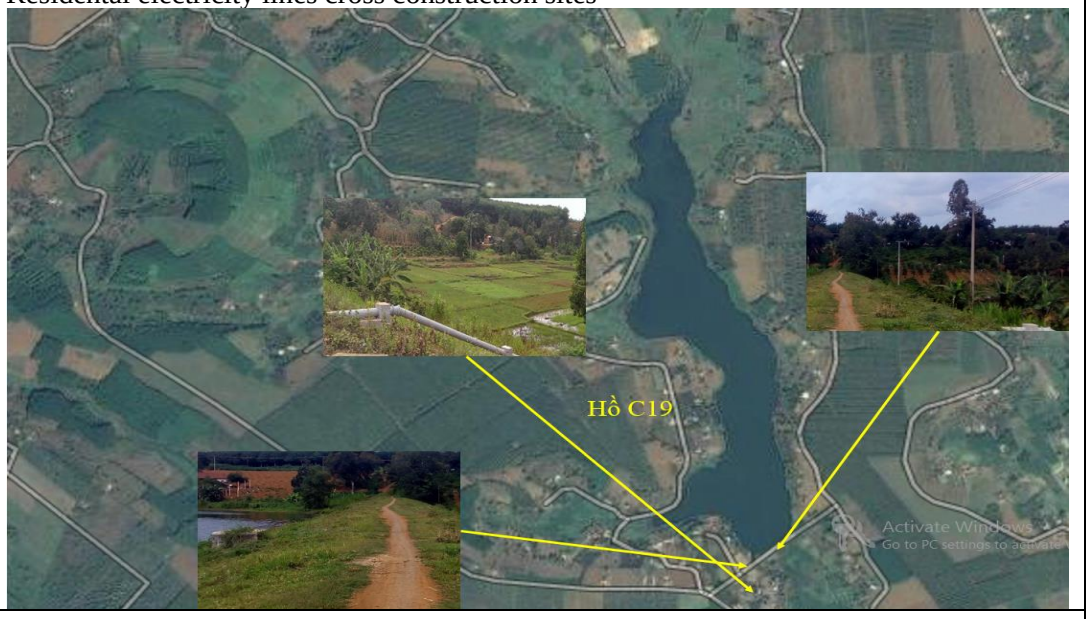
| Location | Current status of works |
|---|---|
| 1, Ea Uy reservoir, Hoa Tien commune, Krong Pak district | ❖ **Residental house**<br>Located near the reservoir, the construction area of the dam and offtake structure<br>❖ **Traffic road**<br>The dam site is also the residential traffic road in the region<br>❖ **Loi Nhon Pagoda**<br>Loi Nhon Pagoda is located 200m away from the material transportation route, 1km from the construction site. This is the belief area of the local community. This area is crowded on the 1st and full moon day of every month and Buddhist week. |

| Location | Current status of works |
|---|---|
| |  |
| 2, Buon Dung II reservoir, Ea Yong commune, Krong Pac district | ❖ **Traffic road**<br>Transportation materials road to the reservoir are earth, sloping, narrow roads, also the road to the fields of the people<br>  |
| 3, Ea Bong Thuong reservoir, Dlie Ya commune, Krong | ❖ **Traffic road**<br>The dam site is also the residential traffic road in the region |

| Location | Current status of works |
|---|---|
| Nang district |  |
| 4, Ea Kmien 3 reservoir, Phu Xuan commune, Krong Nang District | ❖ **Electric line**<br>Civil electric line is on the dam, providing low voltage electricity to local people<br>❖ **Pepper garden**<br>Pepper garden is near the construction work<br>❖ **Ly Tu Trong High School**<br>Ly Tu Trong High School is located near the material transportation road<br>❖ **Residental house**<br>People live near the construction site<br>  |

| Location | Current status of works |
|---|---|
| 5, Ea Bro 2 reservoir, Cu Pong commune, Krong Buk district | ❖ **Traffic road**<br>The dam site is also the residential traffic road in the region<br>❖ **Electric line**<br>Residental electricity lines cross construction sites, providing low voltage electricity to local people<br>❖ **Residental house**<br>People live near the construction site (30m away from the construction site)<br>  |
| 6, Ea Nao Dar reservoir, Cu Bao commune, Buon Ho town | ❖ **Cong Chinh church and parish**<br>Cong Chinh church and parish are located near the material transport road, 1.5 km away from the location of Ea Nao Dar |

| Location | Current status of works |
|---|---|
| |  |
| 7, Ea Ngach reservoir, Ea Drong commune, Buon Ho town | ❖ **Traffic road**<br>The dam site is also the residential traffic road in the region<br>❖ **Rice field**<br>Rice fields is near construction sites<br>❖ **No Trang Long Primary School**<br>No Trang Long Primary School is located near the material transportation road, 1.5 km away from the construction site of Ea Nghach reservoir.<br>  |

| Location | Current status of works |
|---|---|
| 8, C19 reservoir, Ea Rieng commune, M'Drak district | ❖ **Traffic road**<br>The dam site is also the residential traffic road in the region<br>❖ **Electric line**<br>Residental electricity lines cross construction sites<br>  |
| 9, 725 reservoir, Ea Rieng commune, M'Drak district | ❖ **Traffic road**<br>The dam site is also the residential traffic road in the region<br>  |
| 10, Doi 11 reservoir, | ❖ **Traffic road**<br>The dam site is also the residential traffic road in the region |

| Location | Current status of works |
|---|---|
| Ea Kmut commune, Ea Kar district |  |

# CHAPTER 5. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

## 5.1 Types and scale of impacts

The Subproject to be implemented in the area will cause certain impacts during the construction stage, however, the impact level is not high and can be minimized. Upon the completion of construction, the residential areas in the 11 reservoirs will be benefited from the restoration of public services/facilities, which promote economic growth and access to social services. Important flood control structures that are roads and dams to be repaired, reinforced, rehabilitated will increase the safety for people and property in bad weather conditions.

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

The table below defines the levels of negative impacts based on the levels of waste generation by construction activities[1].

**Table 18. The criteria for classification of negative impacts**

| Impact/Level | Low | Moderate | High |
|---|---|---|---|
| Waste water discharge (domestic and industrial wastewater) | Exceeding the technical waste regulation from 1.1 times to less than 1.5 times and the discharge volume is less than 5 m3/day | Exceeding the technical waste regulation from 1.1 times to less than 1.5 times and the discharge volume is less than 5 - 10 m3/day | Exceeding the technical waste regulation to more than 3 times and the discharge volume is more than 10 m3/day |
| Dust and Emissions | Exceeding the standard of 1.1 times to less than 1.5 times with the emission level of less than 500 m3/hour | Exceeding the standard of 1.5 times to less than 3 times with the emission level of less than 500 – 5000 m3/hour | Exceeding the standard of 3 times with the emission level more than 5000 m3/hour |
| Noise | Exceeding the standard of 2 to 5 dB | Exceeding the standard of 5 to 10 dB | Exceeding the standard of 10 dB |
| Vibration | Exceeding the standard of 2 to 5 dB | Exceeding the standard of 5 to 10 dB | Exceeding the standard of 10 dB |
| Domestic solid waste | Generating less than 1,000 kg/day | Generating from 1,000 to 2,000 kg/day | Generating more than 2,000 kg/day |
| Hazardous solid waste | Generating less than 100 | Generating 100 – 600 | Generating 600 kg/ day |

[1] Based on Decree No.155/2016 / ND-CP on sanctioning of administrative violations in the field of environmental protection.

| | kg/ day | kg/day | |
|---|---|---|---|
| Explosion-fire, oil spillage | Less than 2,000 kg | 2,000 to 10,000 kg | More than 10,000 kg |

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

***Direct impacts***: The direct impacts occur through the direct interaction of a subproject activity with environmental and social or economic components.

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

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

***Temporary impacts:*** the impacts that occur during the construction or within a short period of time after the construction.

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

### 5.2 Positive environmental and social impacts

The works of the Dak Lak subproject are aimed to prevent the risk of dam collapse, minimizing damages related to natural disasters, ensuring the safety of people, assets attached to land and long-term land for planting of people in the project area, contributing to the protection of local infrastructure. At the same time, the subproject will improve and enhance the safety of Dak Lak dam as it will also contribute significantly to environment and transport infrastructure improvent in the communes.

#### *5.2.1. Impact on society*

**(a) Economic benefits**

- During the past three years, the weather and climate have unpredictable changes, droughts occur frequently. The field survey time of the consultant group began in the rainy season but the rainfall was very low, not enough to serve production and living for people. People in the project area said that many houses had to drill wells to get water, however, not all households dig wells for water, partly because there is no money for drilling wells, partly because they do not reached groundwater table. The upgrading / repair of irrigation works will contribute to the supply of water for production and water recharge for groundwater sources for daily life.
- The main economic activities of the people in Dak Lak province in general and the people in the project area in particular are cultivation and animal husbandry, including planting of perennial trees and short-term crops with very high demands on irrigation water. The lack of irrigation water has a negative impact on the development of crops and livestock, reducing productivity and affecting the economy and income of people. Therefore, the improvement /

upgrading of irrigation systems will enhance the capacity to store water for the dry season, provide more adequate water for irrigation, increase crop productivity, thereby contributing to promoting economic development, improving people's lives.

**(b) Social benefits**

**(b.1). Improvement in the safety of the construction work**

- Over time of exploitation, use due to many reasons such as: The terrain is mostly steep hills and mountains, the rainfall is large so the ability to concentrate water quickly, rivers and streams are short, small, steep, so the intensity and frequency of floods rise and fall quickly. In addition, due to the exploitation of natural resources, especially watershed forests, there has been a dramatic change in the vegetation cover, causing the projects to be sedimented, the capacity of the reservoir is reduced, the capacity of flood prevention and flood drainage is significantly reduced compared to design capacity.
- In addition, the long-term constructions built on the basis of natural and hydrological conditions and design standards are no longer suitable to the current weather situation and developments, especially in the situation of the situation. Current climate change is taking place more and more complicated and unpredictable.
- Therefore, the implementation of the project will repair the damaged items and contribute to the safety of the construction works.

**(b.2). Impact on gender issues in the area**

- Lack of water affects the entire production and living life of men and women, children and the elderly in the area. However, the impact level for each group of people is different.
- For example, the lack of productive water increases the burden on men more by digging / drilling wells, pumping water for plants, reducing resting time and affecting quality of life. The lack of water for production, affecting crop productivity, decreasing income makes it difficult for the lives of all local people, many girls have to quit school due to the economic difficulties of families and young boys have to drop out of school because they have to add manpower to join the labor force, supplementing the shortage of family income due to drought situation.
- Thus, ensuring production water will contribute to improving economic and social life, reducing environmental pollution for local people. Economic development is a prerequisite for improving the quality of life, expanding opportunities for access to social services for people, especially access to education services for boys and girls.

### *5.2.2. Impact on the environment*

- In the province, river and stream basins often appear flash flood; they appear suddenly and fast. In conditions of climate chasnge, the situation is increasingly complicated. Flood, landslides, etc. occur with increasing frequency and intensity, threatening directly to degraded reservoirs, especially to downstream areas.
- Besides, the reservoirs are built long ago; therefore, the possibility of flood control and

flood drainage is no longer in line with current standards; In addition, the vegetation cover in the basin has changed in a disadvantageous direction compared to the time when the reservoirs were built. Therefore, repairing and improving dam safety for reservoirs is an important content in the flood and storm prevention and disaster mitigation plan in the province.

- When irrigation reservoirs accumulate water, they will contribute to creating a microclimate of the reservoir, embellish the environmental landscape, increase the humidity in the area, create favourable conditions for the formation and development of vegetation. It also has a positive impact on the ecosystem around the reservoir. The availability of irrigation reservoirs will contribute to a reduction in the fluctuation of thermal regime of the day, which will create conditions for some tropical plants to grow and raise the water level of groundwater to prevent forest fires in the dry season and it also facilitates irrigation or water supply in higher areas and help to regulate and balance water resources among regions and regions; between surface water and groundwater ...

## 5.3. Potential negative impacts

### *5.3.1. Preparation phase*

The Subproject consists of 10 scattered components in 7 districts. The scale of each component is small and medium. The construction period is not long. The works during this period were mainly geological survey drilling for feasibility study and detailed design, demarcation of land acquisition, demining and site clearance. Therefore, during this period, we only assess impacts from (1) compensation and land acquisition, (2) risks related to clearance of mines and bombs and (3) geological survey.

**(a) Impact of land acquisition**

**(a.1). Permanent impact**

Items are constructed to ensure Subproject safety shall cause impacts on land acquisition and assets attached to land like house, architecture and plants. Details of impact are presented as follows

***(a.1.1). Impact on land.***

The sub-project is expected to permanently acquire 5870m2 of land for construction of work items around the dam area. In that, 14 households will be loss a part of land for perennial and annual crops (The area of perennial crop land is 4860 m2 and the area of annual crop land is 230 m2). Besides, 1 household will be affected on residential land with an area of 500 $m^2$. 14/16 affected households have their own land use right certificate for the affected land. The summary of impacts on land is shown in the following table.

**Table 19. Impact of permanent land acquisition**

| No. | Reservoir | Commune | Land for perennial crops | | Land for annual crops | | Residential land | | Aquaculture land | | Total area ($m^2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Area ($m^2$) | No. of AHs | Area ($m^2$) | No. of AHs | Area ($m^2$) | No. of AHs | Area ($m^2$) | No. of AHs | |
| 1 | Ea Uy | Hoa Tien | 200 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 200 |
| 2 | Buon Dung II | Ea Yong | 580 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 580 |
| 3 | Ea Blong Thuong | Dlie Ya | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Ea Kmien 3 | Phu Xuan | 1450 | 2 | 0 | 0 | 0 | 0 | 280 | 1 | 1730 |
| 5 | Ea Bro II | Cu Pong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | Ea Nao Dar | Cu Bao | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Ea Ngach | Ea Drong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | C19 | Ea Rieng | 1420 | 2 | 230 | 1 | 0 | 0 | 0 | 0 | 1650 |
| 9 | 725 (C32) | Ea Rieng | 1210 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1210 |
| 10 | Doi 11 | Ea Kmut | 0 | 0 | 0 | 0 | 500 | 1 | 0 | 0 | 500 |
| | **Total** | | 4860 | 13 | 230 | 1 | 500 | 1 | 280 | 1 | **5870** |

*(Source: RAP report, June 2019)*

***(a.1.2). Impact on households***

16 households will be affected by the subproject. The total number of severely affected households is 01 household, including 01 household who has to resettle and lose more than 20% of production land. There are 02 vulnerable households including 1 EM household and 1 female-headed household. There is no affected business. Details of affected households are shown in the following table.

**Table 20. Impact on households**

| No. | Reservoir | Commune | Total No. of AHs | No. of relocated HHs | No. of HHs losing more than 20% of production land | No. of severely AHs | No. of HHs with affected houses and structures | No. of HHs with affected crops | No. of vulnerable HHs |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Ea Uy Thuong | Hoa Tien | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 2 | Buon Dung II | Ea Yong | 3 | 0 | 0 | 0 | 0 | 3 | |
| 3 | Ea Blong Thuong | Dlie Ya | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Ea Kmien 3 | Phu Xuan | 4 | 0 | 0 | 0 | 1 | 4 | 0 |
| 5 | Ea Bro II | Cu Pong | 0 | 0 | 0 | 0 | 0 | 0 | |
| 6 | Ea Nao Dar | Cu Bao | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| No. | Reservoir | Commune | Total No. of AHs | No. of relocated HHs | No. of HHs losing more than 20% of production land | No. of severely AHs | No. of HHs with affected houses and structures | No. of HHs with affected crops | No. of vulnerable HHs |
|---|---|---|---|---|---|---|---|---|---|
| 7 | Ea Ngach | Ea Drong | 0 | 0 | 0 | 0 | 0 | 0 | |
| 8 | C19 | Ea Rieng | 2 | 0 | 0 | 0 | 1 | 2 | |
| 9 | 725 (C32) | Ea Rieng | 5 | 0 | 0 | 0 | 2 | 5 | 2 |
| 10 | Doi 11 | Ea Kmut | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | **Total** | | 16 | 1 | 1 | 1 | 5 | 16 | 2 |

*(Source: RAP report, June 2019)*

***(a.1.3). Impact on houses and structures***

Preliminary impact statistics are shown in the following table. Entire houses of 14 households will be affected and they must relocate.

**Table 21. Impact on houses and structures**

| No. | Reservoir | Commune | 4-level house ($m^2$) | Kitchen ($m^2$) | Breeding facilities ($m^2$) | Gate ($m^2$) | Toilet ($m^2$) | Driven well | Stainless steel tank ($m^3$) | Yard ($m^2$) | Fish pond ($m^3$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ea Uy Thuong | Hoa Tien | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Buon Dung II | Ea Yong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | Ea Blong Thuong | Dlie Ya | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Ea Kmien 3 | Phu Xuan | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 20 | 420 |
| 5 | Ea Bro II | Cu Pong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | Ea Nao Dar | Cu Bao | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Ea Ngach | Ea Drong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | C19 | Ea Rieng | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 725 (C32) | Ea Rieng | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | Doi 11 | Ea Kmut | 40 | 25 | 150 | 0 | 4 | 1 | 2.5 | 70 | 0 |
| **Total** | | | 40 | 25 | 193 | 1 | 4 | 1 | 2.5 | 90 | 420 |

*(Source: RAP report, June 2019)*

**(a.2). Temporary impact**

This subproject will temporarily acquire 189,200 m2 of public land to build camps and material yards. This temporary land acquisition does not affect any household because these lands are the unused public land and managed by CPCs and will be returned after completion of the project. Details of temporary land use in communes are shown in the table below.

In addition, contractors will pay temporary land use fees, if required. In consultation with landowners, about any damage to land and crops, the contractor will pay for damaged crops or

lost income due to the affected households can not cultivate during the temporary use of their land. The contractor is also required to restore the condition of the soil at least the same as before construction. These requirements will be specified in bidding documents and construction contracts.

**Table 22. Impact of temporary land acquisition**

| No. | Reservoir | Commune | Public land | |
|---|---|---|---|---|
| | | | Area (m2) | No. of AHs |
| 1 | Ea Uy Thuong | Hoa Tien | 91,000 | 0 |
| 2 | Buon Dung II | Ea Yong | 5,000 | 0 |
| 3 | Ea Blong Thuong | Dlie Ya | 14,000 | 0 |
| 4 | Ea Kmien 3 | Phu Xuan | 10,000 | 0 |
| 5 | Ea Bro II | Cu Pong | 10,000 | 0 |
| 6 | Ea Nao Dar | Cu Bao | 1,200 | 0 |
| 7 | Ea Ngach | Ea Drong | 17,000 | 0 |
| 8 | C19 | Ea Rieng | 15,000 | 0 |
| 9 | 725 (C32) | Ea Rieng | 7,000 | 0 |
| 10 | Doi 11 | Ea Kmut | 19,000 | 0 |
| **Total** | | | 189,200 | 0 |

**(b) Impact of risk of bombs and mines (UXO)**

The work of mines clearance after the war is very important. In the areas of Dak Lak province, there are many areas heavily affected by persistent mines and ERW. This is a very dangerous source of impact not only affecting the health and life of those who directly implement but also affect the security and order of society. The consequences of explosions caused by intentional or unintentional bombs have left great losses in health, life and material possessions, which are worries and burdens for families of victims and society. Dams under the subproject have been exploiting for long time, however, in the process of repairing and upgrading, many new areas have been acquired, some areas are occupied but have not yet cleared bombs like routes. traffic, material yards, etc. in the process of constructing earthworks, levelling the ground, ... can affect the health and life of construction workers, assets of the subproject and people live near the construction area.

**(c) The site clearance**

The site clearance during this period is mainly carried out by the affected households on the agricultural and forestry land that is temporarily or permanently acquired. As a result, some waste from the site clearance will be generated. These activities will also affect the fauna in the sub-project area due to habitat loss and ecological landscapes change

**Table 23. Summary of trees, crops affected by the Subproject**

| No. | Reservoir | Commune | Coffee (tree) | Durian (tree) | Banana (tree) | Orange (tree) | Tea (m2) | Pepper (tree) | Avocado (tree) | Jackfruit (tree) | Mango (tree) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ea Uy Thuong | Hoa Tien | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| 2 | Buon Dung II | Ea Yong | 20 | 2 | 10 | 0 | 0 | 5 | 3 | 1 | 6 |
| 3 | Ea Blong Thuong | Dlie Ya | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Ea Kmien 3 | Phu Xuan | 0 | 0 | 0 | 0 | 0 | 30 | 8 | 0 | 0 |
| 5 | Ea Bro II | Cu Pong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | Ea Nao Dar | Cu Bao | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Ea Ngach | Ea Drong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | C19 | Ea Rieng | 12 | 12 | 10 | 0 | 10 | 40 | 2 | 7 | 5 |
| 9 | 725 (C32) | Ea Rieng | 5 | 5 | 0 | 50 | 0 | 70 | 2 | 7 | 0 |
| 10 | Doi 11 | Ea Kmut | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| **Total** | | | **37** | **19** | **20** | **50** | **10** | **145** | **20** | **17** | **12** |

*(Source: RAP report, June 2019)*

### (d) Impact due to geological surveys

Prior to the design for the construction works, it needs to survey geological conditions, which imposes risk of impurities affecting the quality of rgroundwater. The number and deep of drill holes are shown in the table below.

**Table 24. Volume of geological survey drilling**

| No. | Construction site | Volume of geological survey drilling | | | | |
|---|---|---|---|---|---|---|
| | | **The feasibility study stage (m)** | **Drilling hole depth (m)** | **Technical design phase (m)** | **Drilling hole depth (m)** | **Total length of drilling holes (m)** |
| 1 | Buon Dung II reservoir, Ea Yong commune, Krong Pac district | 79.00 | 0-30 | 75.00 | 0-30 | 154.00 |
| 2 | Ea Uy reservoir, Hoa Tien commune, Krong Pac district | 118.00 | 0-30 | 20.00 | 0-30 | 138.00 |
| 3 | Doi 11 reservoir, Ea Kmut commune, Ea Kar district | 112.00 | 0-30 | - | | 112.00 |
| 4 | 725 reservoir, Ea Rieng commune, M'Drak district | 80.00 | 0-30 | - | | 80.00 |
| 5 | C19 reservoir, Ea Rieng commune, M'Drak district | 80.00 | 0-30 | 18.00 | 0-10 | 98.00 |
| 6 | Ea Nao Dar reservoir, Cu Bao commune, Buon Ho town | 51.00 | 0-30 | - | | 51.00 |
| 7 | Ea Ngach reservoir, Ea Drong commune, Buon Ho town | 76.00 | 0-30 | 39.00 | 0-10 | 115.00 |
| 8 | Ea Bro II reservoir, Cu Pong commune, Krong Buk district | 102.00 | 0-30 | - | 0-10 | 102.00 |
| 9 | Ea Blong Thuong reservoir, Dlie Ya commune, Krong Nang district | 78.00 | 0-30 | | 0-10 | 78.00 |
| 10 | Ea Kmien 3 reservoir, Phu Xuan commune, Krong Nang district | 86.00 | 0-30 | | 0-10 | 86.00 |
| **Total** | | **862.00** | | **152.00** | | **1,014.00** |

*Source: Management Board of Dam Rehabilitation and Safety Improvement Project (WB8) in Dak Lak Province*

### *5.3.2. Construction phase*

**(a) Construction activities and sources of impact**

**(a.1). Construction activities**

- Site clearance and levelling;
- Repair and construction of culverts;
- Upgrading upstream, downstream dam slopes;
- Repair and construction of spillways;
- Repair and construction of management roads.

**(a.2). Source of waste related impact**

❖ ***Sources of solid waste***

- Waste from site clearance, site preparation;
- Domestic waste from workers at construction sites;
- Waste from building materials at site: stones, soil, cement bags ...

❖ ***Sources of liquid waste***

- Water for washing stone, sand, gravel;
- Waste oil;
- Domestic wastewater from workers at construction sites and camps.

❖ ***Sources of emission***

- Excavation, levelling ground;
- constructing construction road, management road;
- Concrete, mortar mixing;
- Operation of transport vehicles, machines;
- Operation of construction equipment as bulldozers, excavators, compactors, trucks etc.

**(a.3). Sources of non-waste related impacts**

Due to construction methods in levelling the ground, removing waste soil and rock at the place with steep terrain along the river and reservoir, it leads to an increase in the amount of washed away sand into the water body, increasing turbidity, affecting the water supply and use of people living in the downstream.

The bad awareness of local people and workers in the management of domestic waste, water, washing machines and construction equipment can affect surface water, groundwater and soil quality. During the construction period, due to the characteristics of the works, many items may affect the water quality in the downstream area.

Site clearance activities may pose a risk of injury to workers and locals as a result of the operation of machinery, means of transport, breakage when clearing and cutting trees. However, there is not so much work and impacts can be managed through safe construction and advance notice to the people in the project area. Therefore, the impact from this source is low.

During the construction phase, machinery and vehicles for transportation and construction of the subproject items will cause noise and vibration, which may affect the living and health of people living nearby the construction site.

This is a rehabilitation and improvement project which does not allow water level to be lowered, therefore, time of construction is dry season and water diversion is not required. Thus, there is no water cutoff in favor of construction.

**(b) Sources of impact related to waste**

**(b.1). Source of air pollution**

Source of air pollution in the subproject area include:

- Dust and emission generated arising from site clearance;
- Dust and emission arising from the material transportation;
- Dust arising from earthworks;
- Emission ($SO_x$, $NO_x$, CO, $CO_2$) arising from construction equipment, transportation of fill soil and residual soil.

***(b.1.1). Dust and emission generated arising from site clearance***

***b.1.1.1. Emission***

When operating, the vehicles will discharge air pollutants into the environment such as COx, NOx, SOx, hydrogen carbon, dust ...

Biomass generated by site clearance includes shrubs, branches and roots. The volume of transported biomass is shown in the following table:

**Table 25. Volume of transported biomass**

| Structure | Volume of transported biomass (ton) | Total number of transport vehicles (truck) | Transport time (day) | Number of truck in one day (truck/day) | Average transport distance (km) |
|---|---|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 1.5 | 1 | 1 | 1 | 0.3 – 0.5 |
| Ea Uy reservoir, Hoa Tien commune | 47.1 | 5 | 1 | 5 | 1.2 |
| Doi 11 reservoir, Ea Kmút commune | 16.6 | 2 | 1 | 2 | 1.5 |
| 725 reservoir, Ea Rieng commune | 3.8 | 1 | 1 | 1 | 0.25 |
| C19 reservoir, Ea Rieng commune | 2.3 | 1 | 1 | 1 | 0.4 |
| Ea Nao Dar reservoir, Cu Bao commune | 1.2 | 1 | 1 | 1 | 0.1 |
| Ea Ngach reservoir, Ea Drong commune | 7.7 | 1 | 1 | 1 | 0.5 |
| Ea Bro II reservoir, Cu Pong commune | 5.4 | 1 | 1 | 1 | 0.2 – 0.3 |

| Structure | Volume of transported biomass (ton) | Total number of transport vehicles (truck) | Transport time (day) | Number of truck in one day (truck/day) | Average transport distance (km) |
|---|---|---|---|---|---|
| Ea Blong Thuong reservoir, Dlie Ya commune | 11.3 | 1 | 1 | 1 | 0.5 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 11.3 | 1 | 1 | 1 | 0.2 |

*(The project uses 10-ton truck to transport biomass)*

At present, there is no standardized data on the sources of waste generated by vehicles, so it is possible to use the Rapid evaluation method of World Health Organization (WHO) and other relevant documents (*).

**Table 26. Air pollution coefficient for trucks**

| Vehicles | Unit (U) | TSP kg/U | $SO_2$ kg/U | $NO_x$ kg/U | CO kg/U | VOC kg/U |
|---|---|---|---|---|---|---|
| Large trucks with 3.5 to 16-ton diesel engines | 1000 km | 0,9 | 4,29S | 11,8 | 6 | 2,6 |
| | tn of Fuel | 4,3 | 20S | 55 | 28 | 12 |

*Note: S is the sulfur content of diesel oil S = 0,05(%)*

(*) 1. "Assessment of source of Air, water and land pollution" of World Health Organization (WHO);

2. Handbook on Environmental Technology Volume I " Assessment of sources of air, water, and land pollution" Geneva 1993;

3. "Air pollution and waste gas treatment " of Tran Ngoc Chan.

The air pollutant load from biomass transport is listed in the table below:

**Table 27. Air pollution load of biomass transport vehicles**

| Items | Load (kg/day) | | | | |
|---|---|---|---|---|---|
| | TSP | $SO_2$ | $NO_x$ | CO | VOC |
| Buon Dung 2 reservoir, Ea Yong commune | 0.027 | 0.006 | 0.354 | 0.180 | 0.078 |
| Ea Uy reservoir, Hoa Tien commune | 0.079 | 0.019 | 1.038 | 0.528 | 0.229 |
| Doi 11 reservoir, Ea Kmút commune | 0.016 | 0.004 | 0.212 | 0.108 | 0.047 |
| 725 reservoir, Ea Rieng commune | 0.016 | 0.004 | 0.212 | 0.108 | 0.047 |
| C19 reservoir, Ea Rieng commune | 0.016 | 0.004 | 0.212 | 0.108 | 0.047 |
| Ea Nao Dar reservoir, Cu Bao commune | 0.013 | 0.003 | 0.165 | 0.084 | 0.036 |
| Ea Ngach reservoir, Ea Drong commune | 0.022 | 0.005 | 0.283 | 0.144 | 0.062 |

| | | | | | |
|---|---|---|---|---|---|
| Ea Bro II reservoir, Cu Pong commune | 0.014 | 0.003 | 0.177 | 0.090 | 0.039 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 0.009 | 0.002 | 0.118 | 0.060 | 0.026 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 0.014 | 0.003 | 0.177 | 0.090 | 0.039 |

The concentration of pollutants at one point with the coordinates x, y is determined by the following formula:

$$C_{x,0,0} = \frac{10^3.\eta.M.B}{\sqrt{\pi}.C_z u.x^{1-n/2}}.e^{-H^{2/C_z^2 x^{2-n}}} \quad (1)$$

(Tran Ngoc Chan, "Air pollution and waste gas treatment, volume 1, page 164).

Where:

- M: Pollutant unit quantity from road, g/s;
- B = 2 (for long distances);
- H: The height of the road compared to the ground, m;
- x,y: computational point, m
- u: Wind speed; u = 1,13m/s;
- $C_y$, $C_z$: Diffusion coefficients diffuse in horizontal and vertical directions. Under normal conditions, its value is $C_y = C_z = 0,05$;
- n: Factors include the changes in climatic conditions, temperature fields in height. For low height road, n = 0;
- η: The coefficient refers to the measurement time (sampling) of the environmental parameters;

$$\eta = 1 + \frac{5 - \Delta r}{2\Delta r^{0,9}}$$

Δr: Sampling time, minute (Δr=10 minutes).

Air pollution concentration due to biomass transportation are shown in the following table:

**Table 28. Concentration of emission arising from biomass transport vehicles**

| Item | Distance | Norms | | | | |
|---|---|---|---|---|---|---|
| | | TSP | $SO_2$ | $NO_x$ | CO | VOC |
| | | mg/m³ | mg/m³ | mg/m³ | mg/m³ | mg/m³ |
| Buon Dung II Reservoir, Ea Yong commune | 50m | 0.072 | 0.016 | 0.946 | 0.481 | 0.208 |
| | 100m | 0.034 | 0.007 | 0.442 | 0.225 | 0.097 |
| | 200m | 0.013 | 0.003 | 0.173 | 0.088 | 0.038 |
| Ea Uy Reservoir, Hoa Tien commune | 50m | 0.211 | 0.051 | 2.773 | 1.41 | 0.612 |

| Item | Distance | Norms | | | | |
|---|---|---|---|---|---|---|
| | | **TSP** | **$SO_2$** | **$NO_x$** | **CO** | **VOC** |
| | | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| | 100m | 0.099 | 0.024 | 1.296 | 0.659 | 0.286 |
| | 200m | 0.039 | 0.009 | 0.509 | 0.259 | 0.112 |
| Doi 11 reservoir, Ea Kmút commune | 50m | 0.043 | 0.011 | 0.566 | 0.289 | 0.126 |
| | 100m | 0.02 | 0.005 | 0.265 | 0.135 | 0.059 |
| | 200m | 0.008 | 0.002 | 0.104 | 0.053 | 0.023 |
| 725 reservoir, Ea Rieng commune | 50m | 0.043 | 0.011 | 0.566 | 0.289 | 0.126 |
| | 100m | 0.02 | 0.005 | 0.265 | 0.135 | 0.059 |
| | 200m | 0.008 | 0.002 | 0.104 | 0.053 | 0.023 |
| C19 reservoir, Ea Rieng commune | 50m | 0.043 | 0.011 | 0.566 | 0.289 | 0.126 |
| | 100m | 0.02 | 0.005 | 0.265 | 0.135 | 0.059 |
| | 200m | 0.008 | 0.002 | 0.104 | 0.053 | 0.023 |
| Ea Nao Dar reservoir, Cu Bao commune | 50m | 0.035 | 0.008 | 0.441 | 0.224 | 0.096 |
| | 100m | 0.016 | 0.004 | 0.206 | 0.105 | 0.045 |
| | 200m | 0.006 | 0.001 | 0.081 | 0.041 | 0.018 |
| Ea Ngach reservoir, Ea Drong commune | 50m | 0.059 | 0.013 | 0.756 | 0.385 | 0.166 |
| | 100m | 0.027 | 0.006 | 0.353 | 0.18 | 0.077 |
| | 200m | 0.011 | 0.002 | 0.139 | 0.071 | 0.03 |
| Ea Bro II reservoir, Cu Pong commune | 50m | 0.037 | 0.008 | 0.473 | 0.24 | 0.104 |
| | 100m | 0.017 | 0.004 | 0.221 | 0.112 | 0.049 |
| | 200m | 0.007 | 0.001 | 0.087 | 0.044 | 0.019 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 50m | 0.024 | 0.005 | 0.315 | 0.16 | 0.069 |
| | 100m | 0.011 | 0.002 | 0.147 | 0.075 | 0.032 |
| | 200m | 0.004 | 0.001 | 0.058 | 0.029 | 0.013 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 50m | 0.037 | 0.008 | 0.473 | 0.24 | 0.104 |
| | 100m | 0.017 | 0.004 | 0.221 | 0.112 | 0.049 |
| | 200m | 0.007 | 0.001 | 0.087 | 0.044 | 0.019 |
| **QCVN 05:2013/BTNMT** | | 0.3 | 0.35 | 0.2 | 30 | - |

Based on the results of the calculations of the emission concentration arising from biomass transport, most of the indicators are within the permissible limits of QCVN 05: 2013 / BTNMT. However, the NOx concentration exceeds the limit of standard at the distance of 50m and 100m. At the distance of 200m, all the indicators are within the range of standards. Therefore, emissions

affecting people living near the construction area are negligible, and mitigation measures will be applied to workers. In addition, the construction equipment inspection is carried out regularly, so the impact is assessed at an average level.

***b.1.1.2. Dust***

❖ *Dust arising from biomass transport*

During transportation of biomass, dust will be generated in the air environment around the project area and on transportation routes of vehicles..

Based on the formula to calculate the amount of dust arising from the transportation process of the US Environmental Protection Agency *(AP-42: Compilation of Air Emissions Factors, Section 13.2.2. Unpaved Road, EPA, 9/1998)*:

$$L = 1{,}7k\left[\frac{s}{12}\right]\times\left[\frac{S}{48}\right]\times\left[\frac{W}{2{,}7}\right]^{0{,}7}\times\left[\frac{w}{4}\right]^{0{,}5}\times\left[\frac{365-p}{365}\right]$$

Where:

L: The amount of dust (kg / km / car / day);

k: particle size (k = 0.2);

s: soil on the road (s = 8,9%);

S: average velocity of the truck (S = 25 km/h);

W: Total weight of truck (W = 10 ton);

w: number of wheels (w = 6 wheels);

p: Number of rainy days in the year (167 day).

Put in the formular, we can calculate that: L = 0.0013 kg / km / car / day.

**Table 29. The amount of dust arising from the biomass transport**

| Items | Number of transport vehicles (truck/day) | Average transport distance (km) | The amount of generated dust (kg/day) |
|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 1 | 0.3 – 0.5 | 0.52 |
| Ea Uy reservoir, Hoa Tien commune | 5 | 1.2 | 7.8 |
| Doi 11 reservoir, Ea Kmut commune | 2 | 1.5 | 3.9 |
| 725 reservoir, Ea Rieng commune | 1 | 0.25 | 0.325 |
| C19 reservoir, Ea Rieng commune | 1 | 0.4 | 0.52 |
| Ea Nao Dar reservoir, Cu Bao commune | 1 | 0.1 | 0.13 |
| Ea Ngach reservoir, Ea Drong commune | 1 | 0.5 | 0.65 |
| Ea Bro II reservoir, Cu Pong commune | 1 | 0.2 – 0.3 | 0.325 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 1 | 0.5 | 0.65 |

| | | | |
|---|---|---|---|
| Ea Kmien 3 reservoir, Phu Xuan commune | 1 | 0.2 | 0.26 |

However, the emission of dust depends on weather conditions such as temperature, humidity, seasonal wind so the concentration of dust that pollutes the air in the sunny day will be greater than the rainy day. Bad road conditions, earth roads, etc. also cause an increase in local dust concentrations. The affected objectives of the impact of dust arising from the transportation routes are the households living near the transportation route, the workers or the traffic participants. Since the deposition capacity of dust is high and the emission capacity of dust is small, the dust concentration in the emission area is higher and directly affects the traffic participants or the people living near to the source of discharge. Duration of impact is about 1 day.

❖ *Dust arising from site clearance*

The site clearance process includes the following activities: site clearance for the camp,site clearance for the material yard, cleaning weathered dam surface and dredging mud in the spillway area.

The estimated depth of site clearance is about 0.2m.

**Table 30. Volume of soil in site clearance process**

| No. | Item | Unit | Area | Volume of soil in site clearance process ($m^3$) |
|---|---|---|---|---|
| 1 | Buon Dung II reservoir | ha | 0.3 | 600 |
| 2 | Ea Uy reservoir | ha | 6.7 | 13,400 |
| 3 | Doi 11 reservoir | ha | 2 | 4,000 |
| 4 | 725 reservoir | ha | 0.8 | 1,600 |
| 5 | C19 reservoir | ha | 0.265 | 530 |
| 6 | Ea Nao Dar reservoir | ha | 0.55 | 1,100 |
| 7 | Ea Ngach reservoir | ha | 2.9 | 5,800 |
| 8 | Ea Bro II reservoir | ha | 1 | 2,000 |
| 9 | Ea Blong Thuong reservoir | ha | 1 | 2,000 |
| 10 | Ea Kmien 3 reservoir | ha | 1.5 | 3,000 |

The level of dust diffusion is calculated based on the pollution coefficient and soil excavation volume. Based on Enviromental assessment sourcebook of WB *(Enviromental assessment sourcebook, volume II, sectoral guidelines, enviroment, World Bank, Washington D.C, 8/1991),* The pollution coefficient is determined by the formula:

$$E = k \times 0,0016 \times \frac{(U/2,2)^{1,3}}{(M/2)^{1,4}}$$

Where:

E: Pollution coefficient (kg/ton)

k: grain structure of sand: 0.35

U: Average wind speed of 05 years (m/s); 2.2 m/s.

M: The average moisture content of the material (%), 30%

By using the above formula, we have calculated the pollution coefficient E = 0.008 kg / ton of soil.

The volume of dust, sand, soil arising from the site clearance process is calculated according to the formula:

$$W = E \times Q \times d$$

Where:

W: The amount of generated dust (kg)

E: Pollution coefficient (kg/ton)

Q: The volume of soil from site clearance ($m^3$);

d: The density of soil; 1,45 (ton/$m^3$)

**Table 31. The amount of dust arising from site clearance process**

| No. | Item | Volume of soil in site clearance process ($m^3$) | The amount of generated dust (kg) | Construction time (day) | The load of generated dust (kg/day) |
|---|---|---|---|---|---|
| 1 | Buon Dung 2 reservoir, Ea Yong commune | 600 | 7.0 | 8 | 0.9 |
| 2 | Ea Uy reservoir, Hoa Tien commune | 13,400 | 155.4 | 25 | 6.2 |
| 3 | Doi 11 reservoir, Ea Kmut commune | 4,000 | 46.4 | 10 | 4.6 |
| 4 | 725 reservoir, Ea Rieng commune | 1,600 | 18.6 | 5 | 3.7 |
| 5 | C19 reservoir, Ea Rieng commune | 530 | 6.1 | 5 | 1.2 |
| 6 | Ea Nao Dar reservoir, Cu Bao commune | 1,100 | 12.8 | 2 | 6.4 |
| 7 | Ea Ngach reservoir, Ea Drong commune | 5,800 | 67.3 | 10 | 6.7 |
| 8 | Ea Bro II reservoir, Cu Pong commune | 2,000 | 23.2 | 6 | 3.9 |
| 9 | Ea Blong Thuong reservoir, Dlie Ya commune | 2,000 | 23.2 | 7 | 3.9 |

| | | | | | |
|---|---|---|---|---|---|
| 10 | Ea Kmien 3 reservoir, Phu Xuan commune | 3,000 | 34.8 | 9 | 3.9 |

Generated dust includes suspended dust and deposited dust affecting the health of workers of the project, especially the workers working directly with the excavators The dust concentration in the construction site will be higher than the surrounding area. Most of the dust is generated when the weather is hot and the wind is strong. The affected objects are at the downward of the wind direction of the source. In addition, dust also affects the flora in the vicinity of the construction site. Because of the varying quantity of earthwork at each cluster, the duration of impact at each cluster is different. It is mainly about 2 to 25 days. The impacted area is located in the subproject area and the area affected by the downward of wind direction starting from the source. Due to the large weight of the dust, its size is small from 0.05 – 0.1 mm and is limited in space so the dust is deposited in place and disperses along the length of the construction site.

***(b.1.2). Dust and emission arising from machinery and materials transportation***

***b.1.2.1. Emission***

In the transportatio process of construction materials such as sand, stone, iron, steel, cement ... for the construction of project items, it will generate the major emissions of CO, $NO_x$, $SO_2$, etc.

**Table 32. The volume of raw materials and the number of vehicle transport during the construction phase**

| Item | Volume of transported material (ton) | Total number of vehicle transport (truck) | Transport time (day) | Number of truck in one day (truck/day) | Average transport distance (km) |
|---|---|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 8,661 | 866 | 100 | 9 | 18 |
| Ea Uy reservoir, Hoa Tien commune | 32,980 | 3,298 | 150 | 22 | 16 |
| Doi 11 reservoir, Ea Kmut commune | 13,805 | 1,381 | 120 | 12 | 24 |
| 725 reservoir, Ea Rieng commune | 7,278 | 728 | 90 | 8 | 14 |
| C19 reservoir, Ea Rieng commune | 5,910 | 591 | 100 | 6 | 14 |
| Ea Nao Dar reservoir, Cu Bao commune | 1,153 | 115 | 90 | 1 | 17 |
| Ea Ngach reservoir, | 2,124 | 212 | 140 | 2 | 22 |

| | | | | | |
|---|---|---|---|---|---|
| Ea Drong commune | | | | | |
| Ea Bro II reservoir, Cu Pong commune | 6,609 | 661 | 900 | 1 | 16 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 6,474 | 647 | 120 | 5 | 22 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 7,154 | 715.4 | 150 | 5 | 25 |

*(The project uses vehicles with a capacity of 10 tons to transport raw materials)*

The load of emissions causing air pollution from the transport of construction materials and operating machinery and equipment for project implementation are listed in the following table.:

**Table 33. The air pollution load arising from material transport vehicles**

| No. | Item | Load (kg/day) | | | | |
|---|---|---|---|---|---|---|
| | | **TSP** | **$SO_2$** | **$NO_x$** | **CO** | **VOC** |
| 1 | Buon Dung 2 reservoir, Ea Yong commune | 0.156 | 0.037 | 2.044 | 1.039 | 0.450 |
| 2 | Ea Uy reservoir, Hoa Tien commune | 0.594 | 0.141 | 7.783 | 3.958 | 1.715 |
| 3 | Doi 11 reservoir, Ea Kmut commune | 0.248 | 0.059 | 3.258 | 1.657 | 0.718 |
| 4 | 725 reservoir, Ea Rieng commune | 0.131 | 0.031 | 1.718 | 0.873 | 0.378 |
| 5 | C19 reservoir, Ea Rieng commune | 0.106 | 0.025 | 1.395 | 0.709 | 0.307 |
| 6 | Ea Nao Dar reservoir, Cu Bao commune | 0.021 | 0.005 | 0.272 | 0.138 | 0.060 |
| 7 | Ea Ngach reservoir, Ea Drong commune | 0.038 | 0.009 | 0.501 | 0.255 | 0.110 |
| 8 | Ea Bro II reservoir, Cu Pong commune | 0.119 | 0.028 | 1.560 | 0.793 | 0.344 |
| 9 | Ea Blong Thuong reservoir, Dlie Ya commune | 0.117 | 0.028 | 1.528 | 0.777 | 0.337 |
| 10 | Ea Kmien 3 reservoir, Phu Xuan commune | 0.106 | 0.025 | 0.501 | 0.255 | 0.110 |

The maximum pollution concentration level arising from the material transport vehicles is shown in the following table:

**Table 34. The concentration of pollutant emissions of materials transport vehicles**

| Item | Distance | Norms | | | | |
|---|---|---|---|---|---|---|
| | | **TSP** | **$SO_2$** | **$NO_x$** | **CO** | **VOC** |
| | | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| Buon Dung II Reservoir, Ea Yong commune | 50m | 0.417 | 0.099 | 5.46 | 2.776 | 1.202 |
| | 100m | 0.195 | 0.046 | 2.552 | 1.297 | 0.562 |
| | 200m | 0.076 | 0.018 | 1.002 | 0.509 | 0.221 |
| Ea Uy Reservoir, Hoa Tien commune | 50m | 1.587 | 0.377 | 20.791 | 10.573 | 4.581 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 100m | 0.742 | 0.176 | 9.717 | 4.941 | 2.141 |
| | 200m | 0.291 | 0.069 | 3.814 | 1.94 | 0.84 |
| Doi 11 reservoir, Ea Kmút commune | 50m | 0.486 | 0.116 | 6.382 | 3.246 | 1.407 |
| | 100m | 0.227 | 0.054 | 2.983 | 1.517 | 0.657 |
| | 200m | 0.089 | 0.021 | 1.171 | 0.595 | 0.258 |
| 725 reservoir, Ea Rieng commune | 50m | 0.257 | 0.061 | 3.366 | 1.71 | 0.74 |
| | 100m | 0.12 | 0.028 | 1.573 | 0.799 | 0.346 |
| | 200m | 0.047 | 0.011 | 0.617 | 0.314 | 0.136 |
| C19 reservoir, Ea Rieng commune | 50m | 0.208 | 0.049 | 2.733 | 1.389 | 0.601 |
| | 100m | 0.097 | 0.023 | 1.277 | 0.649 | 0.281 |
| | 200m | 0.038 | 0.009 | 0.501 | 0.255 | 0.11 |
| Ea Nao Dar reservoir, Cu Bao commune | 50m | 0.041 | 0.01 | 0.533 | 0.27 | 0.118 |
| | 100m | 0.019 | 0.005 | 0.249 | 0.126 | 0.055 |
| | 200m | 0.008 | 0.002 | 0.098 | 0.05 | 0.022 |
| Ea Ngach reservoir, Ea Drong commune | 50m | 0.074 | 0.018 | 0.981 | 0.5 | 0.215 |
| | 100m | 0.035 | 0.008 | 0.459 | 0.233 | 0.101 |
| | 200m | 0.014 | 0.003 | 0.18 | 0.092 | 0.04 |
| Ea Bro II reservoir, Cu Pong commune | 50m | 0.233 | 0.055 | 3.056 | 1.553 | 0.674 |
| | 100m | 0.109 | 0.026 | 1.428 | 0.726 | 0.315 |
| | 200m | 0.043 | 0.01 | 0.561 | 0.285 | 0.124 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 50m | 0.229 | 0.055 | 2.993 | 1.522 | 0.66 |
| | 100m | 0.107 | 0.026 | 1.399 | 0.711 | 0.309 |
| | 200m | 0.042 | 0.01 | 0.549 | 0.279 | 0.121 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 50m | 0.229 | 0.055 | 2.993 | 1.522 | 0.46 |
| | 100m | 0.119 | 0.011 | 0.241 | 0.654 | 0.387 |
| | 200m | 0.016 | 0.01 | 0.461 | 0.149 | 0.143 |
| **QCVN 05:2013/BTNMT** | | 0.3 | 0.35 | 0.2 | 30 | - |

Based on the calculation results, the concentration of emission arising from the material transport, most of the indicators are within the range of QCVN 05:2013/BTNMT. However, there is only the dust concentration, NOx that exceeds the limit of the norms.

The affected object is the community living on both sides of the road, the air environment and traffic participants on the roads transporting construction materials..

According to the survey, around the dam sites, the management routes of the sub-project have developed vegetation, fresh air environment, most of the works are far away from

residential areas and there are no activities generating emissions. These are good conditions for diluting and reducing air pollutants.

For off-site transportation, the road and the two sides of the transport road are the most affected areas. Inside the construction sites, the affected area concentrated in the gate area of the construction site. The impact to the surrounding environment is negligible; Duration of impact is about 5 months. Therefore the impact from this source is assessed at an average level.

***b.1.2.2. Dust***

In the transport process of the raw materials, the fuel will generate dust to the surrounding air of the project area and on the transport route of motor vehicles. The level of dust emission released into the air environment depends on the quality of the transport system, the quality of the transport vehicles, the methods of unloading and gathering materials. In particular, the dust concentration will increase in dry, sunny, windy days. Dust from the material during material transport process or dust from the depot will be released to the air by wind air, it will cause pollution to the surrounding areas..

**Table 35. Load of dust arising from the material transportation process**

| Item | Number of truck (truck/day) | Average transport distance (km) | The amount of generated dust (kg/day) |
|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 9 | 18 | 0.4 |
| Ea Uy reservoir, Hoa Tien commune | 22 | 16 | 0.8 |
| Doi 11 reservoir, Ea Kmut commune | 12 | 24 | 0.6 |
| 725 reservoir, Ea Rieng commune | 8 | 14 | 0.2 |
| C19 reservoir, Ea Rieng commune | 6 | 14 | 0.2 |
| Ea Nao Dar reservoir, Cu Bao commune | 1 | 17 | 0.03 |
| Ea Ngach reservoir, Ea Drong commune | 2 | 22 | 0.1 |
| Ea Bro II reservoir, Cu Pong commune | 1 | 16 | 0.02 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 5 | 22 | 0.2 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 5 | 25 | 0.3 |

Dust generated by traffic activities affects the health of traffic participants, especially pedestrians and motorcyclists. When dust is dispersed into the air, it also affects the communities living near the roads. Dust deposited on the leaves will affect the development of the flora along the road, especially in the dry season. The concentration of dust depends on the condition of roads, wind and particulate matter. For transport outside the construction site, the most impact is the movement of materials such as sand, stone.

High dust concentration will directly affect the traffic participants near the transport means. Dust

will dazzle, reduce visibility, harm the human body; High dust concentrations will indirectly cause traffic accidents.

Disperse dust will affect the public housing, public structure along the transportation route and cause uncomfortable psychology for the community. In the construction site, dust will affect the health of the workers directly. In addition, the deposition of dust will affect the vegetation on both sides of the road.

The duration of this activity is the duration of transport: about 5 months, the impact area is in the project area and the two sides of the transport route

During calculation process, the project owner uses the most unfavourable coefficients to obtain high predicted dust concentrations; In fact, the dust concentration will be influenced by the weather, the time of day, the amount of dust available on the surface of the road, etc. Therefore, the dust concentration can be less than reality. The impact from this source is assessed at an average level.

***(b.1.3). Dust arising from earthwork, main dam rehabilitation, headwork and management route***

According to the design document, during the construction phase, the subproject will carry out the earthwork of the embankment dam, spillway construction, management road combined with the local road. Therefore, the quantity of earthwork is quite large. The quantity of dust arising from the earthwork process is shown in the following table:

**Table 36. The amount of dust arising from the earthwork**

| Item | Volume of excavated soil ($m^3$) | Volume of fill soil ($m^3$) | Total weight of earthwork (ton) | Emission coefficient (kg/ton) | Construction time (day) | The amount of generated dust (kg/day) |
|---|---|---|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 4,154 | 896 | 7,323 | 0.008 | 60 | 1.0 |
| Ea Uy reservoir, Hoa Tien commune | 574,973 | 496,751 | 1,554,000 | 0.008 | 150 | 82.9 |
| Doi 11 reservoir, Ea Kmut commune | 119,786 | 98,427 | 316,409 | 0.008 | 90 | 28.1 |
| 725 reservoir, Ea Rieng commune | 79,290 | 54,246 | 193,627 | 0.008 | 90 | 17.2 |
| C19 reservoir, Ea Rieng commune | 17,441 | 10,408 | 40,381 | 0.008 | 60 | 5.4 |
| Ea Nao Dar reservoir, Cu Bao commune | 6,372 | 683 | 10,230 | 0.008 | 45 | 1.8 |

| Item | Volume of excavated soil ($m^3$) | Volume of fill soil ($m^3$) | Total weight of earthwork (ton) | Emission coefficient (kg/ton) | Construction time (day) | The amount of generated dust (kg/day) |
|---|---|---|---|---|---|---|
| Ea Ngach reservoir, Ea Drong commune | 71,638 | 52,461 | 179,944 | 0.008 | 60 | 24.0 |
| Ea Bro II reservoir, Cu Pong commune | 52,005 | 32,465 | 122,482 | 0.008 | 60 | 16.3 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 72,104 | 64,468 | 198,029 | 0.008 | 60 | 26.4 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 1,209 | 601 | 2,625 | 0.008 | 45 | 0.5 |

*Density of soil is 1.45 ton/$m^3$*

The most affected objects by this activity are the air environment in the construction site and the workers directly operating machinery in subprojects.

Impact time is about 1.5-5 months depending on each structure, mainly in the dry season. Impact scale is at the dam site, management roads at subproject structures.

Dust is a collection of particles, small in size, persistent in the air in the form of suspended dust, deposited dust and multi-phase systems of smoke. Dust generally range in size from 0.001 to 100 μm including ash, soot, smoke, and solid particles that exist in very small granular forms, moving in the Brown pattern or falling to the ground at a constant rate of change according to Stock law.

This type of dust is usually large, it is easy to settle so the dispersed ability is not high. Dust is the factor affecting directly on the health of workers and the environment in the project area. People exposing to dust in a long time will suffer from some diseases as respiratory and eye diseases. It leaves the consequences for the health of affected people as well as the society such as increasing disease.

During the construction phase, the project air environment will be affected by the increase in local dust concentration. The impact will reach its maximum when the weather is hot and windy. The project will take measures to protect workers and minimize the impact of dust on the surrounding area. Therefore, the impact from this source is assessed at an average level.

***(b.1.4). Emission arising from construction equipment, fill and residual soil transportation.***

***b.1.4.1. Fill soil transportation process***

In the process of transporting soil for items construction of the project, it will generate emissions and the emissions mainly are dust, CO, $NO_x$, $SO_2$- ...

The volume of fill soil, transport duration, number of transportation vehicles during the construction phase of the project is shown in the following table:

**Table 37. Volume of transported fill soil**

| Structures | Total weight of fill soil (ton) | Total number of transport vehicles (truck) | Transport time (day) | Number of transport vehicles in one day (truck/day) | Average transport distance (km) |
|---|---|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 4.154 | 415 | 60 | 7 | 0.3 – 0.5 |
| Ea Uy reservoir, Hoa Tien commune | 574,973 | 57,497 | 150 | 383 | 1.2 |
| Doi 11 reservoir, Ea Kmut commune | 119,786 | 11,979 | 90 | 133 | 1.5 |
| 725 reservoir, Ea Rieng commune | 79,290 | 7,929 | 90 | 88 | 0.25 |
| C19 reservoir, Ea Rieng commune | 17,441 | 1744 | 60 | 29 | 0.4 |
| Ea Nao Dar reservoir, Cu Bao commune | 6,372 | 637 | 45 | 14 | 0.1 |
| Ea Ngach reservoir, Ea Drong commune | 71,638 | 7,164 | 60 | 119 | 0.5 |
| Ea Bro II reservoir, Cu Pong commune | 52,005 | 5,201 | 60 | 87 | 0.2 – 0.3 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 72,104 | 7,210 | 60 | 120 | 0.5 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 1,209 | 121 | 45 | 3 | 0.2 |

*The project uses vehicles with a capacity of 10 tons to transport fill soil.*

The emissions load causing air pollution from fill soil transportation is listed in the following table:

**Table 38. The emission load arising from fill soil transportation**

| No. | Items | Load (g/day) | | | | |
|---|---|---|---|---|---|---|
| | | TSP | $SO_2$ | $NO_x$ | CO | VOC |
| 1 | Buon Dung 2 reservoir, Ea Yong commune | 5.2 | 1.2 | 68.1 | 34.6 | 15.0 |
| 2 | Ea Uy reservoir, Hoa Tien commune | 14.6 | 3.5 | 191.6 | 97.4 | 42.2 |
| 3 | Doi 11 reservoir, Ea Kmut commune | 64.5 | 15.4 | 845.3 | 429.8 | 186.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | 725 reservoir, Ea Rieng commune | 3.9 | 0.9 | 50.5 | 25.7 | 11.1 |
| 5 | C19 reservoir, Ea Rieng commune | 5.2 | 1.2 | 68.4 | 34.8 | 15.1 |
| 6 | Ea Nao Dar reservoir, Cu Bao commune | 0.4 | 0.1 | 5.6 | 2.9 | 1.2 |
| 7 | Ea Ngach reservoir, Ea Drong commune | 15.8 | 3.8 | 206.9 | 105.2 | 45.6 |
| 8 | Ea Bro II reservoir, Cu Pong commune | 7.5 | 1.8 | 98.5 | 50.1 | 21.7 |
| 9 | Ea Blong Thuong reservoir, Dlie Ya commune | 16.3 | 3.9 | 213.4 | 108.5 | 47.0 |
| 10 | Ea Kmien 3 reservoir, Phu Xuan commune | 18.8 | 4.5 | 247.0 | 125.6 | 54.4 |

The maximum emission concentration arising from the fill soil transportation is shown in the following table:

**Table 39. Emission concentration arising from the fill soil transportation vehicles**

| **Items** | **Distance** | **Norms** | | | | |
|---|---|---|---|---|---|---|
| | | **TSP** | **$SO_2$** | **$NO_x$** | **CO** | **VOC** |
| | | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| Buon Dung II Reservoir, Ea Yong commune | 50m | 0.014 | 0.003 | 0.182 | 0.092 | 0.04 |
| | 100m | 0.006 | 0.001 | 0.085 | 0.043 | 0.019 |
| | 200m | 0.003 | <0.001 | 0.033 | 0.017 | 0.007 |
| Ea Uy Reservoir, Hoa Tien commune | 50m | 0.039 | 0.009 | 0.512 | 0.26 | 0.039 |
| | 100m | 0.018 | 0.004 | 0.239 | 0.122 | 0.018 |
| | 200m | 0.007 | 0.002 | 0.094 | 0.048 | 0.007 |
| Doi 11 reservoir, Ea Kmút commune | 50m | 0.173 | 0.041 | 2.27 | 1.154 | 0.5 |
| | 100m | 0.081 | 0.019 | 1.061 | 0.539 | 0.234 |
| | 200m | 0.032 | 0.008 | 0.416 | 0.212 | 0.092 |
| 725 reservoir, Ea Rieng commune | 50m | 0.01 | 0.002 | 0.134 | 0.068 | 0.03 |
| | 100m | 0.005 | 0.001 | 0.063 | 0.032 | 0.014 |
| | 200m | 0.002 | <0.001 | 0.025 | 0.012 | 0.005 |
| C19 reservoir, Ea Rieng commune | 50m | 0.014 | 0.003 | 0.189 | 0.096 | 0.042 |
| | 100m | 0.007 | 0.002 | 0.088 | 0.045 | 0.019 |
| | 200m | 0.003 | 0.001 | 0.035 | 0.018 | 0.008 |
| Ea Nao Dar reservoir, Cu Bao commune | 50m | 0.001 | 0.000 | 0.016 | 0.008 | 0.003 |
| | 100m | 0.001 | <0.001 | 0.007 | 0.004 | 0.002 |
| | 200m | <0.001 | <0.001 | 0.003 | 0.001 | 0.001 |
| Ea Ngach reservoir, Ea Drong commune | 50m | 0.042 | 0.01 | 0.552 | 0.28 | 0.122 |
| | 100m | 0.02 | 0.005 | 0.258 | 0.131 | 0.057 |
| | 200m | 0.008 | 0.002 | 0.101 | 0.051 | 0.022 |
| Ea Bro II reservoir, Cu Pong commune | 50m | 0.02 | 0.005 | 0.265 | 0.135 | 0.058 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 100m | 0.009 | 0.002 | 0.124 | 0.063 | 0.027 |
| | 200m | 0.004 | 0.001 | 0.049 | 0.025 | 0.011 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 50m | 0.043 | 0.01 | 0.567 | 0.289 | 0.125 |
| | 100m | 0.02 | 0.005 | 0.265 | 0.135 | 0.058 |
| | 200m | 0.008 | 0.002 | 0.104 | 0.053 | 0.023 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 50m | 0.048 | 0.011 | 0.63 | 0.321 | 0.139 |
| | 100m | 0.022 | 0.005 | 0.295 | 0.15 | 0.065 |
| | 200m | 0.009 | 0.002 | 0.116 | 0.059 | 0.025 |
| **QCVN 05:2013/BTNMT** | | 0.3 | 0.35 | 0.2 | 30 | - |

Comparing the results of the emission arising from the operation of excavated soil transportation vehicles with QCVN 05: 2013 / BTNMT, most of the pollutant concentrations are within the allowable limits, only NOx At a distance of 50m and 100m above the permissible standards. At a distance of 200 from the source, the NOx concentration is still lower than the limits of the standard. On the other hand, this is a discontinuous source dispersion with short transport time so the effect of this activity is negligible.

The affected objects are the air environment in the construction site and the workers of the project. If the pollutants concentration in the emission is high, it will affect the health of the workers. In case of people exposing to high emission concentration in a long time, it can result in declining health or even death. Therefore, the project should take measures to mitigate these impacts.

According to evaluation, the duration of impact depends on each project and it is about 1.5 to 5 months. Scope of impact on the construction site is in the construction area. For the surrounding environment, the impact is negligible. Particularly for the construction area near the residential area, the scope of impact is the traffic participants and communities surrounding the construction area. The impact from this source is low.

***b.1.4.2. Transportation process of residual soil to landfill***

The amount of residual soil, transport time, the number of transport vehicles, the amount of emission arising from the project are shown in the following tables:

**Table 40. The volume of residual soil transport**

| Item | Total weight of residual soil (ton) | Transport time (day) | Number of truck in one day (truck/day) | Average transport distance (km) |
|---|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 3,258 | 60 | 5 | 0.3 – 0.5 |
| Ea Uy reservoir, Hoa Tien commune | 78,222 | 150 | 52 | 1.2 |

| | | | | |
|---|---|---|---|---|
| Doi 11 reservoir, Ea Kmut commune | 21,359 | 90 | 24 | 1.5 |
| 725 reservoir, Ea Rieng commune | 25,044 | 90 | 28 | 0.25 |
| C19 reservoir, Ea Rieng commune | 7,033 | 60 | 12 | 0.4 |
| Ea Nao Dar reservoir, Cu Bao commune | 5,689 | 45 | 13 | 0.1 |
| Ea Ngach reservoir, Ea Drong commune | 19,177 | 60 | 32 | 0.5 |
| Ea Bro II reservoir, Cu Pong commune | 19,540 | 60 | 33 | 0.2 – 0.3 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 7,636 | 60 | 13 | 0.5 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 608 | 45 | 1 | 0.2 |

*Source: Construction Estimates, 2018*

The project uses 10 ton truck to transport the soil to the landfill.

The emission causing air pollution from residual soil transportation activities is listed in the following table:

**Table 41. Emission load arising from residual soil transportation process**

| Item | Load (g/day) | | | | |
|---|---|---|---|---|---|
| | **TSP** | **$SO_2$** | **$NO_x$** | **CO** | **VOC** |
| Buon Dung 2 reservoir, Ea Yong commune | 45.7 | 10.9 | 598.6 | 304.4 | 131.9 |
| Ea Uy reservoir, Hoa Tien commune | 24.9 | 5.9 | 326.6 | 166.1 | 72.0 |
| Doi 11 reservoir, Ea Kmut commune | 35.7 | 8.5 | 468.6 | 238.3 | 103.3 |
| 725 reservoir, Ea Rieng commune | 14.5 | 3.5 | 190.1 | 96.7 | 41.9 |
| C19 reservoir, Ea Rieng commune | 11.8 | 2.8 | 154.2 | 78.4 | 34.0 |
| Ea Nao Dar reservoir, Cu Bao commune | 11.9 | 2.8 | 155.9 | 79.3 | 34.4 |
| Ea Ngach reservoir, Ea Drong commune | 7.3 | 1.7 | 95.5 | 48.6 | 21.0 |
| Ea Bro II reservoir, Cu Pong commune | 54.2 | 12.9 | 710.3 | 361.2 | 156.5 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 56.5 | 13.5 | 740.9 | 376.7 | 163.3 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 37.9 | 9.0 | 497.0 | 252.7 | 109.5 |

The maximum emission concentration level arising from the residual soil transport is shown in the following table:

**Table 42. Emission concentration arising from the residual soil transport process**

| Item | Distance | Norms | | | | |
|---|---|---|---|---|---|---|
| | | TSP | $SO_2$ | $NO_x$ | CO | VOC |
| | | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| Buon Dung II Reservoir, Ea Yong commune | 50m | 0.122 | 0.029 | 1.599 | 0.813 | 0.352 |
| | 100m | 0.057 | 0.014 | 0.747 | 0.38 | 0.165 |
| | 200m | 0.022 | 0.005 | 0.293 | 0.149 | 0.065 |
| Ea Uy Reservoir, Hoa Tien commune | 50m | 0.067 | 0.016 | 0.872 | 0.444 | 0.192 |
| | 100m | 0.031 | 0.007 | 0.408 | 0.207 | 0.09 |
| | 200m | 0.012 | 0.003 | 0.16 | 0.081 | 0.035 |
| Doi 11 reservoir, Ea Kmút commune | 50m | 0.095 | 0.023 | 1.252 | 0.637 | 0.276 |
| | 100m | 0.045 | 0.011 | 0.585 | 0.298 | 0.129 |
| | 200m | 0.017 | 0.004 | 0.23 | 0.117 | 0.051 |
| 725 reservoir, Ea Rieng commune | 50m | 0.039 | 0.009 | 0.508 | 0.258 | 0.112 |
| | 100m | 0.018 | 0.004 | 0.237 | 0.121 | 0.052 |
| | 200m | 0.007 | 0.002 | 0.093 | 0.047 | 0.021 |
| C19 reservoir, Ea Rieng commune | 50m | 0.032 | 0.007 | 0.412 | 0.209 | 0.091 |
| | 100m | 0.015 | 0.003 | 0.193 | 0.098 | 0.042 |
| | 200m | 0.006 | 0.001 | 0.076 | 0.038 | 0.017 |
| Ea Nao Dar reservoir, Cu Bao commune | 50m | 0.032 | 0.007 | 0.416 | 0.212 | 0.092 |
| | 100m | 0.015 | 0.003 | 0.195 | 0.099 | 0.043 |
| | 200m | 0.006 | 0.001 | 0.076 | 0.039 | 0.017 |
| Ea Ngach reservoir, Ea Drong commune | 50m | 0.02 | 0.005 | 0.255 | 0.13 | 0.056 |
| | 100m | 0.009 | 0.002 | 0.119 | 0.061 | 0.026 |
| | 200m | 0.004 | 0.001 | 0.047 | 0.024 | 0.01 |
| Ea Bro II reservoir, Cu Pong commune | 50m | 0.145 | 0.034 | 1.897 | 0.965 | 0.418 |
| | 100m | 0.068 | 0.016 | 0.887 | 0.451 | 0.195 |
| | 200m | 0.027 | 0.006 | 0.348 | 0.177 | 0.077 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 50m | 0.151 | 0.036 | 1.979 | 1.006 | 0.436 |
| | 100m | 0.071 | 0.017 | 0.925 | 0.47 | 0.204 |
| | 200m | 0.028 | 0.007 | 0.363 | 0.185 | 0.08 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 50m | 0.101 | 0.024 | 1.328 | 0.675 | 0.293 |
| | 100m | 0.047 | 0.011 | 0.62 | 0.315 | 0.137 |

| Item | Distance | Norms | | | | |
|---|---|---|---|---|---|---|
| | | TSP | $SO_2$ | $NO_x$ | CO | VOC |
| | | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| | 200m | 0.019 | 0.004 | 0.244 | 0.124 | 0.054 |
| **QCVN 05:2013/BTNMT** | | 0.3 | 0.35 | 0.2 | 30 | - |

Comparing the emission concentration arising from the transport activity with QCVN 05: 2013 / BTNMT, it can be seen that most of pollutants concentrations are within acceptable limits, only NOx concentration is exceeded the allowable limit. On the other hand, this is a discontinuous dispersion source with short transport time, so the impact of transport of material, machinery and equipment of the project is also significantly reduced. However, during construction phase, the construction unit and the project owner should monitor and prevent the high load sources to limit the impact. The impact from this source is assessed at an average level.

The main affected objects by this activity are the air environment in the construction site and the workers directly operating machinery in subprojects.

Duration of impact is about 1.5 to 5 months depending on each structure, mainly in the dry season. The scale of impact is at the dam site, management routes of subproject.

***b.1.4.3. Construction activities***

In order to calculate the amount of generated emission during the construction phase, it is necessary to rely on the DO fuel oil consumed daily by all types of machinery. The following table summarizes the fuel used in one day of different type of equipment:

**Table 43. Fuel consumption standard in one day**

| No. | Equipment | Amount (machine) | Oil consumption standard / machine / 8h (liter) |
|---|---|---|---|
| 1 | Excavator $1,25m^3$ | 1 | 82.62 |
| 2 | Excavator $0,8m^3$ | 1 | 64.8 |
| 3 | Self- Soil compactor 9T | 1 | 36 |
| 4 | Bulldozer 110CV | 1 | 46.2 |

*Source: List of parameters serving construction machine and equipment shift prices (Annex attached with the Circular 06/2005/TT-BXD dated 15 April 2005 of the Ministry of Construction)*

The amount of fuel that will be used during construction phase is shown in the following table:

**Table 44. The amount of fuel will be used during the construction phase**

| Item | DO oil consumption standard / day (liters) | Construction time (day) | Oil consumption per day (ton) |
|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 26,357.8 | 100 | 0.22 |
| Ea Uy reservoir, Hoa Tien commune | 32,721 | 150 | 0.18 |
| Doi 11 reservoir, Ea Kmut commune | 54,578 | 120 | 0.38 |
| 725 reservoir, Ea Rieng commune | 36,100 | 90 | 0.33 |
| C19 reservoir, Ea Rieng commune | 20,600 | 100 | 0.17 |
| Ea Nao Dar reservoir, Cu Bao commune | 31,250 | 90 | 0.29 |
| Ea Ngach reservoir, Ea Drong commune | 59,280 | 140 | 0.35 |
| Ea Bro II reservoir, Cu Pong commune | 29,800 | 90 | 0.03 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 36,177 | 120 | 0.25 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 29,137 | 150 | 0.16 |

*Source: Basic design demonstration*

(The density of the oil is 0.832 kg /l)

The emission coefficient for burning one ton of Diezel engine fuel from different sources is shown in the following table:

**Table 45. Emission factor**

| Emission factor (kg/ton of oil) | | | |
|---|---|---|---|
| $SO_2$ | $NO_x$ | CO | Dust |
| 6 | 3.3 | 9 | 16 |

*Source: Tran Ngoc Chan, "Air pollution and emission treatment" Vol 1, Page 15.*

The load of emission arising from the machines on the construction site is shown in the following table:

**Table 46. The load of emission arising from the machines on the construction site**

| Item | Load (kg/day) | | | |
|---|---|---|---|---|
| | $SO_2$ | $NO_x$ | CO | Dust |
| Buon Dung 2 reservoir, Ea Yong commune | 1.77 | 0.97 | 2.65 | 4.72 |
| Ea Uy reservoir, Hoa Tien commune | 2.29 | 1.26 | 3.44 | 6.11 |
| Doi 11 reservoir, Ea Kmut commune | 2.34 | 1.29 | 3.51 | 6.24 |
| 725 reservoir, Ea Rieng commune | 1.20 | 0.66 | 1.80 | 3.20 |
| C19 reservoir, Ea Rieng commune | 0.69 | 0.38 | 1.03 | 1.83 |
| Ea Nao Dar reservoir, Cu Bao commune | 2.91 | 1.60 | 4.37 | 7.76 |
| Ea Ngach reservoir, Ea Drong commune | 2.89 | 1.59 | 4.33 | 7.70 |
| Ea Bro II reservoir, Cu Pong commune | 1.99 | 1.09 | 2.99 | 5.31 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 2.43 | 1.34 | 3.64 | 6.48 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 2.15 | 1.18 | 3.22 | 5.72 |

The emission concentration arising from the construction phase is shown in the table below:

**Table 47. The emission concentration arising from the construction phase**

| Item | Distance | Norms | | | |
|---|---|---|---|---|---|
| | | $SO_2$ | $NO_x$ | CO | Dust |
| | | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| Buon Dung II Reservoir, Ea Yong commune | 50m | 0.490 | 0.466 | 5.214 | 12.513 |
| | 100m | 0.229 | 0.218 | 2.437 | 5.849 |
| | 200m | 0.090 | 0.085 | 0.957 | 2.296 |
| Ea Uy Reservoir. Hoa Tien commune | 50m | 0.490 | 0.466 | 5.214 | 12.513 |
| | 100m | 0.229 | 0.218 | 2.437 | 5.849 |
| | 200m | 0.090 | 0.099 | 1.108 | 2.659 |
| Doi 11 reservoir. Ea Kmút commune | 50m | 0.700 | 0.770 | 8.624 | 20.698 |
| | 100m | 0.327 | 0.360 | 4.031 | 9.675 |
| | 200m | 0.129 | 0.142 | 1.587 | 3.808 |
| 725 reservoir. Ea Rieng commune | 50m | 0.257 | 0.282 | 3.164 | 7.593 |
| | 100m | 0.120 | 0.132 | 1.478 | 3.548 |
| | 200m | 0.047 | 0.052 | 0.582 | 1.396 |
| C19 reservoir. Ea Rieng commune | 50m | 0.146 | 0.161 | 1.804 | 4.329 |
| | 100m | 0.069 | 0.076 | 0.848 | 2.034 |

| Item | Distance | Norms | | | |
|---|---|---|---|---|---|
| | | $SO_2$ | $NO_x$ | CO | Dust |
| | | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| | 200m | 0.027 | 0.030 | 0.335 | 0.804 |
| Ea Nao Dar reservoir, Cu Bao commune | 50m | 0.622 | 0.685 | 7.668 | 18.403 |
| | 100m | 0.290 | 0.319 | 3.578 | 8.587 |
| | 200m | 0.114 | 0.126 | 1.409 | 3.383 |
| Ea Ngach reservoir, Ea Drong commune | 50m | 0.617 | 0.678 | 7.599 | 18.238 |
| | 100m | 0.288 | 0.317 | 3.548 | 8.516 |
| | 200m | 0.113 | 0.124 | 1.390 | 3.335 |
| Ea Bro II reservoir, Cu Pong commune | 50m | 0.454 | 0.500 | 5.598 | 13.436 |
| | 100m | 0.213 | 0.234 | 2.622 | 6.292 |
| | 200m | 0.083 | 0.092 | 1.025 | 2.460 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 50m | 0.458 | 0.504 | 5.647 | 13.554 |
| | 100m | 0.214 | 0.236 | 2.641 | 6.339 |
| | 200m | 0.084 | 0.092 | 1.035 | 2.484 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 50m | 0.458 | 0.504 | 5.647 | 13.554 |
| | 100m | 0.214 | 0.236 | 2.641 | 6.339 |
| | 200m | 0.084 | 0.092 | 1.035 | 2.484 |
| **QCVN 05:2013/BTNMT** | | **0.35** | **0.2** | **30** | **-** |

Comparing the emission levels arising from construction activities with QCVN 05: 2013 / BTNMT, most of the pollutant concentrations are within acceptable limits. At some positions, the SO2 and NOx concentrations exceed the allowable limit but not significant. The affected objects are the air environment in the construction site and the workers of the project. If the pollutant concentration in the emission is high, it will affect the health of the workers. In case of people exposing to high concentration emission in a long time, it can result in declining health or even death. Therefore, the project should take measures to mitigate these impacts. According to evaluation, the duration of impact is about 1.5 to 5 months. Scope of impact on the construction site is in the construction area. For the surrounding environment, the impact is negligible. Particularly for the construction area near the residential area, the scope of impact is the traffic participants and communities surrounding the construction area. The impact from this source is low.

### (b.2). Source of pollution from solid waste and hazardous waste

#### *(b.2.1). Domestic solid waste*

Solid waste generated by construction activities of workers includes plastic bags, waste paper, plastic bottles and excess foods...

**Table 48. The weight of domestic solid waste arising from the construction phase**

| Item | Nubmer of workers (person) | Standard (kg/day) | Generated weight (kg/day) |
|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 30 | 0.67 | 20.1 |
| Ea Uy reservoir, Hoa Tien commune | 30 | | 20.1 |
| Doi 11 reservoir, Ea Kmut commune | 30 | | 20.1 |
| 725 reservoir, Ea Rieng commune | 30 | | 20.1 |
| C19 reservoir, Ea Rieng commune | 30 | | 20.1 |
| Ea Nao Dar reservoir, Cu Bao commune | 20 | | 13.4 |
| Ea Ngach reservoir, Ea Drong commune | 30 | | 20.1 |
| Ea Bro II reservoir, Cu Pong commune | 25 | | 16.75 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 30 | | 20.1 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 30 | | 20.1 |

This type of solid waste contains many organic substances which are easily decomposed. If it is not collected, managed and treated appropriately, it will affect the quality of the air due to the smell of waste from the waste decompositions facilitating the mosquito, fly and the pathogenic microorganisms. Also, it will affect the quality of soil due to the contaminated water permeating into the soil and affect the surface water due to the waste flowing with the excessive rainfall. Especially, the solid waste will directly affect the health of workers on the construction site. However, if there is a reasonable management and collection plan, the impact of this source is negligible. The total daily waste volume at the construction sites of the subproject is less than 1000kg / day so the level of impact from this source is low.

#### *(b.2.2). Construction solid waste*

The weight of generated construction solid waste is shown in the table below:

**Table 49. The weight of construction solid waste**

| Item | Demand for materials (ton) | Estimated additional material | Construction time (day) | Generated weight (ton/day) |
|---|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 8,661 | 1% | 60 | 1.4 |
| Ea Uy reservoir, Hoa Tien commune | 32,980 | 1% | 150 | 2.2 |
| Doi 11 reservoir, Ea Kmut commune | 13,805 | 1% | 90 | 1.5 |
| 725 reservoir, Ea Rieng commune | 7,278 | 1% | 90 | 0.8 |
| C19 reservoir, Ea Rieng commune | 5,910 | 1% | 60 | 1.0 |
| Ea Nao Dar reservoir, Cu Bao commune | 1,153 | 1% | 45 | 0.3 |
| Ea Ngach reservoir, Ea Drong commune | 2,124 | 1% | 60 | 0.4 |
| Ea Bro II reservoir, Cu Pong commune | 6,609 | 1% | 60 | 1.1 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 6,474 | 1% | 60 | 1.1 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 7,154 | 1% | 45 | 1.6 |

Solid wastes generating during the construction process include broken bricks, stones, scrap metal, cement bags, etc. The weight of generated construction solid waste depends on the management and labour operations, the use of equipment, quality of materials,...

**Table 50. Composition of construction solid waste**

| No. | Material | Ratio (%) |
|---|---|---|
| 1 | Wood | 45 |
| 2 | Gypsum | 21 |
| 3 | Stone | 15 |
| 4 | Metal | 1 |
| 5 | Plastic | 4 |
| 6 | Cacton | 8 |
| 7 | Others | 6 |

*Source: Characterization of Building-Related construction and Demolition Debris, EPA*

Generally, construction solid waste is a substance that has an inert component to the environment, so most of it does not cause significant impacts if it is collected and managed well. The impact from this source is low.

***(b.2.3). Hazardous waste***

Hazardous solid wastes generating in camps, repair points for construction machinery and equipment include rag, paper during cleaning process for equipment and machinery, and Cans, tanks. This weight of hazardous wastes does not currently have standards to calculate, but based on the same construction works, the weight of this type of waste is not large. The amount of generated hazardous waste during the construction phase is estimated in the following table:

**Table 51. The estimated amount of generated hazardous wastes during the construction phase**

| Item | **The amount of generated hazardous waste** (kg/month) |
|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 10 |
| Ea Uy reservoir, Hoa Tien commune | 25 |
| Doi 11 reservoir, Ea Kmut commune | 12 |
| 725 reservoir, Ea Rieng commune | 10 |
| C19 reservoir, Ea Rieng commune | 10 |
| Ea Nao Dar reservoir, Cu Bao commune | 10 |
| Ea Ngach reservoir, Ea Drong commune | 15 |
| Ea Bro II reservoir, Cu Pong commune | 10 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 12 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 10 |

For waste diesel oil of car and machine, it can be estimated as follows: Average amount of lubricant per discharge of each truck, bulldozer is 16 liters. Depending on the operating distance, operating time or number of working shifts, we will have different oil change times. According to the statistic, the means will change the oil once time per 4 months, but these means will be changed the oil in the garage or repair area, so it will not generate hazardous waste at the construction site. The total amount of daily hazardous waste is much less than the number of 100kg / day, so the level of impact from this source is low.

**(b.3). Sources of wastewater**

The impact on water quality in the construction process is mainly due to domestic wastewater of workers. The composition of the main pollutants in domestic wastewater include: sediment, suspended solids (SS), organic compounds (BOD / COD), nutrients (N, P) and Pathogenic bacteria (Coliform, E.Coli). Domestic wastewater contains biodegradable organic substances, residues, nutrients and microorganisms that can contaminate groundwater if it not being treated properly.

**Table 52. The amount of domestic wastewater generated during the construction phase**

| Item | The number of workers (person) | Water supply standards (liter/day) | Demand (liter/day) | The amount of generated wastewater ($m^3$/day) |
|---|---|---|---|---|
| Buon Dung 2 reservoir, Ea Yong commune | 30 | 100 | 3,000 | 3.0 |
| Ea Uy reservoir, Hoa Tien commune | 30 | 100 | 3,000 | 3.0 |
| Doi 11 reservoir, Ea Kmut commune | 30 | 100 | 3,000 | 3.0 |
| 725 reservoir, Ea Rieng commune | 30 | 100 | 3,000 | 3.0 |
| C19 reservoir, Ea Rieng commune | 30 | 100 | 3,000 | 3.0 |
| Ea Nao Dar reservoir, Cu Bao commune | 20 | 100 | 2,000 | 2.0 |
| Ea Ngach reservoir, Ea Drong commune | 30 | 100 | 3,000 | 3.0 |
| Ea Bro II reservoir, Cu Pong commune | 25 | 100 | 2,500 | 2.5 |
| Ea Blong Thuong reservoir, Dlie Ya commune | 30 | 100 | 3,000 | 3.0 |
| Ea Kmien 3 reservoir, Phu Xuan commune | 30 | 100 | 3,000 | 3.0 |

*(The amount of wastewater equals 100% of the water supply)*

If this wastewater is not treated, it will be one of the significant environmental pollution sources. However, the volume of wastewater is low and the project owner will arrange portable toilets on construction sites, the waste will be collected and transported to the treatment area so the impact from this source is assessed at a low level. Individual washing and bathing activities are carried out in the workers' camps.

**(c) Sources of non-waste related impacts**

This impact comes from noise pollution, vibration due to earthworks, construction equipment and vehicles.

**(c.1). Noise impact**

The noise arising from the construction phase is mainly from motor vehicles transporting raw materials, fuel and construction machinery at the construction site such as concrete mixers, excavators, levelling machine…

To calculate the effect radius of noise, use the Mackerminze formula, 1985 to calculate the noise level.

$$Lp(X) = Lp(X_0) + 20\lg(X_0/X)$$

Where:

$Lp(X_0)$: The noise level at the distance of 1m from the source (dBA);

$X_0$: the location that is 1m away from the source;

Lp(X): Noise level at the location to be calculated (dBA);

X: Location to be calculated.

The results of calculating the noise level from the operation of the construction equipment on the construction site as follows:

**Table 53. Calculation results and noise forecast for the project area**

| No. | Machine | The noise level corresponds to the distance of 1m (dbA) | | The noise level corresponds to the distance (dbA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Range | 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 | Excavator | 75-98 | 86.5 | 72.5 | 66.5 | 60.5 | 52.5 | 46.5 | 40.5 |
| 4 | Bulldozer | 75-96 | 85.5 | 71.5 | 65.5 | 59.5 | 51.5 | 46.5 | 39.5 |

Comparing the calculation results in the table above with QCVN 26: 2010 / BTNMT, it can be seen that at a radius of 50m or more of noise from the equipment, trucks involved in construction activities of the project, the noise level is almost in the range of standard and does not affect the workers at the construction site as well as the surrounding community. Therefore, the impact from this source is low.

**(c.2). Impact due to vibration**

The source of vibration during construction is due to construction machines, transport vehicles on the construction site. The vibration level of construction vehicles is statistically calculated as follows:

**Table 54. Vibration level caused by construction equipment and machinery**

| No. | Machine | The vibration level at the distance of 10m from the machine (dBA) | The vibration level at the distance of 30m from the machine (dBA) | The vibration level at the distance of 60m from the machine (dBA) |
|---|---|---|---|---|
| 1 | Truck | 74 | 64 | 54 |
| 2 | Compactor | 77 | 67 | 57 |
| 3 | Excavator | 77 | 67 | 57 |
| 4 | Concrete mixer | 76 | 66 | 56 |
| QCVN 27:2010/BTNMT (6h - 21h) | | 75 | | |

*Source: Technical guidelines for EIA reports, Institute of Environmental Science and Technology, National University of Civil Engineering*

Note: QCVN 27: 2010 / BTNMT: National technical regulation on vibration

Thus, most vibration levels due to construction machines and equipment at a distance of ≤10m exceed the permitted limits according to QCVN 27: 2010 / BTNMT. However, at a distance of ≥30m, the vibration level due to construction machinery and vehicles is lower than the permitted limit. Therefore, the objects are affected by the vibration caused by machinery and construction equipment are only operators and workers on the construction site. Residential areas will not be affected by vibration. The impact from this source is assessed at an average level.

***(d.1). Aquatic ecosystem***

Construction activities on construction sites such as excavating soil, draining water for construction ... make water sources in the reservoir area become turbid, water can be contaminated by grease from machinery and chemicals used in the project. Land encroachment causes loss of habitat, loss of spawning habitats, death of juveniles, reduction of photosynthesis ability of algae ... This will disrupt and alter the habitat of fish and other aquatic species, affecting aquatic ecosystem life. However, due to the low biodiversity and the absence of endemic species, plus the application of mitigation measures and fast ecosystem recovery times, the level of impact assessment is low.

***(d.2). Terrestrial ecosystems:***

The process of leveling the ground will cause loss of habitat, residence, reproduction and death of some species of land animals such as insects, animals living in caves such as snakes, frogs, ...Dust and exhaust gas from construction activities all affect the living and development activities of flora and fauna in the region and surrounding areas such as: Dust on the leaves reduces the photosynthesis of green plants, leaves the leaves hot; SO $gas_2$, CO, $H_2S$ causes diseases of leaves and affects the growth of trees. However, this impact does not affect much the development of surrounding vegetation. The removal of trees, vegetation and surface soil tillage often causes soil erosion.

The impacts are of short-term nature and are limited to the construction area, plus the indigenous ecosystem that is capable of rapid regeneration after construction, so the impact level is assessed as low.

**(e) Impact on soil environment**

The exploitation of construction materials: exploitation of filling soil, construction activities, transportation, material gathering ... will affect the soil environment, breaking the surface structure, changing the fertility of the topsoil.

Construction waste such as cardboards, steel scraps, plastic boxes, soil, waste stones... without collection will mix on land. Non-degradable wastes such as nylon, iron, etc. will affect the soil environment.

Domestic wastes from workers on site easily disintegrate and create bad odors. If workers are not equipped with hygienic toilets, they will discharge directly into the environment, which will affect soil environment. However, this type of waste is mostly concentrated in the workers' houses, it is easy for the collectors to treat, therefore the impact is not significant. Solid waste containing grease and oil is hazardous waste but there is small volume. This is a non-degradable type of waste in the soil environment, so if there is no waste treatment method, it will affect the soil environment.

Construction wastewater contains cement. Wastewater come from repair points, washing equipment, trucks containing toxic oil, grease. These types of wastewater, when seeping into the soil, will make the soil harden. However the volume is small so the impact scope is low.

According to the study and the field survey, we found that the temporary occupation area for construction of auxiliary items is not large, waste water and garbage arising during the construction time at site are collected and thoroughly treated, which does not affect the soil environment. Therefore the impacts are assessed at low level.

**(f) Social impacts**

**(f.1 Community Health and Safety**

In addition to environmental issues, the construction activities can result in significant increases in the activity of vehicles for the transportation of building materials and waste soil, which is potential for traffic accidents and injuries to local communities as there are households living along the roads near the construction sites, traffic accidents and material spills may occur.

During the construction, workers are potentially at risks of contagious diseases and disease transferring, which may threaten their health and local communities. Contagious diseases that threat public health often involve in such activities as poor hygiene and low living conditions, sexually transmitted diseases and disease transferring. The most concerned infectious diseases in the construction phase due to labor migration are sexually transmitted diseases such as HIV/AIDS, gonorrhea, syphilis, etc.

In fact, the subproject implementation period within 24 months is not continuous. The sites are scattered at 10 location and the number of officials and workers from other localities coming to work is about 10 workers / 1 structure (*The workers are mainly engineers and skilled workers because simple jobs use local labour about 20 people on a structure*). There are many scattered work items. The control of security and order and disease in the area is good. Workers rent local houses with sanitary toilets. All toilets are required to meet QCVN 01: 2011/BYT standard for hygienic latrines. The spread of infectious diseases caused by flies, mosquitoes and insects is restricted. Therefore the impact should be considered average.

**(f.2). Risks and accidents**

*Labor accidents.* Labor accidents may occur in any items during the construction.,

*Fire, explosion and fuel leakage.* These incidents may occur in transport and storage of fuel, or temporary power supply system is unsafe, causing deaths and property damage during construction.

*Welding:* Welding creates extremely strong light and may cause serious injury to workers'eyes. In extreme cases, it can lead to blindness. In addition, welding may create toxic emission that prolonged exposure can cause severe chronic illnes.

*Drowning*: During the construction, workers may die of downing due to bathing near the water bodies.

*Short-circuits and electric shock:* The construction activities may cause short-circuiting hazards to the health of workers and people as well as their property. The temporary power supply for machinery and equipment during construction may cause problems relating to voltage, electric

shock, etc., causing economic losses and labor accidents for workers.

During the implementation of the subproject, the construction sites are mainly in the dam bodies and canals, therefore accidents due to working at heights hardly occur.

Due to the characteristics of the works, the volume and construction items need to use electricity is not large, the management and supervision is strict, therefore the impact level is average.

**(f.3). Impact on traffic safety and infrastructure**

Operation of vehicles serving the project will increase traffic density, affect local traffic, cause road damage and traffic congestion and pose a potential traffic accident if do not follow traffic law, not have proper vehicles.

The rapid increase in the number of vehicles in small areas will put pressure on the traffic conditions. The subproject is estimated to have about 9214 turns of vehicles with a tonnage of 10 tons that will move on the roads of 10 construction sites to transport materials, sand, gravel, cement, steel, etc. At peak construction time, the number of vehicles can be up to 22 turns of vehicles per day/construction site. The increase in transportation means will increase traffic risks for people. In particular, this route passes through residential areas of 10 communes, where there are schools, markets and intra-field traffic routes.. However, the construction work is not continuous for 24 months and the impact is manageable, therefore the impact from this source is average.

Local roads and rural infrastructure may be damaged by large means of transport. Roads through residential areas and intra-field roads are concreted with small load bearing, which can be broken, crushed or sagged when large trucks pass or there is high density of vehicles. Regarding the potential impact on roads, the Project Owner required the Construction Contractors to commit to repair and recover to the status quo if damages occur during the construction process, therefore the impact is considered low.

**(f.4). Impact of the flow of workers in the subproject area**

Construction activities require about 300 workers coming from other places to 10 construction sites, they are mainly key officers and skilled workers (*some items use local labour*). Hence, there may be social impacts such as: gender-based violence, using child labor, harassment of sexual abuse; spreading infectious diseases and social evils; conflicts between workers and local communities; conflicts related to the need to use local infrastructures and services such as electricity & water supply systems and transportation resulting in lack of electricity & water supply and traffic jam in the area. However, the number of people from other localities who come to work is mainly managers and skilled workers and the level of gathering workers is infrequent. The contractor ensures the propaganda and education dissemination of working regulations on the construction site, etc. so all these mentioned impacts could be able to control, the level of influence is assessed as low.

**(f.5). Chance finding**

During the earthwork, workers may find underground cultural heritages. However, these works are usually located near the reservoirs where there are long-term cultivation activities. These areas we resurveyed and confirmed that they are not archaeological sites and cultural heritages, therefore the probability of finding artifacts and cultural heritages is low.

**(g) Specific impacts**

The construction of the different subproject items may affect some sensitive areas near the construction site. However, the levels of impacts are assessed from low to average, in short time and can be minimized.

***Impact due to drilling:*** The subproject will apply the drilling technique to handle dam seepage, so the cement will be mixed with water into a liquid solution to conduct drilling. If this solution is not well controlled during the drilling process, it can penetrate into the surface water and groundwater environment polluting these water sources.

Other specific impacts are summarized in the table below.

**Table 55. The specific impacts of each project in the construction phase**

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| 1, Ea Uy reservoir, Hoa Tien commune, Krong Pak district |  <br>People live near the construction site | *Scope:* Around the repaired and upgraded dam and offtake structure area.<br>*Scale of impact:* People live near the construction site of dam and offtake structure .<br>*Potential impacts:*<br>- Impact on the daily life of people, home architecture and landscape;<br>- Affect the air environment. | Average |
| |  <br>The dam site is also the residential traffic road in the region | *Scope:* The dam site is also the residential traffic road in the region.<br>*Scale of impact:* People living in Hoa Tien commune, construction workers, project staff<br>*Potential impacts:*<br>- Impact on public transport during construction phase;<br>- There is a risk of traffic accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| |  <br>Loi Nhon Pagoda is located 200m away from the material transportation route, 1km from the Ea Uy construction site | *Scope:* Public, cultural and religious works located near the subproject transport route.<br>*Scale of impact:* People come to the temple on the first, full moon of months and Buddhist days.<br>*Potential impacts:*<br>Transporting materials to Ea Uy reservoir may cause some specific impacts, including:<br>- Smoke, dust;<br>- Impact on spiritual activities and beliefs of local people due to noise and traffic congestion;<br>- Risk of traffic accidents. | Average |
| 2, Buon Dung II reservoir, Ea Yong commune, Krong Pak district |  <br>Transportation materials road to the reservoir site is also the traffic road to the field of local people | *Scope:* On the access road to the construction area of Buon Dung II reservoir.<br>*Scale of impact:* Cultivators around the reservoir area.<br>*Potential impacts:*<br>- Smoke, dust;<br>- Risk of traffic accidents;<br>- Restrict travel and harvesting of local people. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| 3, Ea Blong Thuong reservoir , Dlie Ya commune, Krong Nang district |  <br>The dam site is also the residential traffic road in the region | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People living Dlie Ya commune, construction workers, project staff.<br>*Potential impacts:*<br>- Impact on public transport during construction phase<br>- There is a risk of traffic accidents<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning | Average |
| 4, Ea Kmien 3 reservoir, Phu Xuan commune, Krong Nang District |  <br>Civil electric line crosses construction site | *Scope:* Around the repaired and upgraded area of the reservoir where the power line crosses.<br>*Scale of impact:* Construction workers, project staff on the construction site, local people living near the subproject area of Phu Xuan commune.<br>*Potential impacts:*<br>- Construction activities may cause damage to the civil electric line by operating excavators, bulldozers, and compactors close to the civil electric line..<br>- The overhead lines can be hit by metal tools such as ladders and columns. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| | | - Workers in safety corridors may be affected by magnetic fields or electric shocks | |
| |  <br>Pepper gardens along the construction site | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* 02 households plant pepper in the repaired and upgraded reservoir area with the affected area of 1450m$^2$<br>*Potential impacts:*<br>Construction activities restrict travel and damage to pepper gardens, thus it leads to loss or reduction of income from pepper business. | Average |
| |  <br>Ly Tu Trong High School is located near the material transportation road, 1,5km away from the Ea Kmien 3 construction site | *Scope:* Public, cultural and religious works located near the subproject transport route.<br>*Scale of impact:* pupils, teachers, school managers and students' parents of Ly Tu Trong High School.<br>*Potential impacts:*<br>Transporting materials can cause specific effects:<br>- Impact on the health of pupils, teachers and school managers due to smoke, dust and noise from transportation activities;<br>- Risk of insecurity to pupils and parents, and teachers due to the movement of transport trucks. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| |  <br>People live near the construction site | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People in Phu Xuan commune live around the construction site area.<br>*Potential impacts:*<br>- Impact on the daily life of people, home architecture and landscape;<br>- Affects the air environment;<br>- Disturbs the lifestyle of the local people. | Average |
| 5, Ea Bro 2 reservoir, Cu Pong commune, Krong Buk district |  <br>Impact on the daily life of people, home architecture and landscape | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* Residents of Cu Pong commune, construction workers and project staff on construction sites.<br>*Potential impacts:*<br>- Impact on public transport during construction phase;<br>- There is a risk of traffic accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| |  <br>Civil electricity lines cross construction sites | *Scope:* Around the repaired and upgraded reservoir area where civil electricity lines cross.<br>*Scale of impact:* Construction workers, project staff on construction sites, local people living near the subproject area of Cu Pong commune.<br>*Potential impacts:*<br>- Construction activities may affect electric lines due to the operation of heavy machinery causing vibrations or collisions with electric lines.<br>- There is a risk of labor accidents | |
| |  <br>People live near the construction site | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People in Cu Phuong commune live around the construction site.<br>*Potential impacts:*<br>- Impact on the daily life of people, home architecture and landscape;<br>- Affects the air environment;<br>- There is a risk of traffic accidents;<br>- Disturbs the lifestyle of the local people. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| 6, Ea Nao Dar reservoir, Cu Bao commune, Buon Ho town |  Cong Chinh church and parish are located near the material transport road, 1.5 km away from the location of Ea Nao Dar construction site | *Scope:* Public, cultural and religious works located near the subproject transport route.<br>*Scale of impact:* People go to church on weekends and major Catholic holidays.<br>*Potential impacts:*<br>Transporting materials can cause some specific impacts, including:<br>- Impact on spiritual activities and beliefs of local people due to noise and traffic congestion;<br>- Risk of traffic accidents. | Average |
| 7, Ea Ngach reservoir, Ea Drong commune, Buon Ho town |  Impact on the daily life of people, home architecture and landscape | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People living in Ea Drong commune, construction workers, project staff on construction sites.<br>*Potential impacts:*<br>- Affect the daily life of people;<br>- There is a risk of traffic accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| |  <br>Rice fields near construction sites | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* 4000 $m^2$ of rice is grown on public land.<br>*Potential impacts:*<br>- Construction activities restrict travel and damage to rice fields, thus it leads to loss or reduction of income from rice cultivation.<br>- There is a risk of contamination of farmland and water due to workers' waste, indiscriminate disposal of bottles and jars containing gasoline for machinery and equipment. | Average |
| |  <br>No Trang Long Primary School is located near the material transportation road, 1.5 km away from the construction site of Ea Nghach reservoir. | *Scope:* Public, cultural and religious works located near the subproject transport route.<br>*Scale of impact:* pupils, teachers, school managers, parents of the pupils of No Trang Long Primary School.<br>*Potential impacts:*<br>Transporting materials can cause specific effects:<br>- Impact on the health of pupils, teachers and school managers due to smoke, dust and noise from transportation activities;<br>- Risk of insecurity to pupils and parents, and teachers due to the movement of transport trucks. | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| 8, C19 reservoir, Ea Rieng commune, M'Drak district |  Impact on the daily life of people, home architecture and landscape | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People living in Ea Rieng commune, construction workers and project staff on the construction site of C19 reservoir.<br>*Potential impacts:*<br>- Impact on public transport during construction phase;<br>- Affect the daily life of local people;<br>- There is a risk of traffic accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | Average |
| |  Civil electricity lines cross construction sites | *Scope:* Around the repaired and upgraded reservoir area where the electric lines cross.<br>*Scale of impact:* Construction workers, project staff on the construction site, local people living near the construction area of C19 reservoir in Ea Rieng commune.<br>*Potential impacts:*<br>- Construction activities may affect electric lines due to the operation of heavy machinery causing vibrations or collisions with | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| | | electric lines;<br>- There is a risk of labor accidents;<br>- Affects people's daily life. | |
| |  <br>Rice fields are near construction sites | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* 0.5 ha of rice under the dam downstream.<br>*Potential impacts:*<br>- Construction activities cause damage to rice fields, so it leads to loss or reduction of income from rice cultivation;<br>- There is a risk of contamination of farmland and water due to workers' waste, indiscriminate disposal of bottles and jars containing gasoline for machinery and equipment;<br>- There is a risk of labor accidents due to slipping. | Average |
| 9, 725 reservoir, Ea Rieng commune, M'Drak district |  <br>Impact on the daily life of people, home architecture and landscape | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People living in Ea Rieng commune, construction workers and project staff on the construction site of 725 reservoir.<br>*Potential impacts:*<br>- There is a risk of traffic accidents;<br>- It may pollute downstream | Average |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Level of impact |
|---|---|---|---|
| | | water sources due to vehicle, machinery and equipment cleaning. | |
| 10, Doi 11 reservoir, Ea Kmut commune, Ea Kar district |  <br>Impact on the daily life of people, home architecture and landscape | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People living in Ea Kmut commune, construction workers and project staff on the construction site of Doi 11 reservoir.<br>*Potential impacts:*<br>- Impact on public transport during construction phase<br>- There is a risk of traffic accidents<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | Average |

### *5.3.3. Potential impact during operation*

During the operation phase of the reservoirs, some of the major negative impacts are identified and assessed.

**(a) Risk of drowning**

The reservoir can be a bathing place for the local people. Therefore, the risk of drowning is always hidden if appropriate preventive measures are not taken.

**(b) Activities of reservoir operators**

Daily activities of reservoir operators may generate a large amount of domestic solid waste and wastewater. However, the number of reservoir operators in each reservoir ranges from 1 to 2 personnel, so the amount of wastes is not large, about 0.5 kg/day and wastewater is about 20 litters/day. If this amount of waste is not well managed, it will have a direct impact on the reservoir environment, such as water pollution that indirectly affects the reduction of dissolved oxygen in water and therefore it affects the life of aquatic species in the reservoirs. However, this impact is considered to be low because of the small amount of waste.

**(c) Operation and Maintenance**

These activities can lead to water cut-off in a short time. This will have direct impact on the agricultural activities and the living activities of the downstream population and will indirectly cause effects such as reduction of income due to non-cultivation period, environmental pollution and diseases from lack of water. However, this effect is considered minor because the repair and maintenance does not last long (about a few weeks).

**(d) Emergency of flood discharge and dam breakage**

Due to the subproject particularity, which is improving dam safety, the risk of dam breakage is very low. Emergency flood discharge likely affect downstream communities without prior notice, which directly impacts downstream flooding, damage to property, crops and livelihoods, and leads to indirectly impacts such as environmental pollution and outbreaks and loss of income.

## 5.4. Analysis of impact types

### *5.4.1 Cumulative impacts*

The subproject consists of many dams, however, the dams are scattered and independent in the province. Moreover, the size and nature of the subproject activities are small and simple, so that the implementation of the subproject activities is not likely to cause cumulative effects. According to the surveys and exchanges with the concerned agencies, at present, in the construction area of the WB8 Subproject in Dak Lak province, there are not other major projects being implemented on the same spatial scale and time, so the cumulative effects created by other projects are considered to be non-existent..

### *5.4.2 Direct impacts*

The subproject implementation will have direct impacts on the environmental and social conditions in the subproject area. Subproject activities will result in temporary or permanent land loss. Construction activities will have direct impacts on the quality of the surrounding environment such as the air, the soil and the water due to the generation of waste like emissions and wastewater and the removal of vegetation.

### *5.4.3 Indirect impacts*

The temporary or permanent loss of land will affect the livelihoods of affected people like reducing or losing income, occupation change and possible social contradictions. Indirect impacts are also identified through the risk of deterioration of water quality due to soil erosion caused by vegetation clearing from the construction. Water pollution due to waste generated from the construction may lead to a decline in the composition and decline in number of individuals of aquatic species. Soil compaction due to the use of heavy equipment on farmland possibly leads to a decline in the number of useful soil microorganisms due to changes in soil structure. Loss of vegetation will also lead to loss of habitat for many animal species in the subproject area and increase of the risk of erosion and flooding.

### *5.4.4 Temporary impacts*

In general, most impacts associated with construction activities within the subproject area such as noise, vibration, dust and emissions, and the generation of solid waste and wastewater are short. They will no longer exist when construction activities are completed.

### *5.4.5 Long term impacts*

The permanent loss of productive land will be a lasting impact on the affected people as some households are perceived as losing productive material and leading to a change in their occupation. Also, environmental incidents such as oil spills or hazardous chemicals will create long-term effects on the environment and human health as these chemicals get long decomposition, which penetrate into the soil, the water and the food chains. In addition, the risks of occupational accidents will be addressed with long-term effects when workers' health is diminished or lost.

# CHAPTER 6. ANALYSIS OF ALTERNATIVES

With the aim of improving investment efficiency and ensuring safety, minimizing impacts on the environment and society in downstream areas of reservoirs; The scenarios are given to choose the design and construction plan in accordance with the objectives and the actual natural and socio-economic conditions in the area of 10 reservoirs. Main construction activities are reinforced and repair based on existing works, due to the design plans, selection of technical and technological solutions in the construction of subproject items. There are differences in environmental and social impacts in the region that should be implemented in the context of the alternative analysis, focusing on the social and environmental differences in the deployment and non-development scenario; Option of optimal construction solutions.

## 6.1. Without subproject

Structures were built 30 to 40 years ago, which have exploiting in many years and e have been seriously degraded: The dam height does not guarantee flood control, the quality of dam body is not guaranteed, the seepage is high.

The existing dams with the dam crest width are not ensured according to the design standards, some places only reach from 1.5-2.5m. The upstream slope has been eroded due to the wave collision, does not guarantee the slope coefficient as designed, many positions on the slope are eroded 1.2-1.5m deep. Downstream slope is worn off due to flood and rain, currently not guaranteed. The entire dam crest, upper and downstream slopes have not been reinforced yet, so every year, it is eroded by rains and floods causing degradation of the works.

10 spillway works are mostly free spillways, without valve gates, followed by spillway threshold is a slope of water. In which, 05 works are made of un-reinforced soil, narrow spillways do not guarantee flood drainage. In the rainy season, the spill threshold is often eroded deep and wide to the sides, causing unsafety to the structure. 05 remaining spillway works have been constructed by building stone structure and reinforced concrete, but through the process of putting into use and not being repaired regularly, the structure has been damaged and does not ensure the drainage capacity. Post-overflow capacity leads to downstream erosion.

Among 10 reservoirs, there are 05 intake structures that collect water under the dam, 05 reservoirs do not have intake structures. Most of the intake structures have been built for a long time and are now damaged by leakage, seeping through intake structures, failing to ensure water supply capacity and potentially damaging the dam. In addition, many offtake structures have valves but the valve is broken or the valve is placed in an unfavorable position when operating.

There is no monitoring system so it does not promote the effectiveness of natural disaster warning. Road for operation and management is also rural roads. Traffic conditions is difficult and only meet rudimentary vehicles.

The current status of the reservoirs restrict the development plan, improving productivity plan and economic efficiency in agricultural cultivation; The reservoirs do not guarantee the amount of irrigation water which affects the selection of plants and animals, alternating crops; Local authorities cannot fully exploit the economic value from land resources.

Management road which is also residential roads, has not been fully reinforced. It causes difficulties in traveling, managing, responding to natural disasters in reservoirs and residential areas.

When not implementing the subproject, the ecological area around the reservoirs is always stable, but due to the current status of the degraded reservoirs, the potential risk of dam failure will cause disaster, human damage, physical facilities and breaking native ecosystems in areas, especially downstream areas of reservoirs.

In recent years, due to unusual changes of weather, heavy rain and flood, shallow reservoir makes the risk of insecurity very high. A synchronous structural solution such as construction investment to repair and upgrade reservoirs is an imperative, ensuring the safety of lives and assets of households in the downstream area and serving the requirements of economic development of the locality.

### 6.2 With Subproject

10 reservoirs in the subproject are important irrigation works to prevent floods, provide irrigation and water supply for nearly 12,000 people in mountainous communes in 6 districts of Krong Pak, Krong Nang and Krong Buk, M 'Dak Lak, Ea Kar and Buon Ho town of Dak Lak province. Contribute significantly to improving the lives of local people, creating a stable basis for irrigation areas of mountainous communes, stabilizing people's lives in the region.

The subproject will be completed to bring many benefits to the community and local authorities, namely repair, reinforcement of the dam body, dam slope will ensure safety for the downstream area during the rainy season; Limiting losses and leaks, ensuring the flow of irrigation water for downstream agricultural cultivation according to the local production regulatory plan; increase agricultural productivity and output, increase crops and develop aquaculture by increasing irrigated area.

The works after completion will ensure stable irrigation water for over 1665.75 ha of rice, vegetables, and year-round industrial crops in the downstream area of 10 communes; take initiative in farming plans, change plant varieties and animal breeds, leading to an increase in economic efficiency in the area of local agricultural land.

Provide water for aquaculture and limit negative impacts on the environment, landscape of the reservoir and downstream areas. After the reservoirs have been repaired, with a capacity of over 11.5 million cubic meters of water, it will facilitate aquaculture with quite large aquatic resources. Stabilize water surface for aquaculture; develop production and non-agricultural business, increase income, improve living standards. Create more jobs, income, improve living standards, especially for manual and seasonal workers.

Construction, repair and upgrade of reservoir works may cause potential negative environmental and social impacts as analyzed above, however short construction time and scale of activities not large and deployed in a smal space, negative impacts are assessed as not high, temporary, local and potentially mitigable. Compared to the environmental, economic and social efficiency after the subproject is completed and operational compared to potential adverse environmental and social impacts, the subproject implementation is acceptable. During the operation phase, the project will increase the stability of the water source, ensure the safety of the project and the downstream area.

Currently, 10 reservoirs are being exploited and used with some flood spills, some of the sluice gates are leaked, there are no roofing concrete and service roads. According to the design consultant's proposal, to ensure safety for dam body, discharge culvert, reinforcement, replacement and concreting to ensure water storage, avoid loss and convenience in the process of regulating water export and operate the reservoir. Ensuring development conditions for coastal flora populations, creating landscapes around reservoirs and local transport, opening up development opportunities, attracting visitors.

After completion of construction works in 10 reservoirs, stable water flow and irrigation will contribute to the development of flora and fauna ecosystems in reservoirs, coastal areas and downstream areas. Impact on ecosystems in a long time, continuously in a positive direction, diversifying and enriching flora and fauna in the subproject area

Complete the construction items of the subproject will stabilize the water volume at 10 reservoirs, stabilize the water level of the reservoir higher than the downstream area, so after maintaining the reservoir, the downstream aquifers will always be stable for the year, meeting the demand of local people for water and farming use.

In the process of implementing the subproject, it will affect the ecosystem around the reservoirs, however the impact is small and can be restored in a short time; The impacts and mitigation measures are analyzed and detailed in the next content in the report.

**Selection of construction solutions**

In addition to the socio-economic and environmental benefits offered in the case of non-implementation and implementation of the project, choose construction solutions for the required items in the bidding documents in order to minimizing impacts on the natural and social environment during the implementation process. Specific options

*Execution:* With the current status of works in service of irrigation, the preferred construction method does not drain the reservoir completely, but only lowers the water level in the reservoir and maintains a minimum amount of water for medium irrigation (irrigation with the lowest irrigation level), both construction and safety and economy.

*Excavation:* Peeling dam foundation using bulldozer 110CV, combine excavator 0.8m3 to 1.25 m3 and transport by car 10 - 16T. Excavate soil using excavators, digging soil and pouring into cars transporting to waste dumps. This will save time to reduce dust and emissions generated on the site.

*Earth working* Excavators excavating soil at material mines, using cars to transport to 2 dams. Using bulldozer 110-140CV to organic top soil layer of mine surface materials, excavator 1.25m3 to dump soil into transport cars with load of 10-16T. Trucks transporting soil back into the dam face, the process of pouring soil is mixed. Bulldozer 110CV leveled into 0.3m thick layers, at this stage, depending on the weather, it is possible to add water spray at the dam surface. Finally, the lagoon work, using the vibrator (9-16) T to cover the soil ensures design requirements. Specific compaction parameters will be accurately determined through field compaction experiment, carried out at the construction stage. Parts of the work that the machine cannot execute (tray feet, processing on adjacent surfaces) use manual toads. Reinforcement of downstream slope is mainly

used for construction. This will minimize noise and dust generation and limit traffic accidents and damage to local roads

*Foundation Excavation:* Excavation work is using a combination of 1.25 m3 excavators to excavate a part of the pit, a part of the manual excavation. Excavator 1.25m3 scooped up 7T cars to transport soil to landfill. The combination of manual excavation and digging saves time, cost, and excavation pit according to design drawings and reduces the amount of dust generated in the surrounding environment.

*Concrete poured in place*

- Construction methods are used manually and mechanically to construct, saving cost and time but still meet the requirements.
- Construction machines : Erection of formwork - reinforcement → use self-propelled mixer → Improved vehicle transporting concrete → Workers pour concrete → dresser or dresser → Craft complete. These steps help to limit the amount of dust generated during the concrete mixing process and ensure labor safety.

*Paving the upstream dam slope:* using on-site concrete slabs will limit vehicle traffic and traffic safety issues in transport.

*Planting downstream grass:* Slope protection grass is exploited in the vicinity of the building. When growing grass, reinforce the slope, you must choose a grass with a strong root system, grow and live, good drought tolerance and low body. The grass is made into a halo that leads to the planting site and pinches the slope. The location and size of grass plots complying with the regulations in the design dossier will help the native ecosystem recover quickly, protect the dam surface against erosion when it is raining in the new construction phase.

*Pavement and Construction work:* Mainly using manual methods to limit the impact of mechanical means to the surrounding environment and in accordance with local construction conditions.

*Formwork work:* Installing the formwork at the pouring points manually, most of the steel formwork can be used to facilitate the installation and dismantling to ensure labor safety and cost savings in construction ..

*Reinforcement work* Steel reinforcement is gathered and machined mainly in warehouse premises in the construction site and transported into the installation site. At the site, only small details of construction steel and auxiliary works are processed to save time, cost and minimize the impact on the surrounding environment due to the construction conditions in the area. There is no wide area around the dam.

Other work: Mainly using manual methods to minimize the impact of motorbike mobilization on construction sites and in accordance with each construction item in the condition of each reservoir area..

# CHAPTER 7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

## 7.1. Objectives

- Ensure the compliance with the World Bank's regulations as well as Vietnam's legal system, standards and guidelines applied at the provincial and national levels.
- Ensure that sufficient resources are allocated based on the subproject budget to carry out the activities related to the ESMP.
- Ensure that the environmental and social risks of the Subproject are adequately predicted and managed.
- Ensure specific and feasible response plan with unforeseen environmental issues in the subproject's environmental impact assessment.
- Create an effective feedback mechanism for further improving environmental protection results.
- The Environmental and Social Management Plan (ESMP) outlines mitigation, monitoring and institutional measures that will be implemented during the development and operation of the Subproject to avoid or control adverse impacts on the environment, society and outlines the actions required to implement mitigation measures. The ESMP creates a useful link between adverse impact and mitigation measures and ensures that such measures are implemented.
- The ESMP imposes responsibilities for the implementation, monitoring, time and cost for the proposed mitigation measures. The summary of the Subproject's environmental and social management plans is presented in the following sections.

## 7.2. Mitigation measures

### *7.2.1. Mitigation measures during the preparation phase*

The main issue in this period is the compensation, assistance and resettlement for affected people whose land, houses, income and assets are affected. The compensation for site clearance will follow the updated resettlement plan of the subproject. The estimated cost of for implementing the Resettlement Action Plan for the Subproject works is VND 1,787,019,000, which includes the cost of compensation/assistance for land, works, assets affected by the subproject, support funds, monitoring and evaluation, management and contingency costs.

**(a) Implementation of compensation and assistance for affected households**

- The Subproject Owner contracts and coordinates with the District Centers for Land-fund Development, the Department of Natural Resources and Environment, the District People's Committees, the Divisions of Natural Resources and Environment, the Commune People's Committee, the concerned organizations, households and individuals whose land and assets attached to land are located in the acquired area to inform and guide the accuracy, public measurement, determination of ownership, asset declaration in order that the compensation, support and resettlement plans are approved the most exactly.
- Disseminate the compensation, support and resettlement plan of the subproject.

- Disseminate the proper implementation of the State's legal obligations and interests.
- Publicize detailed compensation prices of each type of damage to affected households.
- Payment of compensation to the right subjects and on schedule.
- Coordinate with local authorities if any disputes occur to ensure the smooth site clearance.

The cost of compensation, support and other management costs for affected land/property (land, houses, structures and trees) for the Subproject are shown in the table below

**Table 56. Summary of estimated compensation costs**

| No. | Content | Number of affected households | Unit | Quantity | Unit Price (VND) | Amount (VND) |
|---|---|---|---|---|---|---|
| **A** | **Compensation and support** | | | | | **1,592,709,000** |
| **1** | **Land compensation** | | | | | **633,750,000** |
| | Land for perennial crops | 16 | m2 | 5.090 | 35.000 | 178,150,000 |
| | Residential land | 1 | m2 | 500 | 900.000 | 450,000,000 |
| | Aquaculture land | 1 | m2 | 280 | 20.000 | 5,600,000 |
| **2** | **Compensation for houses and architectural objects** | | | | | **370,854,000** |
| | 4-level house | 1 | m2 | 40 | 3,060,000 | 122,400,000 |
| | Kitchen | 1 | m2 | 25 | 1,034,000 | 25,850,000 |
| | Breeding facilities | 3 | m2 | 193 | 948.500 | 183,060,500 |
| | Gate | 1 | each | 1 | 1,478,000 | 1,478,000 |
| | Toilet | 1 | m2 | 4 | 1,897,000 | 7,588,000 |
| | Driven well | 1 | each | 1 | 4,640,000 | 4,640,000 |
| | Tank | 1 | m3 | 2.50 | 1,263,000 | 3,157,500 |
| | Yard | 1 | m2 | 90 | 154.000 | 13,860,000 |
| | Fish pond | 1 | m3 | 420 | 21.000 | 8,820,000 |
| **3** | **Plant compensation** | | | | | **209,805,000** |
| | Coffee | 6 | tree | 37 | 320.000 | 11,840,000 |
| | Pepper | 11 | tree | 145 | 655.000 | 94,975,000 |
| | Avocado | 8 | tree | 20 | 1,450,000 | 29,000,000 |
| | Jackfruit | 4 | tree | 17 | 810.000 | 13,770,000 |
| | Mango | 3 | tree | 12 | 1,000,000 | 12,000,000 |
| | Durian | 5 | tree | 19 | 2,300,000 | 43,700,000 |
| | Banana | 2 | tree | 20 | 70.000 | 1,400,000 |
| | Oranges | 2 | tree | 50 | 60.000 | 3,000,000 |
| | Tea | 1 | tree | 10 | 12.000 | 120.000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **4** | **Supporting** | | | | | **378,300,000** |
| | Training and job change support | | m2 | 5.090 | 70.000 | 356,300,000 |
| | Rent assistance | | month | 6 | 2,000,000 | 12,000,000 |
| | Household relocation support | | household | 1 | 6,000,000 | 6,000,000 |
| | Vulnerable households support | | household | 2 | 2,000,000 | 4,000,000 |
| **B** | **Management costs (2%)** | | | | | **31,854,180** |
| **C** | **Subtotal (A + B)** | | | | | **1,624,563,180** |
| **D** | **Provision (10%)** | | | | | **162,456,318** |
| | **Total** | | | | | **1,787,019,498** |
| | **Total (rounded)** | | | | | **1,787,019,000** |

*(Source: RAP Report, June 2019)*

**(b) Method for management of waste generated from tree-cutting in favor of site clearance**

- Waste sources including solid waste from weathering and demolition of construction works shall be buried at the low land area lying in the dam protection area. Waste from demolition works is crumbled and buried down, followed by the soil is peeled and top is the soil cover, color to grass. During discharge, the waste dumps are compacted, compacted to minimize dust emissions as well as avoiding landslide, ensuring safety.

- Digging of soil around the camp site to collect runoff as well as domestic wastewater for settling ponds. Settling pit is compacted.

- Daily waste will be collected and the transport agencies shall be hired to handle the waste in accordance with regulations.

**(c) Method for mitigating impacts from geological drilling**

- After drilling and geological exploration work, all boreholes, after being tested, must be filled to ensure that the changes in the nature and state of the stratigraph are maintained or limited. , on the hydrothermal status in the soil layers, ensure the safety in the daily life and production of the local people, and ensure the stability of the work that has been and will be built later in the hole.

- Use the soil equivalent to the soil of each layer of soil in the borehole to fill, especially for the borehole through the stone, using clay or heavy clay to fill. When filled with sticky soil, small dirt or earthen to a size equal to 1/2-1/3 hole diameter. Backfilling the hole in the hole by one meter and then push the wall up one meter until the hole is filled. Do not pour the soil into the hole to avoid clogging the hole. (*Source: TCVN 9437:2012 - Geological drilling for the work*)

**(d) Method for mitigating impacts from postwar bomb and mine defusal**

Post-war demining will be conducted before land acquisition. This work will be done by specialized units of the Army in the province. Project owners and specialized demining units

must inform local residents at least one month before site clearance and use barriers and warning signs to reduce the risk to people and pets. The demining unit will designate staff responsible for guiding local people not to enter the demining area after the war. The clearance of mines after the war will be in line with the Ministry of Defense's Circular 146/2007/TT-MOD.

### *7.2.2 General mitigation measures to construction impacts*

Mitigation measures are developed based on the World Bank Group's environment, health and safety guidelines and national regulations and standards to minimize construction impacts, in general, which are presented in the ECOP. The ECOP describe the typical requirements implemented by the Project Owner and supervised by the Construction Supervision Consultant during the construction process. The ECOP will be incorporated in the appendices of bidding documents and contract documents. The mitigation measures are identified for the following issues:

- Dust and emissions;
- Vibration and noise;
- Waste management;
- Management of hazardous materials and chemicals;
- Management of camps;
- Biological effect;
- Soil erosion;
- Sedimentation and drainage;
- Stockpile and borrow pits management;
- Traffic safety management;
- Interruption of infrastructure services;
- Chance finds;
- Management of labor influx;
- Occupational health and safety;
- Community Health and safety;
- Communication with the local community.

**Table 57. Environmental Codes of Practice (ECOP) for addressing construction impacts**

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| **1) Dust and emissions** | - The Contractors are responsible for the compliance with the requirements of Vietnamese regulations on ambient air quality.<br>- The Contractors must ensure that dust emissions are minimized and will not disturb local people, while implementing dust control measures to maintain a healthy working environment and minimize disturbance to surrounding households.<br>- The Contractors are responsible for the implementation of dust mitigation measures (e.g. use of water sprinklers, covering vehicles for transporting materials ...).<br>- Construction materials such as cement, sand and gravel must be properly covered and secured during transportation to prevent spillage of soil, sand, other materials or dust.<br>- Spoilt and stones and stockpile material must be protected against the effects of wind and the locations of the material stores should be checked for current wind direction and locations of the sensitive works.<br>- Anti-dust masks should be used when dust content is too high.<br>- All transportation and construction vehicles must comply with the Vietnamese regulations on the emission limits.<br>- All vehicles must undergo a regular emission test and receive: "certificate of quality, technical safety and environmental protection" under the Decision No.35/2005/QD-BGTVT; | - TCVN 6438-2005: Road vehicles. Maximum allowable emission.<br>- No.35/2005/QDBGTVT on quality control, technical safety and environmental protection;<br>- QCVN 05: 2013/BTNMT: National technical regulation on ambient air quality<br>- WBG EHS Guidelines | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | - It is important to ensure that no solid waste or construction materials (e.g. wood, rubber, oil dusters, cement bags, paper, plastic, bitumen etc.) are destroyed. | | | |
| **2) Noise and vibration impacts** | - The Contractors are responsible for compliance with the Vietnamese laws regarding noise and vibration.<br>- All vehicles must have the "Certificate of quality control, technical safety and environmental protection" under Decision No.35/2005/QD-BGTVT; to avoid over-noise generation from machinery which is less maintained.<br>- Measures to reduce noise must be applied as follows:<br>+ Selection of low noise equipment<br>+ Installation of sound muffler for fans<br>+ Installation of silencer for exhaust and compressor components<br>+ Installation of soundproofing chamber for the equipment cover causing noise<br>+ Installation of adjacent sound insulation barriers and the continuous minimum surface density is 10 kg/m2 to minimize sound transmission.<br>+ The sound insulation barriers should be located near the sound source or the sound transmission source.<br>+ Installation of vibration control for mechanical machines<br>+ Control of operation time for specific equipment or activities, especially when they work close to residential areas. | - QCVN 26: 2010/BTNMT: National Technical Regulation on noise<br>- QCVN 27: 2010/BTNMT: Technical regulation on vibration<br>- WBG EHS Guidelines | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | + Moving noise sources to other areas to take advantage of distance and barriers<br>+ Installation of fixed equipment as far away from residential areas as possible<br>+ Taking advantage of natural terrain in the design to prevent noise<br>+ Restriction the use of means of transportation serving the project through residential areas<br>+ Establishment of a reception and feedback mechanism | | | |
| **3) Waste management** | **I. General waste**<br>**(a) Wastewater**<br>- The Contractors are responsible for the compliance with the Vietnamese laws regarding the discharge of wastewater into water sources.<br>- Hiring local workers to limit waste<br>- The wastewater treatment system must be provided for the treatment of domestic water or sanitary wastewater in areas without wastewater collection network. Wastewater treatment systems should only be used for the treatment of sanitary wastewater. When the wastewater treatment system being the form of wastewater treatment selected, it is necessary:<br>• Design and installation in accordance with the local regulations and guiding to prevent any risk to public health or the contamination of soil, water or groundwater.<br>• Maintaining good performance. | - QCVN 14: 2008/BTNMT: National Technical Regulation on domestic wastewater quality;<br>- QCVN 40: 2011/BTNMT: National Technical Regulation on wastewater<br>- Decree No. 59/2007/ND-CP on Solid Waste Management;<br>- Decree No. 38/2015/ND-CP on management of waste and discarded materials<br>- Circular No. | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | • Installing in areas with sufficiently permeable soil for the design wastewater percentage.<br>• Installing in stable areas at the same level, which are well draining and permeable, with separation between drainage and groundwater or other receiving waters.<br>- Wastewater from washing construction machines and equipment must be collected in the settling pond before being discharged into the local sewage system.<br>- Upon the completion of the construction works, the waste water tanks and septic tanks must be safely treated or sealed up.<br>**(b) Storm water**<br>- Rainwater should be separated from the treatment and sanitary sewage to reduce the amount of wastewater to be treated before discharging.<br>- Preventing water surface runoff from construction areas or potential sources of pollution.<br>- If this approach is not practical, the amount of wastewater discharged from the treatment and storage area must be separated from the contaminated water stream which is likely to be less polluted.<br>- Reducing water runoff from the areas where there are no potential sources of contamination (e.g. minimizing the impermeable surface area) and reducing the maximum discharge rate (e.g. using aquacultural ponds).<br>- In case, it is necessary to treat rain water to protect the | 36/2015/TT-BTNMT on management of hazardous wastes<br>- WBG EHS Guidelines | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | receiving water quality, priority should be given to managing and treating the first discharge of rainwater, where most pollutants are potential present.<br>- When the water quality criteria meets the permission, rainwater must be managed as a natural resource, either for groundwater recharge or for meeting the water need of the facility.<br>- It is essential to install and maintain oil separators and lubricant traps at refuelling facilities, workshops, parking areas, fuel depots and storage areas.<br>- Sludge from rainwater tanks or collection and treatment systems may contain high levels of pollutants must be treated in accordance with local requirements. If it is not treated, it must be suitable to the protection of public health and safety and the preservation and long-term sustainability of water and land resources.<br>**(c) Solid waste**<br>- Prior to construction, the Contractors should prepare solid waste control process (storage, garbage bins, cleaning schedules, etc.) and be careful during the construction.<br>- Before construction, the Contractors must ensure that all permits or waste treatment contracts are available.<br>- Measures should be taken to minimize potential waste generation and improper behaviour related to waste disposal. At all construction sites, the Contractors must provide garbage bins, containers and waste collection facilities. | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | - Solid wastes may be temporarily stored at site in the designated areas approved by the Contractors, Construction Supervision Consultant and local authorities before being collected and treated through licensed waste collectors.<br>- Waste packaging must be protected against corrosion.<br>- Do not burn, bury or dump solid wastes in place.<br>- Re-usable materials such as wood panels over grooving, steel, scaffolding, packaging materials, etc. will be collected and classified at site from other sources for recycling or for sale.<br>- If not being dismantled on site, solid waste or construction debris will only be disposed at designated locations that are approved by the Construction Supervision Consultant and included in the Solid Waste Plan. In any case, the Contractor shall not dispose of any material in sensitive environmental areas such as natural habitats or water bodies.<br>**II. Hazardous waste**<br>**(a) Storage of hazardous waste**<br>Hazardous waste must be stored to prevent or control accidental release into the air, soil, and water sources in the area where:<br>- Wastes are stored in a way that prevents any disturbance or contact between incompatible wastes and allows inspection among the tanks to track leaks or spills, e.g. including spaces between compatible areas or physical isolations like walls or barriers.<br>- Store in a tightly closed containers for direct sunlight, wind and rain. | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | - Storage should be on a waterproof surface that is easily cleaned, and properly packaged to contain any spill or leakage. The storage area should be covered to prevent rainwater from accumulating.<br>- The secondary prevention system must be constructed with appropriate materials for the storage of waste and sufficient to prevent leakage into the environment.<br>- Secondary storage includes wherever liquid waste is stored in volumes greater than 220 litters. The available volume of secondary containment must be at least 110 percent of the largest repository, or 25 percent of total storage (whichever is larger) at that particular location.<br>- Providing adequate ventilation where volatile materials are stored.<br>**(b) Transportation of hazardous waste**<br>- Onsite and offsite waste transportation must be carried out to prevent or minimize spillage, release, and exposure to staff and the public.<br>- All waste containers designated for on-the-spot transport must be protected and labelled with relevant content and hazards, properly loaded on the transport vehicle prior to departure and must be accompanied by a shipping document (e.g. manifest) describing the load and associated hazards, in accordance with the instructions.<br>**(c) Burial of hazardous wastes**<br>- Chemical waste of any kind must be disposed of at appropriate | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | burial sites and approved in accordance with the requirements of local law. The contractor must have the necessary processing certificate.<br>- The disposal of hazardous waste must be carried out and handled by specially trained and certified workers.<br>- The use of oils, lubricants, detergents ... from vehicle and machine maintenance must be collected in a storage tank and recycled by the company specializing in waste oil recycling at the waste disposal site.<br>- Unused or rejected bitumen or bitumen products will be returned to the supplier's factory. | | | |
| **4) Soil erosion** | - Limitation of construction activities on rainy days<br>- Using geotextile to temporarily cover erosion-prone soil<br>- Covering a layer of soil over the soil surface to help soil absorb water gradually<br>- Building walls around the erosion area to block the flow of water<br>- Stabilizing surface erosion by cultivation or concreting | WBG EHS Guidelines. | Contractors | PPMU, CSC, Community Monitoring Committee |
| **5) Drainage and sediment management** | - The Contractors should follow the detailed design of the wastewater system in the construction plan to prevent water spills or erosion of hillsides and areas which are not protected from floods, resulting wastewater pollution to local water resource.<br>- Ensuring that the sewage system is not filled with mud and other obstructions. | - TCVN 4447: 1987: Construction regulations and acceptance<br>- Circular No.22/2010/TT-BXD of the Ministry of Construction regulating labour safety in | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | - Maintenance of the current status of the areas that are not under construction.<br>- Carrying out reasonable earthwork, excavation and filling, complying with construction standards, including such measures as installation of wastewater system, planting trees.<br>- In order to avoid waste sediment, that impacts the water source, a sediment management system should be installed to slow or divert waste and sediment until the crop is cultivated. A sediment management system may include the removal of canal waste, canal banks, waste tank, straw material, post-storm sewage protection system or barriers.<br>- Draining or supplying water: In case the construction works should be carried out at water sources (e.g. bridges, retaining walls, anti-erosion system), the areas should be drained, ensuring dry conditions for construction. Settling water from the construction site must be discharged into the sediment management system to be treated before flowing into the water source.<br>- Mitigation measures should be implemented for each specific area under the EMP when changing water flows or constructing dykes. | construction work.<br>- QCVN 08-MT: 2015/BTNMT - national technical standards on surface water quality. | | |
| **6) Management of hazardous materials and chemicals** | - The use of hazardous materials and chemicals within the subproject must adhere strictly to the manufacturer's instructions.<br>- Using types of chemicals on the list of authorized agencies<br>- Persons exposed to hazardous materials and chemicals should | - Decree No. 38/2015/ND-CP on waste and waste management;<br>- Decision No. 23/2006/QD-BTNMT on | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | receive intensive training in the risk prevention measures due to exposure to hazardous materials and chemicals.<br>- Persons who are frequently exposed to hazardous materials and chemicals should be periodically checked health (no less than 6 months) and appropriate rest periods are recommended.<br>**Transportation of hazardous materials and chemicals**<br>- Using accessories, pipe lines and hoses dedicated to the materials in the tanks (for example, all acids use one type of connection, all caustics use different equipment) and maintain procedures to prevent the inaccurate addition of toxic substances to the tanks.<br>- Using compatible transfer device and match the characteristics of the transfer material and design to ensure safe transfer.<br>- Regularly checking, maintaining and repairing accessories, pipes and tubes.<br>- Providing secondary containment, dripping or other spill prevention and containment measures for containers of hazardous materials at possible connection points or spill points.<br>**Overload control**<br>- Preparing written procedures for transportation including a checklist of measures to be taken during the filling process and use of the trained persons.<br>- Installing the measuring equipment on the tanks to measure the volume inside.<br>- Using water dripping pipes for tank trucks and fixed | the list of hazardous wastes;<br>- Circular No.36/2015/TT-BTNMT on management of hazardous waste;<br>- Circular No.03/2016/TT-BNNPTNT on the list of plant protection drugs permitted for use in Vietnam;<br>- Circular No. 21/2015/TT-BNNPTNT on management of plant protection drugs<br>- WBG EHS Guidelines. | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | connections to the tanks.<br>- Providing automatically sealed valves on the tanks to avoid overload.<br>- Using a water tank around the spillway tubes to collect the spillage.<br>- Using pipe connection with automatic overload protection valves (float valves).<br>- Pumping less than the allowed capacity in the tanks or ship by placing less material than its availability.<br>- The case of overload or overpressure of tubes, the load should be controlled down.<br>**Response to fire and explosion prevention**<br>- Storage of incompatible materials (acids, bases, flame retardants, oxidants, chemical reactants) in separate areas, and facilities to separate the material storage areas.<br>- Providing specific material storage for extremely hazardous or reactive materials.<br>- Using flame arresters on vents from flammable containers.<br>- Providing lightning protection for tanks, transfer stations and other equipment used to treat flammable materials.<br>- Selecting compatible building materials with products stored for all parts of the storage and distribution system and avoiding reuse of containers for various products without material interoperability testing.<br>- Storage of hazardous materials in the area of the establishment | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | isolated from the main works. If the tangibility can not be avoided, physical separation must be made using structures designed to prevent fire, explosions, spills, and other emergencies that affect the operation of the facility.<br>- The storage area should be on a non-absorbent surface and be easily cleaned, properly packaged to avoid any spills or leaks. Storage areas should be covered to prevent accumulated rainwater.<br>- All sources of ignition are prohibited from areas near flammable tanks.<br>**Secondary chamber (liquid)**<br>- Transferring dangerous substance from storage tanks to storage areas where there is sufficiently permeable surface to avoid environmental degradation and sloping down to collection places or storage structures to avoid connecting to wastewater/rain water collection systems.<br>- If no permanent containment structure is provided for transfer activities, one or more other spill prevention forms such as mobile casings (which can be deployed throughout the duration operating hours) of pressure relief valves on rainwater tanks or closing valves in drainage or sewer equipment, in conjunction with oil water separators should be provided.<br>- Storing hazardous materials in tanks capable of equal to or larger than 1,000 litters in the unwaterproof surface areas, which are covered or braided to contain at least 25% of total storage amount. | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | - Providing secondary containment to the parts (tanks, pipes) of the hazardous materials storage system, at the feasible extent.<br>- Carrying out routine tank inspections (e.g. daily or weekly), and inspection of visible parts of tank trucks and pipes to avoid leakage.<br>- Using composite or special storage systems and pipelines, especially in the use of underground tanks (USTs) and underground pipelines. If using a dual wall system, there should be a means of detecting leakage between the two walls.<br>**Training - Employees need training in hazardous waste management. The training programs include:**<br>- List of trained staff;<br>- Specific training objectives;<br>- Mechanisms for achieving goals (practical workshops, videos, etc.);<br>- Means of determining whether the training program is effective or not;<br>- Training procedures for new recruits and new courses for existing staff.<br>**Community Participation and Awareness**<br>- There is general information to the community which is likely to be affected by the scope and extent of the subproject activities and on-site preventive and control measures to ensure that there is no impact on human health.<br>- Potential impacts on human health or the environment caused | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | by incidents or from existing hazardous wastes.<br>- Specific and timely information on the behavior and appropriate safety measures will be adopted in the event of an accident, including practice exercises at high risk locations.<br>- Access to the information needed to understand the nature of the possible impacts of the accidents and the opportunity to contribute effectively to the<br>- relevant decisions and to develop emergency preparedness plans.<br>- The Department of Natural Resources and Environment and the Department of Health will be informed in time about any environmental incidents.<br>- Preparation and implementation of remedial measures after the oil spills. In this case, the Contractor must provide a report explaining the reason for the spill, corrective actions, consequence/damage from the spill incident, and corrective action. | | | |
| **7) Biological effect** | - The contractor should establish a management plan for site clearance, vegetation rehabilitation and re-planting in accordance with the relevant regulations for pre-approval by the Engineer. The site clearance plan must be approved by Construction Supervision Consultant and Contractor should strictly follow this plan and limit the number of areas that need to be cleared as low as possible.<br>- The site clearance in forest land in mountainous areas requires the permission of the Ministry of Agriculture and Rural | - Law on Biodiversity No. 20/2008/QH12<br>- Decree No.65/2010/ND-CP guiding the Law on Biodiversity | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | Development.<br>- The contractor should release the topsoil of all areas where the topsoil will be affected by the rehabilitation work, including temporary measures such as storage and piling up. Removed topsoil will be concentrated in the areas agreed with the Construction Supervision Consultant for future reforestation and protection.<br>- It is prohibited to use chemicals in the release of vegetation.<br>- Do not cut trees unless getting allowance in the vegetation clearance plan.<br>- Installing temporary protection fences to protect plants that need to be retained if necessary before commencing work at the site.<br>- Do not encroach important ecological resources unless the Construction Supervision Consultant has obtained permission, who should consult with the PPMU and the Independent Environmental Monitoring Consultant (IEMC) and relevant authorities. These include the areas where birds, animals, fish farms, or green protected areas are developed.<br>- The Contractor should ensure that no hunting, trapping and poisoning activities occur. | | | |
| **8)Traffic management** | - The Contractor must strictly comply with the provisions of the Road Traffic Law.<br>- Adopt the best traffic safety measures in all aspects of subproject activities with the aim of preventing traffic accidents and minimizing injuries suffered by sub-project staff | - Law on Transportation No.23/2008/QH12;<br>- Decree No.46/2016/ND-CP on administrative sanctions against traffic | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | and the public. The measures should include::<br>• Emphasizing the safety aspect of the drivers.<br>• Improving driving skills and driving license requirements.<br>• Adoption of travel time limits and arrangement of dashboards to avoid overload.<br>• Avoiding dangerous roads and times of day to reduce the risk of accidents.<br>• Using the speed control equipment on the trucks and remotely tracking the actions of the driver.<br>- Regular maintenance of the vehicles and use of the parts approved by the manufacturers to minimize serious accidents that may occur due to equipment malfunction or premature failure.<br>- Minimizing the interaction of pedestrians with construction vehicles.<br>- Cooperating with local communities and competent agencies to improve the signage, vision and overall safety of roads, especially along strips located near schools or other places where there are children; Working with local communities on traffic education and pedestrian safety (e.g. school education campaigns).<br>- Coordinating with emergency response agencies to ensure that appropriate first aid measures are provided in the event of an accident.<br>- Using locally sourced materials, whenever possible, to minimize transportation distances; Locating associated | safety violations;<br>- Law on Construction No.50/2014/QH13;<br>- Circular No.22/2010/TT-BXD, regulating labour safety in construction.<br>- WBG EHS Guidelines | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | facilities such as labor camps in the subproject area and arrange transportation of workers by bus to minimize external traffic.<br>- Using safe traffic control measures, including signs and flaggers to warn of hazardous conditions. | | | |
| **9) Disruption access to utility services** | - Planned and unplanned disruption of water supply, gas, electricity, internet: The Contractors must conduct prior consultation and prepare a contingency plan with the local authorities for the consequences of discontinuance.<br>- Collaborating with relevant utilities to develop appropriate construction plans.<br>- Providing information for affected households on construction time as well as planned service interruption (at least 5 days in advance).<br>- The Contractors plan to provide replacement irrigation water for agriculture for affected people in the event of a long disruption more than one day.<br>- Any damage to the cable lines, power lines, irrigation water ... will be reported to the authorities and repaired immediately. | - Decree No.167/2013 /ND-CP on sanctioning administrative violations in the field of security, social order and safety. | Contractors | PPMU, CSC, Community Monitoring Committee |
| **10) Management of workers' camps** | - Contractors' and workers' camps are built temporarily on the subproject land.<br>- These areas are far enough to accommodate building materials, oil, waste, discharge canals, and sensitive places such as schools, hospitals, churches, temples and other dangerous areas such as landslides, subsidence or erosion. | - Labor Law 10/2012/QH13<br>- WBG EHS Guidelines | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | - Camps should be well-ventilated, sunlight, clean water, garbage collection, septic toilets, mosquito nets, fire extinguishers, first aid kits, and other health protection facilities for workers. | | | |
| **11) Managing social issues related to labor influx** | - Employment of local workers for simple jobs and limitation of worker increase in the subproject area.<br>- Explanation to the workers about the local customs to avoid conflicts with local people.<br>- The Subproject Owners and the Contractors should cooperate with local agencies to prevent social evils.<br>- Strengthening campaigns to eliminate social evils<br>- Communicating with local organizations to ensure effective management and GRM so that affected local people can rely on.<br>- Temporary workers living in camps and rental housing must register their temporary residency with local authority.<br>- Employees are strictly forbidden to:<br>+ Use alcoholic beverages during construction<br>+ Controversy, fighting<br>+ Gambling, social evils such as drug use, prostitution<br>+ Littering waste | - Decree No.167/2013/ND-CP, stipulating administrative sanctions in the field of security, social order and safety; prevention of social evils<br>- WBG EHS Guidelines | Contractors | PPMU, CSC, Community Monitoring Committee |
| **12) Chance finds** | If the Contractors discovers archaeological sites, historical relics, remains and antiques, including graveyards and/or individual graves during excavation or construction, the Contractors shall: | - Amended and supplemented Law on Cultural Heritage | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | + Cease construction activities within the scope of discovery;<br>+ Delineate location or area of discovery;<br>+ Keep the locations safe to protect objects that can be removed from the areas. In the case of detachable antique objects or sensitive objects, it needs to protect them at night until the local authorities or the Department of Culture, Sports and Tourism take over;<br>+ Notify the CSC, who will inform the local or national authority responsible for cultural property of Vietnam (within 24 hours or less);<br>+ The agency in charge of protection of local or national heritages will be responsible for protecting and preserving these sites before deciding on further procedures. A preliminary assessment report on the detection process is prepared. The meaning and importance of the findings are assessed according to different criteria related to cultural heritage, including aesthetic, historical, scientific, research, social and economic values;<br>+ The decision on how to handle the search is made by the agency responsible for protecting local heritages. This may include changes in arrangement (such as when a heritage is found and can not remove) for conservation, preservation, restoration and recovery;<br>+ If cultural monuments, high value heritages and protected conservation areas are recommended by experts and required by the Cultural Relics Agency, the Subproject | No.28/2001/QH10;<br>- Amended and supplemented Law on Cultural Heritage No.32/2009/QH12;<br>- Supplemented and amended Decree No.98/2010/ND-CP; | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | Owner will need to make necessary changes to meet the requirements and conservation of the area;<br>+ Decisions relating to the management of the search for objects will be notified in writing by the competent authority.<br>+ The buildings can only be restored after being permitted by local authorities to protect the heritages | | | |
| **13) Occupational health and safety** | **Overworking**<br>- Training workers in lifting and handling materials in construction and finishing, including the setting of weight limits on which mechanical assistance or two-person lifts, which are required.<br>- Planning work arrangements to minimize the need for manual transportation of heavy loads.<br>- Selecting tools and work points to reduce power requirements and retention time, and promoting improved posture, including workstations that can accommodate users.<br>- Implementing administrative controls on work processes, such as job rotation and rest or break<br>**Slide and fall**<br>- Implementing good sanitation measures, such as placement and arrangement of loose building materials or debris in designated areas away from pedestrian walkways.<br>- Regular cleaning of waste residue and liquid waste.<br>- Locating electrical wires and connections in common areas | - Directive No.02/2008/CT-BXD on strengthening measures to ensure occupational safety and health in units in the construction industry<br>- Circular No.22/2010/TT-BXD dated 03/12/2010 of the Ministry of Construction on regulations on labor safety in construction work<br>- QCVN 18: 2014/BXD: National technical regulation on safety in construction<br>- WBG EHS Guidelines | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | and marked corridors.<br>- Using non-slip shoes.<br>**Working at height**<br>- Training and using temporary fall prevention devices such as rails or other fences, which may support a weight of 200 pounds, when workers are working at or above two meters in height or at any height, if the risk involves in falling into the active machinery, into water or other liquids, into the hazardous substance, or through the open area on the work surface.<br>- Training and using personal fall arrest systems such as seat belts and power harnesses which are capable of supporting 2,268 kg (it is also described in the section above), as well as rescue procedures to prevent people from falling to the ground. The connection point of the fall protection system can also support 2,268 kg.<br>- Using control areas and safety monitoring systems to alert workers to the locations near fallacious risk areas as well as to tighten, mark and label lids for openings on floors, slopes or pedestrian surfaces.<br>**Stabbed by widgets**<br>- Using restricted or discharge areas and/or gully to safely move waste from top to bottom.<br>- Sawing, cutting, grinding, sanding, splitting or chiselling with appropriate protection and anchorage when working.<br>- Maintaining clear ways to avoid heavy equipment crossing | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | discarded materials.<br>- Using protective measures when someone or material is dropped from scaffolding and the edges of work surfaces, such as handrails and planks, to prevent material from being shot.<br>- Moving work areas during blasting and use of explosive or deflecting methods to minimize flying stones or demineralization if the work is conducted close to people or structures.<br>- Wearing appropriate personal protective equipment such as safety glasses with side shields, masks, helmets, and safety shoes<br>**Moving machinery**<br>- Planning and isolating traffic locations; operating machinery and walkways; controlling vehicle traffic through one-way lane, speed limits, and on-site personnel; Wearing easy-to-observe jackets or carrying specialized clothing to regulate traffic.<br>- Ensuring visible observation through the use of identifiable coats when working in or walking through heavy equipment operating areas; training workers to check eye contact with operators before reaching the vehicle.<br>- Making sure movable equipment is equipped with alarm system.<br>- Using lifting equipment that is well inspected and maintained for loads, e.g. cranes, and ensuring load when lifting them higher than the required height | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | **Dust**<br>- Dust minimization techniques such as the use of water or non-toxic chemicals should be implemented to minimize dirt from vehicle movements.<br>- Personal protective equipment such as respirators will be used where dust levels are too high.<br>**Excavation and filling in limited space**<br>- Controlling site specific factors that may contribute to the instability of the slope of the earthworks, e.g. the use of water removal techniques in earthworks, side wall support and adjustment of slope to eliminate or minimize the risk of collapse, trapping, or drowning.<br>- Providing safe facilities to access to and get out of excavated areas such as step slope, grade entry, or stairs and ladders.<br>- Avoiding operating incinerators for long periods in excavation or embankment areas where other workers must enter unless the area is ventilated.<br>**Other site hazards**<br>- Assigning trained staff to identify and eliminate wastes from containers, pots, vats, processing equipment or contaminated soil as the first step in excavation, construction, dismantling or destroying the safety.<br>- Assigning specially trained staff to identify and select the removal of potentially hazardous materials in the construction prior to the demolition, for example, insulators or structures containing asbestos and polychlorinated biphenyls, mercury- | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | containing electrical components.<br>- Using appropriate protective equipment based on occupational health and safety assessment including respirators, protective clothing, gloves, and eye protection. | | | |
| **14) Community health and safety** | **A. Common site hazards**<br>- The Subproject must implement risk management strategies to protect the community from physical, chemical or other hazards associated with construction areas.<br>- Limiting access to construction site via a combination of internal controls and administrative measures for the high risk structures or areas, depending on specific circumstances, fencing, signage, and communications of the risk to the local community.<br>- Eliminating dangers on construction sites that can not be effectively controlled by restricting access to the site such as covering open areas into shielded spaces, creating paths to the larger openings such as ditches or dug holes or store them around hazardous materials.<br>**B. Disease prevention**<br>*Communicable disease*<br>- It needs to monitor, screen and treat workers.<br>- Preventing diseases among workers, in the local community by:<br>• Providing initiatives to raise awareness on health and education, for example by implementing an information strategy to strengthen individual awareness in order to | - Law on road traffic No. 23/2008/QH12<br>- Circular No. 22/2010/TT-BXD on regulations on labor safety in construction<br>- QCVN 18: 2014/BXD: Technical regulations on safety in construction<br>- WBG EHS Guidelines | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | address systemic factors that may affect fish behavior, which also promotes personal protection and protects others from infection by encouraging the use of condoms.<br>• Training health workers on disease treatment.<br>• Implementing vaccination programs for local community workers to improve health and prevent infection.<br>• Providing health services.<br>• Providing treatment through case management at on-site or community-based health care facilities; Ensuring the access to appropriate medical treatment, confidentiality and care, especially for migrant workers.<br>• Promoting cooperation with local authorities to increase access of families of workers and the community to public health services and promoting vaccination<br>*Diseases spread by transmission vectors*<br>- Preventing the spread of larvae and pathogens through hygienic measures and removal of habitats and reproduction of larvae of human settlements.<br>- Removing unused water.<br>- Increasing flows of natural and man-made canals.<br>- Considering the application of fencing pesticide residue areas.<br>- Implementing integrated vector control programs.<br>- Promoting the use of chasing drugs, clothing, nets, and other preventive measures to prevent insect bites.<br>- Implementing preventive treatment with non-immune drugs | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | and coordination with health workers to destroy the reservoirs that contain diseases.<br>- Monitoring and treating endemic and migratory populations to prevent the spread of the diseases.<br>- Cooperating and exchanging equipment and machinery with other control programs in the subproject area to maximize benefits.<br>- Training sub-project staff and local people on risk, prevention and treatment.<br>- Monitoring the communities in high risk seasons for the detection and treatment of cases.<br>- Distributing appropriate educational materials.<br>- Following the safety instructions for storing, transporting and using pesticides to minimize the potential for misuse, overexposure, and human exposure to accidents. | | | |
| **15) Management of stockpile and borrow pits** | - Large-scale borrow pits or stockpiles will need site-specific measures that go beyond those in this ECOP<br>- All using locations must be pre-designated in accordance with the approved construction standards.<br>- There should be a drain around the collection area to prevent wastewater discharge.<br>- The ground at the collection site will be dug out and then used to return the status quo as initially as possible.<br>- If there is a need for new locations during the construction process, prior approval by the construction engineer is | | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | required.<br>- If landowners are affected when their lands are used for digging or piling, they should be included in the Sub-project Resettlement Plan (RAP).<br>- If a connection to the roads is required, which should be considered in the environmental assessment process | | | |
| **16) Communications with local community** | - Maintaining communications with local authorities and communities. The Contractors should cooperate with local authorities (commune-level chairpersons and village heads) on the construction plans agreed in the areas near the sensitive areas or in the sensitive times like religious festivals.<br>- Vietnamese copies of ECOP and other relevant environmental safety documents will be provided to the local community and workers in the construction sites.<br>- Amusement park, parking lot is narrowed: Losses in public infrastructure during construction are often an inconvenience to people in sensitive areas. However, surveys on affected populations will provide opportunities for research and implementation of alternative measures.<br>- Disseminate information on the Subproject to the affected parties (e.g. local government, affected businesses and households, etc.) through community meetings before commencement of construction.<br>- Providing public relations contacts for interested parties to collect information on site activities, status and results of the subproject. | - Decree No.167/2013/ND-CP on sanctioning administrative violations in the field of security, social order and safety | Contractors | PPMU, CSC, Community Monitoring Committee |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | - Providing information, especially technical findings in understandable language to the public and useful form to elected citizens and officials through documentation and dissemination of key findings during the subproject phase<br>- Managing the involvement to community and information requirements for subproject implementation.<br>- Responding promptly and accurately to requests by phone and text.<br>- Informing local people about construction plans, service disruptions, roundabouts and bus routes, in case of necessary explosion or destruction.<br>- Limiting construction in the evening. If it is necessary well preparation and notice to everyone is adequately informed to take the necessary measures.<br>- Notifying at least 15 days of disruption of services (electricity, water, telephone, bus, etc.) to the public by posting notice at the place of implementation of the Subproject, bus station and at affected businesses/households.<br>- Providing documentation and technical drawings to local authorities and residents, especially the construction area outline and the ESMP for the construction site.<br>- Bulletin boards should be arranged at all construction sites to provide information on the subproject as well as contact liaison with the PPMU, environmental staff, safety and health staff, and communications, telephone numbers and other contact information so that any affected people can present | | | |

| Environmental and Social impacts | Mitigation measures | National code, standards | Responsible agencies | |
|---|---|---|---|---|
| | | | Implementation | Monitoring |
| | their concerns and suggestions. | | | |

❖ ***Measures to mitigate impacts on gender equality and children***

During the construction of the subproject, it may affect gender equality, women and children in the area around the project and on the construction site, so mitigation measures are proposed for the contractor to perform under the supervision to the PPMU and from construction supervision and local community supervision board. Specifically, the mitigation measures are as follows:

- Continue to promote communication to raise awareness about gender equality and HIV / AIDS to all levels of people and women themselves. Develop and implement communication activities, models of gender equality in accordance with the subproject area. At the construction site area, there should be propaganda materials on gender, HIV / AIDS
- Manage labor flow, especially women. Coordinate with the locality to have good management measures. To promote the responsibility of the local government, the contractor is to promote the role of the heads of agencies, localities, supervision consultants and site leaders in implementing gender equality objectives; arrange and assign work to women.
- In the process of construction, it is necessary to take measures to prevent prostitution, sexual assault on women and children.
- Construction site should have signs and lights at night to ensure that women and children are not affected when passing through the construction site at night.
- Children are strictly prohibited from entering the construction site. It is necessary to arrange barriers and dangerous signs at construction sites, areas prone to drowning at the dam reservoir.
- It is banned to hire children under 16 years old. It is necessary to coordinate with the locality to have a good workflow management plan.

### *7.2.3 Mitigation measures for specific impacts of grouting*

**Measures to minimize negative impacts from grouting**

- Grouting works shall be implemented in accordance with the current GoV's regulation on grouting works;
- Preparation of grout shall be done carefully in a dedicated area on the site so as to avoid causing environmental pollution;
- An assessment of the danger of grout shall be done before carrying out the grouting works;
- All equipment and tools to be used for the grouting works shall be properly managed and cleaned up so as to avoid the penetration of the grout into the soil, surface water and groundwater; and

- Temporary settling ponds shall be constructed on the site to collect the grout in case it escapes from seepage treatment, and then the grout from the settling ponds shall be treated in accordance with the current GoV's regulation on waste treatment.

**Table 58. Mitigation measures for the site-specific impacts during the construction phase**

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| 1, Ea Uy reservoir, Hoa Tien commune, Krong Pak district |  <br>People live near the construction site | *Scope:* Around the repaired and upgraded dam and offtake structure area.<br>*Scale of impact:* People live near the construction site of dam and offtake structure .<br>*Potential impacts:*<br>- Impact on the daily life of people, home architecture and landscape;<br>- Affect the air environment. | - Schedules, construction activities and related impacts must be sent to the households at least one month before the start of construction;<br>- Limit the honking of vehicles;<br>- Revert back the landscape after construction completion. | Contractor | PPMU, CSC, Community Monitoring Committee |
| |  <br>The dam site is also the residential traffic road in the region | *Scope:* The dam site is also the residential traffic road in the region.<br>*Scale of impact:* People living in Hoa Tien commune, construction workers, project staff<br>*Potential impacts:*<br>- Impact on public transport during construction phase;<br>- There is a risk of traffic | - Place signs and signals at turns, blind spots;<br>- Rationally arranging vehicle traffic in and out of the construction area, regulating vehicle speed during transportation;<br>- Do not clean vehicles, machinery and equipment near water sources. | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| | | accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | | | |
| |  <br>Loi Nhon Pagoda is located 200m away from the material transportation route, 1km from the Ea Uy construction site | *Scope:* Public, cultural and religious works located near the subproject transport route.<br>*Scale of impact:* People come to the temple on the first, full moon of months and Buddhist days.<br>*Potential impacts:*<br>Transporting materials to Ea Uy reservoir may cause some specific impacts, including:<br>- Smoke, dust;<br>- Impact on spiritual activities and beliefs of local people due to noise and traffic congestion;<br>- Risk of traffic accidents. | - Detailed transport schedule and related impacts must be sent to the temple's abbot 1 month before the start of the material transportation implementation.;<br>- Rationally arrange transport schedules, especially on the 1st and the full moon of months and Buddhist week;<br>- Officers and workers are required to have a gentle attitude towards the local culture and respect the faith of the local people.. | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| 2, Buon Dung II reservoir, Ea Yong commune, Krong Pak district |  <br>Transportation materials road to the reservoir site is also the traffic road to the field of local people | <u>*Scope:*</u> On the access road to the construction area of Buon Dung II reservoir.<br>*Scale of impact:* Cultivators around the reservoir area.<br><u>*Potential impacts:*</u><br>- Smoke, dust;<br>- Risk of traffic accidents;<br>- Restrict travel and harvesting of local people. | - The schedule of construction and transportation of materials must be informed to the people 1 month in advance<br>- Rationally arranging vehicle traffic in and out of the construction area, regulating vehicle speed during transportation.<br>- Place signs and signals at turns, blind spots.<br>- Arrange schedule to transport raw materials reasonably, avoid coinciding with the time when people harvest | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| 3, Ea Blong Thuong reservoir , Dlie Ya commune, Krong Nang district |  <br>The dam site is also the residential traffic road in the region | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People living Dlie Ya commune, construction workers, project staff.<br>*Potential impacts:*<br>- Impact on public transport during construction phase<br>- There is a risk of traffic accidents<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning | - Place signs and signals at turns, blind spots;<br>- Rationally arranging vehicle traffic in and out of the construction area, regulating vehicle speed during transportation;<br>- Do not clean vehicles, machinery and equipment near water sources. | Contractor | PPMU, CSC, Community Monitoring Committee |
| 4, Ea Kmien 3 reservoir, Phu Xuan commune, Krong Nang District |  | *Scope:* Around the repaired and upgraded area of the reservoir where the power line crosses.<br>*Scale of impact:* Construction workers, project staff on the construction site, local people living near the subproject area of Phu Xuan commune.<br>*Potential impacts:* | - Place warning signs saying "keep away at least 7m" along the electric line;<br>- Do not perform construction activities within 20 meter radius from the electricity line during rainy days;<br>- When constructing near the electric line, it is necessary to cut off the electricity before | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| | Civil electric line crosses construction site | - Construction activities may cause damage to the civil electric line by operating excavators, bulldozers, and compactors close to the civil electric line..<br>- The overhead lines can be hit by metal tools such as ladders and columns.<br>- Workers in safety corridors may be affected by magnetic fields or electric shocks | construction and notify the owner;<br>- Prohibit the use of devices that cause vibration or damage to electric lines. | | |
| |  <br>Pepper gardens along the construction site | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* 02 households plant pepper in the repaired and upgraded reservoir area with the affected area of 1450$m^2$<br>*Potential impacts:*<br>Construction activities restrict travel and damage to pepper gardens, thus it leads to loss or reduction of income from pepper business. | - Construction schedule, activities and related impacts must be sent to landowners at least 3 months before construction takes place.<br>- Maintain the path to the pepper garden as long as possible<br>- Do not harm plants when performing construction activities<br>- Compensation and support for affected households | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| | | | - Revert back the landscape after construction completion. | | |
| |  <br>Ly Tu Trong High School is located near the material transportation road, 1,5km away from the Ea Kmien 3 construction site | *Scope:* Public, cultural and religious works located near the subproject transport route.<br>*Scale of impact:* Students, teachers, school officials and students' parents of Ly Tu Trong High School.<br>*Potential impacts:*<br>Transporting materials can cause specific effects:<br>- Impact on the health of students, teachers and school officials due to smoke, dust and noise from transportation activities;<br>- Risk of insecurity to students and parents, and teachers due to the movement of transport trucks. | - Construction schedule, transportation and related impacts must be sent to the school at least 1 month before the construction and transportation activities are carried out;<br>- Transportation is strictly prohibited during rush hours (from 6 am to 8 am; 4 to 6 pm);<br>- Limit to honk;<br>- Vehicles transporting materials must be carefully covered. | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| |  <br>People live near the construction site | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People in Phu Xuan commune live around the construction site area.<br>*Potential impacts:*<br>- Impact on the daily life of people, home architecture and landscape;<br>- Affects the air environment;<br>- Disturbs the lifestyle of the local people. | - Schedules, construction activities and related impacts must be sent to the households at least one month before the start of construction.<br>- Limit the honking of vehicles.<br>- Vehicles transporting materials need to be covered to avoid spillage that affects the air environment<br>- Revert back the landscape after construction completion<br>- Registration of temporary residence for project workers | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| 5, Ea Bro 2 reservoir, Cu Pong commune, Krong Buk district |  <br>Impact on the daily life of people, home architecture and landscape | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* Residents of Cu Pong commune, construction workers and project staff on construction sites.<br>*Potential impacts:*<br>- Impact on public transport during construction phase;<br>- There is a risk of traffic accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | - Place signs and signals at turns, blind spots<br>- Rationally arranging vehicle traffic in and out of the construction area, regulating vehicle speed during transportation<br>- Do not clean vehicles, machinery and equipment near water sources<br>- Noting the reflection of the people | Contractor | PPMU, CSC, Community Monitoring Committee |
| |  | *Scope:* Around the repaired and upgraded reservoir area where civil electricity lines cross.<br>*Scale of impact:* Construction workers, project staff on construction sites, local people living near the subproject area of Cu Pong commune.<br>*Potential impacts:* | - Place warning signs saying "keep away at least 6m" along the electric line;<br>- When constructing near the power line, it is necessary to cut off the electricity before construction and notify the owner.<br>- Do not use large vibration- | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| | Civil electricity lines cross construction sites | - Construction activities may affect electric lines due to the operation of heavy machinery causing vibrations or collisions with electric lines.<br>- There is a risk of labor accidents | causing machinery and equipment that affect power lines<br>- Do not perform construction activities within 20 meter radius from the electricity line during rainy days. | | |
| |  <br>People live near the construction site | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People in Cu Phuong commune live around the construction site.<br>*Potential impacts:*<br>- Impact on the daily life of people, home architecture and landscape;<br>- Affects the air environment;<br>- There is a risk of traffic accidents;<br>- Disturbs the lifestyle of the local people. | - Schedules, construction activities and related impacts must be sent to the households at least one month before the start of construction.<br>- Lights and signal lights are necessary to help people to avoid unnecessary accidents when the sky is dark<br>- Limit the honking of vehicles.<br>- Revert back the landscape after construction completion<br>- Registration of temporary residence for project workers | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| 6, Ea Nao Dar reservoir, Cu Bao commune, Buon Ho town |  Cong Chinh church and parish are located near the material transport road, 1.5 km away from the location of Ea Nao Dar construction site | <u>*Scope:*</u> Public, cultural and religious works located near the subproject transport route.<br><u>*Scale of impact:*</u> People go to church on weekends and major Catholic holidays.<br><u>*Potential impacts:*</u><br>Transporting materials can cause some specific impacts, including:<br>- Impact on spiritual activities and beliefs of local people due to noise and traffic congestion;<br>- Risk of traffic accidents. | - Detailed transport schedules and related impacts must be sent to the church and parish manager 1 month before the start of the transportation of materials.;<br>- Arrange a reasonable transportation schedule, especially on weekends and major Catholic holidays;<br>- Officials and workers are required to have a gentle attitude towards the local culture and respect the faith of the local people.. | Contractor | PPMU, CSC, Community Monitoring Committee |
| 7, Ea Ngach reservoir, Ea Drong commune, Buon Ho town |  | <u>*Scope:*</u> Around the repaired and upgraded reservoir area.<br><u>*Scale of impact:*</u> People living in Ea Drong commune, construction workers, project staff on construction sites.<br><u>*Potential impacts:*</u><br>- Affect the daily life of people;<br>- There is a risk of traffic | - Place signs and signals at turns, blind spots<br>- Lights and signal lights are necessary to help people to avoid unnecessary accidents when the sky is dark<br>- Rationally arranging vehicle traffic in and out of the construction area, regulating vehicle speed during | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| | Impact on the daily life of people, home architecture and landscape | accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | transportation<br>- Check vehicles and machinery regularly.<br>- Do not clean vehicles, machinery and equipment near water sources | | |
| |  <br>Rice fields near construction sites | <u>*Scope:*</u> Around the repaired and upgraded reservoir area.<br><u>*Scale of impact:*</u> 4000 $m^2$ of rice is grown on public land.<br><u>*Potential impacts:*</u><br>- Construction activities restrict travel and damage to rice fields, thus it leads to loss or reduction of income from rice cultivation.<br>- There is a risk of contamination of farmland and water due to workers' waste, indiscriminate disposal of bottles and jars containing gasoline for machinery and equipment. | - Construction schedule, activities and related impacts must be sent to landowners at least 3 months before construction takes place.<br>- Compensation and support for affected households<br>- Do not clean vehicles, machinery and equipment in areas near water sources, near cultivated land of people<br>- Do not throw garbage indiscriminately and need to gather garbage and waste to a point to transfer to the disposal site<br>- Revert back the landscape after construction completion | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| |  <br>No Trang Long Primary School is located near the material transportation road, 1.5 km away from the construction site of Ea Nghach reservoir. | <u>*Scope:*</u> Public, cultural and religious works located near the subproject transport route.<br><br><u>*Scale of impact:*</u> Students, teachers, school officials, parents of the student of No Trang Long Primary School.<br><br><u>*Potential impacts:*</u><br><br>Transporting materials can cause specific effects:<br><br>- Impact on the health of students, teachers and school officials due to smoke, dust and noise from transportation activities;<br><br>- Risk of insecurity to students and parents, and teachers due to the movement of transport trucks. | - Construction schedule, transportation and related impacts must be sent to the school at least 1 month before the construction and transportation activities are carried out.;<br><br>- Material transportation is strictly prohibited during rush hours (from 6 am to 8 am; 4 to 6 pm);<br><br>- Limit to honk ;<br><br>- Vehicles transporting materials must be carefully covered. | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| 8, C19 reservoir, Ea Rieng commune, M'Drak district |  Impact on the daily life of people, home architecture and landscape | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* People living in Ea Rieng commune, construction workers and project staff on the construction site of C19 reservoir.<br>*Potential impacts:*<br>- Impact on public transport during construction phase;<br>- Affect the daily life of local people;<br>- There is a risk of traffic accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | - - Construction schedule, activities must be sent to the people at least 3 months before the construction takes place.<br>- Lights and signal lights are necessary to help people to avoid unnecessary accidents when the sky is dark.<br>- Rationally arranging vehicle traffic in and out of the construction area, regulating vehicle speed during transportation .<br>- Check vehicles and machinery regularly.<br>- Do not clean vehicles, machinery and equipment near water sources | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| |  <br>Civil electricity lines cross construction sites | *Scope:* Around the repaired and upgraded reservoir area where the electric lines cross.<br>*Scale of impact:* Construction workers, project staff on the construction site, local people living near the construction area of C19 reservoir in Ea Rieng commune.<br>*Potential impacts:*<br>- Construction activities may affect electric lines due to the operation of heavy machinery causing vibrations or collisions with electric lines;<br>- There is a risk of labor accidents;<br>- Affects people's daily life. | - Place warning signs saying "keep away at least 6m" along the power line<br>- When constructing near the power line, it is necessary to cut off the electricity before construction and notify the owner.<br>- Do not use large vibration-causing machinery and equipment that affect electric lines.<br>- Do not perform construction activities within 20 meter radius from the electricity line during rainy days. | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| |  <br>Rice fields are near construction sites | *Scope:* Around the repaired and upgraded reservoir area.<br>*Scale of impact:* 0.5 ha of rice under the dam downstream.<br>*Potential impacts:*<br>- Construction activities cause damage to rice fields, so it leads to loss or reduction of income from rice cultivation;<br>- There is a risk of contamination of farmland and water due to workers' waste, indiscriminate disposal of bottles and jars containing gasoline for machinery and equipment;<br>- There is a risk of labor accidents due to slipping. | - Compensation and support for affected households<br>- Do not clean vehicles, machinery and equipment in areas near water sources, near cultivated land of people<br>- Revert back the landscape after construction completion<br>- There are warning signs in steep places to avoid unfortunate accidents<br>- Equipping workers with anti-slip shoes | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| 9, 725 reservoir, Ea Rieng commune, M'Drak district |  <br>Impact on the daily life of people, home architecture and landscape | <u>*Scope:*</u> Around the repaired and upgraded reservoir area.<br><u>*Scale of impact:*</u> People living in Ea Rieng commune, construction workers and project staff on the construction site of 725 reservoir.<br><u>*Potential impacts:*</u><br>- There is a risk of traffic accidents;<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | - Construction schedule, activities must be sent to the people at least 3 months before the construction takes place<br>- Lights and signal lights are necessary to help people to avoid unnecessary accidents when the sky is dark<br>- Check vehicles and machinery regularly.<br>- Do not clean vehicles, machinery and equipment near water sources | Contractor | PPMU, CSC, Community Monitoring Committee |
| 10, Doi 11 reservoir, Ea Kmut commune, Ea Kar district |  <br>Impact on the daily life of people, home | <u>*Scope:*</u> Around the repaired and upgraded reservoir area.<br><u>*Scale of impact:*</u> People living in Ea Kmut commune, construction workers and project staff on the construction site of Doi 11 reservoir.<br><u>*Potential impacts:*</u><br>- Impact on public transport during construction phase | - Construction schedule, activities must be sent to the people at least 3 months before the construction takes place<br>- Check vehicles and machinery regularly.<br>- Do not clean vehicles, machinery and equipment near water sources | Contractor | PPMU, CSC, Community Monitoring Committee |

| Location | Sensitive objects and relations with subproject activities | Scope, scale, and potential impacts | Mitigation measures for the specific impacts | Person in charge | |
|---|---|---|---|---|---|
| | | | | Impleme-ntation | Supervisi-on |
| | architecture and landscape | - There is a risk of traffic accidents<br>- It may pollute downstream water sources due to vehicle, machinery and equipment cleaning. | | | |

### *7.2.4 Mitigation measures in operation phase*

After the completion of the construction works, the reservoirs will ensure the water capacity according to the designs and ensure irrigation planning for downstream agricultural cultivation. The solutions related to the safety and operation of reservoirs are discussed further in the "Dam Safety Report" of the same subproject.

**Table 59. General mitigation measures for impacts during operation phase**

| Impact | Mitigation measures | Responsibility for implementation | Responsibility for monitoring |
|---|---|---|---|
| Falling into reservoirs, drowning | - Equipping warning signs and installation of dangerous warning system on the dam areas.<br>- Disseminating drowning risk to the community along the reservoirs. | Reservoir owners | Department of Agricultural and Rural Development |
| Domestic waste from activities of reservoir operators and tourists | - Limiting the activities that generate solid waste and wastewater.<br>- No littering.<br>- Waste must be collected and transported to the local landfill.<br>- Waste water must be collected into the settling pits before being discharged into the environment.<br>- If the reservoir operators are regularly present on reservoirs, the septic tanks should be built. | Reservoir owners | Department of Agricultural and Rural Development |
| Repair and maintenance | - Informing the downstream people about the annual repair and maintenance plans.<br>- Performing periodic maintenance and repairs during the shortest period of time and at the time of the lowest water demand.<br>- Performing measures to maintain water supply during repair to ensure there is no disruption in water supply. | Reservoir owners | Department of Agricultural and Rural Development |
| Regulation of reservoirs and flood discharges in case of big floods affecting downstream | - Preparing emergency response plans as part of the dam safety reports.<br>- The Management and Operation Unit should timely and accurately inform the flood discharge plan for the community to actively get informed and respond.<br>- At risky times like in rainy season, it is necessary to appoint persons to regularly monitor, to ensure proper regulation of water sources.<br>- Building safety corridors for flood discharge on the basis of impact scenarios. The specific solutions are | Reservoir owners | Department of Agricultural and Rural Development |

| Impact | Mitigation measures | Responsibility for implementation | Responsibility for monitoring |
|---|---|---|---|
| | detailed in the dam safety reports and emergency response plans. | | |
| Disaster risk causes unsafety | - The Management Units of Reservoirs regularly check the reservoir safety.<br>- Performing proper operation procedures to ensure the safety of the reservoirs.<br>- The Management Units of Reservoirs closely coordinates with the Commune People's Committees and the local people to promptly report the risks associated with dam safety in order to take timely corrective measures.<br>- Local people and local authorities take initiative in community-based coping strategies.<br>- Developing scenarios for predicting the extent of dam breakage effects, options for human evacuation, solutions for life and community property in emergency situations, etc.. Details are included in the Dam Safety Report and the Emergency Response Plan of the Subproject. | Reservoir owners | Department of Agricultural and Rural Development |

## 7.3. Organization of implementation

### *7.3.1. Project management*

**(a) Central level**

The Ministry of Agriculture and Rural Development (MARD) is responsible for implementing and managing the entire project. The provinces carrying out the rehabilitation and improvement of the dam safety under Component 1. MARD will coordinate the activities with the Ministry of Industry and Trade and the Ministry of Natural Resources and Environment (MONRE) under Component 2. The Central Project Management Unit (CPMU) under MARD is responsible for coordinating and monitoring the overall project. The improvement and preparation of dam safety plans, including protection and authorization, are focused on the provincial governments. The Provincial People's Committees and the Departments of Agriculture and Rural Development (DARD) are the provincial chairmen. The Provincial Project Management Units (PPMU) are responsible for managing and supervising the works with the support from the CPMU.

The CPMU will assist the project implementation via an Environmental and Social Technical Assistance Agency. In addition, the CPMU will hire an independent consultant to evaluate the implementation of the Environmental Safety Policy for the entire subproject, once every 6 months which is selected through a competitive process to provide support and quality assurance for the central level during the project implementation. This includes the support to the CPMU in reviewing, refining when necessary and re-implementing the development framework during the project implementation, which can provide a general framework for the national programs. This process will be considered in accordance with the context of Decree No.114 to assist MARD in establishing necessary systems for the implementation of the National Dam Safety Program.

**(b) Provincial level**

The People's Committee of Dak Lak province assigned the Department of Agriculture and Rural Development (MARD) to carry out the subproject in the area, set up the WB8 Project Management Unit (PPMU) to implement the bidding, supervision of construction, resettlement action plan, environmental and social action plan, and these actions must be in line with the overall framework of the overall project. The PPMU will be supported by the CPMU in term of technical assistance, environmental and social consultation. The project implementation organization is outlined in the following diagram.

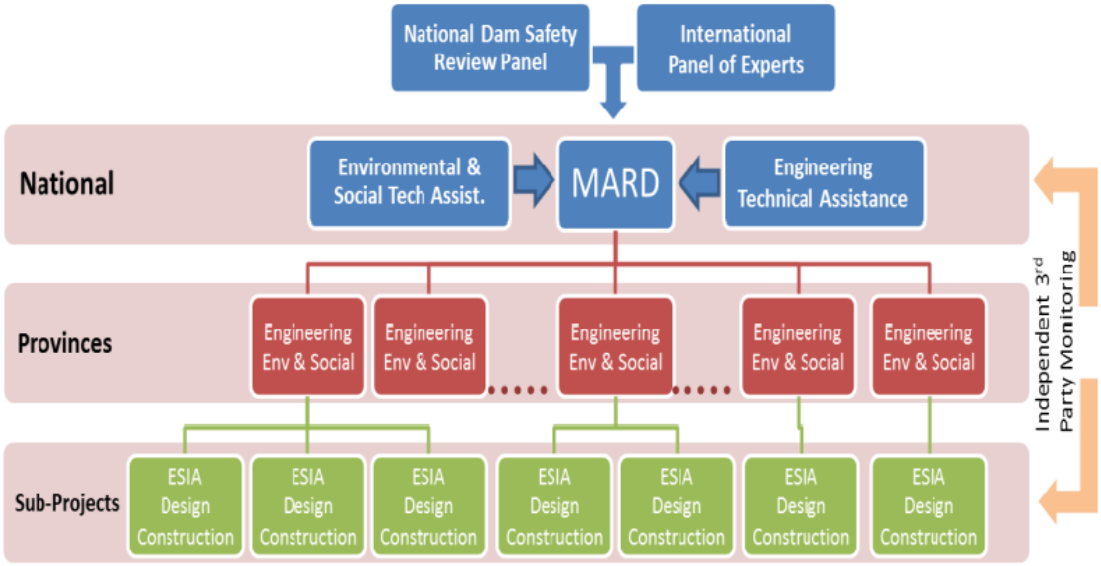



**Figure 3. The Subproject Organization**

*(Source: DRSIP Framework, 2015)*

### *7.3.2 Roles and responsibilities for environmental and social safety management*

In terms of the regular investment monitoring activities, the CPMU will carry out the monitoring with the coordination of the local environmental authority to determine whether the subproject implementation meets all requirements of the local environmental and social management framework, socio-environmental impact assessment reports and environmental management plans or not. The agency will also visit the site at various stages of the project to confirm that the Environment Social Management Plans and the environmental and social monitoring plans are being implemented in full. A monitoring report including environmental and social management issues will be included in the overall field report. The designated environmental and social experts are responsible for preparing quarterly and annual reports on major project implementation steps, outputs and results of environmental management actions to be made for all investments throughout the subproject cycle.

The CPMU requests the PPMU to include their corresponding environmental component in their investments, which include important mitigation activities and environmental incidents. The PPMU must integrate the environmental component in all reports prepared for the World Bank.

The Stakeholders should be fully aware of the CESMP implementation mechanism in the subproject investments. This will be very important in supporting and evaluating their roles in the

environmental monitoring and the monitoring and evaluation of the subproject activities. The organization diagram during the CESMP implementation is outlined in the following Figure.

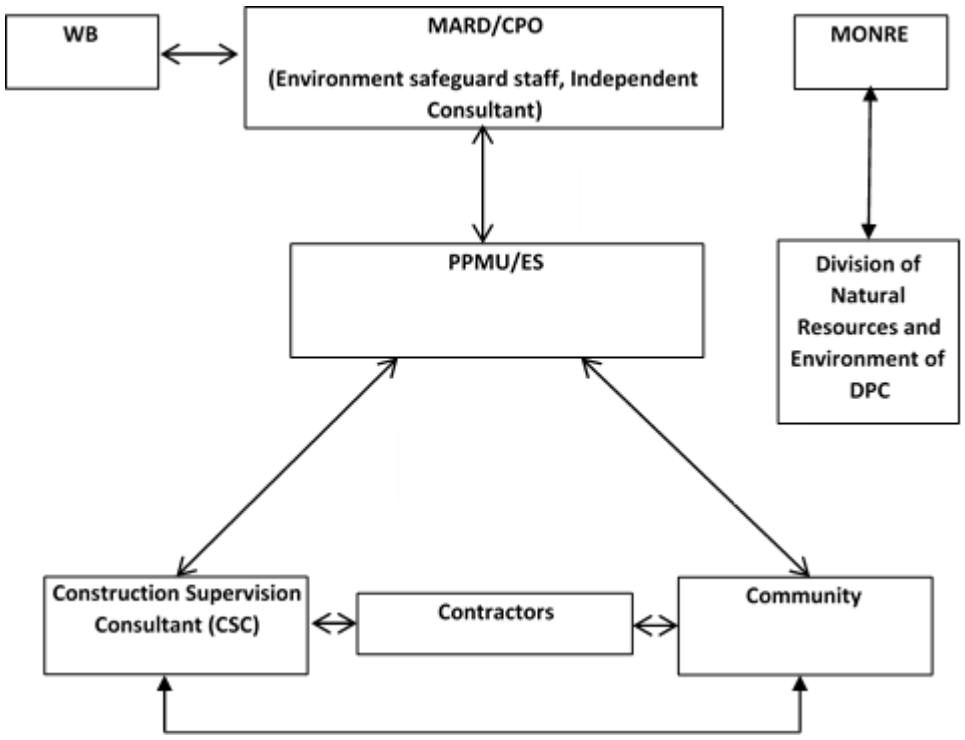



**Figure 4. The Subproject's diagram for implementation of Environment Safeguard Policy**

The details of the roles and responsibilities of the stakeholders involved in the environmental and social management during the subproject implementation are presented in Table below.

**Table 60. Roles and responsibilities of stakeholders**

| Unit | Responsibilities |
|---|---|
| Central Project Management Unit (CPMU) | - The CPMU, on behalf of the Project Owner, MARD will be responsible for monitoring the overall implementation of the subproject, including the compliance with the subproject's environmental and social safeguard policy.<br>- Responsible for reporting the implementation of the subproject environmental protection policy to the MONRE and the World Bank.<br>- The CPMU will be assisted in the overall implementation of the pubproject by the Technical Assistance (TA), which will develop a system to properly monitor the social and safety aspects during the subproject implementation.<br>- The independent monitoring of the third party will carry out regular independent evaluation of the subproject activities. This agency will also assess the compliance with the policy application and the implementation of safety instruments, including environmental management plans/environment code of practices, resettlement policy framework/resettlement action plan, ethnic minority development plan and gender action plan. |

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|---|---|
| Provincial Project Management Unit (PPMU) | - The PPMU will be responsible for monitoring the implementation of the subproject, including the compliance with the project's environmental safeguard policies. The PPMU will be responsible for implementation and compliance with ESMP during the construction and operation phases.<br>- Specifically, the PPMU will: (i) work closely with the local authorities on the community consultation during the subproject preparation and implementation phases; (ii) oversee the implementation of the ESMP, including the incorporation of ESMP into detailed engineering designs, tender documents and contract documents; (iii) ensure that the environmental management system is well established and functions; (iv) responsible for reporting on the implementation of the ESMP to the CPMU, the DoNRE and the World Bank. |
| PPMU environmental and social staff (ES) | - The PPMU's ES is responsible for monitoring the implementation of the World Bank's social and environmental safeguard policies at all subproject stages and during the subproject implementation. Specifically, the environmental staff will be responsible for: (i) assisting the PPMU to integrate ESMP into detailed engineering designs, civil engineering tender documents and contracts; (ii) assisting the PPMU to oversee ESMP and Resettlement Action Plan in accordance with the Terms of Reference, bidding documents and contract documents for Construction Supervision Consultant (CSC), if needed; iii) providing relevant inputs for the consultancy selection process; (iv) reviewing reports submitted by the CSC and the safeguard consultant; (v) conducting periodic field surveys; (vi) supporting the PPMU with the measures to address the social and resettlement issues of the subproject; and vii) developing social and environmental implementation contents in line with the progress and the DD reports to submit to the CPMU and the World Bank. |
| Construction Supervision Consultant (CSC) | - The Construction Supervision Consultant will entrust the Environmental and Social Officers to maintain regular monitoring of all construction activities and ensure that the Contractors comply with the contract requirements and the ECOP. The Construction Supervision Consultant will arrange sufficient number of qualified staff (e.g. Environmental Engineers) with full knowledge of environmental protection and construction project management to perform the required tasks and supervise the Contractors' activities.<br>- The Construction Supervision Consultant will also assist the PPMU in (i) reporting and maintaining close coordination with local communities, and (ii) strengthening the capacity of civil protection for the construction Contractors. |
| Bidders | Bidders will submit the following additional documents to the bidding documents:<br>**Code of Conduct (ESHS)**<br>• The Contractor will submit a Code of Conduct that will be applied to employees and subcontractors to ensure the compliance with the contractual environmental, social, health and safety obligations (ESHS).<br>• In addition, the Contractor will make details on how this Code will be implemented. This will include: how it will be incorporated into the conditions of employment/participation, training to be provided, how it will be monitored and how the Contractor proposes to deal with any violation.<br>**Management Strategies and Implementation Plans (MSIP) for Risk** |

| | |
|---|---|
| | **Management (ESHS)**<br>The Contractor shall submit Management Strategies and Implementation Plans (MSIPs) to manage the following major Environmental, Social, Health and Safety (ESHS) risks:<br>+ Traffic management plan to ensure the safety of local communities from construction traffic;<br>+ Water resources protection plan to prevent drinking water pollution;<br>+ Strategic marking and boundary protection for mobilization and construction to prevent adverse externalities;<br>- Strategies to obtain consent/permits prior to commencement of related work such as opening a quarry or mine. |
| Contractors | - The Contractors will appoint Environment Safeguard Monitoring Officer to implement the proposed environmental and social mitigation measures in the CESMP.<br>- The Contractor shall submit to the PPMU/CSC for approval, and then to implement, the Contractor's Environmental and Social Management Plan (C-ESMP) [2] must be in accordance with the Specific Conditions of the Terms of Contract 16.2, including the agreed Management Strategy and Implementation Plan.<br>- The Contractors are required to appoint competent individuals who are Site Environmental Safeguard Officers (SSEO), who will be responsible for monitoring the compliance with the Code of Conduct and Management Strategies and Implementation Plans (MSIP) for Risk Management (ESHS).<br>- Take action to minimize any potential negative impact that is consistent with the objective described in the CESMP.<br>- Actively discuss with local people and propose actions to prevent disturbance during construction.<br>- Ensure that all employees and workers to understand their procedures and tasks in the environmental management program.<br>- Report to the PPMU and the Construction Supervision Consultant about any problems and solutions.<br>- Report to local authorities and PPMU and Construction Supervision Consultant in the event of environmental incidents and coordinate with the agencies and |

[2] The Contractor shall not be commenced any works, including mobilization and/or pre-construction proceeds (e.g., restricted site clearance for roads, service roads and construction site, geotechnical investigations or investigations to select ancillary features such as quarries and coal mines unless the PPMU is satisfied that appropriate measures are taken to address the risks and environmental, social, health and safety impacts. At least, the Contractor will apply Management Strategies and Implementation Plans and Code of Conduct, submitted as part of the bid and agreed as part of the Contract. The Contractor shall, on a continuing basis, submit to the Subproject Manager for approval of additional Management Strategies and additional Implementation Plans as needed to manage the risks and impacts of the ESHS on the ongoing works. These management strategies and implementation plans cover the entire Contractor's Environmental and Social Management Plan (C-ESMP). The C-ESMP will be approved prior to the commencement of the construction activities (e.g. exhumation, earthworks, bridges and structures, streams and roads, exploitation or extraction of materials, mixing concrete and production of asphalt). The approved C-ESMP will be reviewed periodically (but no less frequently than every six months), and updated promptly, as required by the Contractor, to ensure that it is in conformity with the activities to be implemented. The C-ESMP update will require prior approval of the Subproject Manager.

| | |
|---|---|
| | the stakeholders to address these issues. |
| Local government, local community | - The local community monitoring boards are set up under the Prime Minister's Decision No.80/2005/QD-CP dated 18 April 2005 on the "Regulation on Community Investment Supervision Mechanism". The commune community supervision committees have the power and responsibility to supervise construction activities, environment negative impacts caused by construction activities, and the potential negative impact mitigation measures. Ensure that the potential negative mitigation measures are effectively implemented by the Contractors. In case of environmental problems affecting the community, they will inform the CSC and/or the PPMU. |
| Provincial People's Committee, Department of Natural Resources and Environment | - Supervise the implementation of the environmental protection of the Subproject's construction components, ensuring the compliance with the Government's policies and regulations. The DoNRE and MONRE in the districts monitor the compliance with the Government's environmental requirements. |

## 7.4 The compliance with the Environment framework

The duties of the Contractor, Social and Environment Safety Officer (SSEO) and CSC here which are not mentioned in the SPD are required to be included in the Subporject Owner Request (Section 7 of the SPD).

### *7.4.1. Contractor's environmental duties* [3]

Firstly, the Contractor must comply to mitigate potential impacts of construction activities of the Subproject. Secondly, the Contractor must apply the mitigation measures within the framework of the environment and Social Management Plan to prevent damage and disturbance for local communities and the environment due to impacts during the construction and operation phases.

The Contractor is required to submit for approval and then implement the Contractor's Environmental Management and Social Management Plan in accordance with the Specific Conditions of Contract Clause 16.2, including the Management Strategies and Plan Implementation.

[3] If the Contractor is not performing or does not perform any of the ESHS obligations or works under the Contract, the values of the obligations or works determined by the Project Manager may be withheld until they are implemented and / or repaired or replace. The cost as determined by the Project Manager may be withheld until the repair or replacement is completed. Failure to implement includes, but not limited to, the following:

- Failing to comply with any of the ESHS obligations or works described in the Building Requirement, including: working beyond the boundaries of the site, excessive dust, failing to keep public roads in condition safe use, damage to vegetation, water or sediment contamination, soil contamination e.g. from oil, human waste, archaeological damage or cultural heritage characteristics, air pollution due to fire is not allowed and / or is ineffective;
- Unregularly reviewing the C-ESMP and / or updating it in a timely manner to address emerging ESHS issues or anticipate risks or impacts;
- Not implementing C-ESMP;
- Having no prior consent / permission before commencing work or related activities;
- Not submitting ESHS reports (as described in Appendix C of the SPD), or failing to submit reports timely;
- Not taking remedies under the Engineer's direction for the specified period of time (e.g., correcting non-compliance)..

The remedial actions that can not be carried out during the construction process must be carried out at the completion of the construction (and before the acceptance of the completion of a work). The tasks of the Contractor include, but are not limited to:

- The compliance with the legal requirements relating to the environment, safety and public health.
- Working within the scope of contract requirements and other bidding conditions.
- Establishment of representatives of construction teams that participate in the joint inspections conducted by the Environmental Safety Officers of the PPMU and the CSC.
- Coordinating with the functional units which are responsible for conducting periodic environmental monitoring according to the ESIA.
- Coordinating with the PPMU to conduct training and dissemination of social and environmental safety policies for officials and workers on site.
- Carrying out any corrective actions as directed by the Environmental Officers of the PPMU and the CSC.
- If there is a case of non-compliance or falsification, the investigation and submission of options on mitigating measures should be carried out and measures are taken to minimize environment impacts.
- Stopping obstructing construction activities when receiving instructions from the Environmental Safety Officers of the PPMU and the CSC; proposing and implementing remedial measures and alternative construction methods to minimize environment impacts. If the Contractor fails to comply with the above requirements, the Contractor will be suspended from work or receive penalties until the matter is resolved and the PPMU and CSC's approvals are obtained.

### *7.4.2. The Contractor's Safety, Social and Environmental Officers*

The Contractor is required appointing competent staff, including the Safety, Social and Environmental Officers (SSEOs). The SSEOs must be adequately trained in environmental management and provided with necessary skills to transfer environmental management knowledge to all staff involved into the contract. The SSEOs will be responsible for monitoring the Contractor's compliance with the ESMP requirements and the environmental requirements. The assignments of the SSEOs will include but is not limited to the following:

- Organizing the inspection of the environment current state to assess and inspect the status of the Contractor's construction site, Contractor's equipment and construction methods related to pollution control and mitigation measures to environmental impacts, which is fully realized or not;
- Monitoring the compliance with environmental protection measures, pollution prevention and control measures and contract requirements;
- Assisting the functional units to periodically monitor the environment according to the ESIA content;
- Monitoring the implementation of environmental mitigation measures;
- Preparing audit reports on environmental conditions at site;

- Investigating complaints and proposing corrective measures;
- Advising the Contractor on environmental improvement, awareness and measures to prevent immediate pollution;
- Proposing appropriate mitigation measures for the Contractor in case of non-compliance; Implementing additional monitoring of non-compliance under the instructions of the PPMU environmental officers and the CSC;
- Notifying the Contractor and environmental staff (PPMU and CSC staff) of environmental issues; submitting the Contractor's ESMP to the environmental staff of PPMU and CSC, and other concerned agencies, if necessary;
- Maintaining detailed records of all site activities related to the environment.

### *7.4.3. Environmental and social monitoring during construction*

During the construction process, the CSC who are able to report to the PPMU will carry out the environmental and social monitoring. The CSC will assign environmental and social staff who will be responsible for monitoring and supervising all construction activities to ensure that the mitigation measures selected in the CESMP are properly implemented and the negative environmental and social impacts caused by the Subproject are minimized. The CSC will hire environmental and social monitoring engineers with knowledge of project management, construction and environmental and social management to perform the required responsibilities and supervise the implementation of the Contractor. In particular, the CSC's environmental and social staff will:

- On behalf of the PPMU, review and evaluate if the construction design meets the CESMP's requirements for mitigation and management measures;
- Supervise the Contractor's environmental and social management at the site including the implementation, experience and ability to address environmental and social issues on site and providing guidance on correction;
- Review the Contractor's CESMP, verifying and confirming the environmental and social monitoring procedures, parameters, monitoring sites, equipment and results;
- Report on the implementation of the CESMP to the PPMU and preparation of environmental and social monitoring reports during construction phase.

### *7.4.4 Compliance with contract and legal requirements*

The construction activities not only comply with the environmental protection and pollution control requirements of the contracts but also comply with the Law on Environmental Protection and Pollution Control of the Vietnamese Government.

All Contractors' reports on construction methods submitted to the CSC and the PPMU for approval must provide with adequate measures to control pollution and protect the environment.

The CSC and the PPMU will also review the progress and program of the works to verify that the relevant environmental laws are violated and to possibly prevent any one who manage to break the law.

The Contractors must copy the documents related to the SSEO and the ES of the CSC and the PPMU. The documents must at least include updated work progress reports, updated construction

methods, and other licensing applications under the Environmental Protection Law and all valid permits/licenses. The Environmental and social staff of the CSC and the PPMU will also have right to access to the website logbook upon request.

After reviewing the documents, the environmental and social staff of the CSC and the PPMU will advise the PPMU and the Contractor on any non-compliance with the contractual and legal requirements relating to the environmental protection and pollution control so that they can continue the next actions. If the environmental and social staff of the CSC and the PPMU conclude that the status of the permit application and any environmental protection and pollution control activities may not be consistent with the works or may lead to violations of environmental protection and pollution control requirements, they will promptly notify the Contractor and the PPMU.

### *7.4.5. Reporting organization*

In addition to the progress reports, the Contractor shall also provide reports on the Environmental, Social, Health and Safety (ESHS) data set out in Appendix B to the Standard Bidding Document (SPD). In addition to the reports in Appendix B, the Contractor shall immediately notify the PPMU of any incidents in the following groups. Full details of these incidents will be provided to the PPMU within the time agreed upon with the PPMU.

- Confirmation or any act which is likely to violate law or any international agreement;
- Any death or serious injury (time damage);
- Significant adverse effects or damage to personal property (e.g. car accidents, damage caused by flying stones, working outside the boundaries)
- Severe pollution of groundwater or damage to or destruction of habitats or endangering rare species (including protected areas); or
- Any allegations of sexual harassment or sex offenses, child abuse, defamation, or other violations related to the child

**Table 61. Reporting requirements**

| No. | Reported by | Submitted by | Report frequency |
|---|---|---|---|
| 1 | Contractors | CSC | Immediately reporting incidents or accidents and monthly with other normal issues |
| 2 | Construction Supervision Consultant | PPMU | Immediately reporting incidents or accidents and monthly with other normal issues |
| 3 | Community monitoring boards | PPMU | When the community has any complaints about the implementation of the subproject safety policy |

| | | | |
|---|---|---|---|
| 4 | PPMU | Provincial DONRE and Central Project Management Unit | Once every six months in compliance with the Government's environmental regulatory requirements |
| 5 | CPMU | WB | Once every six months in compliance with Section II of the Loan Agreement. |

### 7.5 Grievance redress mechanism

All complaints related to any subproject issues will be resolved through negotiations to reach consensus. The complaints will go through three stages before appealing to the courts. The agencies in charge of complaint settlement will pay all administrative and legal fees related to the acceptance of complaints. This cost is included in the Subproject budget:

#### *7.5.1. Procedures for complaints and settlement*

**(a) The People's Committees at commune levels (CPCs)**

The affected people can bring their complaints to any members of the CPCs through the village heads or directly to the CPCs in writing or orally. The members of the CPCs or the village heads will inform the CPCs of the complaints. The CPCs will work directly with the affected people who complains and decide on the reconciliation/settlement within 5 days of receiving the complaints (about 15 days for the mountains and remote areas). The secretaries of the CPCs are responsible for filing and archiving documentation of all complaints that the CPCs handle.

After decisions are made by the CPCs , the concerned households can make complaints against within 30 days. In the case of the second decisions made by the CPCs, if the households are still unsatisfied with the decisions, they can appeal to the superior people's committees in accordance with the complaint procedure stipulated in the Law on Complaint in 2011 and related documents.

**(b) The District People's Committees (DPCs)**

When there are complaints, the DPCs will have a period of 15 days (or 30 days for mountains and remote areas) to resolve them. The DPCs are responsible for filing and archiving documentation of all complaints that they handle.

When the DPCs issued decisions, the complainants can appeal again within 30 days. In the case of the second decisions made by the DPCs, if the households are still unsatisfied with the decisions, they can appeal to the provincial people's committee in accordance with the complaint procedure stipulated in the Law on Complaint in 2011 and related documents.

**(c) The Provincial People's Committee (PPC)**

The PPC has a period of 30 days (or 45 days for mountains and remote areas) from the date of receipt of the complaints to settle. The PPC is responsible for filing and archiving documentation of all complaints that it handles.

After the PPC issued decisions, the complainants can appeal again within 45 days. In the case of the second decisions made by the PPC, if the households are still unsatisfied with the decisions, they can appeal to the court within 45 days. The PPC will have to pay compensation costs to an account.

**(d) The Provincial Court**

When the complainants take their cases to the provincial court and the rules of the court are favourable to the complainants, the provincial authorities will increase the compensation to a level that the court can approve. In the case that the court judgments are favourable to the PPC, the complainants will be reimbursed the charges they paid to the court.

The complaint decisions must be sent to the complainants and the involved parties and publicly posted up at the offices of the people's committees of the competent levels. The complainants will receive the judgments three days at the commune level and seven days at the district or provincial levels after there are decisions on the settlement of their complaints.

To minimize the number of complaints at the provincial level, the PPMU will coordinate with District Compensation Committees to organize the consultations on the complaint settlement. Its role and capacity is to provide compensation, assistance and resettlement to affected households and displaced persons.

Personnel: The environmental and resettlement staff selected by the PPMU will design and maintain a database on the subproject complaints from affected households, including information like the nature of the complaints, the sources and dates of receipt of the complaints, the names and addresses of the complainants, the action plans, and the current status.

For verbal complaints, the agency that settle complaints will record these requests in a complaint form at the first meeting with the affected households.

### *7.5.2. Contractors and Construction Supervision Consultant*

Beside, during the construction process, the grievance redress mechanism will be managed by the Contractors under the supervision of the CSC. The Contractors will inform affected communities the availability of the grievance redress mechanism to resolve grievances and concerns regarding to the Subproject. This will be done through a community consultation and disclosure process whereby the Contractors will regularly communicate with affected communities and relevant agencies. The meetings will be held quarterly, monthly at least. The subproject information flyers will be announced. The announcements will be made on the local media and announcements that the upcoming activities will be posted ...

All complaints and actions taken by the Contractors will be recorded in the subproject monitoring reports. Complaints and claims for damages may be made in the following forms:

- By word of mouth: directly to the CSC and/or the Contractor's security guards or regional office representatives.
- In writing: by hand or by posts to specific addresses.

- By telephone, fax, e-mail: to CSC, security guards or Contractor's representative.

When a complaint is received, the CSC and Contractor's safeguard officers or representatives will file the complaint and record incidents subsequent to the complaint until it is settled. Immediately after receiving complaint, it is necessary to make 04 copies. The original will be kept in the file, 01 copy will be kept by the Contractor's safeguard officer, 01 copy will be sent to the CSC and 01 copy will be sent to the PPMU within 24 hours of receipt of the complaint.

The complain information recorded will include:

- Dates and hours of complaints.
- Names, addresses and contact details of complainants.
- Brief descriptions of complaints.
- The actions taken to resolve complaints, including contact persons and findings at each stage of complaint settlement process.
- Dates and hours when complainants are contacted during the resolution process.
- Final decisions about complaints.
- Dates, times and how complainants were informed.
- Signatures of complainants when making decisions.

Small-scale claims will be resolved within a week. Within two weeks (and every week thereafter), the written response will be sent to the complainants (manual, post, fax, e-mail) which states the procedures to be followed and the process by date.

The main objective is to solve the problem as quickly as possible by the simplest means, involving as few persons as possible and at the lowest possible level. Only if the problem can not be solved at the simplest level and/or within 15 days, other functional agencies will participate. Such situations may arise, for example, where damages are claimed, the volume of claims can not be resolved, or the causes of damages are determined.

### *7.5.3. The World Bank's Grievance Redress Mechanism*

Individuals and communities can believe that if a subproject funded by the World Bank adversely affects their lives, they may file complaints to that subproject grievance mechanism or the World Bank's grievance redress committee. The World Bank's grievance redress committee ensures that complaints are addressed in a timely manner related to the subproject. Individuals or organizations affected by the subproject may file complaints with the World Bank Inspectorate to determine if any damage occurs or may occur, as a result of failing to complying with the World Bank policies and procedures. Complaints may be made at any time. When the matter is of concern to the World Bank, the PPMU will have responsibility to answer. For more information on how to file a complaint with the WB's grievance redress committee, please visit www.worldbank.org/grs. For more information on how to file a complaint with the World Bank Inspectorate, please visit www.inspectionpanel.org.

## 7.6 ESMP implementation plan

### *7.6.1. Contractor's Social and Environmental Management Plan*

As soon as the contracts are signed, based on the ESIA report, the subproject construction methodology, the construction plans which are approved by the CSC and the PPMU, the Contractors prepare the ESMP of their packages and submit to the PPMU for review and approval.

Once the ESMPs are approved, the Contractors will implement measures to minimize environmental and social impacts on site.

The ESMP information will be posted at the workers' camps and workplaces to disseminate information about mitigation measures for workers.

The Contractors post information of mitigation measures at the entrances of the sites, including the addresses, representatives, phone numbers of the parties involved for the local community to follow and contact as necessary.

Assign staff responsible for environment safety; train knowledge on environment safety and workers' health.

Survey, check the environmental status at site, report to CSC/PPMU if there are significant differences compared to the environment.

Sign contracts with authorized units for treatment of daily-life wastes, hazardous wastes, and supply of clean water.

Manage workers and construction equipment and issue new certificates in case of expiration.

Implement the ESMP and update, submit to the CSC/PPMU for approval if changes are made prior to application.

Collaborate with the CSC/PPMU to resolve complaints from people about environmental issues and the safety of the packages in a timely manner.

Report on the implementation of the monthly ESM.

### *7.6.2 Start up the sub-project and personnel*

The Contractor's Environmental Safety Officers must be trained in the relevant regulations, have certificates of occupational health and safety, and are full-time employees on site.

The provision of training on occupational health and safety for workers and the regular inspection of the health and safety service on site must be implemented.

## 7.7 Capacity building and training

### *7.7.1. Training on safeguard policy*

Since the PPMU have implemented projects funded by the World Bank, some PPMU staff may have a clear understanding of the World Bank's safeguard policy requirements. The PPMU has appointed an officer to be responsible for the environmental safety of the Subproject. This environmental officer has participated in some safety training courses organized by the World Bank and the CPMU at the early stage of the subproject implementation. Training and capacity

development, however, is required annually through technical assistance of the World Bank's Safeguard Policy Officers addressing new safeguard policy requirements. Because the new environmental, social, health and safety (MXSA) requirements are set out in the standard bidding documents, the training in the MXSA requirements will be provided by the World Bank's Safeguard Policy Officers to the environmental and social staff of the PPMU, the CSC and the environmental and social staff of the Contractors as soon as they are mobilized. The PPMU will be responsible for organizing the training compatible with the World Bank's Safeguard Policy Officers.

Such training courses will be held at the beginning of the Subproject to ensure that the CESMP is properly integrated into the bidding documents (subsequently are the contracts). Technical assistance should be provided by experienced staff and the skills of construction supervision consultants in accordance with the terms of reference which encompass specific references to the development of the items of the request of the Subproject Owner on the standard tender documents.

### *7.7.2 Training on occupational safety and health*

The provisions will be made to provide occupational safety and health training for all new employees to ensure that they are informed of the site's basic workplace conditions and work practices to protect personal and prevent injuries to their colleagues.

The training will include perceptions on basic hazards, specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disasters, which must be practice properly. Any specific hazards or color codes to be used will be considered thoroughly as part of the training orientation.

### *7.7.3 Orientation of visitors*

If visitors are allowed accessing to the areas with hazardous conditions or substance presence, visitor orientation and control program will be established to ensure that they do not enter dangerous areas without the accompanying persons.

### *7.7.4. Training contractors and new workers*

The PPMU will ensure that workers and contractors, before undertaking new jobs, receive adequate training and information so that they can understand the hazards at work and protect themselves from the hazards which may occur. The training will include:

- Understanding about materials, equipment and tools
- Understanding about the hazards of operation and how to control them
- Potential risks to health
- Alerts to prevent exposure
- Sanitary requirements
- Wearing and using protective clothing and equipment
- Actions to severe operating conditions, incidents and accidents

### *7.7.5. Training on basic occupational health and safety*

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

Workers with first aid and rescue obligations receive special training not to exacerbate the exposure and health hazards to themselves and their colleagues. Training will include the risk of transmitting diseases through blood due to contact with body tissues and body fluids.

Through appropriate contractual terms and monitoring, the PPMU will ensure that service providers as well as contractual workers and subcontractual workers are adequately trained before commencement of their works.

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

## 7.8 Environmental monitoring plan

### *7.8.1 Monitoring the compliance with mitigation measures*

The PPMU and the CSC will monitor the compliance of the standards. The PPMU and the CSC will monitor the Contractors' activities in accordance with the agreed mitigation measures. The results are summarized in the monthly reports.

Local authorities and communities of 9 communes in 08 reservoir areas will perform monitoring tasks in accordance with the Government's regulations, the Law on Environmental Protection 2014 and Decree No.80/2005/ND-CP regarding the regulations on investment community monitoring.

In addition, the Contractors' environmental safety staff will be responsible for day-to-day monitoring of labor safety and environmental sanitation and reporting to the CSC.

The detailed monitoring plans will be prepared during the detailed design phase. Expenditures for the monitoring program will be included in the cost of the CESMP implementation.

### *7.8.2 Monitoring environment quality*

**(a) Periodic monitoring**

An environmental monitoring program for the air quality, soil and water supply information can be used to assess the effectiveness of pollution management strategies. A systematic planning process is recommended to ensure that the collected data is appropriate to their intended purpose (and to avoid unnecessary data collection). This process, sometimes referred to as the process of data quality objectives, determines the purpose of data collection, decisions based on data and consequences of making wrong decisions, time and place boundaries, quality and data required to make a correct decision. The environmental monitoring program will consider the following factors:

- Monitoring parameters: The selected monitoring parameters should reflect disturbing pollutants related to the subproject processes.
- Basic calculations: Prior to the construction of the Subproject, monitoring the environment quality in the ambient and in the subproject area should be carried out to assess the contamination level of the main pollutants to distinguish between the conditions of the current surrounding environment and impacts related to the Subproject.
- Type and frequency of monitoring: The ambient environmental quality data generated through monitoring program should represent contaminated pollutants caused by the Subproject by time. The time and monitoring frequency can also be arranged from continuous to infrequent, monthly, quarterly or yearly occurrence.

- Monitoring locations: Monitoring the ambient environmental quality may be external or within the subproject area by the Subproject Owner, DONRE, or by the cooperation among the parties. The locations of the monitoring stations should be established based on the results of scientific methods and mathematical models to estimate potential impacts on the receptors from emission sources, taking into account such aspects as the locations of the communities which are likely affected.
- Sampling and analysis methods: The monitoring programs should use national or international methods for sample collection and analysis, such as those published by the International Organization for Standardization (ISO). The sampling must be conducted by or under the supervision of the trained staff. The analysis will be by authorized or certified entities for this purpose. The quality control plans (QA/QC) should be documented to ensure that the quality of data is consistent with the intended use of the data (for example, the method limits detection to less than the level of interest). The monitoring reports should include QA/QC documents.

The noise monitoring programs can be useful for the purpose of setting the ambient noise level, which is present in the proposed subproject area or useful for checking the noise level at the operation phase. The noise monitoring programs should be designed and implemented by trained professionals. Typical monitoring cycles should be sufficient for statistical analysis and may last up 48 hours in parallel with the noise monitoring devices to to able to record continuous data during this time period, or by hour, or more often, if appropriate (or include different time periods for several days, including weekdays and weekends). Sound indicator types are recorded depending on the types of noise which is being tracked and are determined by the noise specialists. The equipment should be placed about 1.5m from the ground and not closer than 3m to any reflective surfaces (e.g. walls). In general, the noise level is limited by the level of ambient noise or the level of baseline noise in the absence of the noise source which is being investigated.

The details are shown in the table below:

**Table 62. Environmental monitoring plan during the construction period and operation**

| Environment | Location | Frequency | Measured parameters | National Technical Regulations to be applied | Responsibility for implementation |
|---|---|---|---|---|---|
| **Construction phase** | | | | | |
| Air quality, noise and vibration | Conduct measurement and sampling at 10 construction sites.<br>Monitoring vibration positions are near the construction sites that | Every 3 months | PM10, PM 2,5; noise,vibration | QCVN 05:2013/BTNMT; QCVN 26:2010/BTNMT and QCVN 27:2010/BTNMT | PPMU |

| | | | | | |
|---|---|---|---|---|---|
| | affect people and local authorities. | | | | |
| Surface water quality | 02 samples (01 sample in front of and 01 sample beyond the structure) at 10 reservoirs | Every 3 months | pH, DO, COD, BOD5, TSS, , Total N, oil, grease, Total P, Total Coliforms | QCVN 08-MT: 2015/BTNMT | PPMU |
| **Operation phase** | | | | | |
| Surface water quality | 02 samples (01 sample in front of and 01 sample beyond the structure) at 10 reservoirs | Every 6 months | pH, DO, COD, BOD5, TSS, , Total N, oil, grease, Total P, Total Coliforms | QCVN 08-MT: 2015/BTNMT | PPMU /DARD |
| The subproject estimated duration is 24 months. The periodic sampling locations is the same with the sampled locations during the ESIA implementation. In the implementation process, depending on the construction conditions, we change environmental monitoring locations to suit the reality. The detailed estimates are given in Appendix. | | | | | |

**(b) Incident monitoring**

The purpose of this monitoring is to assess the soil and water pollution levels caused by sudden discharge like discharge of wastewater and oil into nearby water and soil sources and to make timely pollution control decisions to reduce environmental risk.

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

### *7.8.3 Dam safety monitoring*

Once the water is accumulated and the dams start operating, the dam owners are responsible for monitoring the dam safety. This task is done by qualified independent specialists who are not involved in the investigation, design, construction or operation of the dams. After the dams are in normal operation, the regular inspection stages take place, including safety inspection of the dams before and after annual flood season in accordance with Government Decree No. 72/2007/ND-CP on Dam Safety Management.

## 7.9 Estimated cost

The estimated cost for the CESMP monitoring is given in the table below. The cost for implementing mitigation measures will be included in the construction costs

**Table 63. Estimated costs for CESMP implementation monitoring and training**

| No. | Items | Cost *(VND)* |
|---|---|---|
| 1 | Monitoring of CESMP implementation | 686,633,000 |
| 2 | Capacity Strengthening (Detailed in Appendix 1) | 315,000,000 |
| **3** | **Total** | **1,001,633,000** |

The community involvement in the ESIA implementation is voluntary for the benefit of the community and people themselves. Therefore, people participating in the CESMP monitoring will not be paid. However in order to encourage the community participation, the cost of materials and tools should be allocated to the monitoring activities to support selected community members to participate in the monitoring. According to Decision No.80/2005/QD-TTg dated 18/4/2005 by the Prime Minister on the Regulation on Investment Community Supervision and the Joint Circular guiding the implementation of Decision No.80/2005/QD-TTg: "The cost of investment community supervision in the communes/wards is included in the estimated cost of the budget of the Fatherland Front at the commune level and deducted from the commune/district budget and financial support for dissemination, training courses, guidelines, preliminary and final reports. the provincial and district levels will reimburse from the cost estimate of the Front Fatherland at the provincial/district levels, which is deducted from the provincial budget".

The table below summaries the funding flow for the environmental quality monitoring and capacity building during the implementation of Dak Lak Subproject..

**Table 64. Funding for ESMP monitoring**

| Contents | Cost | Funding sources |
|---|---|---|
| (a) Minimization during construction | Part of the construction contract | WB |
| (b) Control of safeguard policy during construction | Part of the cost of the Construction Supervision Consultant (CSC) | WB |
| (c) PPMU in charge of environmental safeguard policy | Part of the cost of the PPMU | Counterpart funding |
| (d) Monitoring environmental quality | Cost of renting environmental monitoring | WB |
| (e) Capacity building program on safety policy | Training cost | WB |

**Table 65. Summary of mitigation measures**

| Stage | Environmental and Social Issues | Mitigation Measures | Location | Applied Standards | Mitigation Costs | Implementing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|---|
| **Pre-construction phase** | | | | | | | |
| | Clearing vegetation on temporarily and permanently acquired land | - Only clearing the vegetation on the defined area.<br>- Utilizing plant waste as a raw material or fuel<br>- Collecting unused plant waste and transporting to a local landfill.<br>- Repopulating the vegetation as soon as possible to maintain the landscape, microclimate and local habitats. | Sub-project area | | Compensation and site clearance cost | Affected homeowners | PPC, DPCs, CPCs |
| | Land acquisition: The subproject implementation will permanently acquire 5,870 m2 land of 15 households. In addition, it temporarily affects 189,200 m2 of public land managed by CPCs | Compensation, assistance and resettlement for people affected by damage to land, housing, income, property. Compensation for site clearance will follow the updated resettlement plan of the subproject | The entire subproject area to be affected | Land Law No. 45/2013/QH13, relevant decrees and circulars | VND 1,623,712,500 | Affected homeowners | PPC, DPCs, CPCs |
| | Risks from mines | Ensuring the safe | The entire | QCVN | Demining cost | The military | PPC |

| Stage | Environmental and Social Issues | Mitigation Measures | Location | Applied Standards | Mitigation Costs | Implementing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|---|
| | | distance and warnings for people during the implementation in accordance with QCV 01: 2012/BQP- National technical regulation on clearance of explosive ordnance and QCVN 02: 2008/BCT- National regulation on safety in transporting, preserving, using and destroying industrial explosive materials. | subproject area to be affected | 01:2012/BQP<br>QCVN 02:2008/BCT<br>Circular No.146/2007/TT-BQP | | unit under Military Zone II | |
| | Groundwater contamination due to geological drilling | After drilling for geological exploration, the design surveyor will refill drill holes to minimize the effect of rinsing dirt into the boreholes that affects the quality of groundwater. | The entire subproject area to be affected | QCVN 09-MT: 2015 | Cost for setting up FS | FS Consultant | PPC |
| **Construction phase** | | | | | | | |
| | The general environmental and social negative impacts are related to construction activities and specific impacts | - Environmental Codes of Practice (ECOP)<br>- Measures to mitigate specific impacts | All affected subproject areas include construction sites, transport routes, material mines | Laws, decrees, circulars and current national technical regulations<br>Guiding to the Environment, | Included in the construction costs | Contractor | PPMU, CSC, independent monitoring consultant of the CMPU, Provincial Department of Natural |

| Stage | Environmental and Social Issues | Mitigation Measures | Location | Applied Standards | Mitigation Costs | Implementing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|---|
| | | | | Health and Safety of the World Bank Group | | | Resources and Environment, local communities, |
| **Operation phase** | | | | | | | |
| | Risk of drowning | - Equipping warning signs and dangerous warning systems on dams and reservoirs.<br>- Disseminating risk of drowning to the community along the reservoirs. | Reservoir area | Official Letter No. 5675/BGDDT-GDTC dated 30 November 2017 | Operating costs of the reservoirs | Dam owners | Department of Agricultural and Rural Development |
| | Domestic waste from activities of reservoir operators | - Limiting activities that generate solid waste and wastewater<br>- No littering<br>- Waste must be collected and transported to the local landfill<br>- Waste water must be collected into the settling pit before being discharged into the external environment<br>- If the reservoir operator is present, the septic tanks should be built | Reservoir area | Decree No. 38/2015/ND-CP | Operating costs of the reservoirs | Dam owners | Department of Agricultural and Rural Development |

| Stage | Environmental and Social Issues | Mitigation Measures | Location | Applied Standards | Mitigation Costs | Implementing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|---|
| | Repair and maintenance can lead to reduction of downstream water | - Informing downstream people of the annual repair and maintenance plan<br>- Performing periodic maintenance and repairs during the shortest period of time and at the time of the lowest water demand<br>- Implementing measures to maintain water supply during repair to ensure there is no disruption in water supply | Reservoir area and downstream area | Decree No.114/2018/ND-CP | Operating costs of the reservoirs | Dam owners | Department of Agricultural and Rural Development |
| | Operating reservoirs and discharging flood in case of big floods affecting downstream | - Preparing an emergency response plan as part of the dam safety report.<br>- The management and operation units should promptly and accurately announce the flood discharge plans so that the communities may take initiative in grasping and responding.<br>- In times of insecurity such as the rainy season, | Reservoir area and downstream area | Decree No.114/2018//ND-CP | Operating cost of the reservoir | Dam owners | Department of Agricultural and Rural Development |

| Stage | Environmental and Social Issues | Mitigation Measures | Location | Applied Standards | Mitigation Costs | Implementing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|---|
| | | people should be regularly arranged to monitor to ensure proper water regulation.<br>- Building a safety corridor for flood discharging, on the basis of impact scenarios; Specific solutions are detailed in the Dam Safety Report and Emergency Response Plan. | | | | | |
| | Disaster risk causes insecurity | - The management units of the reservoirs regularly to check the reservoir safety.<br>- Properly performing the operation procedures to ensure the safety of the reservoir.<br>- The management units of the reservoirs work closely with the Commune People's Committee and the local people to promptly report on dam-related risks so that timely remedial actions are taken. | Reservoir area and downstream area | Decree No.114/2018/ND-CP | Operating cost of the reservoir | Dam owners | Department of Agricultural and Rural Development |

| Stage | Environmental and Social Issues | Mitigation Measures | Location | Applied Standards | Mitigation Costs | Implementing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|---|
| | | - People and local authorities take initiative in community-based disaster preparedness planning.<br>- Developing scenarios for predicting the extent of dam breakage effects, options for migration, solutions for evacuation and community property in emergency situations, etc.. The details are in the Dam Safety Report and Subproject Emergency Response Plan. | | | | | |

# CHAPTER 8. COMMUNITY CONSULTATION AND INFORMATION DISSEMINATION

## 8.1. Purpose and method of consultation

In the process of environmental and social impact assessment, the community consultation and environmental information disclosure is required to ensure consensus among local authorities, local NGOs and affected communities in the subproject area. The community participation is one of the basic conditions to ensure the support of local authorities and communities to the Subproject and to put forward views and opinions in the report. Through community consultation, unforseen environmental impacts are identified and mitigation measures can be documented and included in the environmental and social impact assessment. In fact, if the community commented early in the project preparation process, the relationship between the community and the project staff became more intimate. Based on that, the community can contribute valuable opinions to the Subproject.

***Purpose of public consultation***

The consultation with local authorities and affected people in the subproject area at the stage of preparation and implementation of environmental management plan, Environment and Social Impact Assessment Reports will provide necessary information to better understand the Subproject, impacts of the implementation, and possible preventive and mitigation measures to the community and the surrounding environment, specifically:

- Clarify the issues discussed at the beginning of the Subproject;
- Notify benefits to be gained when the Subproject is implemented;
- Point out responsibilities and awareness of the parties, beneficiary people in the subproject area during the implementation;
- Encourage the community participation in identifying environmental impacts of the Subproject.
- Gather information about the needs and responses of local people and local authorities regarding the subproject construction and proposals to mitigate its environmental impacts or to consider adjustments during the technical design.
- The World Bank's policy (OP/BP 4.01) on Environmental Impact Assessment requires that affected groups and local governments must receive notification and consultation during the preparation of the social and environmental impact assessment.

The community consultation during the preparation of the ESIA report of Dak Lak Dam Rehabilittion and Safety Improvement Subproject meets the World Bank's safeguard requirements and the requirements of Decree No.18/2015/ND-CP dated 14/02/2015 of the Government and Circular No.27/2015/TT-BTNMT dated 29/05/2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environment impact assessmentand environmental protection plan.

The community consultation provides opportunities for affected people to participate in all project implementation stages. Feedback from the consultations will be considered and incorporated into the design of construction measures and mitigation measures of the Subproject. The consultation will be conducted during the implementation process as a necessary condition to address arising issues in the subproject implementation such as environmental and social impacts. The community consultation includes the following groups:

- Representatives of villages/villages which may be affected;
- Representatives of affected households, communities living near the construction site which may be affected;
- Representatives of People's Committees at all levels;
- Representatives of mass organizations, Women's Unions, Farmers' Unions ...

***Principles of community consultation***

Facilitate the participation of affected people and local authorities in the subproject area as soon as possible.

Dak Lak Dam Rehabilitation and Safety Improvement Subproject consulted twice:

- First time: Soon after the environmental screening is completed and before the TOR, the ESIA report is completed.
- Second time: After the first draft of the ESIA report is prepared.

Different methods and techniques are applied in the community consultations, consultations with affected peoplein the subproject area, including:

- Community meetings;
- Household surveys;
- Focus group discussions, field monitoring and interviews with key informants: The use of these methods and techniques is intended to increase the reliability and validity of feedbacks from the stakeholders, particularly affected people and ensure that (i) affected people get full information about the Subproject; and (ii) all affected people are involved in the process of free consultation, prior notification and full information during the preparation and implementation process.

**8.2 Consultation process**

Dak Lak Dam Rehabilitation and Safety Improvement Subproject, according to the World Bank's policies(OP/BP 4.01) on environmental impact assessment, requires 02 times of community consultations. The Environmental Consultant Unit has worked closely with the PPMU, local authorities and communities in the affected area to conduct community consultation to meet the WB requirements.

According to the preliminary design report of the Subproject, there are 10 reservoirs located at 7 districts/towns: Krong Pak, Krong Nang, Krong Buk, M'Drak, Ea Kar districts, Buon Ho town. Prior to the consultations in each commune and residential area, the PPMU organized joint meetings in the province and districts to introduce and collect comments from DARD, DOC, DONRE, DPI, ... and the specialized departments of Krong Pak, Krong Nang, Krong Buk, M'Drak, Ea Kar districts, Buon Ho town about the Subproject.

At the first consultation meeting in each commune, the Consultant introduced an overview of the Subproject, identified residential areas/groups in the subproject area, collected information on local environmental sanitation, discussed potential environmental impacts and mitigation measures, developed and coordinated with the local authorities in the consultation in the subproject areas. At the same time, the Consultant send written requests for consultations with concerned agencies.

The effective participatory plan of consultation process was developed and implemented with the participation of all affected people and stakeholders, which is an important part of the Subproject. This process identified beneficiary and affected people. The Consultant applied professional works and directly participated at site to collect information about community feedback on the proposed subproject components during the implementation and monitoring. During this period, community consultation meetings were held in 09 communes/ward/town (Hoa Tien, Ea Yong in Krong Pak district, Dlie Ya, Phu Xuan in Krong Nang district, Cu Pong in Krong Buk district, Cu Bao, Ea Drong in Buon Ho town, Ea Rieng in M'Drak district, and Ea Kmut in Ea Kar district) with the participation of the following stakeholders:

- Representatives of local authorities from 9 communes/towns in the subproject area;
- Departments and unions: Father Front, Women's Union, Youth's Union, Farmer's Union ...
- Representatives of households in the subproject area, including those whose land is possibly acquired and beneficiariesi.
- Representatives of project owner and consultant.

The contents which were consulted and exchanged:

(i) Introduction about the subproject items and components;
(ii) Review of local socio-economic status;
(iii) Current status of technical and social infrastructure in residential areas: electricity, roads, schools, health stations; irrigation canal system, ...
(iv) Screening/evaluating potential impacts which likely occur in the subproject preparation, construction and operation phases which may affect the environment, society, culture of local people;
(v) Community consultation on mitigation measures.

The first direct consultation process with the community and the Commune People's Committee was carried out from February 22, 2018 to March 7, 2018; The letters issued by PPMU were sent for local authorities regarding the community consultation for the preparation of the social and environmental impact assessment report..

**Table 66. List of localities conducting consultations**

| No. | Region | Reservoir | Location | Participant | Time | Number of participants | Women participants | EM participants |
|---|---|---|---|---|---|---|---|---|
| 1 | Hoa Tien commune, Krong Pak district | Ea Uy | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected | 8:00 24/02/2018 | 30 | 10 | 5 |

| No. | Region | Reservoir | Location | Participant | Time | Number of participants | Women participants | EM participants |
|---|---|---|---|---|---|---|---|---|
| | | | | organisations, groups and household, household which benefits | | | | |
| 2 | Ea Yong commune, Krong Pak district | Buon Dung 2 | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected organisations, groups and household, household which benefits | 8:00 06/03/2018 | 27 | 13 | 6 |
| 3 | Dlie Ya commune, Krong Nang district | Ea Blong thuong | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected organisations, groups and household, household which benefits | 8:00 27/02/2018 | 27 | 15 | 6 |
| 4 | Phu Xuan commune, Krong Nang district | Ea Kmien 3 | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected organisations, groups and household, household which benefits | 14:00 28/02/2018 | 26 | 13 | 7 |
| 5 | Cu Pong commune, Krong Buk district | Ea Bro II | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected organisations, groups and household, household which benefits | 8:00 22/02/2018 | 25 | 11 | 8 |
| 6 | Cu Bao Commune, Buon Ho Town | Ea Nao Dar | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected | 8:00 23/02/2018 | 27 | 13 | 5 |

| No. | Region | Reservoir | Location | Participant | Time | Number of participants | Women participants | EM participants |
|---|---|---|---|---|---|---|---|---|
| | | | | organisations, groups and household, household which benefits | | | | |
| 7 | Ea Drong Commune, Buon Ho Town | Ea Ngach | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected organisations, groups and household, household which benefits | 8:00 03/03/2018 | 28 | 13 | 7 |
| 8 | Ea Rieng commune, M'Drak district | C19 and 725 | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected organisations, groups and household, household which benefits | 14:00 02/03/2018 | 28 | 13 | 7 |
| 9 | Ea Kmut commune, Ea Kar district | Dọi 11 | Headquarter of People's Committee of the commune | Representative of People's Committee of the commune, affected organisations, groups and household, household which benefits | 14:00 07/03/2018 | 29 | 11 | 6 |

After the first draft of the Environmental and Social Impact Assessment (ESIA) of the Dak Lak Subproject was completed, the PPMU sent a letter to Commune People's Committees to organize the second consultation meeting in April & May 2018 with the same participants for the first time to consult with local authorities, Fatherland Front Committees, mass organizations and local communities about the content of the ESIA.

**.3 Consultation results**

***8.3.1. Consultation, introduction of subproject and impacts on natural and socio-economic environment, proposal on measures to mitigate impacts during subproject implementation***

**(a) Opinions of Commune People's Committees and local organizations and organizations**

The results of consultation meetings are summarized below (*Detailed consultation minutes in appendix 3*):

- In Phu Xuan commune and Ea Yong commune, people affected by land acquisition want that upon land acquisition, it must coordinate with local people, comply with the State procedures on support, compensation and resettlement and reasonable prices close to market prices;
- Local authorities and unions support the implementation of the subproject and look forward to implementation soon. Representatives of commune authorities comments that the project information must be disseminated publicly and transparently so that people can contribute their opinions and supervise.
- Local authorities and unions want the contractor to announce the construction plan and progress to let affected households (AHs) know so that farmers can arrange suitable crops and livestock.
- The contractor minimizes any delays in construction progress to avoid direct impacts on household income and daily life.
- Specific impact mitigation measures must be strictly implemented as presented in the report to avoid disturbing the cultural, religious and educational life of the local people.
- It must minimize dust and noise when transporting materials collected from construction sites
- The project owner must have a representative at the construction site to closely manage the contractor's activities and ensure the contact points so that people can contact in case of an emergency.

**Figure 5. Images of public consultation with people and local authorities in communes in the project area**

**(b) Opinion of the community**

The results of the community consultation meeting with local people in the project area show that people participate quite positively in expressing opinions and suggestions related to the implementation of potential environmental items and social issues; Mitigation measures should be applied and highly feasible in the project site. The results of the community consultation meeting in the communes in the project area are summarized below.

- Local people want to participate in planning the construction schedule because all the items are related to the irrigation water source of the people, so when construction needs to pay attention to the farming season, time harvest points for crops and crops to minimize losses.
- People want to receive full, public information on compensation policies and support to households so that they can know compensation options and have opportunities to choose.
- The construction unit should set up and announce the plan of construction, signage, lighting at construction sites, gathering materials to ensure traffic safety. Most of the route to the dam is the only local road, so it is required that contractors regularly check traffic safety, especially the time of departure and return of students.
- Local residents want the contractor to announce the construction plan before 6 months to let AHs know so that farmers can arrange suitable plants and animals.
- Project management, contractors regularly update information on local construction progress to let people know to arrange daily work and life to minimize inconvenience during construction. It is necessary to provide a reasonable method of rolling construction to avoid rampant construction on the entire site area to narrow the radius of influence.
- Should organize, provide the Board to monitor community training programs so that they can accurately understand their functions and tasks. At the same time, funds are needed to maintain and support members of the Community Supervisory Board in performing their tasks.
- Provides the necessary support for business households who are directly or indirectly affected by the construction process.
- Reduce all delays in construction progress to avoid direct impacts on household income and daily life.
- Minimize dust and noise when transporting materials collected from construction sites, especially speed and load when traveling in village roads.
- The project owner must have a representative at the construction site to closely manage the contractor's activities and ensure the contact points so that people can contact in case of an emergency.

Summarizing the comments according to the minutes of the community consultation meetings directly affected by the local subprojects took place on the same day as the local government consultation meetings. These are the opinions that are most concerned, paid attention and concern by the people when implementing the subproject.

### *8.3.2 Second consultation: Consult with authorities, mass organizations and communities on the draft ESIA report*

The Management Board of Dak Lak Rehabilitation and Safety Improvement project in Dak Lak province sent a consultation letter to the Commune People's Committee to hold a second consultation meeting in April & May 2018 with participants similarly for the first time to consult the local authorities, Fatherland Front, mass organizations and communities about the content of the ESIA. At the second meeting, the draft Environmental and Social Impact Assessment Report was made available to consult with local authorities, mass organizations and local communities, in which the content of the report stated. Impacts can occur during the implementation of

construction activities to the community and natural conditions of the project area. The feedback of the local majority agreed with the content of the report on the issues of environmental and social status mentioned; issues that may arise during project implementation, from the preparation stage, the construction phase to the operational phase, as well as solutions and measures to minimize environmental and social impacts.

### 8.4. Commitment of the project owner

After two consultations, the opinions of the People's Committee, representatives of mass organizations and local communities, representatives of the Project Management Board (PPMU in Dak Lak), and the environmental consultancy unit received and integrate in the content of the ESIA report, stating:

- Regarding opinions on environmental sanitation and public health: The Project Management Unit and the construction unit will fully implement the mitigation measures set out in the environmental and social impact assessment report. At the same time, the project will coordinate with the locality, publicize activities, impacts and measures to mitigate the impacts of the project so that people can know.
- Implementing all forms of penalties under contract terms and payment for contractors who fail to comply with the commitment to protect the social environment according to the report on environmental and social impact assessment.
- Regarding compensation and resettlement and social impacts, the Management Board commits to coordinate with the authorities and related units to comply with the provisions of Vietnamese law and World Bank’s policies.; During the implementation of the project, the Management Board and the community and local authorities regularly monitor the implementation and disclosure of information on measures to minimize social impacts of construction units on the site. table.
- On the issue of traffic safety, with the aim of minimizing the impact of traffic congestion, traffic insecurity, community utility damage due to construction activities, transportation of raw materials and soil and rock. , the contractor committed to apply mitigation measures according to the content of the environmental and social impact assessment report prepared.
- Measures to minimize the specific impacts of each reservoir will be implemented by the PMU and closely monitored to the maximum extent affecting the daily life of culture, beliefs and education of the people.
- In construction tests, means of transporting materials according to the prescribed load of the vehicle and running at the prescribed speed on each transport route. Materials are covered during transport.
- PPMU requires contractors to sign commitments with localities when using transport infrastructure works for construction, ensuring the quality of works and returning the status quo after finishing construction items.
- Closely coordinate with the authorities of the communes in the project construction area during the construction process to solve arising problems and ensure regional security.
- The Management Board requires all contractors to have appropriate construction solutions so as not to affect the water supply for agricultural cultivation and the activities of the downstream area of the reservoir.

- Construction progress: The construction items are on schedule.
- The Project Management Unit will require the Project Design Consultant to implement the design to ensure the convenience of the people in the process of accessing community facilities.
- The Project Management Unit and the construction unit will perform environmental refunds after construction. Commitment to dredge, clear the flow and revert the current situation to the canals around the construction site of dams, culverts, management roads and embankments.
- The Project Management Unit will direct and supervise the Construction Contractors to fully implement the measures to minimize adverse environmental and social impacts as committed.

### 8.5. Information dissemination

Dak Lak Dam Rehabilitation and Safety Improvement Sub-project complies with the World Bank's policy on access to information and current regulations of the Government of Vietnam. Information of the subproject is published for subproject affected people and participating agencies in February and March 2018 through all media and subproject information leaflets to provide subproject information, as follows:

a) Disseminating general information on the policies of the World Bank, Vietnam's policies, Dam Rehabilitation and Safety Improvement Project and subprojects.

b) Informing about the proposed items and activities of the subproject, subproject objectives and World Bank policies on resettlement, environment, policies on gender and ethnic minorities to affected people.

c) Sharing information on potential positive and negative impacts during subproject implementation, subproject implementation progress, resettlement, compensation, support, compensation procedures and specific policies on compensation to affected people and affected communities

d) Draft report on Environmental and Social Impact Assessment, Resettlement Action Plan has been sent to local authorities, affected people and local non-governmental organizations for consideration and comments before conducting community consultation meetings.

e) It is expected that in August 2019, the final report on Environmental and Social Impact Assessment in Vietnamese will be disclosed on the project website, and at the offices of the People's Committees of communes under the subproject to ensure accessible to affected people and local NGOs, and on the World Bank website in English before subproject appraisal.

# CONCLUSIONS AND RECOMMENDATIONS

## Conclusions

(i). The Subproject is classified as Category B in accordance with the WB's Environment Safeguard Policy, which is not located in environmentally sensitive areas and do not violate the "exclusion" criteria of the WB;

(ii). The report identified and adequately assessed the significant impacts in all three phases of preparation, construction and operation. At the same time, it outlined the mitigation measures with the consultations with local authorities and affected people including the vulnerable groups;

(iii). The implementation of Dak Lak Dam Rehabilitation and Safety Improvement Subproject may cause negative impacts during the construction phase. However, as the scale of construction works is small, the impacts are in short term and within small and negligible scope, therefore, feasible mitigation measures are introduced and appropriate to the natural and socio-economic conditions and local management and construction conditions.

(iv). The Environmental And Social Management Project is prepared as part of the ESIA report and also includes a monitoring plan. The environmental and social management plan will be implemented duly by stakeholders including the PPMU, relevant consultants and contractors. Local authorities, communities, NGOs shall report to the CPMU, WB and other relevant agencies periodically on compliance with the approved environmental and social management plan of the subproject.

## Recommendations

Based on the findings of the environmental impact assessment and the Environment Social Management Plan outlined in this document, it is recommended that:

- The mitigation measures mentioned in the Environment Social Management Plan will be developed as an integral part of the Construction Bidding Documents. The Contractors will dismantle the workload and submit the total cost for the implementation of the mitigation measures. The cost is considered as the implementation cost of the Environment Safeguard Policy and will be paid when the Contractors committed that they have been effectively implemented the mitigation measures.
- Based on results of the Environment and Social Impact Assessment Report, the PPMU recommends the local competent authorities and the World Bank to review and advise so that PPMU can proceed with the next steps to ensure an agreed progress. .

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