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MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)

CENTRAL OFFICE FOR WATER RESOURCES PROJECTS (CPO)

PROJECT: PROPOSED MEKONG DELTA INTEGRATED CLIMATE RESILIENCE AND SUSTAINABLE LIVELIHOODS PROJECT (MD-ICRSL)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

SUBPROJECT "ENHANCING THE ABILITY OF ADAPTATION AND WATER MANAGEMENT FOR THE UPPER PART OF BASSAC RIVER IN AN PHU DISTRICT AN GIANG PROVINCE

(Final)

March 2016

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ABBREVIATIONS

CPMU	Central Project Management Unit of CPO
CPO	Central Project Office (MARD)
CSC	Construction Supervision Consultant
CSEP	Contract Specific Environmental Plan
DARD	Department of Agriculture and Rural Development
DONRE	Department of Natural Resources and Environment
DWR	Department of Water Resources
ECOP	Environmental Codes of Practice
EHSO	Environment Health and Safety Officer
EMC	Environmental Management Consultant
ESMP	Environmental and Social Management Plan
ESC	Environment Safeguard Coordinator
ESMF	Environment and Social Management Framework
ESU	Environment and Social Unit
GOV	Government of Vietnam
GRM	Grievance Redress Mechanism
HH	Household
IMC	Independent Monitoring Consultant
MARD	Ministry of Agriculture and Rural Development
MD-ICRSL	Proposed Mekong Delta Integrated Climate Resilience And Sustainable Livelihoods Project
PMF	Pest Management Framework
PPC	Provincial People's Committees
PPMU	Provincial Project Management Unit
RPF	Resettlement Policy Framework
SIWRR	Southern Institute of Water Resouces Research
SSC	Social Safeguard Coordinator
UXO	Unexploded Ordnance
WB	World Bank
NGO	Non-Governmental Organisation
TOR	Terms of Reference

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PREFACE

1. PROJECT BACKGROUND

1.1. Summary on the background and necessity of the subproject

The subproject "*Enhancing the ability of adaptation and water management for the upper part of Bassac River in An Phu district An Giang province*" is a subproject of the Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project (MDICRSL), which is proposed for the World Bank funding. The Central Office for Water Resources Projects (CPO) of Ministry of Agriculture and Rural Development (MARD) is the managing agency of MDICRLS. The subproject owner is An Giang DARD, and its An Giang Construction and Investment Project Management Unit will be responsible for the planning and construction. Upon construction completion, An Giang Irrigation Works Operated Limited Company will be responsible for the operation and maintenance. The World Bank will finance the subproject, and funding for the counterpart will be from the state budget.

An Phu district has a relatively flat topography; in the flood season (from August to December) under the natural condition, most of the district area is flooded by 2-3m of water, seriously affecting the production and living conditions of the people. To mitigate the impact of flooding, many areas in the district (Vinh Truong, Da Phuoc, An Phu town, Vinh Hoi Dong, Khanh An, Khanh Binh and a part of Phu Huu communes) built complete flood protection dikes (high dikes), to maintain triple crop production. The remaining area does not have sufficient conditions for such flood protection dike construction; thus, the temporary flood protection dikes were built for double crop production (low dikes for Spring and Summer-Autumn seasons). Because these dikes are temporary, they are often damaged by the floods, and the local people have to spend billions of Vietnamese Dongs for repairs annually. In some years, they are broken right at the start of the flooding season, causing damage to the Summer-Autumn rice production.

In 2013, local people in three communes East of the Hau River (Phu Huu, Vinh Loc, and Vinh Hau communes) developed a plan to build flood dikes in order to maintain triple crop rice farming. However, after considering the significant impacts of the construction that would substantially limit the flood discharge capacity and the large investment expenditures, the plan has not been implemented.

If there is no intervening solution for developing a resilient for the floodwater, the local people will build their own inadequate temporary embankments for flood protection that will greatly affect the flood drainage of the area. Therefore, the investment and construction to be considered necessary for all civil works need to be guided and executed by experts to ensure a properly engineered and reasonable long-term solution. The purpose is to maintain a sustainable flood drainage capacity in this district area to increase farming production for the local people.

The subproject is recommended with the objective that, through infrastructure investment, livelihood models are developed and maintained to assure that the local people can gain income even under the worst flooding conditions, stabilize production, improve their livelihoods at the present and in the future, facilitate people to live productively within the floods, and to bring about harmony between farmers and the environment.

1.2. The link of the subproject to the Regional Environmental Assessment (REA)

During the MDICRSL project identification and preparation a Regional Environmental Assessment have been carried out to identify the main environmental and social issues and challenges that relevant to the project and subproject design and environmental management. The section below provides a summary of the REA findings and recommendations for the subproject.

a) The main environmental and social challenges in the upper delta floodplain

Shrinking floodplains and exacerbated flood damages

- **Rapid development of the delta over the past 20 years has reduced flood relief capacity of upstream areas through the intensification of multiple crop rice farming.** Extensive water infrastructure was developed for flood control and to support rice intensification in the Mekong Delta.
- **Protecting traditional flood plains against seasonal flooding for rice intensification reduces flood retention impacting downstream provinces negatively**. The 2011 flood season experienced a smaller inflow volume than 2000, yet the water levels at Long Xuyen and Can Tho City were higher (MDP 2013). GIS analysis revealed that in the intervening decade between these two floods there was a 42% reduction in flooded area within the LXQ. Between 2000 and 2011, approximately 1,1000 km^2 of the LXQ was isolated from normal riverine processes of overbank flood and flood storage because of the expansion of triple crop rice. This resulted in an additional 4,700 MCM of water exacerbating the peak flood water levels at Can Tho in September and October, and accounted for approximately 10% of the increase in water levels at Can Tho relative to the year 2000 flood.
- **Since 2000, the Government has made efforts to diversify land use planning in the delta and promote the policy of "living with floods" in inland provinces**. Controlled flooding can protect crops and other infrastructure from floods. However, dikes and their associated irrigation systems can considerably affect the nature of the flood as they can fragment the floodplains and interrupt the natural flow of water, sediments, nutrients, and fisheries.

Acidification and surface water quality

- **Draining of wetland depressions for agricultural expansion have led to increasing acidification of surface water environments with knock-on effects for ecosystems (especially fisheries) and water supply.** Each year about half of the delta is flooded by river water up to three metres in depth under extreme conditions. And after the recession of the floodwaters new problems arise. Reduced river flows cause the sea to intrude far inland, affecting over 1.4 million ha with saline waters. The drainage of naturally occurring acid sulphate soils causes an additional problem for farms on low-lying land in the Upper Delta.
- **People living in acid-sulphate soil and saline-affected zones are more vulnerable to natural resources threats than those in freshwater and alluvial zones.** The decline of soil fertility in the flood and alluvial zones and soil and water acidity in the acid sulphate zones are impacting agricultural productivity. Farmers in acid-sulphate soil and saline-affected zones contend with more bio-physical threats than farmers in freshwater and alluvial zones. Especially where infrastructure and human capacity remain under developed. In addition, the occurrence of crop pests and surface water pollution from aquaculture and domestic users are emerging threats to natural resources.
- **Surface waters are polluted by acid water leaching from acid soils, increased use of agricultural fertilisers and pesticides and domestic wastes in the upper delta floodplain.** Draining of wetland depressions in the delta for agricultural expansion have led to increasing acidification of surface water environments with knock-on effects for ecosystems (especially fisheries) and water supply. Water quality is reported as an issue by farmers and people living in the Mekong Delta.
- **Increased levels of nutrients from agricultural run-off have been detected by bio monitoring.** Aquatic life in the delta is abundant and diverse with 347 species recorded

including 187 species of phyto-plankton, 100 species of zoo-plankton and 60 species of zoo-benthos. The species structure comprises mainly typical freshwater species and some species migrated inland from the sea. Many of these species are adaptive to the nutrient rich environments, showing an increasing trend in organic pollution at the monitoring areas.

Higher inputs of agro-chemicals, reducing agricultural productivity

- **Rice intensification has driven farmers to apply more pesticides and fertilisers, reducing the cost benefits of the winter-autumn crop.** A 40% difference in rice yield per ton of fertiliser between rice plantations in low-dike and high-dike areas in sites where high dikes had been built for more than 10 years.
- **The use of agro-chemicals also poses a threat to aquatic organisms and water quality**. Agrochemicals are most intensively used in the upper delta floodplain, where farmers may have as many as three crops of rice per year. Also, the use of pesticides in high value fruit and on vegetables is also high, where large quantities are suspected to end up in the aquatic environment. Chemicals used in livestock farming and aquaculture, such as antibiotics for *Pangasius* and shrimp farming may pose a threat to aquatic organisms.
- **Trends for high value agriculture and aquaculture are also increasing in An Giang**. Shifting from rice intensification is important to consider in the upper delta floodplain, farmers with rice monoculture had more expenditure per rice crop than those farmers with rice rotation and intercropping.

Rapid economic growth with a persistent poverty gap

- **Poverty rates are declining in An Giang and Dong Thap, not all communities have benefited from rice intensification**. From 2006 to 2013 poverty rates declined in both An Giang. Compared to the Mekong Delta average, An Giang has lower rates and Dong Thap has higher poverty rates. In An Giang, relatively high poverty rates occur in Tinh Bien, Tri Ton and An Phu districts.
- **Rice intensification is driven by production targets assigned by the national government to provinces in the Mekong Delta.** The scaling up has been made possible with the support from the government through dyke heightening. Farmers do not have to pay for all the costs of dyke construction, so the cost is not internalized into the rice production cost of the additional crop. The third rice crop has allowed farmers to accumulate more savings than two crops. However, not all farmers wanted to plant three crops of rice per year, once their land is trapped inside a polder they have no choice but to practice triple rice cropping. This inflexible approach to farming systems has limited opportunities for farmers to diversify to high value fruit and vegetables.
- **Intensive crop farmers have been able to adapt to some of the impacts of dike heightening by increasing inputs (i.e. fertilisers, pesticides) and changing rice varieties**. However, they are still constrained by the environmental impacts of reduced biodiversity and fisheries associated with intensive farming.
- **The risks and opportunities of rice intensification impacts farmers with less than one hectare of rice land disproportionately**. Rice farmers with less land are shifting from rice to other non-rice production activities and more young people are migrating to urban areas for employment. One survey conducted in An Giang and Dong Thap provinces found that 58.8% of the rice farmers' children were working away from home and were not engaged in rice production-related activities. More mechanised farming associated with rice intensification has reduced employment opportunities for rural households.

River bank erosion

- **River bank erosion has had severe impacts in both the An Giang province**. An Giang has around 50 erosion hot spots with a total length of 150km along the Tien and the Hau rivers.
- **The risks of riverbank erosion increase as the river system adjusts to new sediment loads**. Reduced sediment supply to the delta is likely to have serious consequences, particularly with regard to increased coastal erosion, a situation which is aggravated by possible sea level rise due to climate change. The sensitivity of the area to the available sediment budget is illustrated by increased bank erosion downstream of areas associated with sand mining. The impacts of upstream sediment trapping are likely to be long term.

b) Strategy for project interventions in the Upper Delta - managing the floods

Given the above environmental and social issue of the upper delta region in general the An Giang in particular. The REA recommends the key strategies for the upper delta flood plains to increase (or as a minimum maintain the existing) water retention capacity by moving away from the advocated system of high dykes that facilitates triple crop rice production towards a more climate resilient flood based production system that adapts to and optimizes wet and dry-season water conditions. Flood Management in the upper delta floodplain is critical to protect and/or reclaim the benefits of flood retention and flood diversion measures while increasing rural incomes and protecting high value assets. Over the last decades, the region has seen substantial changes to the landscape through the intensification of agriculture and aquaculture. High dykes have been constructed around rice fields to control flooding and enable a third rice crop to be grown per year. The key strategy for building resilience is embracing flood-based agriculture and flood management. Achieving the balance between flood control, adaptive land and water use and restoring flood retention and ecosystem connectivity.

The subproject has been designed in line with this strategic direction to protect and/or reclaim the benefits of controlled flooding (flood retention) measures while increasing rural incomes and protecting high value assets in An Giang. This will potentially consist of: i) modifying water and agricultural infrastructure to allow for more beneficial flooding (expanding flood retention capacity) in rural areas and offer new agricultural/aquaculture cropping alternatives; ii) providing livelihoods support measures to farmers so they have alternatives to the wet season rice crop, including aquaculture; iii) constructing/upgrading infrastructures for protecting select high value assets; and iv) facilitating agricultural water use efficiency in the dry season.

1.3. The relationship between subproject and other subprojects, development plans appraised and approved by the administrative competent authorities

The proposed MD-ICRSLP and this subproject areclosely related to the current Government efforts to protect coastal resources and improve livelihood of local people, and the key plans and programs are highlighted below.

The subproject "Strengthening the resilience and water management for the Mekong upstream" is located inside the flood drainage/ discharge corridor route of the upper Mekong river.

- According to the short-term Mekong delta flooding plan, which was approved by the Prime Minister in 1999, the protective dike items in the subproject location are proposed and selected to be the non-flood control region.
- According to the project "Mekong delta region protective dike plan" made by the Sothern Institute for Water Resources Planning (SIWRP) in 2006, the subproject location is selected to be the flood control point in August.

- According to the detailed irrigation plan provided for the agricultural cultivation production in An Giang province until 2020 which was approved in Decision No. 1773/QD-UBND dated 13 October 2014 by An Giang provincial People'Committee (PC), the subproject "Flood control in Eastern Hau river, An Phu district, An Giang province" is proposed to implement in the period of 2016 – 2020.

1.4. Subproject location in Component 2 of MDICRSL Project

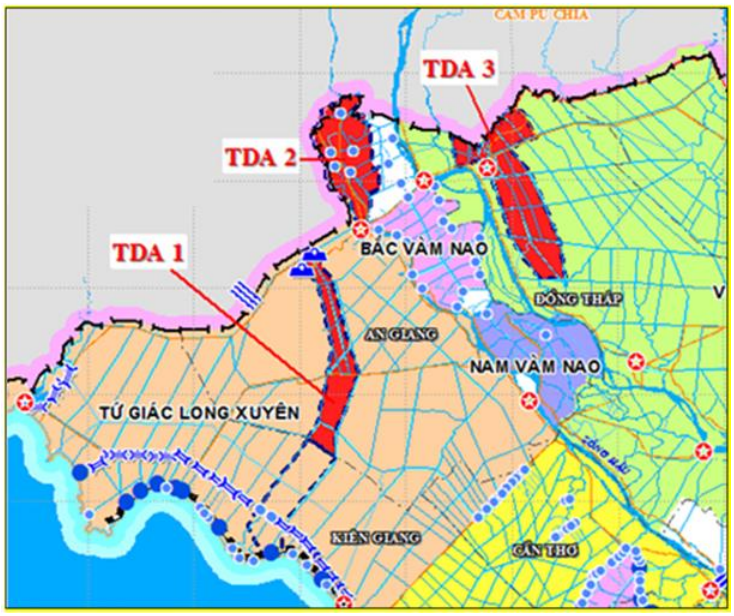

Figure 1: Section flood control in upper delta (An Giang, Dong Thap)

An Giang subproject is included in Component 2: Managing Floods in the Upper Delta of MDICRSL. The primary objective of this component is to protect and/or reclaim the benefits of controlled flooding (flood retention) measures while increasing rural incomes and protecting high value assets in An Giang and Dong Thap provinces. This will potentially consist of: i) modifying water and agricultural infrastructure to allow for more beneficial flooding (expanding flood retention capacity) in rural areas and offer new agricultural/aquaculture cropping alternatives; ii) providing livelihoods support measures to farmers so they have alternatives to the wet season rice crop, including aquaculture; iii) constructing/upgrading infrastructures for protecting select high value assets; and iv) facilitating agricultural water use efficiency in the dry season. The subproject location reletive to the other 9 subprojects of the MDICRSL is presented in *Figure 2*.

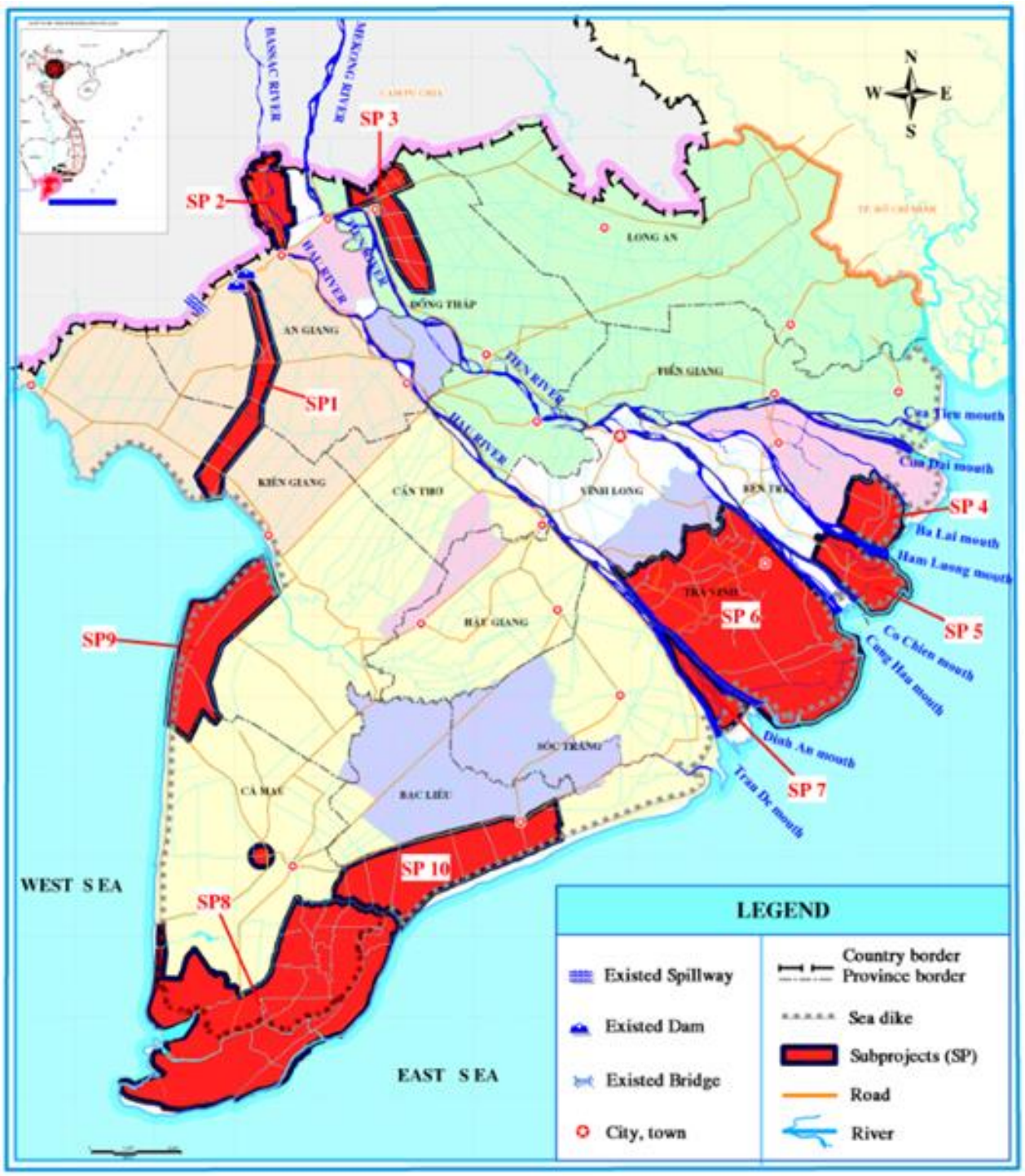

Figure 2: Location of ten subprojects in MDICRLS project

2. NATIONAL LAWS AND REGULATIONS AND WB SAFEGUARD POLICIES

2.1. Relevant National Laws and Regulations

The following national laws and regulations are applied for the subproject environmental and social assessment and environmental management during the subproject preparation, construction, and operation:

- Law on Environmental Protection No. 55/2014/QH13 passed by the National Assembly on 23 June 2014 and took effect since 01 January 2015;

- Law on Land No. 45/2013/QH13 passed by the National Assembly of the Socialist Republic of Vietnam on 29 November 2013 and took effect since 01 July 2014;
- Law on Fisheries Land No. 17/2003/QH11 passed by the National Assembly of the Socialist Republic of Vietnam on 26 November 2003 and took effect since 01 July 2004;
- Law on Natural disaster prevention and control No. 33/2013/QH13 passed by the National Assembly of the Socialist Republic of Vietnam on 19 June 2013 and took effect since 01 May 2014;
- Law on Labor No.10/2012/QH13 of the National Assembly of Vietnam Socialist Republic of Vietnam dated June 18, 2012 provides labor standards; rights, obligations and responsibilities of employees, employers, employees' representative organizations and employers' representative organizations in industrial relations and other relations directly related to industrial relations; and state management of labor.
- Law on amending and supplementing a number of articles of the law on cultural heritages No. 32/2009/QH12 of the National Assembly of Vietnam dated June 18, 2009 to amend and supplement a number of articles of the Law on Cultural Heritages.
- Law on biodiversity No. 20/2008/QH12 of the National Assembly of Vietnam dated November 13, 2008 provides for the conservation and sustainable development of biodiversity; rights and obligations of organizations, households and individuals in the conservation and sustainable development of biodiversity.
- Decree No. 18/2015/ND-CP of 14 February 2015 of the Government on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plans;
- Decree No.19/2015/ND-CP of 14 February 2015 of the Government detailing the implementation of a number of articles of the Law on Environmental Protection;
- Decree No. 25/2013/ND-CP of 29 March 2013 of the Government on environmental protection charges for wastewater;
- Decree No. 174/2007/ND-CP of 29 November 2007 on environmental protection charges for solid waste;
- Decree No. 43/2014/ND-CP of 15 May 2014 of the Government detailing the implementation of a number of articles of the Land Law;
- Decree No. 140/2006/ND-CP of the Government dated 22 November 2006 on regulations for establishment, appraisal, approval and organization of implementing of strategies, planning, plans, programmes and development projects;
- Decree No. 47/2014/ND-CP of the Government dated 15 May 2014 on Regulations on compensation, support, and resettlement upon land expropriation by the state.
- Decree No. 67/2012/ND-CP of the Government dated 10 September 2012 on the amendment of Decree No. 143/2003/ND-CP of the Government dated 28 November 2003 on detailing the implementation of a number of articles of the ordinance on exploitation and protection of irrigation works
- Decree No. 83/2009/ND-CP of 15 October 2009 of the Government on amending and supplementing a number of articles of Decree No. 12/2009/ND-CP of the Government on management of investment projects on the construction of works.
- Decree No. 179/2013/ND-CP of the Government dated 14 November 2013 on the sanction of administrative violations in the domain of environmental protection

- Decree No. 38/2015/ND-CP of 24 April 2015 of the Government on management of waste and discarded materials;
- Decree No. 39/2015/NĐ-CP of the Government dated 27 April 2015 on assistance policy applied to ethnic minority and poor women who comply the population policy.
- Circular No. 27/2015/TT-BTNMT of 29 May 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plans;
- Circular No. 36/2015/TT-BTNMT of 30 June 2015 on hazardous waste management;
- Circular No. 37/2014/TT-BTNMT of 30 June 2014 on Detailed regulations on compensation, support, and resettlement upon land expropriation by the state
- Circular No 13/2007/TT-BXD of December 31st 2007. Providing guidance on a number of articles of decree no. 59/2007/nd-cp dated 09/4/2007 by the government on solid waste management
- Circular No. 30/2014/TT-BTNM, regulating the records for land allocation or land lease, the change of land use purposes, land acquisition
- Circular No. 36/2015/TT-BTNMT of 30 June 2015 on hazardous waste management.
- Circular No. 19/2011/TT - BYT of 06 June 2011 of the Minsitry of Health guiding labor hygiene, laborers' health and occupational diseases.

The following national technical regulations and standards related to environmental quality and waste management are applied to the subproject:

- QCVN 03:2008/BTNMT: National technical regulation on the allowable limits of heavy metals in the soils.
- 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 07:2009/BTNM: National Technical Regulation on Hazardous Waste Thresholds
- CVN 08:2008/BTNMT: National technical regulation on surface water quality.
- QCVN 09:2008/BTNMT: National technical regulation on underground water quality.
- QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater.
- QCVN 15:2008/BTNMT - Soil quality - National technical regulation on the pesticide residues in the soils.
- QCVN 17:2011/BGTVT: National technical regulation on Rules for Pollution Prevention of inland waterway ships.
- QCVN 19:2009/BTNMT: National Technical Regulation on Industrial Emission of Inorganic Substances and Dusts
- QCVN 26:2010/BTNMT: National technical regulation on noise.
- QCVN 27:2010/BTNMT: National technical regulation on vibration.
- QCVN 39:2011/BTNMT: National technical regulation on Water Quality for irrigated agriculture.
- QCVN 38:2011/BTNMT: National technical regulation on Surface Water Quality for protection of aquatic lifes

- QCVN 43:2012/BTNMT - National technical regulation on sediment quality in fresh water areas.
- Decision 3733/2002/-BYT October 10, 2002: Promulgating 21 labor hygiene standards, 05 principles and 07 labor hygiene measurements

2.2. The documents and data of the sub-project owner to be used in the process of environmental impact assessment

- Report on the feasibility study of sub-projects: Enhancing the ability of adaptation and water management for the upper part of Bassac River in An Phu district An Giang province (updated 13/01/2016).
- The analysis results of the baseline environmental data in the subproject area by the Southern Institute of Water Resources Research conducted in 10/2015.
- The field survey data in November 2015.
- The socioeconomic data, orientation of land-use planning, production outputs in An Phu district provided by the Department of Agriculture and Rural Development of An Giang province and the People's Committee of An Phu district.
- The results of the public consultations on the Subproject's draft report of the environmental and social impact assessment in 27/01/2016.
- The result of water environment monitoring activities under project "Basic water environment monitoring downstream of Mekong river region" plays the legal role in the compilation and monitoring of water utilization regulations of the countries in Mekong River Committee / Mekong River Commission.
- The environmental quality monitoring data in the region provided by the An Giang province Department of Natural Resources and Environment (An Giang DONRE).

2.3. Applicable WB Safeguard Policies

The environmental and social screening for the subproject according to the criteria described in the Environment and Social Management Framework (ESMF) which has been designed to be applied for the Project (MD-ICRSLP) has been carried out, and the result shows that the WB policies on Environmental Assessment (OP/BP 4.01)[1], Pest Management (OP/BP 4.09), Physical Cultural Resources (OP/BP 4.11); and Involuntary Resettlement (OP/BP 4.12)[2] are triggered for this subproject. The subproject has also to comply with the WB's requirements on public consultation and Policy on Access to Information. The implementation of the policy on OP/BP 4.12 is addressed in the Resettlement Policy Framework (RPF) of the MDICRSL project, and the Resettlement Action Plan (RAP) of this subproject. The environmental and social screening and the detailed ESIA confirmed that the proposed subproject is classified as Category B because its potential adverse environmental and social impacts are site-specific, few if any of them are irreversible, and in most cases mitigatory measures can be designed more readily.

World Bank Group Environmental, Health, and Safety Guidelines[3]

[1]Full treatment of OP/BP 4.01 can be found at the Bank website: http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543912~menuPK:1286357~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html

[2]Detailed description of OP/BP 4.12 is available at the Bank website: http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543978~menuPK:1286647~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html

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

World Bank-financed projects should also take into account the World Bank Group Environmental, Health, and Safety Guidelines (known as the "EHS Guidelines"). The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group and are generally considered to be achievable in new facilities at reasonable costs by existing technology. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to the World Bank, become project- or site-specific requirements. This subproject should conform to the general EHS Guidelines and industry specific EHS Guidelines on Aquaculture.

3. ORGANIZATION OF ENVIRONMENTAL IMPACT ASSESSMENT

For the subproject, the Ministry of Agriculture and Rural Development decided the investment necessary and assigned the Vietnam Institute for Water Resources Research to make an environmental impact assessment report for the subproject to conform with the provisions of Vietnam and the requirements of the World Bank.

SIWRR has legal capacity to prepare this report. Regarding the research facility, SIWRR has second facility for experimental laboratories located in Binh Duong province with three specialized laboratories registered LAS -1037, LAS - 155, LAS - 143 with the Ministry of Construction.

Besides the ISO 9001 – 2008 of the Institute, the Labs have been accredited by the Laboratory Accreditation System. Regarding Machinery and Equipment: In addition to common machinery and equipment, the Institute's professional units are also equipped with many advanced research machines and devices such as Distomat wind meter; Wave height-speed-direction and current data in a single Instrument, Acoustic Doppler Velocimeter, Sediment Instruments for all environments, Echo-sounding meter, ADCP (acoustic doppler current profilers), GPS, gas chromatography, atomic absorption spectrometer, Programmable electromagnetic four quadrant liquid velocity meter, control unit for ultrasonic high concentration meter (UHCM), concrete compression gauging machine, cement bending compression machine and steel laminating machine, triaxial compressor (ELLE), etc., and advanced supporting softwares: ArcGIS, Satellite image processing software, MIKE set, HYDROGIS, DUFLOW, KOD, SAL, VRSAP, IMSOP, SOIL, SOICHEM. Regarding human resources, SIWRR has 178 staff members working in different professional scientific and technological field. To implement this report, SIWRR has nominated the necessary staff (*Table 1*) who have a high-level of experience not only in their specialized disciplines but who also have an exceptional competency in English as well. They are the reliable staff of our Institute to fulfill the tasks of this report.

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knowledge but English as well. They are really reliable staffs of our Institute to fulfill the tasks of this report

Organization of environmental impact assessment

The consultant: Southern Institute of Water Resources Research (SIWRR)

Represented by: Dr. Tran Ba Hoang - Position: Director

Address: 658 Vo Van Kiet, Ward 1, District 5, Ho Chi Minh City.

Phone: (08) 39233700 - Fax: (08) 39235028

Table 1: List of consultants working for this report and their roles

No	Full name	Background	Assigned tasks
A	**Representative of subproject owner – CPO irrigation**		
1	Tran Anh Thu	Environment	Directing the implementation of reporting environmental impact assessment
2	Phan Van Tuan	Environment	- Providing subproject information for the consultant - Collaborating with the consultants in working with local authorities - Monitoring EIA report implementation of the consultant
B	**Consultant – Southern Institute of Water Resouces Research**		
3	MSc. Duong Cong chinh	Environmental Ecology	- Team leader - The administrative procedures, contacts and transactions related to the reporting EA - Public consultation Writing EA report
5	BSc. Nguyen Thi Tam	Analytical chemistry	- Writing report on the existing environmental quality (water, soil, air and sediment quality). - Developing environmental monitoring and management in subproject life - Estimating costs of environmental monitoring. Organizing public consultation
6	MSc. Pham The Vinh	Water resources	- Hydraulic and water quality modelling Assessing the results of water quality and salinity intrusion models
7	MSc. Nguyen Xuan Du	Construction - Water works, water supply	- Develop and implementing scenarios of salinity intrusion - Developing and implementing scenarios of organic pollution forcasting Writing section on hydrological and meteorological characteristics in the subproject area and the affected areas
8	MSc. Dong Thi An Thuy	Environment and climate change	- Writing report on analyzing and evaluating the impact of the works on the environmental quality of land, water and air in stages of the subproject. - Analyzing and assessing impacts of climate change on the region, considering and impacts of the subproject with or without climate change Public consultation

4. ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGIES AND APPROACHES

Given that the ESIA report will be submitted both to the Government and the WB, the ESIA report has adopted the conventional methods being used for the preparation of an EIA in Vietnam

(Sections 4.1 and 4.2) as well as the technical guidance from the ESMF with respect to the preparation of an ESMP for the subprojects ***installing water/flood control structures in the upper delta and the development of the livelihood models in the upper part of the delta***, as recommended by the Regional Environmental Assessment (REA), which will be presented in Chapter 3.

4.1. Methods of ESIA

a). Rapid assessment method

The Rapid Assessment Method was issued by the World Health Organization (WHO) in 1993. Basis of this method is nature of materials, technologies and rules of natural processes as well as experiences in rating pollution load.

In Vietnam, this method is introduced and applied in many ESIA studies, performing the relatively accurate calculation of the pollution load in the context of limited measurement and analysis instruments. In this report, the pollution load coefficients are taken under the EIA guidelines of the World Bank (Environmental Assessment Sourcebook, Volume II, Sectoral Guidelines, Environment, World Bank, Washington D.C 8/1991) and Handbook of Emission, Non-Industrial and Industrial source, Netherlands).

b). Impact matrix method

Building correlation between effects of each subproject activity to each issue and environmental composition as shown in the impact matrix. On such basis, to orientate detailed contents to be studied with impacts.

c). Comparison method

The comparison method is to assess the environmental quality, effluent quality, pollution load, etc. On the basis of comparison with the concerning environment norms and standards, the regulations of the Ministry of Health as well as the related researches and experiments.

d). Impact identification method

This method is applied through the following specific steps: describe the environment system; identify the subproject components that affect the environment; and identify the full range of related waste streams, environmental issues to serve the detailed evaluation.

e). Listing method

It is used quite common (since the establishment of the National Environmental Protection Agencies in some countries - NEPA) and bring positive results thank to many advantages as clear approach, systematic provision during system analysis and evaluation. It includes 2 main categories: The description listing table which lists the environment components in need of research in addition to the information on the measurement, prediction and evaluation; and Simple checklist which will list environmental components to be studied and likely to be affected.

f). Method of Public Consultation and Disclosure of Information

Public consultation is used to help identify opportunities and risks, improved subproject design and implementation, and increase subproject ownership and sustainability. Public consultation is specifically required by the World Bank's environmental and social safeguard policies. A meaningful public consultation will be used. This is a two-way process in which beneficiaries provide advice and input on the design of the proposed subproject that affect their lives and environment, promotes dialogue between governments, communities, NGOs and implementing agencies to discuss all aspects of the proposed subproject. The feedbacks from consultation will be incorporated into the subproject ESIA and design.

Those affected by the subproject include those resettled and those in the nearby communities affected by subproject impacts, intended beneficiaries of the subproject, key interest groups –

depends upon the project, local NGOs/Mass organizations, including women's unions, local, state and central governments, other donor and development agencies, and other stakeholders.

Disclosure of the subproject information including the subproject safeguards and instruments will allows the public access to information on environmental and social aspects of the subprojects. Disclosure is mandated by policies for the WB's Environmental Assessment, Involuntary Resettlement, and Indigenous Peoples. The subproject safeguards and instruments will be disclosed in country and in local languages and at the World Bank Infoshop, like all consultations, it is an ongoing process during the subproject preparation and supervision process.

4.2. Other Methods

a). Method of information and data inheritance, summary and analysis

This method is to identify and assess natural conditions and socio-economic conditions of the subproject area through data and information collected from various sources such as the statistic yearbooks, regional socio-economic profile reports, and regional baseline environmental and relevant studies. At the same time, the inheritance of the available studies and reports is really essential to use up available findings and further identify limitations.

b). Field survey method

Field survey is compulsory for ESIA/EIA to identify the status of the subproject area, relevant surrounding objects to select sampling positions, survey of status of natural environment, hydrography, weather conditions, land use, vegetation cover, fauna and flora in the subproject area. These survey results will be used for assessment of natural conditions of the subproject area.

c). Consensus method

Based on knowledge and experiences in environmental science of EIA, the specialists of the consultant team and and other scientific research units with in the institute will discuss and agree the the fidings of the ESIA.

d). Sampling and analyzing methods in laboratory

Sampling and analyzing samples of environmental components (soil, water, air) are integral to identify and evaluate status of baseline environment quality in the subproject area as following:

- Surface and underground water quality: samples were taken and analyzed, complying with the Vietnam standards, and results compared with National Technical Regulation on Surface Water Quality - QCVN 08/2008/BTNMT and National Technical Regulation on Underground Water Quality - 09/2008/BTNMT.
- Ambient air quality: samples were taken and analyzed, complying with the Vietnam standards, and results compared to QCVN 05:2013/BTNMT– National Technical Regulation on ambient air quality.
- Noise and vibration: samples were taken and analyzed, complying with the Vietnam standards, and the results compared to QCVN 26:2010/BTNMT- National technical regulation on noise and QCVN 27:2010/BTNMT- National technical regulation on vibration.

CHAPTER 1. BRIEF SUBPROJECT DESCRIPTION

1.1. SUBPROJECT NAME

Subproject name: Enhancing the ability of adaptation and water management for the upper part of Bassac River in An Phu district An Giang province

Under project: Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods – MD-ICRSL.

1.2. SUBPROJECT OWNER

- **Subproject approval authority:** People's Committee of An Giang province
- **Subproject owner:** DARD of An Giang province
- **Address:** 7th Le Trieu Kiet St., My Binh comune. Long Xuyencity, An Giang
- **Telephone:** 0763.852164; Fax: 0763.3856705
- **Representative:** Mr Tran Anh Thu

1.3. SUBPROJECT GEOGRAPHICAL LOCATION

The subproject is mainly carried out in three communes East of the Hau River. However, the area identified to have the potential for growth through the subproject activity's dissemination is located across the entire An Phu district.

The subproject's boundary: (i) the East borders with Tan Chau town, located in An Phu district in An Giang province; (ii) The South borders with Chau Doc city; (iii) the West, Northwest and North border with Cambodia. Most of the subproject area is separated from other areas by rivers and canals (*Table 2*).

The expected potential area for development through the operation of the subproject is the entire An Phu district, however, construction of the infrastructure facilities to stabilize livelihood for the local people in this subproject focuses only on these 3 three communes of Vinh Hau, Vinh Loc, and a part of Phu Huu (*Figure 4*).

Table 2: The coordinates of boundary points

N	Points	The coordinates of points on the map *Figure 3*	
		Longtitude	Latitude
1	A	10°57'40.58"N	105° 6'56.64"E
2	B	10°46'57.64"N	105° 9'35.12"E
3	C	10°42'39.93"N	105° 7'22.43"E
4	D	10°53'32.79"N	105° 1'45.39"E

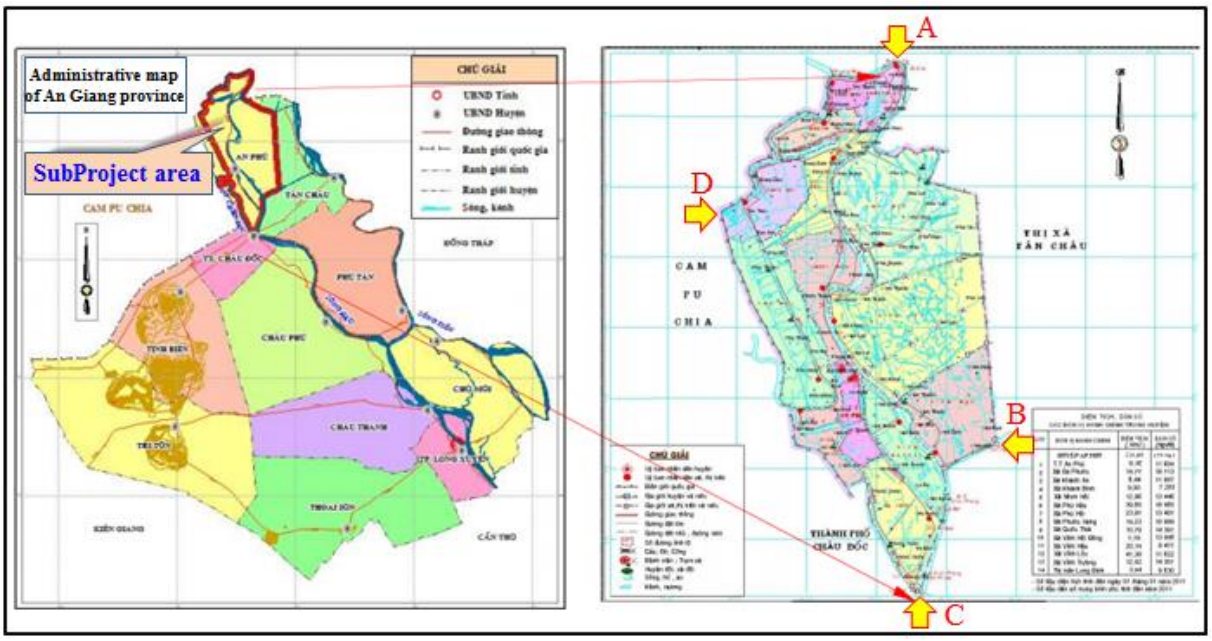


Figure 3: Location map of the subproject

Figure 4: The expected construction area in the general view of An Phu district

The area planned for the works of construction is limited by: (i) North: Co Lau canal; (ii) East: the Bay Xa canal – the border between Tan Chau district and An Phu district; (iii) South: the Xang canal - the border between An Phu and Tan Chau; and (iv) West: the Hau River.

The area planned for the subproject construction and the beneficiary area of the subproject have no biosphere reserve, national park or nature reserve sites.

The area planned for the infrastructure construction is mainly agricultural land and contains no religious works, historical and cultural monuments or business and service operations.

Most of the land in the subproject area is agricultural land allocated to local people for management, exploitation and use. Rivers and canals are still managed by the state.

According to the land use planning, the land of the three communes East of the Hau River, planned for the construction is a double rice cropping area (Winter-Spring and Summer-Autumn)

1.4. SUBPROJECT COMPONENTS

Subroject's objectives

a. Short-term objectives:

- Strengthen the adaptability of natural conditions, water resources and actively respond to climate change in the Mekong River upstream of An Giang province with an area of 22,640 hectares, actively regulate freshwater and flood control to enhance the added value of agricultural production, plant and livestock production restructuring, stabilize livelihoods, preserve, rehabilitate and protect sustainable fisheries resources; manage and protect eco-environment and biodiversity.
- Develop an infrastructure system relevant to the production model to facilitate the development of multi-purpose agricultural production, plant and livestock farming restructuring, environmental protection, bring about livelihoods for people, take the advantages of the flooding season, contribute to socioeconomic development, national security and defense, rural development and improve people's living conditions.

b. Long-term objectives:

- The long term objectives of the subproject are to to switch from the triple crop rice farming in the West bank of Hau River to other models that have higher efficiency, while ensuring the storage and drainage of the main season, maintaining the flood drainage corridor of the river and replicating this experience to other flooded areas.
- Together with other investments of the Government, stabilize people's living; build the rural region in flooded areas towards modernization and industrialization.

Quantity and scale of the subproject's work items

1.4.1.1. Component 1: Construction of Dykes and Culverts

As the current infrastructure in the area cannot meet the requirements of proactive production, particularly in communes in the East of Hau River, it's required to build irigation infrastructure to maximize the effiency of the proposed livelihoods. This subproject's scope focuses only on the construction of water management works for the three communes East of the Hau River.

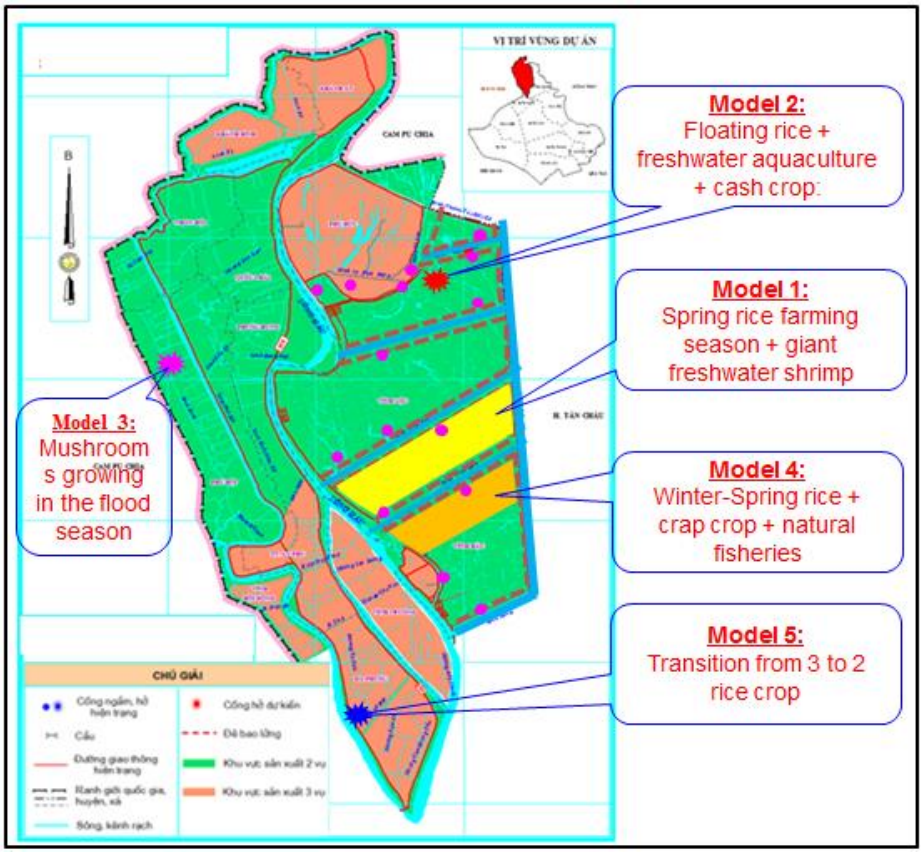


Figure 5: The expected locations of the models

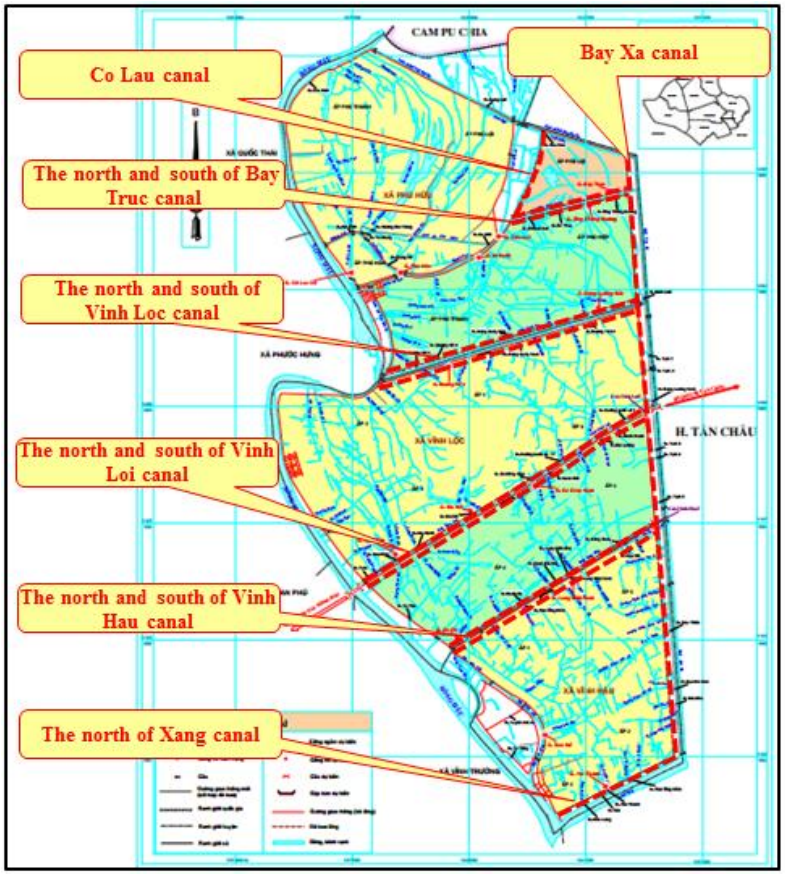


Figure 6: Location of 11 semi-dike sections in the subproject

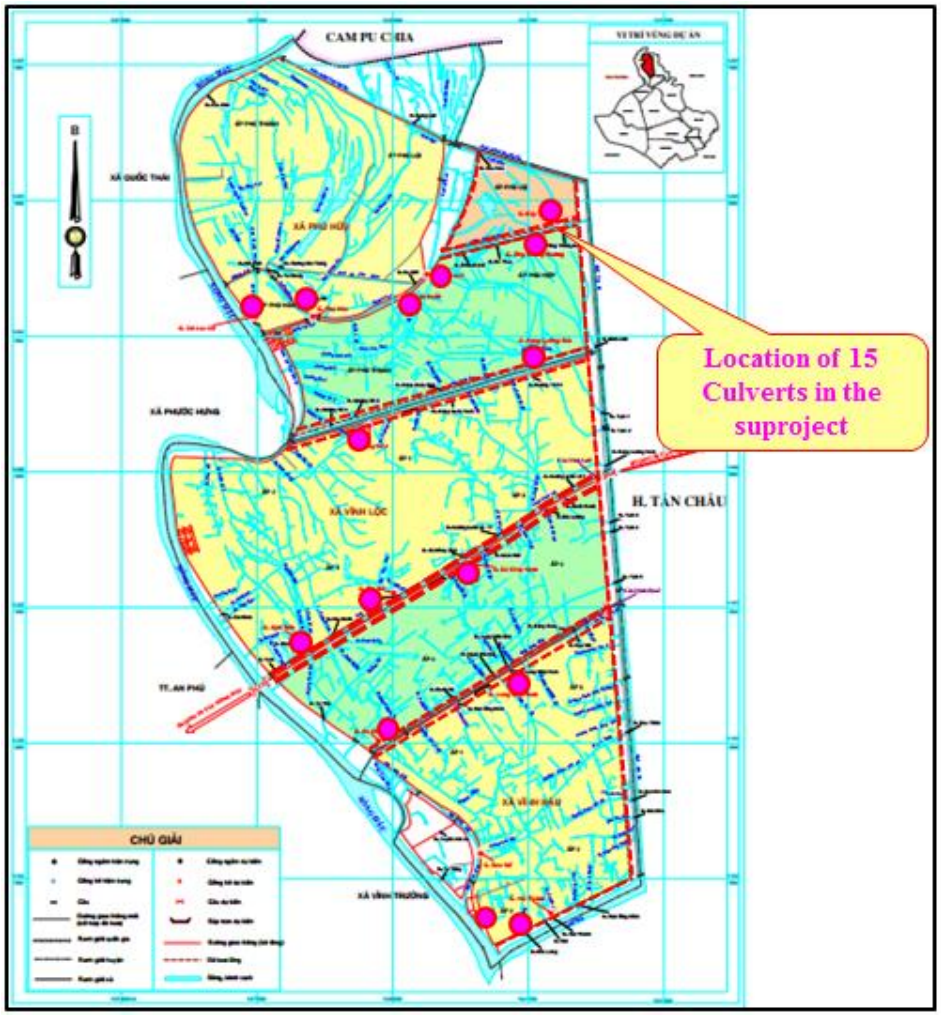


Figure 7: Location of 15 Culverts in the suproject

To build the livelihood models, the subproject only covers the construction of works in three communes East of the Hau River, to include Vinh Hau, Vinh Loc and a part of Phu Huu (*Table 3*), as follows:

a. Ring dike section. It's expected to build 11 semi-dike sections with the dike crest and roof reinforced with concrete and the expected dike section length of 60,953m (*Figure 8 to Figure 12* and *Table 4*).

Table 3: List of works planned for investment in 3 communes in the East of Hau River

No.	Works	Construction quantity
I	Ring dike	Construct 11 dike sections to control flood and develop transport in off-flooding season with a total length of 60,953m, dike crest elevation is from +3 - +4.5m, slope coefficient of 1.5. Dike crest width is 3m. In the south of Vinh Loi canal, this width is 6.5m.
II	Culvert system	Build 15 open culverts for drainage, waterway transport for production in the area with the culvert aperture of B = 3.0m and culvert bottom elevation of -1,50m (*Table 5*)

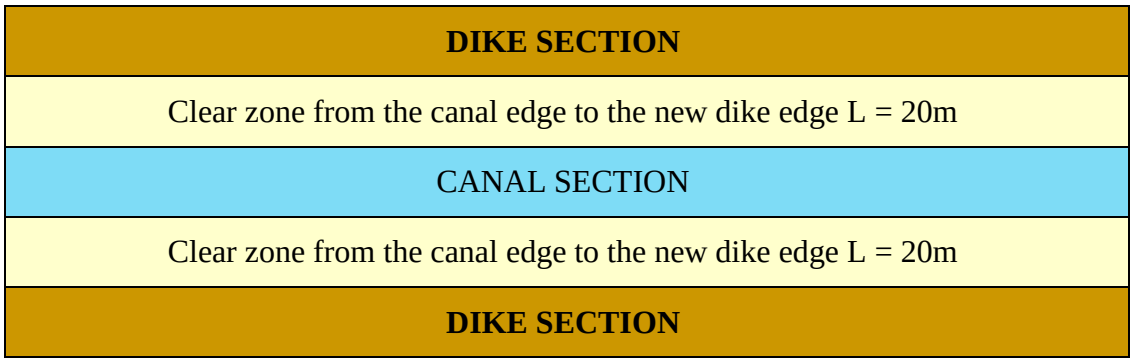


Figure 8: *Layout of the dike embankment section of Vinh Loc, Vinh Loi and Vinh Hau canals*

Table 4: The statistic parameters of dike

N^0	Semi-dike sections	Slope coefficient of 1.5	Curent elevation	Designed Elevation	w	L	Note
			m	m	m	m	
1	**Bay Xa canal**					**12,764**	
	From Nam Nhanh Tay canal to Vinh Loc canal	1.50	+4.00	4.50	3.00	2,989	Reinforce dike slope and concrete slab surface
	Vinh Loc canal to Vinh Hau canal	1.50	+3.90	+4.50 =>+4.00	3.00	4,702	Reinforce dike slope and concrete slab surface
	From Vinh Hau canal to Kinh Xang canal	1.50	+3.50	+3.50	3.00	5,073	Reinforce dike slope and concrete slab surface
2	**Bay Truc canal**					**6,143**	
	On the south of Bay Truc canal	1.50	+4.30	+4.50	3.00	3,082	Reinforce dike slope and concrete slab surface
	On the north of Bay Truc canal	1.50	+3.60	+4.50	3.00	3,061	Reinforce dike slope and concrete slab surface
3	**Co Lau canal**					**2,298**	
	From Nam Nhanh Tay to Bay Truc canal	1.50	+3.60	+4.50	3.00	2,298	Reinforce dike slope and concrete slab surface
4	**Vinh Loc canal**					**11,801**	
	On the north of Vinh Loc canal	1.50	+4.20	+4.30	3.00	5,898	Reinforce dike slope and concrete slab surface
	On the south of Vinh Loc canal	1.50	+4.40	+4.30	3.00	5,903	Reinforce dike slope

N⁰	Semi-dike sections	Slope coefficient of 1.5	Curent elevation	Designed Elevation	w	L	Note
			m	m	m	m	
							and concrete slab surface
5	**Vinh Loi canal**					**14,491**	
	On the northwest of Vinh Loi canal	1.50	+3.60	+4.00	3.00	7,268	Reinforce dike slope and concrete slab surface
	On the southeast of Vinh Loi canal	1.50	+3.80	+4.00	6.50	7,223	Reinforce dike slope and concrete slab surface
6	**Vinh Hau canal**					**10,543**	
	On the northwest of Vinh Hau canal	1.50	+3.90	+3.80	3.00	5,238	Reinforce dike slope and concrete slab surface
	On the south of Vinh Hau canal	1.50	+4.10	+3.80	3.00	5,305	Reinforce dike slope and concrete slab surface
7	**Kenh Xang canal**	**1.50**	**+3.30**	**+3.50**	**3.00**	**2,913**	**Reinforce dike slope and concrete slab surface**
	Total					**60,953**	

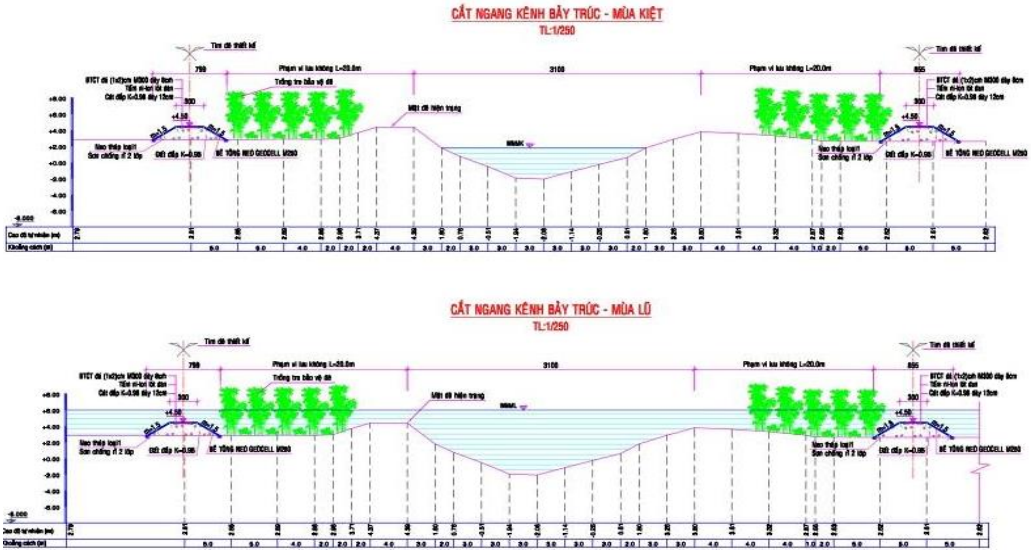


Figure 9: The typical cross section of dikes along Bay Truc canal, Vinh Loc canal and Vinh Hau canal

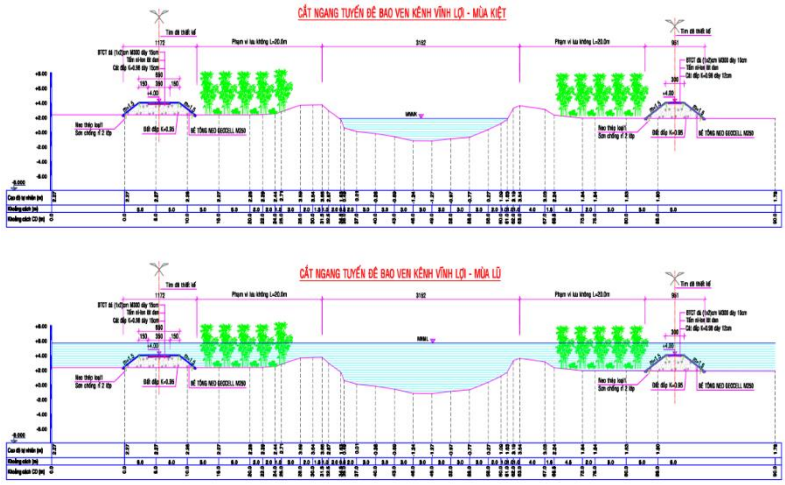


Figure 10: The typical cross section of Vinh Loi canal

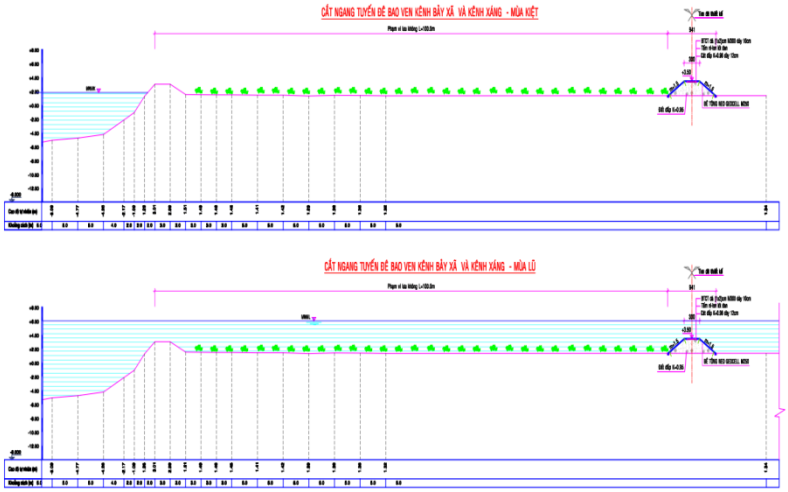


Figure 11: The typical cross section of dikes along the Bay Xa and Kenh Xang canals

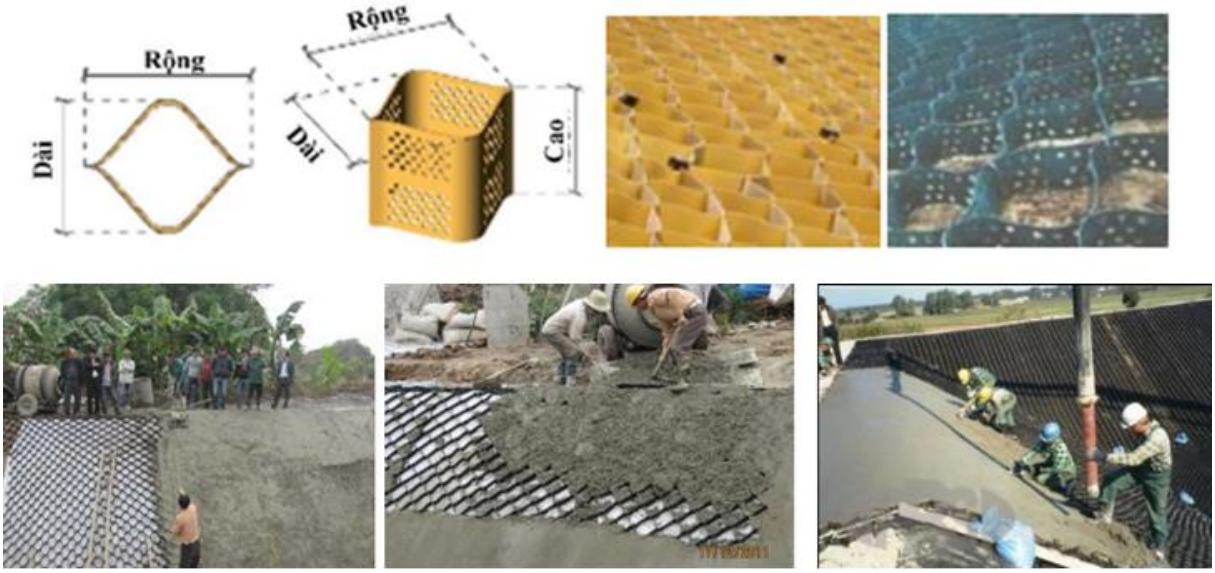


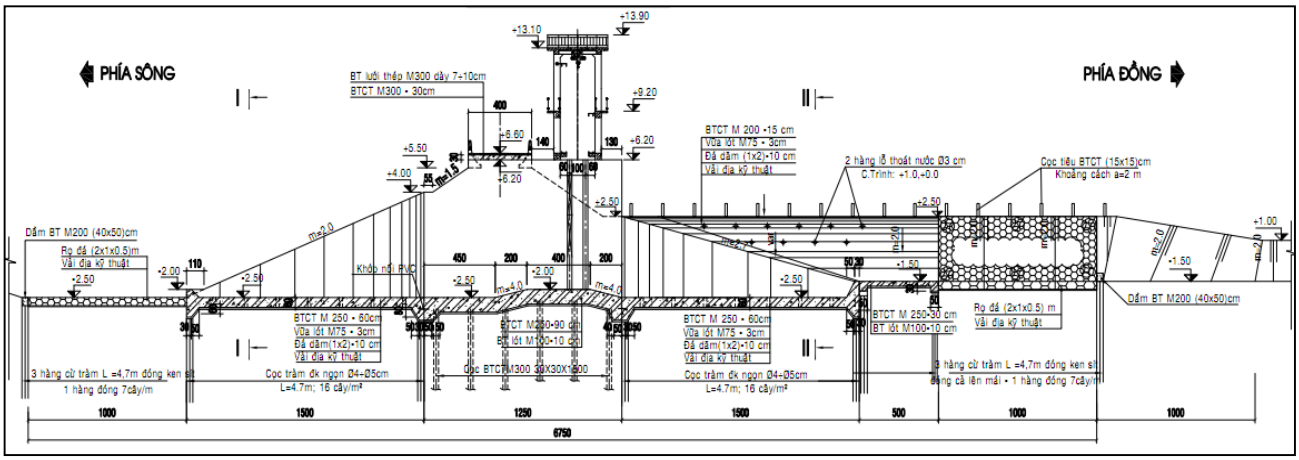
Figure 12: The E'GRID Geocell structure of dike slope

b. Culvert system To ensure the production, water drainage and waterway transportation for production in the inner or outer area of the dike, additional open culverts must be built with the aperture B = 3.0m, elevation of the bottom of the culvert of -1.50m. The elevation of the pin pile

peak will depend on the culvert location, the elevation of the ring dike section to be built. Expected number of culverts: 15 culverts, see detail in *Table 5*.

Table 5: The statistics parameters of drainage culverts

No.	Name of culvert	Location		Scale		
		Canal	Commune	Width	Crest elevation of valve gate	Crest elevation of pier
1	Bay Truc	Canal 3	Phu Huu	3.0	-2,00	+4,50
2	Ong Thong Duong	Ong Thong Duong	Phu Huu	3.0	-2,00	+4,50
3	Co Lau	Co Lau	Phu Huu	3.0	-2,00	+6,20
4	Ut Xuan	Ut Xuan	Phu Huu	3.0	-2,00	+4,50
5	Phu Hoa	Ut Xuan	Phu Huu	3.0	-2,00	+4,50
6	Co Lau Cu	Co Lau Cu	Phu Huu	3.0	-2,00	+4,50
7	Bung Luong Bac	Bung Luong	Phu Huu	3.0	-2,00	+4,50
8	Canal 3		Vinh Loc	3.0	-2,00	+4,50
9	Bung Ren	Bung Ren	Vinh Loc	3.0	-2,00	+4,00
10	Dia Mo	Dia Mo	Vinh Loc	3.0	-2,00	+4,00
11	Ca Chay Nam	Ca Chay Nam	Vinh Loc	3.0	-2,00	+4,50
12	Ba De	Can Tho	Vinh Loc	3.0	-2,00	+3,80
13	Lung Mon Nam	Lung Mon	Vinh Hau	3.0	-2,00	+3,80
14	Sau Ho	Muong Sau Ho	Vinh Hau	3.0	-2,00	+3,50
15	Hai Thanh	Muong Hai Thanh	Vinh Hau	3.0	-2,00	+3,50



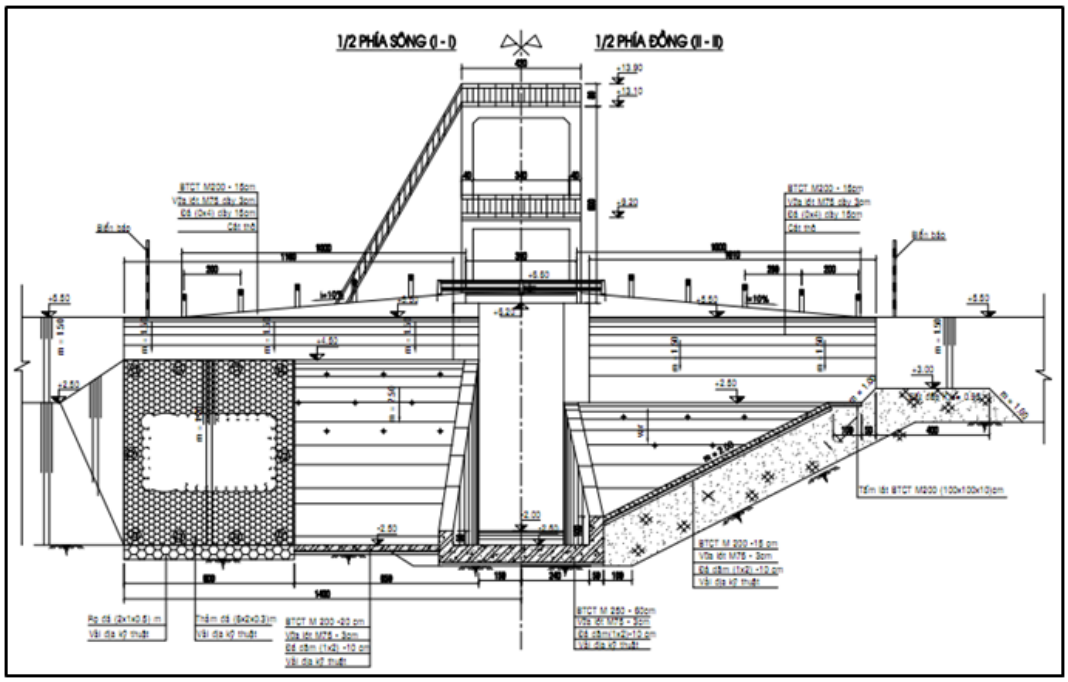


Figure 13: Culvert structure, B = 3.0 m

1.4.1.2. Component 2: Development of livelihoods models for local people

The subproject's main task is to develop livelihoods models in relevance with water source features and to enhance the adaptability to climate change, sea-level rise.

This component will support the implementation of five livelihood models in the subproject area. These models have been selected and designed based on the results of some pilot models being implemented in the Mekong Delta. However, the final design and locations of the demonstration sites will be confirmed after discussion and confirmation with the local authorities and communities during the preparation of an implementation plan.

5 livelihoods models are proposed for 2 areas: (1) The area affected by floods, having only two rice farming seasons and (2) the area already having high dikes and stable 3 rice farming seasons.

The main activity of this component is to develop sustainable livelihood models in conformity to the investment works which have been built and the characteristics of the water resources to enhance the adaptive capacity to climate change and sea level rises.

In fact, the local households do not have large areas of production land (the average is 0.89 ha/household, 0.23 ha/person). While rice does not bring good profit, the people's lives in this area remain difficult, and workers have no jobs particularly in the flood season. Most people in the region have said they need the dikes in order to grow 3 crops even during the flood season. However, 3 crops may affect the flood drainage for the upstream, making the effects of rising sea levels and upstream flood changes greater if the double-rice crop production areas become triple-rice crop areas (for more detail, please see section 2.3 page 85). To ensure a steady income for the local people, but not to affect the flood drainage and to adapt to climate change and sea level rises, there are great needs to develop a production method for the people in the floodplain which is suitable for the flooding conditions taking advantage of the flood water and the natural conditions. There are 5 livelihood models to be proposed for two areas: The prone of flood area with low dike (only 2 rice crops/year) and the area with high dike (the main flood controlled providing for stable triple-rice crop production).

a. For 4a area (double-rice crop area): 04 farming models will be developed:

Model 1: Spring rice farming season (Biosafety, do not use pesticides and insecticides) + giant freshwater shrimp

Each shrimp farm has an area of about 4 hectares. Each farm is divided into 2 smaller parts: one is nursing (raceway) area (30% of the area) and the other is growout area (70%).

Build small embankments with the embankment peak to be about 1m higher than the field. Each farming cell has water intake and drainage culverts with an aperture of 40cm.

+ *Winter-Spring rice farming.* This is from November to February of the following year. The following activity after rice farming is shrimp farming, the use of pesticides and insecticides must be minimized to avoid impact on the environment for the shrimp farming season.

+ *Giant freshwater shrimp (Macrobrachium rosenbergii) farming in flood season*: (i) Upon the completion of the rice farming season, a pond bank must be improved and water must be pumped into the nursing pond. Stocking density at this stage is 20-25 heads/m^2. The period for nursing is about 2 months (from March to April); (ii) Bringing the shrimp to the larger area: During the shrimp nursing phase, workers consolidate embankments for the rest area and use the mesh for the entire farming area; the mesh height should be 2m higher than the embankment, to prevent prawn loss when flood inundates the shore; and (iii) After 2 months of prawn nursing, the ahrimps are released to the farming field. At this point, the farming density is just 3 – 5 heads/m^2. In July, the flood season begins and water floods the field, creating a favorable environment and providing natural food for shrimps.

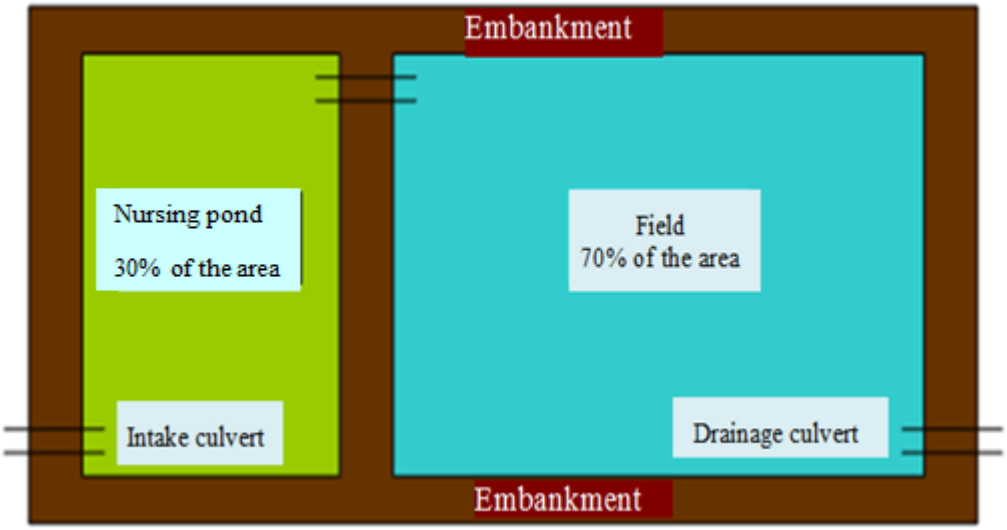


Figure 14: Typical structure of a prawn field

Expected yield of the model is 1,300 kg/ha -1,500 kg/ha and area of the pilot model: 60 to100ha; Implementation period: 2016 - 2018, in which: (i) in 2016 the subproject will provide 100% of the cost for 60ha; and (ii) In the next years in 2017-2018, the subproject will provide 50% of the cost and the area is 100ha. It is expected that at the end of the subproject, the area for the model application is 1,000ha.

Figure 15: Giant freshwater shrimp farming in the flood season in Dong Thap Province

Model 2: **Floating rice in combination with aquaculture (**Featherback fish, Snakeskin gourami, etc.) **+ crops**

In fields, workers build small culverts for water supply and drainage and low embankments surrounding small ponds and ditches as in **Error! Reference source not found.** and **Error! Reference source not found.**.

Table 6: Area allocation in the model

	Type of farming			
	Floating rice + Gourami + Featherback in flooding season	**Crops in the off-flooding season**		
		Allium chinense	Sesamum indicum Linn	Corn (baby corn)
Area (ha)	3.0	1.0	1.0	1.0

Table 7: Schedule for floating rice + aquaculture + crops

Month	12	01	02	03	04	05	06	07	08	09	10	11
Season	Crops					Floating rice + Gourami + Featherback						

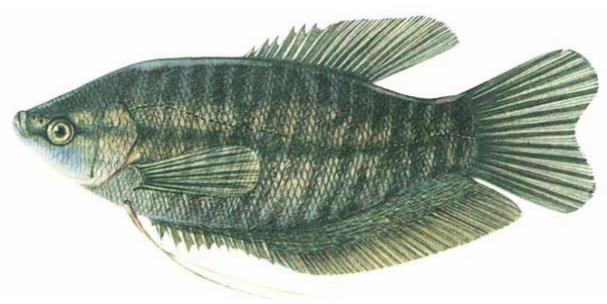
The embankment surrounding the farming systems must be high enough (approximately 1.5-2.0m lower than that of the main rice season), and firmly reinforced against landslides affecting the building structure. During the flood, screen made of bamboo and nylon mesh should be used to protect fish in the rice field. In the field, there must be a low-lying zone or ditches surrounding the embankments that must be installed to harvest fish after each season which can also be used as drainage ditches for crop planting. The pond area must have drainage having intake culverts with an aperture of Φ30 ÷ 40cm.

Figure 16: Floating rice in flood season

Source: http://www.mekongcommons.org/conserving-the-benefits-of-floating-rice-in-viet-nam/2015/03/26

At the beginning of the rainy season (May), rice seeding are planted and ploughing must be also carried out to create moisture for the soil and to prevent the birds, rats from destroy them, etc. Under the first rains, rice plants will sprout and when the floods overflow, rice plants will grow in accordance with the increasing speed of the flood waters. In November, when the flood is gone, harvest can be done and no fertilizers, pesticides are required. For this reason, floating rice is considered as the natural and clean rice. Along with the rice seeding, Gourami released into the rice fields must also be done: 0.5 head/m², Featherback fish: 1 head/m².

Featherback fish *(Notopterus notopterus)*



Snakeskin gourami (*Trichogaster pectoralis*)

Fishes will eat zooplanktons and others under the canopy of the rice. This brings about economic and environmental efficiency.

Area of the pilot model: 3 ha and implementation period: 2016 - 2018 includes: (i) In 2016 the subproject will provide 100% of the cost; and (ii) In the next years in 2017-2018, the subproject will provide 50% of the cost. It is expected that at the end of the subproject, the area for model application is 500ha in the 2-season farming areas of An Phu district.

Model 3: Mushrooms growing in the flood season

Although the floodplain but most people stay in the flood protection residential areas. With plentiful sources of agricultural byproducts. The subproject will have technical assistance for the people using the straw to produce mushrooms. This activity will not burn straw after havert (limiting environmental pollution) as well as it will create employment and income for the people.

The Famer burn straw after havert

The farm using the straw to produce mushrooms

Model 4: Winter-Spring rice + Crops for livestock farming + Flood release/Fishing

Winter-Spring rice: Use the normal the season timing and techniques.

Corn trees for baby corns and trunks for cow feeding: Upon the completion of the Winter-Spring rice season, the soil will be prepared for corn planting and the planting period of corn is 45 days, therefore, 02 seasons of corns can be produced (**Error! Reference source not found.**).

Table 8: Schedule for Winter-Spring rice + crops for livestock farming + Flood release/Fishing

Timing	11	12	01	02	03	04	05	06	07	08	09	10
Season	Winter-Spring rice				2 seasons of corn				Flood release/Fishing			

- ✓ Area of the pilot model: 5 ha.
- ✓ Implementation period: 2016 - 2018: In 2016 the subproject will provide 100% of the cost. In the next years in 2017-2018, the subproject will provide 50% of the cost.
- ✓ It is expected that at the end of the subproject, the area for model application is 500ha in the 2-season farming areas of An Phu district.

b. For 4b area (tripple rice crop area): 01 farming models will be built:

With a long-term objective for the subproject, i.e. changing from the existing tripple rice farming areas (area not effect by flood) to areas that can provide drainage or storage of flood water as follows:

Model 5: Winter-Spring rice + 1 Crops season + Flood release/Fishing

Table 9: Schedule for Winter-Spring rice + Crops for livestock farming + Flood release/Fishing

Timing	11	12	01	02	03	04	05	06	07	08	09	10
Season	Winter-Spring rice				Sesamum indicum Linn or hybrid corn				Flood release/Fishing			

Area of the pilot model: 5 ha and implementation period: 2016 - 2018: (i) In 2016 the subproject will provide 100% of the cost; and (ii) In the next years in 2017-2018, the subproject will provide 50% of the cost. It is expected that at the end of the subproject, the area for model application is 1,000ha in the tripple rice farming areas of An Phu district.

c. Steps for livelihood model development

- ✓ Raising local awareness of climate change impact
- ✓ Establishment of farmer organizations and Commune CC Response Team
- ✓ Identify and Pilot CC farming models & FFS extension
- ✓ Infrastructure upgrades
- ✓ Linking farmers to market

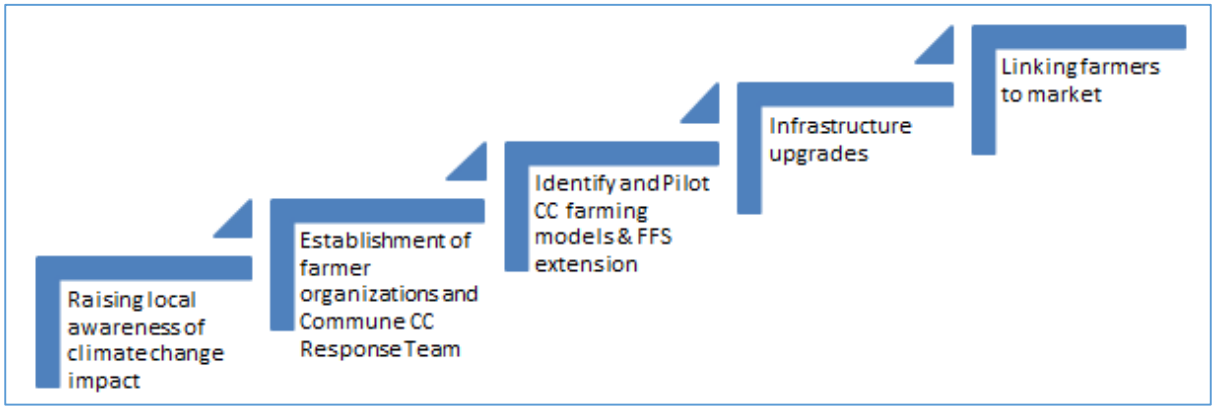


Figure 17: Steps for livelihood model development and success

Table 10: Subproject development target for livelihood models Bảng triển vọng phát triển mô hình sinh kế

No	Models	Area of pilot models (ha)		Target of subroject			
		2016	2017-2018	Area (ha)	HH	Number of model	Production team
I	**For 4a area** (double-rice crop area)						
1.1	**Model 1:** Biosafety, Spring rice farming season + giant freshwater shrimp	60	100	1.000	1.000	6	3
1.2	**Model 2**: Floating rice in combination with aquaculture	3	3	500	500	4	2
1.3	**Model 3:** Mushrooms growing in the flood season				500	2	0
1.4	**Model 4:** Winter-Spring rice + Crops for livestock farming + Flood release/Fishing	5	5		500	2	0
II	**For 4b area** (tripple rice crop area)						
2.1	**Model 5:** Winter-Spring rice + 1 Crops season + Flood release/Fishing	5	5		1.000	2	0

1.4.1.3. Ancilary Facilities

The subproject will not envolve any anciliary facilities such as access roads, quarries, and borrow pits. Construction materials such as cement, iron bars, sand, and stones will be bought from whole sale suppliers in Tan Chau city which is 8km from the subproject site. All the construction materials will be tranposted to the subproject by water way. At this stage, decision on where to buy sand and stones could not be made because specific requirements on the quality of these materials will only be available during the detailed technical design stage. Nevertheless, during subproject implementation due diligence procedures will be followed to ensure that these sources

are legally-produced and practicing sound environmental and social management. Requirements for environmental and social due diligence of materials sources are included in the ESMP.

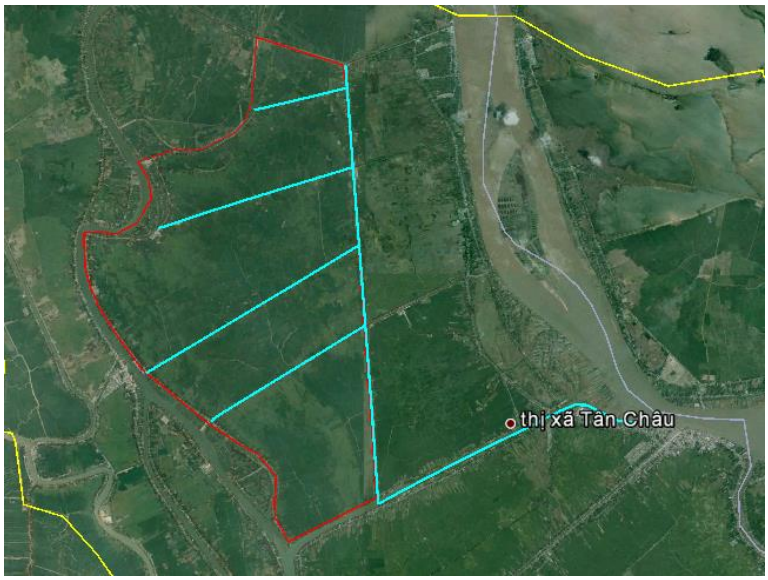


Figure 18: Water way route will be use for transport of materials for subproject

1.4.1.4. Technical Assistance

Monitoring water quality, shrimp disease,

Branding and market development for the product.

Land acquisition and resettlement of the subproject

Land only acquires for infrastructure construction in the 3 communes East of the Hau river and not for proposed livelihoods models. Land acquisition for infrastructure construction including:

- Land area used for works: 110.0ha
- Temporary land: 15.0 ha

In cross canal lines (Bay Truc, Vinh Loc, Vinh Loi, Vinh Hau), land clearance scope will be from the edge of the existing embankment bottom to the end of the occupying dike body and in the Bay Xa and Xang canals, the clearance scope is the body of the occupying dike. During dike construction, earthworks will be required. It's expected that the corridor for dike construction shall be 1.0 m on each side along the total dike length of 60,953m. No household will be displaced physically and no house/structures will be affected by the subproject.

Construction method, technology for the subproject items

Transport system: The road system can only bear small loads so the transportation of materials and equipment is mainly by waterways.

On-site human resources: In the subproject area, there is almost no skilled workers, primarily workers of ordinary jobs such as material handling, installation of gabion, stone, manual earthworks, etc.

Diversion canal in construction: With a dense network of canals in the subproject area, Diversion canal in construction is often not necessary except for some special locations that require further study on method and detailed works in the construction design stage.

1.4.1.5. Construction of dike sections

a. Earth fill

The dike body is earth filled. The construction must follow a certain number of principles, mechanical and manual combined construction methods. For dike sections along the cross canals such as Bay Truc, Vinh Loi, Vinh Loc and Vinh Hau, filling material will be from the existing dike and within the clear zone. Therefore, it will be transported by excavators to the construction area. Bulldozers and road rollers will compact the fill soil. Human resources will be used for manual leveling. If the amount of material is not sufficient, and the soil in the canals must be used, excavators will be then used and the above mentioned filling step will be followed. Regarding dikes along the Bay Xa and Xang Xa canals, as the new dike shall be relocated to a new place which is 50-100m away from the existing one, there are two options for filling material provision: For existing dikes covering non-residential areas, soil from these dikes will be used for the new dikes and soil from Bay Xa canal and can be exploited using excavators and transported to the site for filling.

b. Installation of the E'GRID Geocell for dike body reinforcement

The construction using Neoweb material must comply with current regulations on occupational safety; environmental protection; construction conditions, etc. Once the earth fill is completed, the following protective layer construction steps are as follows: (i) E'GRID Geocell material is transported to the site in bundles. Other materials, such as anchors, ligaments, and pins must be fully prepared in terms of quantity. Device toolss used include an air compressor, a generator (for areas with no access to electricity), hammers, etc; (ii) Place E'GRID Geocells on the dike slope in parallel with the dike section, and spread the material basing on the direction of the slope and E'GRID Geocell; (iii) Pin E'GRID Geocells: Pin the ends of the Geocells together, creating cells (walls); (iv) Install anchor piles and spread E'GRID Geocells; (v) Fill the material and cover layer to E'GRID Geocell (*Figure 12*)

Table 1: Construction material quantity

No	Item	Unit	Quantity		
			Dike	Culvert	Total
1	Concrete	m^3	71,874	8,265	**80,139**
2	Steel	Ton	1190	28	**1,218**
3	Excavated soil and Backfill soil	m^3	3,509,952	121,165	**3,631,116**

1.4.1.6. Installation of water supply and drainage culverts

Culverts are located on the dike, at the banks of canals where materials, construction equipment, machinery, worker camps are located. Construction locations are concentrated and often very close to the canal for convenience in transporting materials and equipment, etc.

Culvert construction sequence is as follows: (i) Site preparation; (ii) Unload and pile up construction materials, machineries and equipment; (iii) Build the cofferdam in combination with the road; (iv) Install electricity, water systems for construction; (v) Get the ground and infrastructure ready for construction; (vi) Ground treatment and building pit construction; (vii) Casting and building; and (viii) Equipment installation.

List of planned machinery and equipment

Table 11: The list of main machinery and equipment for /culvert construction

No.	**Machinery**	**For one site**	**Number site**	
			dike	**Culverts**
1	Excavator 0.8m^3 BX	1	6	5
2	Concrete mixer (500 liter capacity)	1-2	6	5

No.	Machinery	For one site	Number site	
			dike	Culverts
3	Trucks (3.5-5 ton)	3	6	-
4	Compactor	1	6	-

Subproject schedule

FS preparation and approval: 3/2016

Site clearance and compensation: 2016-2018

Subproject implementation: 2017-2020

Investment

Total investment of the subproject: 32.382 million USD)

Subproject management and implementation

1.4.1.7. Subproject management and implementation

An Giang PPC is responsible for approving FS, procurement plan and subproject settlement. Assisting agencies include the Department of Agriculture and Rural Development, An Giang PPMU under An Giang DARD, being responsible for the implementation of the subproject's activities.

Department of Agriculture and Rural Development of An Giang Province is the subproject owner, in charge of the subproject coordination.

An Giang PPC, An Phu district shall steer the subproject, be responsible for the site clearance, compensation and resettlement of the subproject.

1.4.1.8. Role of contractors

The main contractors involved in FS, Construction Drawing preparation, etc., construction of civil works of the subproject shall be selected and contracted in compliance with the Vietnamese Government Guideline on Procurement and WB's Guideline on Procurement.

Contractor is responsible for the construction and installation of works according to technical requirements and the drawings. They shall follow the tentative schedule. Contractors are also responsible for the design of temporary works, the safety of all activities at the site.

Contractor shall implement sufficient solutions to manage and protect the environment during construction as per the environmental management plan reviewed by WB and approved by competent authorities.

Contractors are given the right to access and manage all parts of the site during construction by the Investor. Any item that is historical in nature or has significant value discovered accidentally at the site will be the property of the Vietnamese Government, and the Contractor shall notify the Works Managing Director for instruction. Role of Contractors is also detailed in the current legislation of Vietnam and the World Bank.

1.4.1.9. Role of the Advisor

The Project Technical Advisor (TA), under the framework of the project, has an important role in all project's activities, including (i) Assist in the overall management in the project implementation process, while assisting in plan preparation and integrated measure implementation; (ii) Monitor the project implementation and (iii) Support the sustainable management system.

Technical assistance will accelerate the process of modernization of the project management system, designed in a participatory approach with the participation of farmers, irrigation

management company and stakeholders to determine the priority of irrigation service improvement and drainage, to ensure that farmers are beneficiaries of irrigation infrastructure investments.

1.4.1.10.Role of organizations and other project implementation stakeholders

In order to coordinate all activities of the organization and other project implementation stakeholders are to facilitate the application of an integrated approach, the Project Advisory Board shall be established consisting of the following members: CPO Director, PPMUs, senior representatives of the Department of Agriculture and Rural Development and related agencies. The Project Advisory Board will have regular meeting (at least once per quarter) during the project implementation period. This activity should be maintained more frequently.

1.4.1.11.Role of donor and co-donors

World Bank will provide a loan of USD 24,102,000 to fund for the costs of subproject management cost, consulting cost, construction, equipment and some other expenses. The remaining shall be funded by the counterpart funding of the Vietnamese Government, which is USD 8,280,000.

The bidding packages implemented from the WB funds will comply with the Bank's procurement guidelines. The contracts that contractors are selected according to the procedures of the World Bank will be paid 100% before tax of the Bank capital.

1.4.1.12.Role of enterprises in the development of livelihood models

The model of shrimp farming in rice fields has grown sharply in Dong Thap province; however, in the subproject area, it has not been introduced. Currently, Nam Viet enterprise has had a commitment with the local on the transfer of the model and shrimp consumption.

The enterprise will lease land from the local people at the cost, which is higher than the income from rice farming of local people. It will invest in infrastructure of embankments and pens to raise prawn in flood season. The enterprise will also hire some workers from the land leasing households to take care of the prawn and do rice farming. This helps not only to maintain people's income stability but also increase their income. Besides, workers still have some spare time for other jobs to improve their income.

With this pioneering shrimp farming of the enterprise in this area, local people can learn from that and transit the farming in the coming time.

1.4.1.13.Role of local agricultural, fisheries extension agency

An Giang Agricultural Extension Center will be the focal point for the implementation and transfer of new models on livelihoods to localities, as follows: (i) Organize farmer field school for technology transfer and guide local people to apply the model in practice; (ii) Expand the model to areas with similar conditions; (iii) Training and guiding IMP for rice cultivation for local farmers; and (iv) take actions to mitigate potential negative impacts during operations of the models including those related to potential conflicts on land and/or water uses and possible expansion of farming without proper mangement and control.

Summary of the key information of the subproject

Table 12: Summary of the key information of the subproject

Subproject stages	Activities	Implementation progress	Technology/how to perform	The environmental factors which likely arise
Preparation	Preparation of site	2016-2019	Identifing land area, geodesic marking for construction	Acquiring 110ha of land permanently, and 15ha temporarily, 752 HHs affected by land acqusition. No HH needs to be physically displaced. 23 graves will be relocated affecting psychology of the affected people.
Construction	Leveling ground for construction of works	2017 – 2020	Removing topsoil fields	Emissions, noise caused by construction equipment
	Transport of materials	2017 – 2020	Using barges for transporting materials on waterways	- Causing turbidity, pollution of water, air environments. - Affecting waterway traffic.
	Filling and reinforcing embankment	Only construction in dry season	Bucket Excavator	- Construction machine causes noise, dust and emissions. - Cement dust caused by concrete mixing plants. - Rain water, runoff of sediment to the environment. - Affecting the social order.
	Construction of regulating culverts	Only construction in dry season	Excavator, concrete compactor, concrete mixer	- Construction machine causes noise, dust and emissions. - Cement dust caused by concrete mixing plants. - Rain water, runoff of sediment to the environment. - Excavation of the culvert foundation affect the shallow groundwater. - Affecting the social order.
Operation	Combination production of aquaculture and crop	After 2020		- At the beginning of flood season, flow velocity in the Bay Xa canal may increase. - The upstream water pollution affects the aquaculture. - Increase waste from aquaculture operations. - Residues of pesticides from rice production affect aquaculture operations. - Land use change due to scaling up of the livelihoods models

CHAPTER 2. SOCIOECONOMIC & ENVIRONMENTAL CONDITIONS IN THE SUBPROJECT AREA

2.1. NATURAL ENVIRONMENTAL CONDITION

Geographical and geological condition

The geological feature of this area is relatively homogeneous, including fill layer (layer 1a) with the thickness ranges from 0 - 2.5 m depending on the location of the borehole; beneath layer 1a is layer 2 which is soft and mixed of clay and sand. This layer has a poor bearing capacity and high deflection compression. Its thickness varies from 2.5 m - 11.5 m, not suitable for the foundation of the works. Also, the canal slope located on this layer is prone to landslides, affecting stability of the dikes. Under layer 2 is layer 3 with sand. This layer has a thickness of about 1.5 m - 23.6m, good bearing capacity, suitable for placing the works foundation. In the design calculations, depending on the size, nature and the load of the works, pile foundation can be used; pile heads lean on the sand layer. However, due to the sand layer, it must be ensured that the permeable border must be extended. Foundation should not be too deep to avoid being eroded.

According to the soil map in the Mekong Delta, in An Giang province, acid soils mainly concentrates in the southwest of the province (Long Xuyen Quadrangle). The soil in the subproject area is defined alluvial soil enriched by the Mekong River, which is not affected by alkaline (*Figure 16*). This is advantageous for the subproject area especially for the excavation and filling dike embankments as well as the development of aquaculture activities.

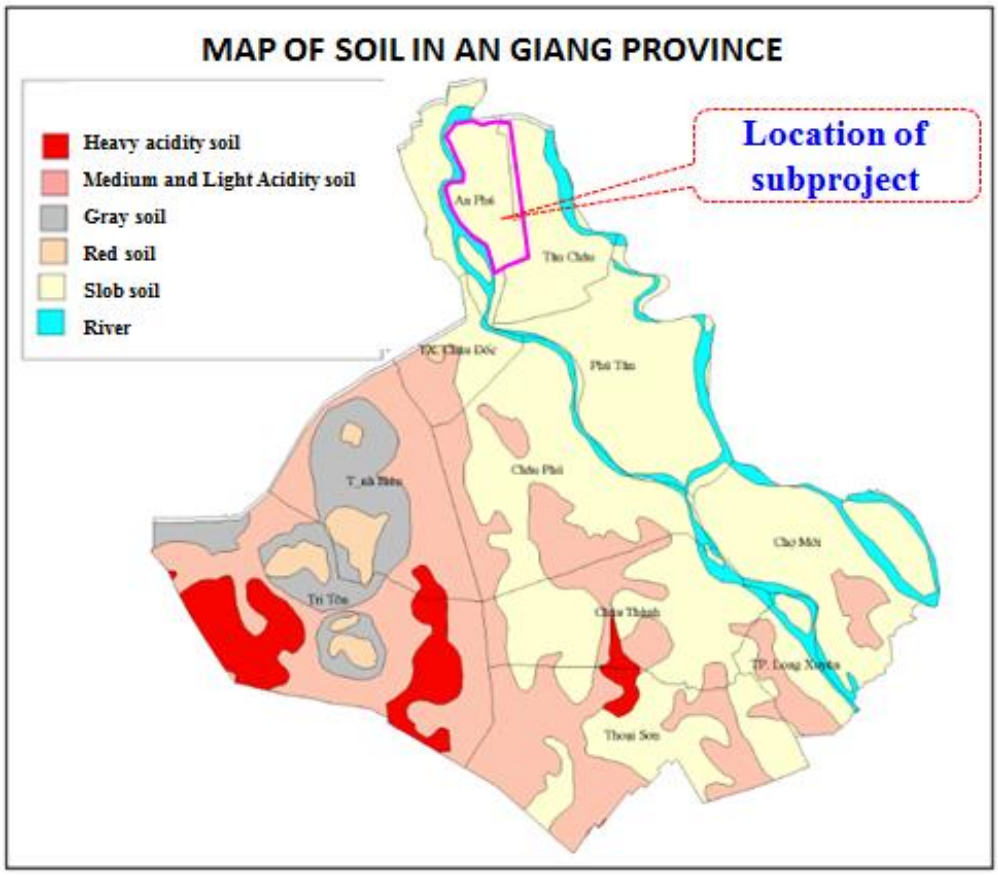


Figure 19: Soil map of An Giang province

Topographical characteristics

An Giang province in general and in An Phu district in particular, the terrain is largely formed by inning so the terrain is relatively flat. In the three communes of the eastern region of the Hau river, the natural elevation does not differ much, mostly fluctuating between 2-2.5m. Only in a small area, including residential areas adjacent to Hau river and in residential areas along the Bay Xa canal which was updated to control flooding, the elevation is in the range of 4.5-5m. Due to

the very low natural terrain of the region, the average flood level for most years is usually 4m and during the main flood season the area is submerged about 1.5-2m (*Figure 20*).

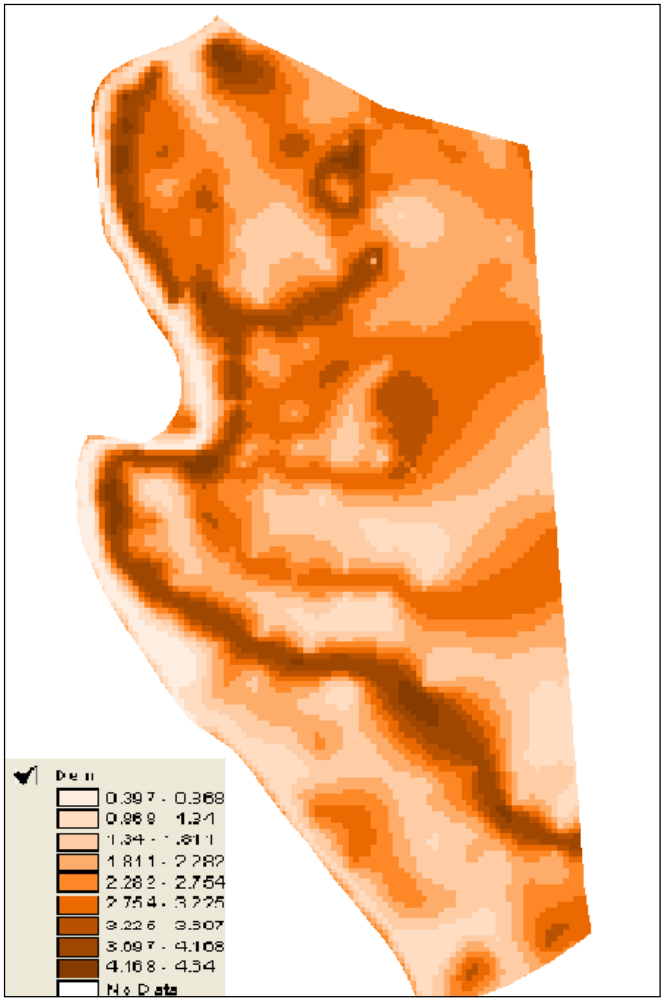


Figure 20: Elevation Map in the subproject area in 2000 (source: SIWRR, 2013)

Climate, meteorological condition

2.1.1.1. Temperature

During the year, the average temperature is relatively stable in the range of 27.3 – 27.9 ^{0}C, with the lowest and highest average temperatures of 25.9 ^{o}C and 28.9 ^{o}C recorded in January and April, respectively (*Table 13*).

Table 13: Average ambient temperature (^{o}C) in Chau Doc from 2009 - 2013

Year	Month												Entire year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2009	26.2	25.9	27.4	28.6	27.9	27.9	27.9	27.6	27.5	28.1	26.8	26	**27.3**
2010	24.6	26.7	28.2	28.9	28.1	28.4	27.5	28.4	27.6	27.6	27.6	26.8	**27.5**
2011	26.3	27.1	28.7	30	30.4	28.6	27.5	27.8	27.9	27.1	26.7	26.3	**27.9**
2012	25.7	26	27.4	28.2	28.5	27.7	27.6	27.8	27.4	27.6	27.8	26	**27.3**
2013	26.6	26.8	28.1	28.7	28.5	28.4	27.9	28.5	27.4	27.9	27.9	27.7	**27.9**
Monthly average	**25.9**	**26.5**	**28.0**	**28.9**	**28.7**	**28.2**	**27.7**	**28.0**	**27.6**	**27.7**	**27.4**	**26.6**	

Source: Statistical Yearbook 2014, An Giang Province

2.1.1.2. Rainfall

As this area has quite a large rainfall annually, on average 1,425 mm/year from 2008 to 2012, the rainfall is not consistant every year. In 2008, the highest rainfall reached 2,020 mm while in 2009 it was only 966mm (*Table 14*). The rainfall changes significantly over the years and during a given year it is not evenly distributed. Over 80% of the rainfall of the year concentrates during the rainy season. This rainfall, in combination with floods, causes widespread flooding. During the dry season, there is almost no rain, resulting in low water-levels in the canals and causing difficulty for production without a water regulation works.

Table 14: Average rainfall (mm) in Chau Doc

Year	Month												Entire year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2008	11.3	8.2	3.1	169.1	206.4	91	263.4	240	361.7	230.1	256.3	180.2	2,020
2009	18.9	10.6	34	93.8	158.5	63.7	159.9	162.5	127	109.7	22.8	5.1	966
2010	6.4	-	5.5	0.9	76.4	151.4	302.3	245.3	217.3	384.6	199.7	148.8	1,738
2011	-	-	27	80.5	56.9	158	139.3	188.1	128	113.7	189.1	32	1,112
2012	7.4	8.3	31	155.3	188.5	81.5	220	86.3	151.8	172.2	146.7	11	1,260
Monthly average	11	9	20	99.9	137.3	109.1	217	184.4	197.2	202.1	162.9	75.4	

Source: Statistical Yearbook 2014, An Giang Province

2.1.1.3. Humidity

Relative humidity is inversely proportional to temperatuture. In the rainy season, air temperature is low, thus, the humidity is high. In the dry season, temperature is high, vapor amount is low (due to insignificant rainfall), and humidity is low. The basic humidity data of Chau Doc is as follows (*Table* 15):

- Annual average humidity: U_{bq} = 81.2 - 81.9%.
- The month with highest humidity is September, average humidity reaches 84.2%.
- The driest month is March, average humidity is 77.8%.

Table 15: *Average humidity (%) of Chau Doc station from 2008 - 2012*

Year	Month												Entire year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2008	78	79	78	79	84	84	81	84	84	84	82	77	**81.2**
2009	78	83	80	80	85	83	84	82	83	84	79	79	**81.7**
2010	81	81	75	74	78	84	87	84	84	85	84	79	**81.3**
2011	76	81	77	79	83	85	83	83	84	84	81	78	**81.2**
2012	81	81	79	78	83	90	82	78	86	84	82	79	**81.9**
Monthly average	**78.8**	**81.0**	**77.8**	**78.0**	**82.6**	**85.2**	**83.4**	**82.2**	**84.2**	**84.2**	**81.6**	**78.4**	

Source: Statistical Yearbook 2014, An Giang Province

Hydrological condition

2.1.1.4. Hydrological features of the subproject area in the dry season

Hydrological regime in the infield subproject area is dominated by the following elements: the water regime of Hau River crossing Chau Doc, the East Sea tidal regime crossing Hau River, Tien river, and the tidal regime of the West Sea. In the dry season, normally from February, as freshwater flows from upstream it reduces the flow from the sea having a strong impact on the area. The West Sea tide has a small amplitude (in the range of 0.5 - 0.8 m), thus, the tidal flow does not have a direct impact on the water-levels in the area. The East Sea tide has a large amplitude (2-3 m), thus, in the dry season or even in the years of small floods, the tide still has a direct impact on Hau river water-levels and water-levels of this area. Hau River tidal amplitude reaches 1 - 1.2 m. Water level in canals at this time varies in accordance with irregular semi-diurnal tidal oscillation of the East Sea and the tidal current reaching the center of the subproject area still reaches about 20-30 cm.

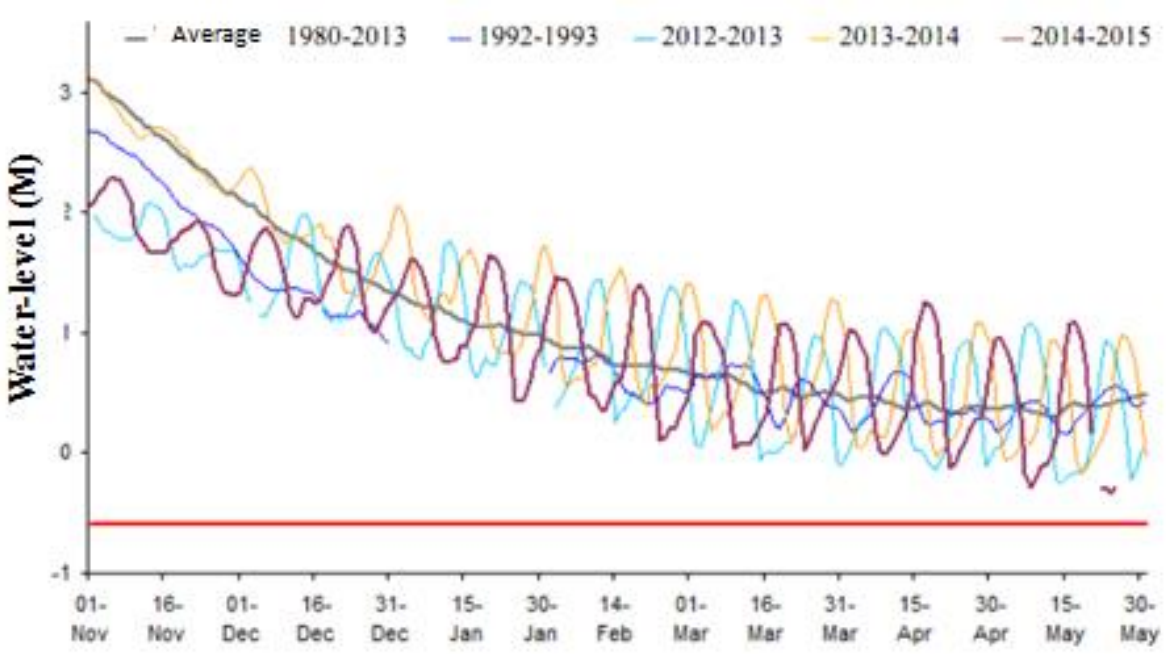


Figure 21. The tidal impacts by the East Sea effects the water-levels of the entire province of An Giang.

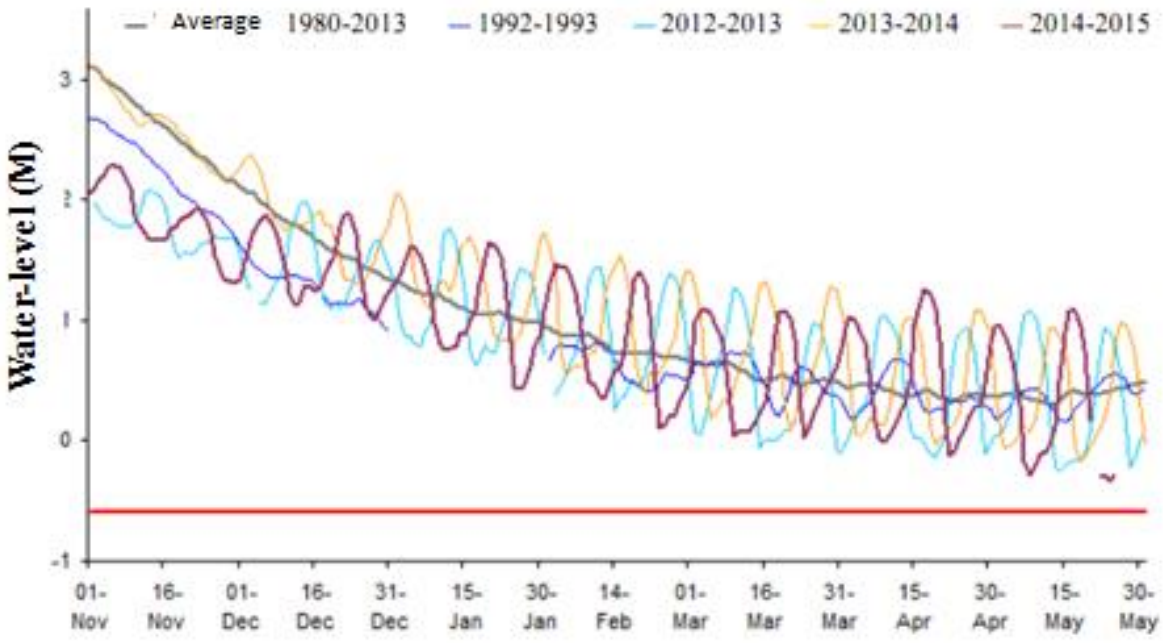


Figure 21: Hau River's daily average water-level in dry season in Chau Doc station, Period: 1/11/2014 - 30/5/2015 (Source: MRC, 2015)

2.1.1.5. ***Hydrological features of the subproject area in the flood season***

Topography of the Mekong Delta in general and of the subproject area in particular, has a lot of changes, especially after the liberation. The development of canals, bridges, culverts, embankments, etc. has led to significant changes in the flood mechanism of the region. Since 1996, the Mekong Delta has constructed irrigation, transport works and residential areas, developed flood control planning, issued the policy of living with the flood, etc. and a large-scale flood control system has been introduced. This system has partly been efficient in limiting the pressure of the flooding in the subproject area.

The awareness of floods has been continuously improved. Besides the flood's negative impacts, its positive impacts have been recognized and exploited. With the benefits from the floods, the production development and land use planning do not aim to eliminate the flooding, but to limit flooding as calculated by each area. Flood zoning and development of a flood drainage corridor are carried out. There are two levels of flood adaptability, living with floods and flood control. But not only these levels are applied, works construction measures are also applied.

Due to the changes of the subproject area's terrain, the hydrological regime has had adverse impacts on flood prevention and control. Water levels in Chau Doc, located in one end of the subproject area in 2011 reached +4.27 while water levels measured in another end of the subproject area, Khanh An reached +5.44 (*Figure 22* and *Figure 23*). The significant difference between these two locations of water levels led to the increased flow within the area, causing landslides of the dike sections, as well as, of infrastructure works in the area.

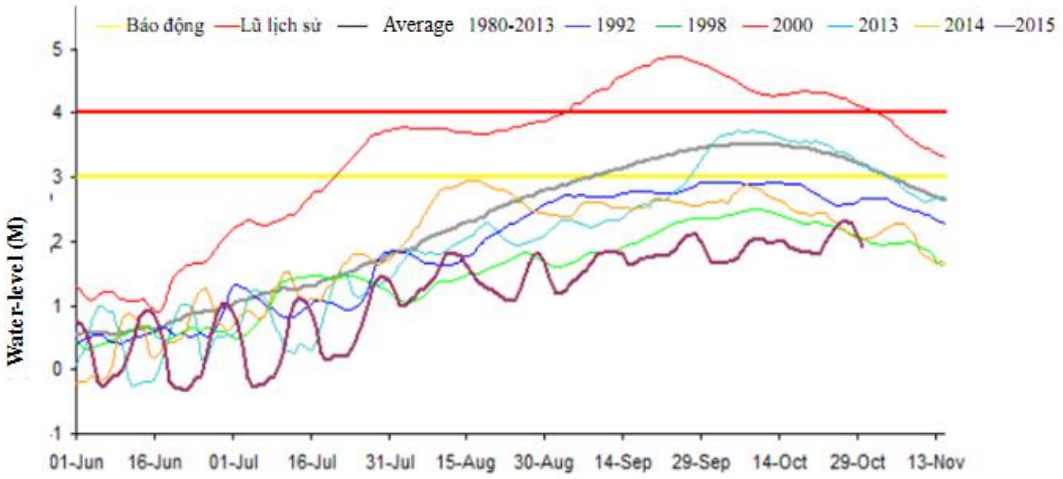


Figure 22: Hau River's daily average water-level in rainy season in Chau Doc station, Period: 1/6 - 30/10/2015 (Source: MRC, 2015)

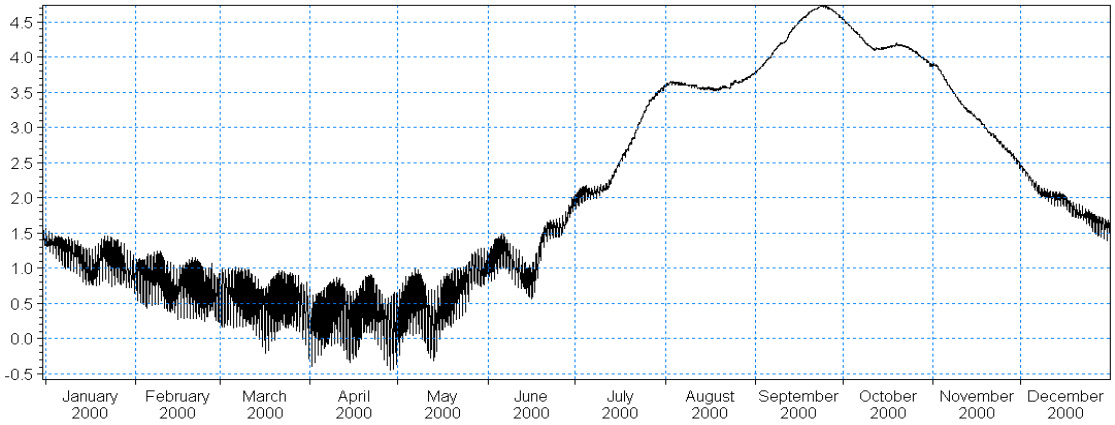


Figure 23: Hau River's hourly water-level in Chau Doc station in 2000 (Source: SIWRR, 2013)

2.1.1.6. The flood situation in the region

An Giang province is located in the Mekong upstream flowing into Vietnam, so by nature, from July to November, upstream floods submerge the region annually.

To be active in production, the areas to be full dike recently have initiated a basic control of inundation and flooding. However, due to large rainfalls, local flooding in the diked areas then flood and farmers have to pump water from their fields to canals (*Figure 24*).

Figure 24: Pumping water from diked areas to canals in flood reason

In the areas where dikes are only semidikes (low dikes for early flood control), the main flood still occurs annually, affecting the production and quality of life for the people. In the three

subproject communes, because the dike embankment has not been strengthened thoroughly, large areas of natural land typically become deeply flooded during the flood season. In the flood reason of 2000, the whole area was flooded 2 - 3m deep (*Figure 25*).

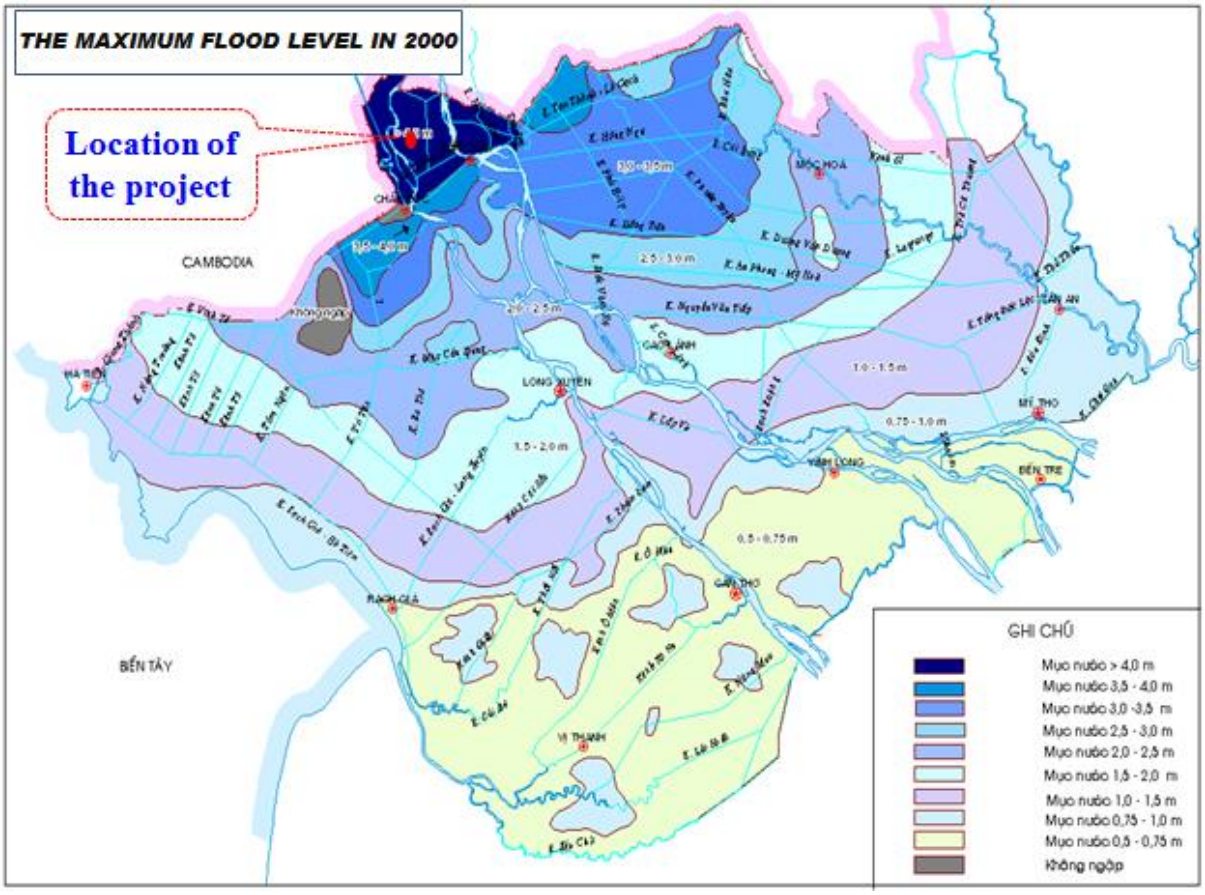


Figure 25: The maximum flood level in 2000 in the Mekong Delta. Source: SIWRR, 2013

River systems and canals in the project area

Being the agricultural production areas, the canals system has an important role in water supply for production in the dry season, flood drainage in rainy season as well as transportation of agricultural products.

Hau river is the large river flowing along An Phu district with average width of about 150-400 meters and is the important waterway transportation routes in the region. It also plays the role of the main flood drainage route of the Mekong River.

In the area of the three communes in Eastern Hau river, the canal system fully meets the needs for production. To the east, it is the Bay Xa canal which runs along 3 communes river region with the width of 30 - 50 meters. This is the main flood drainage route, and at the same time, this waterway ensures the waterway traffic route for boats and ships with a load of from 100 to 300 tons.

Crossing the subproject area, there are canals including Bay Truc canal, Vinh Loc canal, Vinh Loi canal, Vinh Hau canal which connect the Bay Xa canal to Hau river. These canals are also flood drainage canals from the border to the Bay Xa canal and leads to the Hau river. These canals have the width of from 20 to 50 meters which ensure the traffic flow of boats and ships from 50 to 100 tons.

The ending point of sub-project area is Xang canal with the width of 100-150 m which is an important waterway. This is also a flood drainage route from the Bay Xa canal area to Hau river. This canal is also the important waterway for boats and ships from 100 to 500 tons.

To the inner field side, there is a series of small canals with the width of 2-4 m which mainly play role of water supply for agricultural harvest production and transportation of agricultural products as well as materials for production activities.

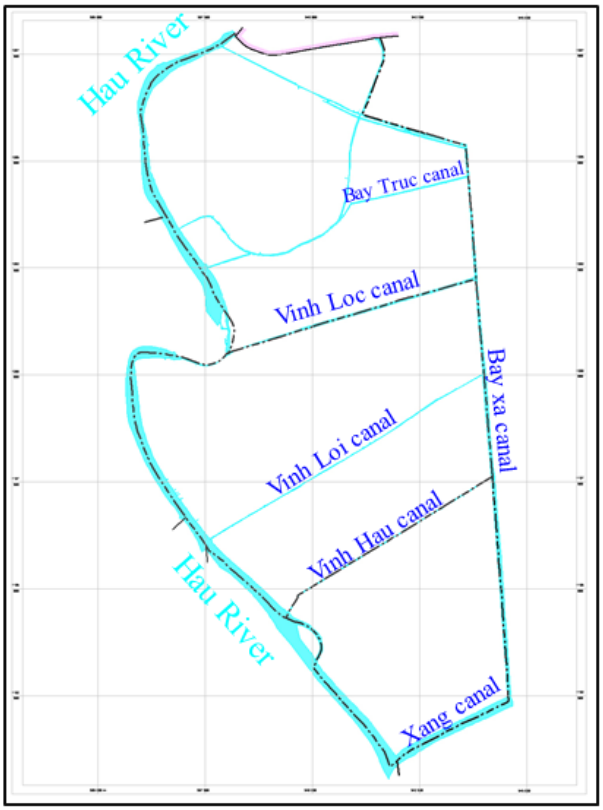


Figure 26: Map main canal in the subproject area

Bay Xa Canal

Vinh Hau Canal

Current situation of environmental quality in subproject area

2.1.1.7. Air Quality

To evaluate the air quality of the subproject area, the Consultants carried out the survey, measurements and sampling of the environmental components.

To assess the air quality in the subsubproject area, 8 air samples were collected where the culvert will be built and at the residential areas near the culvert (see locations in Figure 27).

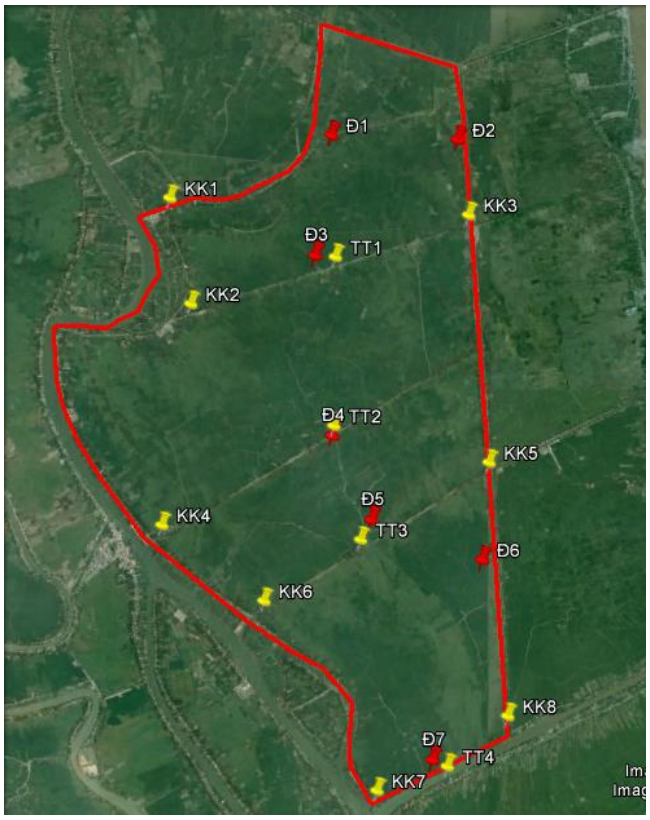


Figure 27: Air (KK), Soil (Đ) and sediment (TT) sampling stations

To assess the air quality in the construction areas, the Consultant took 8 air samples at the locations near the dike to be built and also close to the residential areas (Figure 1 page 24, the coordinates of the locations are included in the appendix). The measurement and analysis results of the air environment in the region are shown in *Table 16*, we can see that the ambient air quality in the region is very good. The concentration of air pollutants are much lower than the standards (QCVN 05:2013/BTNMT). The relatively low noise ranges at 56.5 - 64,2dB, which is within the standards (QCVN 26: 2010/BTNMT).

Table 16: Analytical Results Of Ambient Air Samples

Label	T°C	Humidity	TSP	NO_2	SO_2	CO	Noise (dB)		
	T^0C	%	µg/m^3				Avarage	Max	Min
KK1	30.6	81	86	22	17	830	60.4	72.1	46.4
KK2	31.9	83	140	24	29	1300	61.4	76.4	47.3
KK3	31.1	85	80	31	17	950	56.5	73.1	42.5
KK4	31.9	81	160	34	25	1200	64.2	78.6	46.4
KK5	30.7	83	94	21	22	1300	58.7	70.4	41.1
KK6	30.4	79	110	27	28	1400	58.4	76.8	47.2
KK7	30.9	77	140	43	24	1400	61.7	80.3	50.7
KK8	30.6	82	82	22	22	1200	60.1	76.4	45.2
QCVN 05:2013/BTNMT (1 hour)			300	200	350	30,000	-	-	-
QCVN 26:2010/BNTNMT			-	-	-	-	70	-	-

2.1.1.8. Soil and Sediment Quality

a. Soil Quality

To assess soil quality in the subproject area, thereby seeking factors that may cause adverse environmental impacts to land in the subproject area, and as a basis for proposing a reasonable solutions both in the construction phase and in the operation phase, soil samples were collected at 7 stations (Figure 27) (1 station took 3 samples at 3 soil layers: 1st layer depth of 0-20 cm, 2nd layer depth of 50 - 70 cm, 3rd layer depth 1.3 - 1.5 m). The analysis and results of the soil environmental quality are shown in *Table 17*.

Table 17: Analytical results of soil quality

N^0	Label	Layer	pH_{KCl} (1:5)	EC (1:5)	Humity	TN	TP	SO_4^{2-}	$Fe_{TĐ}$	Cl^-	Cd	Hg	Pb	As	Cu	Zn
				mS/cm	*%*			mg/kg								
1	Đ1	T1	5.18	108.5	1.63	0.15	0.030	10.6	51.5	4.7	0.014	ND	1.02	0.25	5.2	52
2		T2	5.19	82.5	2.03	0.17	0.030	8.5	70.5	3.1	0.027	ND	0.84	0.31	6.4	41
3		T3	4.92	76.9	1.52	0.16	0.030	8.2	71.0	2.6	0.011	ND	0.57	0.22	8.1	67
4	Đ2	T1	4.46	186.3	3.25	0.16	0.030	13.8	236.1	8.3	0.028	ND	0.61	0.27	7.4	34
5		T2	4.88	120.7	1.63	0.21	0.040	11.4	154.2	5.2	0.013	ND	0.55	0.34	6.8	26
6		T3	5.12	93.9	0.93	0.17	0.040	9.3	68.5	3.1	0.007	ND	0.81	0.24	7.4	51
7	Đ3	T1	4.34	238.0	4.55	0.15	0.030	31.8	206.2	8.3	0.015	ND	0.73	0.41	5.8	43
8		T2	4.62	195.1	3.75	0.15	0.030	33.2	155.0	9.9	0.018	ND	1.21	0.22	6.3	29
9		T3	4.79	150.4	2.17	0.13	0.020	14.4	115.3	6.8	0.022	ND	0.37	0.37	7.1	51
10	Đ4	T1	6.36	178.5	2.24	0.16	0.050	22.1	73.5	6.8	0.037	ND	0.24	0.41	8.6	64
11		T2	4.96	247.0	2.37	0.16	0.030	35.4	87.5	7.8	0.041	ND	0.61	0.56	5.7	27
12		T3	4.88	221.0	2.87	0.13	0.020	30.7	96.0	5.2	0.054	ND	0.53	0.42	9.2	35
13	Đ5	T1	5.24	121.8	3.84	0.11	0.030	9.9	55.6	10.4	0.021	ND	0.68	0.56	3.6	46
14		T2	5.29	129.3	4.65	0.16	0.040	13.7	32.7	7.8	0.017	ND	0.52	0.27	4.4	29
15		T3	5.53	99.2	1.15	0.16	0.030	12.2	60.1	5.2	0.033	ND	0.61	0.38	5.9	41
16	Đ6	T1	4.74	103.0	2.81	0.18	0.030	14.1	55.2	7.4	0.019	ND	0.55	0.21	7.2	34
17		T2	4.61	127.0	2.64	0.11	0.020	16.4	47.6	7.2	0.022	ND	0.37	0.64	3.8	71
18		T3	5.17	114.0	1.16	0.13	0.030	13.7	58.1	8.6	0.017	ND	0.64	0.54	6.2	52
19	Đ7	T1	5.88	181.3	2.49	0.19	0.040	22.8	43.0	8.8	0.024	ND	0.53	0.26	7.2	48
20		T2	5.69	146.7	3.72	0.14	0.020	14.3	36.9	8.8	0.041	ND	0.38	0.24	5.9	64
21		T3	5.62	165.9	1.63	0.17	0.030	21.9	57.5	8.3	0.034	ND	0.24	0.31	6.3	73
QCVN 03:2008/BTNMT (For Agriculture)											2	-	70	12	50	200

The results of the soil samples show that the heavy metal contents are below the thresholds as defined by the national technical regulations on soil quality (QCVN 03/2008/BTNMT for Agriculture). The data analysis also showed the EC value in all soil layers between 0-1.5 m in the region ranges at 76 - 247µs/cm, and belong to the soil group that is not completely saline. The pH values measured in the soil samples are shown that (*Figure 28* and *Table 18*). There are no significant differences between pH values in most of the soil layers which contain a moderate to neutral acidity, except one sample at D3 where the pH value in the 1st soil layer is lower than 5.5 but not too low. With such soil properties, the risk is minimal for any acide soil washing within this region by the construction of the dike embankments or by the embankment filling for the shrimp ponds.

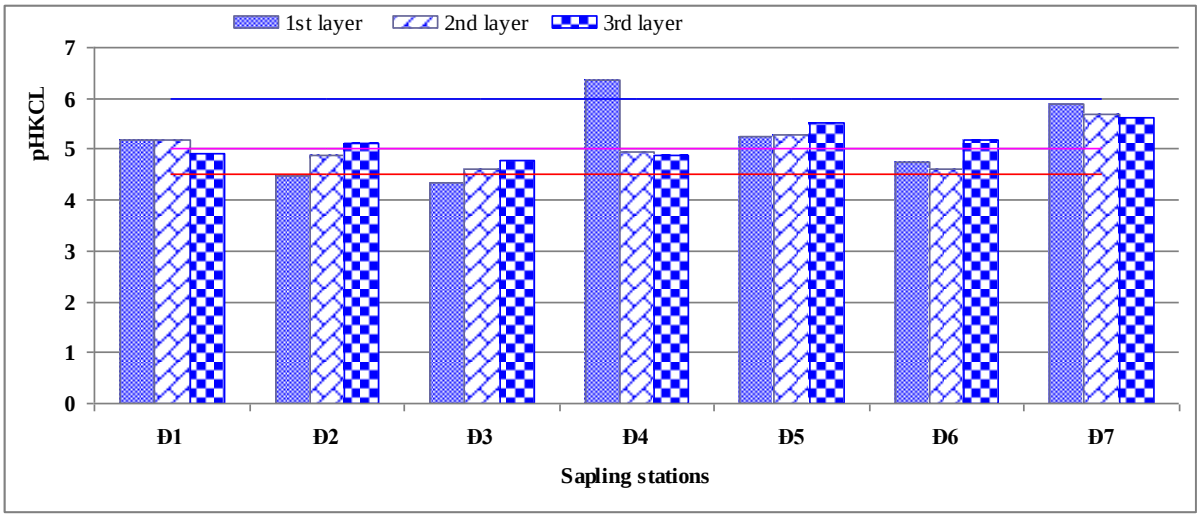


Figure 28: pH values of the soil samples in the subproject area

Table 18: Soil acidity clasification

TT	pH_{KCl}	Level of soil acidity
1	< 4.0	Extremely acid
2	4.0 – 4.5	Very strongly acid
3	4.5 – 5.0	Moderately acid
4	5.0 – 6.0	Slightly acid
5	6.0 – 7.0	Neutral
6	> 7.0	Alkaline

Source: Le Van Khoa, 2000

b. Sediment Quality

To assess sediment quality in the subproject area, thereby seeking factors that may cause adverse environmental impact to the land in the subproject area, a basis for the proposed reasonable solutions in both the construction phase and operation works phase was derived from 4 sediment sample stations (Figure 27). The analysis results of the sediment quality is shown in *Table 19*. To assess the bottom sediment quality of the canals in the construction areas of the works, the Consultant undertook 4 soil samples of bottom sediment (Figure 1 Page 24, the coordinates of the locations and the details are included in the appendix). The analysis and results of the soil quality is shown in *Table 19*.

The results of sediment reveal heavy metals in the sediment samples to be below the thresholds as defined by the national technical regulations on soil quality (QCVN 43/2008/BTNMT).

The data also shows the pH values of the sediment samples. In most samples, the acid levels are minimal and the pH value is close to the alkaline soil. This is advantageous if the subproject dredges sediment from the cannals to embankments.

Table 19: Analytical Results Of Sediment Quality

N^0	Label	pH_{KCl} (1:5)	$Fe_{TĐ}$	Cd	Hg	Pb	As	Cu	Zn
			mg/kg						
1	TT1	5.89	39.5	0.3	KPH	0.59	0.27	6.13	62,1
2	TT2	5.91	33.5	0.4	KPH	0.47	0.35	7.31	74,5
3	TT3	5.58	46.7	0.3	KPH	0.54	0.42	5.2	47,9
4	TT4	5.8	35.9	0.4	KPH	0.61	0.25	8.17	55,3
QCVN 43:2008/BTNMT				3.5	0.5	91.3	17	197	315

2.1.1.9. Water Quality

a. Surface Water Quality

To assess surface water quality in the subproject area, thereby seeking factors that may cause adverse environmental impacts, surface water samples were collected at 10 stations (Figure 29) (1 station took 2 samples: at high tide and low tide).

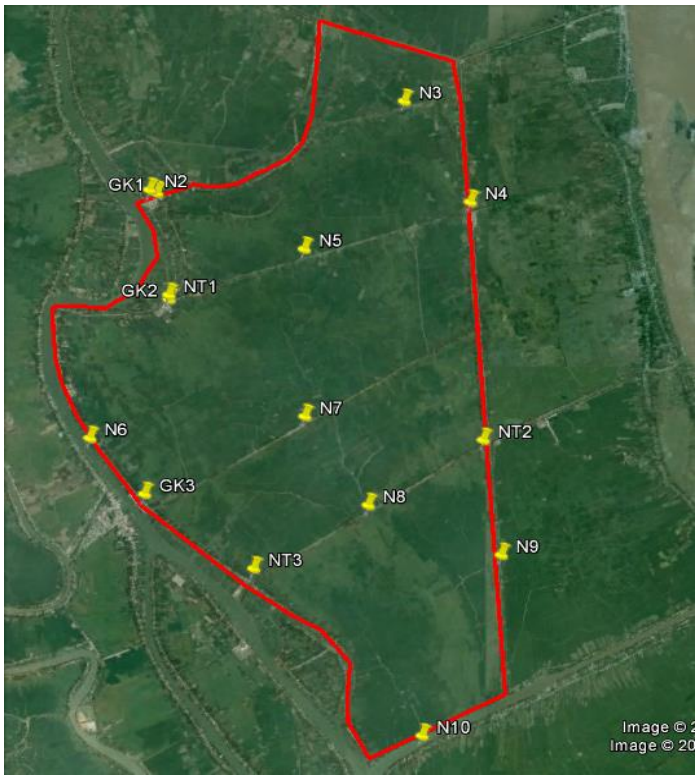


Figure 29: Surface water and aquatic organism (N), Wastewater (NT) sampling stations

The analytical results of surface water quality in the area in *Table 20* showed that the water quality in the region is quite good. The water is not affected by any adverse acidity (pH values range from 6.36 to 6.94 meeting the environmental regulations in Column A1 of QCVN 08:2008/BTNMT). Many parameters meet the environmental regulations in Column A, as well as, the environmental regulations of Column A1.

Separately, the TSS value in the water fluctuates at 60.7 to 188.1 mg/l, meeting the environmental regulations in Column B2 and in many locations the TSS value does not meet the environmental regulations in Column B2. However, it is natural and in the flood season upstream waters bring in alluvials, which is a main reason for the high TSS values in the water.

The coliform values in the water are quite high, but are within the environmental regulations of Column A, except location N2 and N9 where at peak tide the coliform values exceed the environmental regulations for surface water quality in Column A2, specifically because the environment sanitation in the region is not good.

Referring to the monitoring results in the Chau Doc River measured by the Environmental Monitoring Center of An Giang Province (MH2 in Chau Doc River upstream and MH3 in Chau Doc River - which borders on Cambodia as shown in *Table 21*.

Table 20: Analytical results of surface water samples

N^0	Code of Sampling position	Tide	Tur.	EC	pH	DO	BOD_5	COD	TSS	$N\text{-}NH_4^+$	$N\text{-}NO_2^-$	$N\text{-}NO_3^-$	$P\text{-}PO_4^{3-}$	Fe_{TS}	Cl^-	Total Coliform
			NTU	*µS/cm*		*mgO_2/l*			*mg/l*							*MPN/100 ml*
1	N1	Low	79.3	122	6.69	5.6	4.7	9.1	95.1	0.097	<0.01	1.225	<0.01	1,330	11.0	3300
2		High	64.1	137	6.86	5.9	4.9	9.7	72.5	0.094	<0.01	1.318	<0.01	1,240	12.4	2600
3	N2	Low	99.40	130	6.36	6.6	5.3	10.8	116.2	0.177	0.015	1.128	<0.01	1,525	9.0	4900
4		High	71.3	123	6.75	5.9	7.0	14.5	85.9	0.223	<0.01	1.188	<0.01	0,781	9.0	24000
5	N3	Low	87.3	141	6.70	6.1	2.3	4.5	104.8	0.149	<0.01	1.170	<0.01	1,155	11.0	1700
6		High	68.4	152	6.91	5.9	2.2	4.2	80.1	0.024	<0.01	1.275	<0.01	1,318	13.7	1700
7	N4	Low	63.8	144	6.62	5.7	7.0	14.1	76.1	0.120	<0.01	0.754	<0.01	1,194	11.0	3300
8		High	68.4	134	6.72	5.4	4.2	7.1	78.4	0.174	<0.01	0.864	<0.01	1,620	10.5	2800
9	N5	Low	75.0	154	6.68	6.0	4.6	8.7	89.9	0.313	<0.01	1.233	<0.01	1,030	11.0	3300
10		High	62.1	124	6.78	5.5	6.0	12.1	74.9	0.141	<0.01	0.751	<0.01	0,911	11.0	1300
11	N6	Low	73.40	131	6.53	6.8	3.4	5.4	87.0	0.109	<0.01	0.856	<0.01	1,100	11.0	1100
12		High	72.70	128	6.62	6.0	5.3	10.9	86.7	0.102	<0.01	1.181	<0.01	0,808	11.0	2700
13	N7	Low	63.40	118	6.86	5.8	5.4	10.7	82.1	0.103	<0.01	1.370	<0.01	0,840	10.8	1800
14		High	58.10	126	6.94	5.4	5.8	11.4	70.6	0.124	<0.01	1.240	<0.01	1,370	11.7	1500
15	N8	Low	60.10	123	6.71	6.2	4.2	8.4	72.4	0.092	<0.01	1.050	<0.01	0,840	10.2	2400
16		High	55.40	127	6.82	5.5	5.1	10.1	60.7	0.131	<0.01	1.270	<0.01	1,250	11.8	3500
17	N9	Low	101.00	136	6.55	5.2	6.4	12.9	119.8	0.165	<0.01	1.177	<0.01	1,393	11.0	4900
18		High	95.20	131	6.77	5.9	5.3	10.5	80.6	0.153	<0.01	1.640	<0.01	1,610	12.1	7200
19	N10	Low	159.00	118	6.52	5.2	5.7	11.5	188.1	0.122	<0.01	1.850	<0.01	2,585	11.0	2700
20		High	92.7	129	6.62	5.6	4.8	9.3	115.3	0.147	<0.01	1.520	<0.01	1,33	9.4	1300
QCVN 08:2008/BTNMT																
Colum A1					6-8.5	≥ 6	4	10	20	0.1	0.01	2	0.1	0.5	250	2500
Colum A2					6-8.5	≥ 5	6	15	30	0.2	0.02	5	0.2	1	400	5000
Colum B1					5.5-9	≥ 4	15	30	50	0.5	0.04	10	0.3	1.5	600	7500
Colum B2					5.5-9	≥ 2	25	50	100	1	0.05	15	0.5	2	-	10000

Table 21: Surface water quality on Chau Doc river

Parameter	Unit	March 2015		June 2015		Sep /2015		QCVN 08:2008/BTNMT			
								A		B	
		MH2	MH3	MH2	MH3	MH2	MH3	A1	A2	B1	B2
T^0	^0C)	29.9	30.8	28.4	28.2	26.8	27.1				
pH		7.57	7.31	7.08	7.12	7.04	6.79	6-8.5	6-8.5	5.5-9	5.5-9
DO	mgO_2/l	5.60	5.92	6.12	6.06	5.03	5.12	≥ 6	≥ 5	≥ 4	≥ 2
TSS	mg/l	56	63	28	81	124	115	20	30	50	100
COD	mg/l	8	8	8	12	14	11	10	15	30	50
BOD_5	mg/l	5	5	5	8	9	7	4	6	15	25
$N\text{-}NO_3^-$	mg/l	0.351	0.051	0	0	0.012	0.020	2	5	10	15
$P\text{-}PO_4^{3-}$	mg/l	0.057	1.030	0.104	0.087	0	0.08	0.1	0.2	0.3	0.5
Coliforms	MPN/100ml	9300	2300	90	46000	9300	2400	2500	5000	7500	10000
As	mg/l	1.51	-	0	-	0.0021	-	0.01	0.02	0.05	0.1
Pb	mg/l	0	-	0	-	0.0026	-	0.02	0.02	0.05	0.05
Hg	mg/l	0	-	0	-	0	-	0.001	0.001	0.001	0.002

Source: The Environmental Monitoring Center An Giang DONRE, 2015

The Environmental Monitoring Center of An Giang province has an automatic measurement station in the Binh Di River, at the town of Long Binh, in An Phu district. The monitoring results from 2010-2014 are presented in Figure 30, Figure 31, Figure 32, Figure 33 showing that the surface water quality in Binh Di River (Long Binh Town) in 2014 is relatively good for the parameters such as pH, DO, which are mostly achieved or approximated of QCVN 08: 2008/BTNMT- Surface Water Quality – Collumn A1. The water turbidity is high, especially in the flood season, but this is natural due to flood alluvials and the affect on the water quality is considered insignificant.

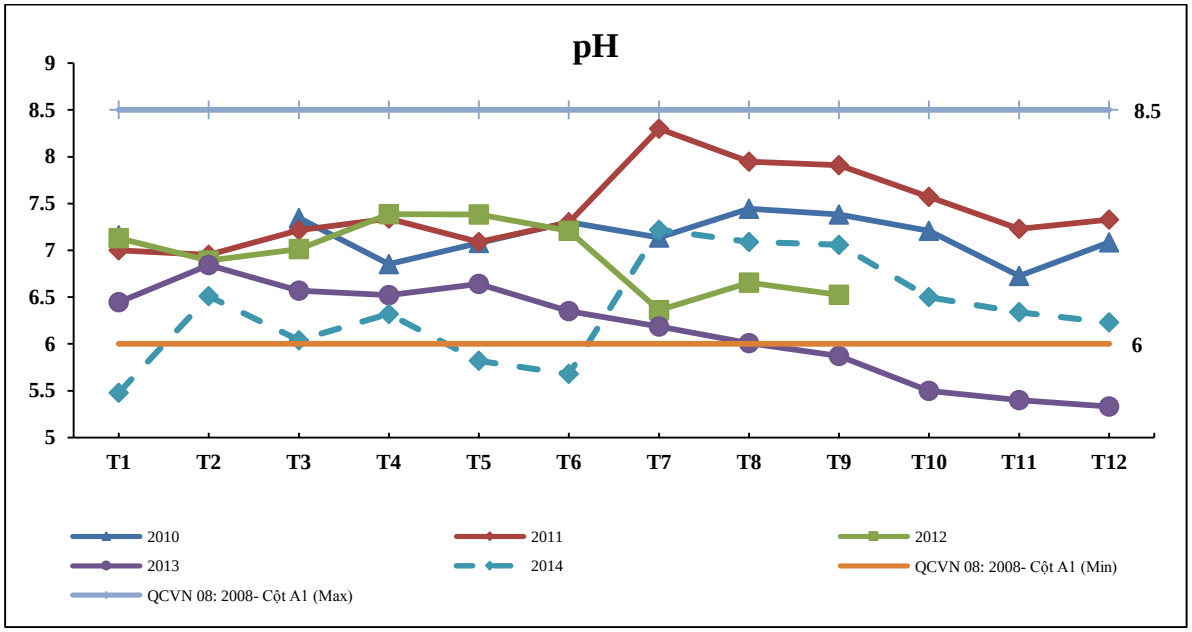


Figure 30: Monthly average fluctuations of pH values in 2010 - 2014 at Hau River upstream station (Long Binh town, An Phu district).

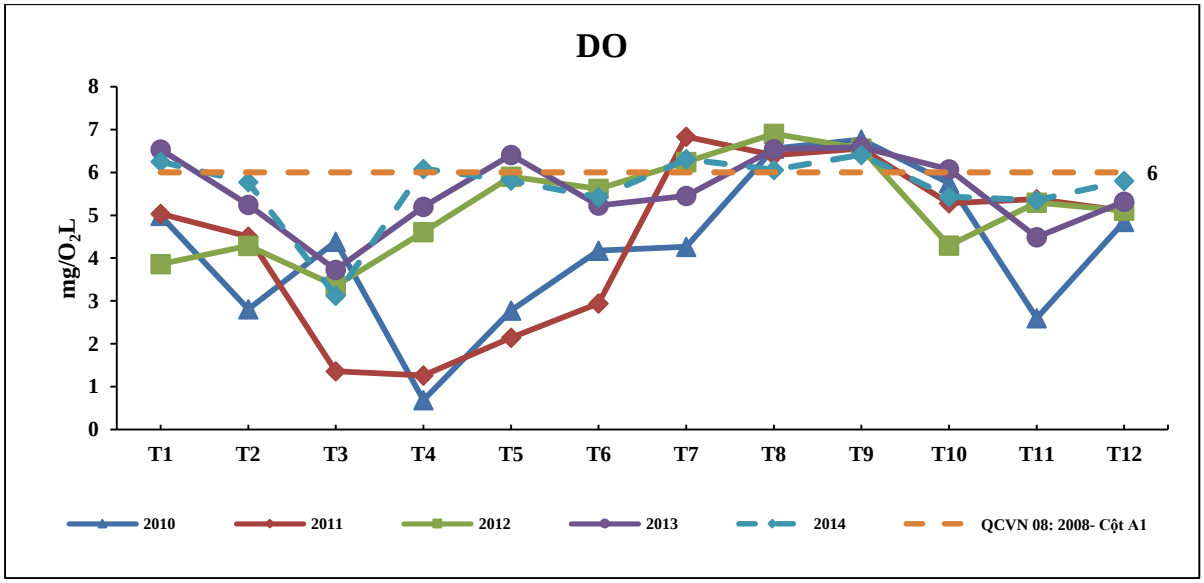


Figure 31: Monthly average values of DO values in 2010 - 2014 at Hau River upstream station (Long Binh town, An Phu district).

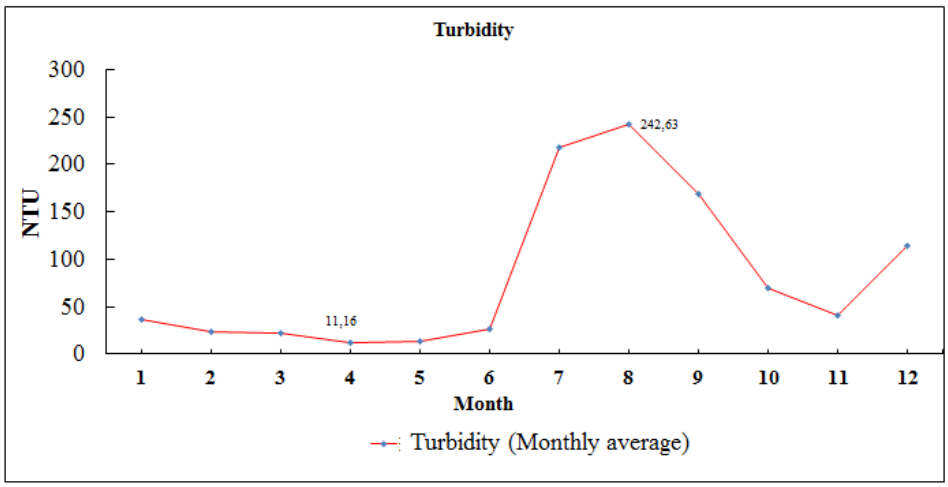


Figure 32: Monthly average trendss of turbidity values in 2014 at Hau River upstream station (Long Binh town, An Phu district)

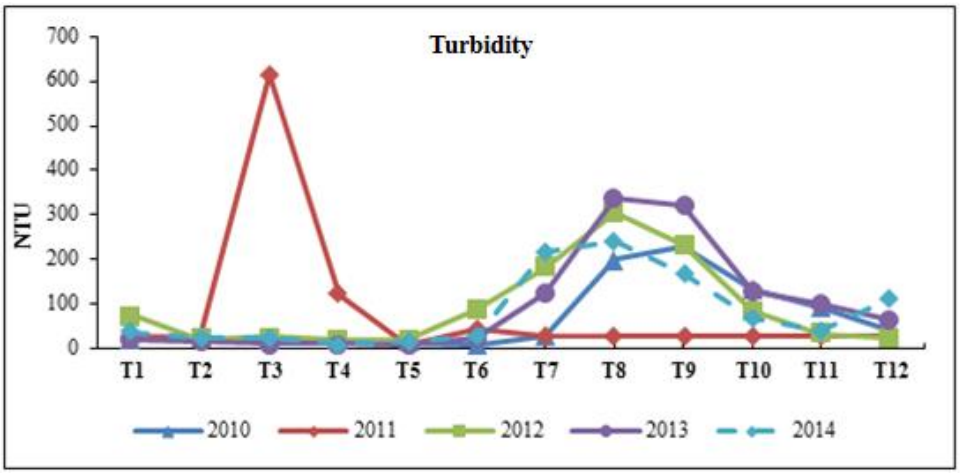


Figure 33: Monthly average trends of turbidity values in 2010 - 2014 at Hau River upstream station (Long Binh town, An Phu district).

c. Domestic Wastewater Quality

From the results in *Table 22* show the BOD5 values exceed the wastewater quality standards, Column A from 2.4 to 2.9 times and Column B from 1.4 to 1.7 times. Similarly, the coliform values are very high in excess of the domestic wastewater standard (QCVN 14: 2008/BTNMT) Column A from 2.4 to 11 times and Column B from 1.4 to 6.8 times. This shows the relatively low sanitation quality in the region.

Although the pollutants in domestic wastewater (BOD_5 and coliforms) are very high compared with the standards, they are largely dispersed in the residential areas. The amount of domestic wastewater is not significant, so its negative impact on the surface water quality in the region is not significant.

Table 22: Analytical results of domestic wastewater quality

N^0	Parameter	Unit	Locations			QCVN 14 : 2008/BTNMT	
			NT1	NT2	NT3	Colum A	Colum B
1	T^{0}C	^{0}C	29.4	9.8	30.4		
2	pH	-	6.21	6.84	6.56	5-9	5-9
3	EC	µs/cm	386	412	374		
4	DO	mg/l	1.87	0.92	2.35		
5	Đục	NTU	12.4	18.26	31.08		
6	TDS	mg/l	171	184	157	500	1000
7	H_2S	mg/l	0.105	0.047	0.082	1	4
8	Total hardness	mg $CaCO_3$/l	51	85	102		
9	TSS	mg/l	232	122.8	177	50	100
10	Fe_{TS}	mg/l	0.27	0.08	0.15		
11	BOD_5	mg/l	35	72	88.4	30	50
12	COD	mg/l	58.9	119.4	173.8		
13	TN	mg/l	6.77	4.18	7.34		
14	NH_4^+	mg/l	2.88	0.87	3.96	5	10
15	NO_2^-	mg/l	0.184	0.1434	0.1371		
16	NO_3^-	mg/l	2.69	0.85	2	30	50
17	TP	mg/l	0.52	0.47	0.76		
18	PO_4^{3-}	mg/l	0.13	0.27	0.31	6	10
19	SO_4^{2-}	mg/l	13.5	15.7	16.4		
20	Cl^-	mg/l	18.3	19.1	17.4		
21	Cd	mg/l	KPH	KPH	KPH		
22	Hg	mg/l	KPH	KPH	KPH		
23	Pb	mg/l	KPH	KPH	KPH		
24	As	mg/l	KPH	KPH	KPH		
25	Cu	mg/l	KPH	KPH	KPH		
26	Zn	mg/l	0.05	0.065	0.042		
27	Coliform	MPN/100ml	34,000	7,200	22,000	3,000	5,000

Current status of the biological resources

2.1.1.10.Terrestrial Biodiversity

This area has been exploited for agricultural development, particularly in the surrounding areas which have 3-crops rice farming, thus, the biological resources in the area are quite limited, mostly of plants and livestocks used for rice farming. Perennial plants are available such as mango, coconut, jackfruit, banana, orange, eucalyptus, bamboo which are often grown in the upper ground flood area; in the flooding areas are mainly paddy rice, weeds on the slope fo the embankments; some areas, the local people grow peanuts, vegetables, chilly ... The domestic animals are raised including cows, pigs, chickens, dogs and cats. Wild animals which can be observed including water snakes, mice, sparrows which are common species.

According to a survey of local people, there are not many wild birds flying through the sky or foraging in the area.

Figure 34: Rice and upland crops in the Subproject area

2.1.1.11. The aquatic status

The analysis of aquatic samples at the monitoring sites in the project area (Figure 29 P.56) obtained the following results:

a). Phytoplankton

The results showed that a total of 42 phytoplankton species belonging to 05 Division was found in the subproject areas. In which Chlorophyta is 18 species (42.9%), Cyanophyta is 10 species (23.8%), Bacillariophyta is 7 species (16.7%), Euglenophyta 5 species (11.9.%) and Chrysophyta is 2 species (4.8%)

Table 23: Phytoplankton in the subproject area

No	Species	Quantity (species)	Percentage (%)
1	Euglenophyta	5	11.9
2	Chrysophyta	2	4.8
3	Cyanophyta	10	23.8
4	Chlorophyta	18	42.9
5	Bacillariophyta	7	16.7
Total		**42**	**100**

b). Zooplanton

Result analysis of zooplankton species in the subproject describes show 23 species of zooplankton and 5 larva or other mature individuals, of which 6 species of Copepoda 48.5%, 17 species of Cladocera 51.5% (see *Table 24*).

Table 24: Zooplankton in the subproject area

No.	Species	Quantities (species)	Percentage (%)
1	Cladocera	17	51,5
2	Copepoda	16	48,5
	Total	**33**	**100**

c). Zoobenthos

The result of zoobenthos analysis illustrates (Table 25) 19 species belongs to 4 groups, in which Gastropoda is 7 species (36.8%), Mollusca is 4 species (21.1%), Oligochaeta is 5 species (26.3%) and Crustacae 3 species (15.8%).

Table 25: Zoobenthos in the subproject area

No.	Species	Quantity (species)	Percentage (%)
1	Oligochaeta	5	26.3
2	Gastropoda	7	36.8
3	Bivalvia	4	21.1
4	Crustacea	3	15.8
	Inserta	(5)	
	Total	**19**	**100**

d). Fish and fisheries

Survey data result obtained from the residential people shows that: due to the fishing activity in recent years is excessive, people use a lot of pesticides and fertilizer; therefore, in the dry season, fish and crabs on paddy field are very few.

In the canals, due to overexploitation by people, there is lack of fish and crabs. There are very few fishing activities on the canals. If the fishing activity is done, there is temporary for food service rather than for a living.

In the flood season: Flood water brings along many species of fish and aquatic species. Some people organize the exploitation of natural fish but not many. Common fish species are the snakehead fish, the perch fish, dark sand goby fish, color belt goby fish, thornback goby fish, farm eel, and loach fish, etc.

According to Dinh Minh Quang, 2009, when doing the survey for component of the fish species on Hau River in An Phu district, 68 fish species were identified belonging to 50 breeds, 29 families and 10 orders which is equivalent to 30% fish species in comparison with general fish components in the Mekong Delta.

Results from fishermen survey in February, 2016 showed that there have 16 species of fish and 4 species of Crustacea in An Phu district

Table 26: List of fish and Crustacea in the district

No	English name	Latin name
II	**Fish**	
1		*Wallago attu*
2	Bronze featherback	*Notopterus notopterus*
3	Climbing perch	*Anabas testudineus*
4	Broadhead catfish	*Clarias macrocephalus*
5	Walking catfish	*Clarias batrachus*
6		*Oxyeleotris marmorata*
7	Swamp eel	*Monopterus albus*
8		*Rasbora tornieri*
9	Iridescent shark-catfish)	*Pangasianodon hypophythalmus*
10	Bangkok river sprat	*Corica laciniata*

No	English name	Latin name
11	Tire track eel	*Mastacembelus favus*
12	Gray eel-catfish	*Plotosus canius*
13	Congaturi halfbeak	*Hyporhamphus limbatus*
14	Nile tilapia	*Oreochromis niloticus*
15		*Cynoglossus felmanni*
16	Jullien's mud carp	*Cirrhinus jullieni*
II	**Crustacea**	
17	Giant river prawn	*Macrobrachium rosenbergii*
18	Rough river prawn	*Macrobrachium equidens*
19	Riceland prawn	*Macrobrachium lanchesteri*
20	Freshwater crab	*Somaniathelphusia sinensis*

Table shows that there are no species of fish in the Red Book of Vietnam or IUCN which were caught in the canals.

The survey data also shows that sometimes, these fishermen caught fish namely Red tail catfish - cá lăng nha (*Hemibagrus wyckioides*), Giant catfish - Cá tra dầu (*Pangasianodon gigas*) but only in the Hau river and no one caught these fish in the subproject canals

2.1.1.12.Biodiversity around subproject area

In the diameter of about 10 km from the subproject area, there is no ecological sensitive areas, forests, or nature conservation concerns.

The neighboring provinces of An Giang and Dong Thap also have some areas.

This area has been exploited for agricultural development. Particularly, surrounding areas have applied 3-season rice farming, thus, biological resources in the area are quite limited, mostly plants and livestocks used for farming (*see Figure 34 pp.63*).

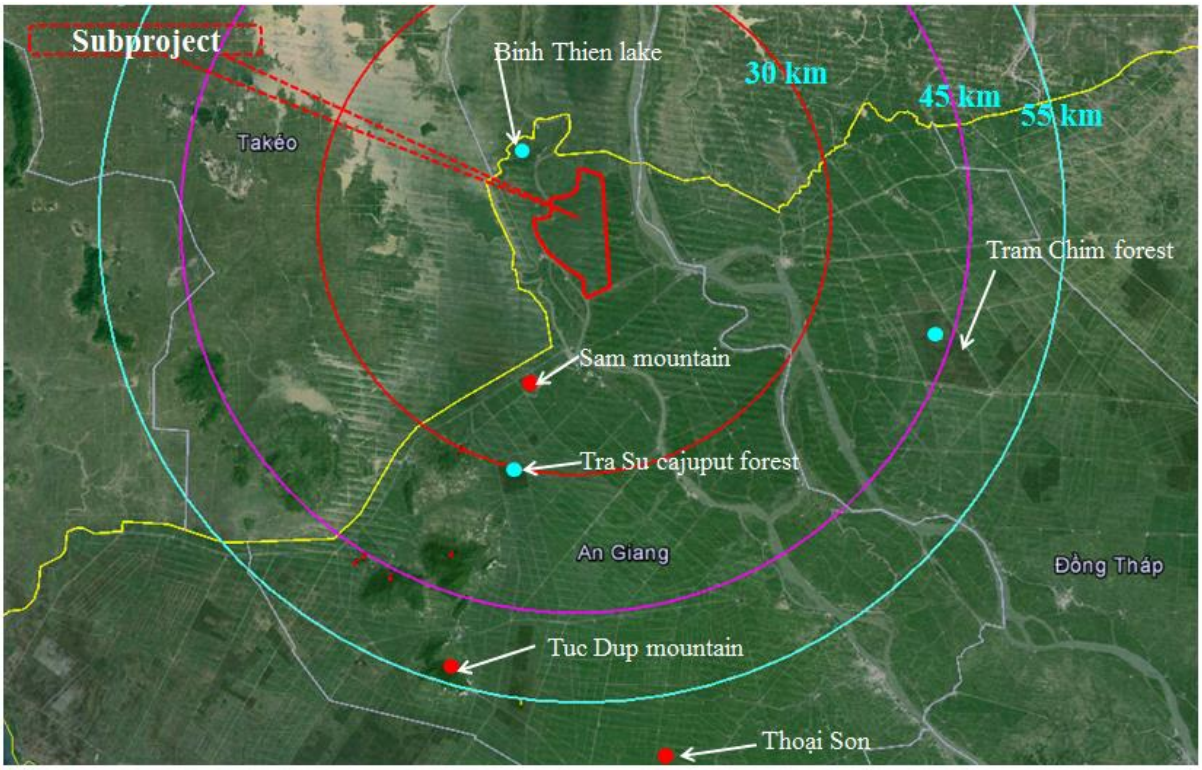


Figure 35: Some landscapes around the subproject area

An Giang has 4 protected landscape areas under Decision No.1107/QD-BTNMT dated 12/5/2015 by the Ministry of Natural Resources and Environment. This published list of protected areas in the An Giang province (see Table 27).

Table 27: The landscape protected areas in An Giang province

N^0	Name	Area (ha)	Owner
1	Sam mountain	171	An Giang PPC
2	Tuc Dup	200	
3	Thoai Son	370,5	
4	Tra Su	1.050	

a. Sam and Tuc Dup mountain forest

Sam and Tuc Dup mountain forest in the Bay Nui forest in An Giang province. It is considered a high biodiversity region with recent surveys identifying 815 species of plants (116 species of large trees, 149 species of medium trees, 208 species of shrubs, 105 species of vines, 178 species of grass, with 34 species of vascular plants, 25 parasite, epiphyte species).

b. Tra Su cajuput forest

The Tra Su cajuput forest is about 30km far from the subproject to the south, where there the natural ecosystem is of important scientific significance. It is the cradle, the food source, and the home to many animals, especially bird species. Identified is 11 species of mammals, and 70 species of birds, remarkable are the Indian storks, darters, and anhinga melanogaster which are all listed in Vietnam's Red Book. There are 20 species of reptiles and five species of amphibians. There are about 23 species of fish, including a fish group (10 species) that appear

throughout the year (and can suffer from acide conditions) and another fish group (about 13 species) that appears during the flood season (which cannot suffer from acide conditions).

c. Binh Thien Lake

Away from the subproject area about 6 km is Binh Thien Lake , which is defined as a high diversity of aquatic fauna. Binh Thien Lake is located in a territory of three communes (Khanh Binh, Nhon Hoi and Quoc Thai, all in An Phu district, of An Giang province) and it has no connection to Binh Di River. The lake area is about 174 hectares. The average water level is about 3.5m and about 6m high in the flood season. Binh Thien Lake is a good environment for tourism, fishing, aquaculture, cultivation and the water reservoir for domestic service. According to Le Cong Quyen, in 2015, there are 66 species of phytoplankton and 28 species of zooplankton identified in the Lake, which means low diversity. Although the subproject is located close to Binh Thien Lake (about 6km), it is not connected with Binh Di River. The subproject area links with The Hau river, so the subproject area has no connection with Binh Thien Lake.

d. Tram Chim – Dong Thap province

About 45 km to the southeast is the national bird park of Dong Thap province. Here is characterized by significant biodiversity.

About Animals: Tram Chim National Park has 231 water birds, 130 species of fish, 93 species of zooplankton, 90 benthic species, 15 mammals, about 44 species of amphibians and reptiles (Duong Van Ni, Tran Triet, 2010). Among the water birds, there are 16 species of birds listed in the Red Book of the IUCN at the levels of (EN, VU, R, T, V, E), with 14 species listed in the Red Book of Vietnam, 6 species on the list of endangered species, rare and issued together with Decree No. 32/2006/ ND-CP by the Government; 14 species in the CITES list. Flora species are abundant. There are 130 species of vascular plants and 185 species of phytoplankton.

2.2. SOCIOECONOMIC CONDITION

Economic condition

Being upstream of the Mekong Delta, the area is part of a vast river system severely affected by flooding, and it has a poor transport system, therefore the area's economy has not really developed. The main activity in the area is agriculture. *Figure 36* shows that in localities to the subproject area, 70-90% of natural land is used for agricultural production.

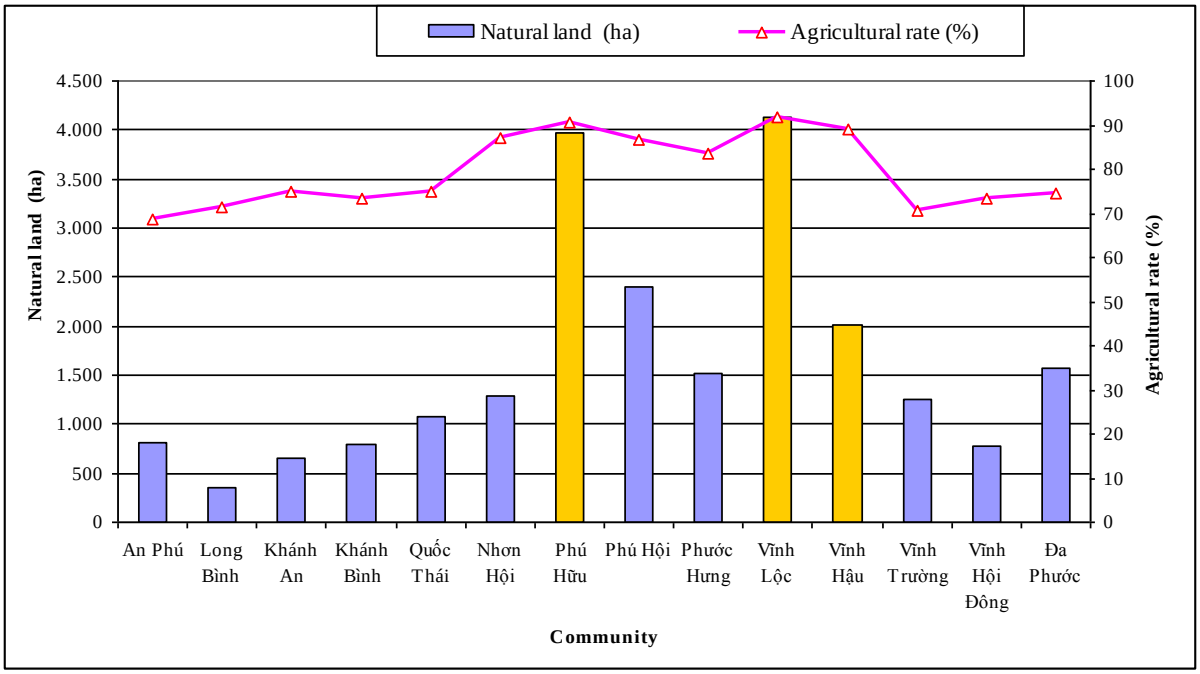


Figure 36: The natural land and rate of natural land used for agricultural production

Notably, in the three subproject communes, more than 90% of natural land is used for agricultural production. As being separated by the Hau River, these three communes seem to have no major business activities with the external market. The main production activity is the 2-season rice farming. In this farming system, season 1 (Winter-Spring) is from December to late February. After 4 weeks, season 2 (Summer-Autumn, or earlier, called Spring-Summer) begins in early April and ends in mid-July. Because in this area, there is no flood control system, certain limitations persist: The timing of seasons in this system depends on the water-levels, especially in the early season (mid-November), people must wait for the flood water to recede then they will pump out water. In the Summer-Autumn season, if the flooding comes earlier than the harvest time, rice will be submerged in water, causing losses to local people, as well as, an increase in the cost of harvesting.

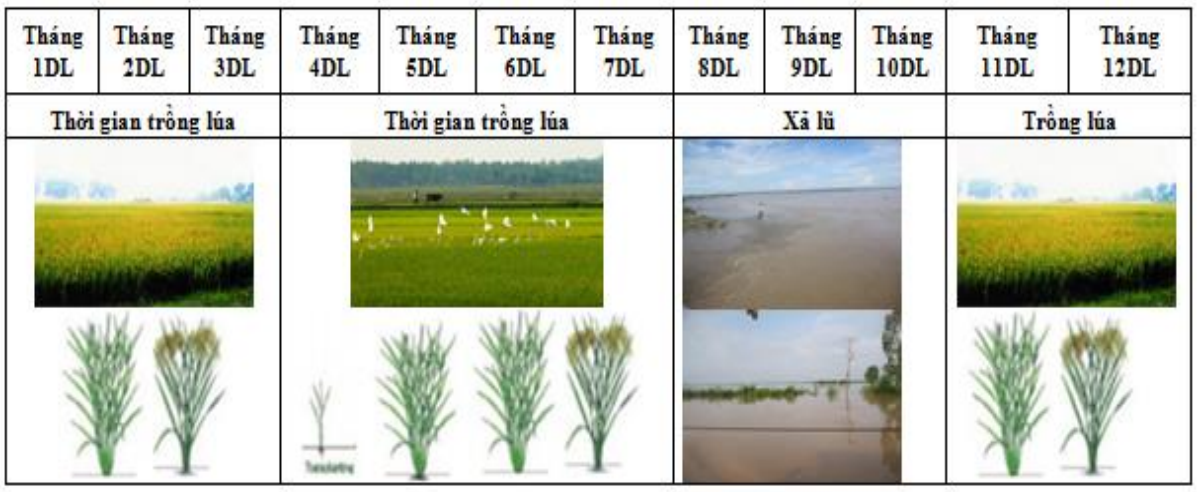


Figure 37: The time for 2 crops of rice production in flood-prone areas with semi dike

Table 28: Seasonal Calendar in Vinh Loi commune in the eastern part of the subproject area

Topics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Winter-Spring	x									x	x	x
Summer-Autumn			x	x	x	x						
Cash crops	x	x	x	x	x	x				x	x	x
Floods							x	x	xx	x	x	
Rain				x	x	x	x					
Capture fisheries							x	x	x			

The main activity in this area is agricultural production. The flood waters impact significantly production quotas, therefore, the local people's income is still quite low.

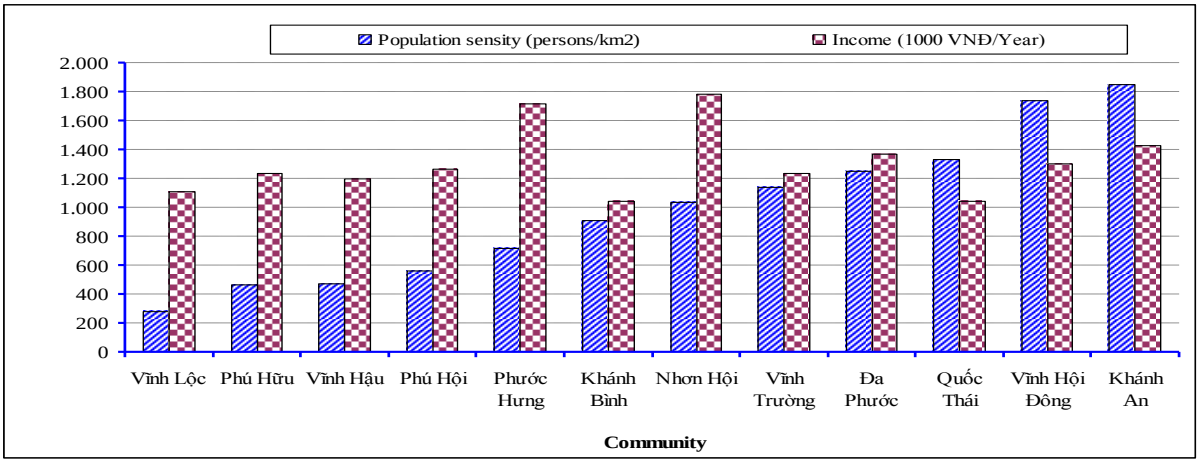


Figure 38: Relationship between population density and income in the suproject area

Error! Reference source not found. shows that, although Vinh Loc, Phu Huu, and Vinh Hau have the lowest population density among others in the subproject area, income per capita has had no breakthrough compared with the neighboring areas. This reflects that despite the rich land resources available, due to natural conditions and the inactive control of the floodwater by the local people, their income has not been improved.

The statistics also show that an average farming family of five members owning less than one hectare of rice land can be considered land-poor as the family cannot survive on the income from rice farming alone, whether it be double crop or triple crop farming.

According to the social impact assessment, the subproject's construction of works affects about 752 households primarily in the horizontal canals and along the Bay Xa canal. These areas are far from the commune center, but they are not in remote areas. Most of the affected households are farmers engaged in agricultural production, where people's income is quite low compared with the local average income.

The cattle feeding in the subproject area is insignificant. According to the Statistics in 2014, An Phu district has 823 buffaloes and 1136 cows, which are notably distributed evenly in the district.

This shows that it's necessary to control water level to ensure stable production and increase income for farmers and the investment in works shall be the first step to have a stable production.

Current livelihood models

Many types of livelihood activities appear in the An Giang province, but the rice cultivation remains the mainstream which absolutely occupies most of the land. Where there are no dike embankments, the cultivation implemented is only 2-rice crops and where there are dike embankments and flood overflows, 3-rice crops are implemented.

Floating rice has also been developed in the deeply-flooded areas in the Long Xuyen quadrangle. The Macrobrachium rosenbergii farming has been specially developed in that district area.

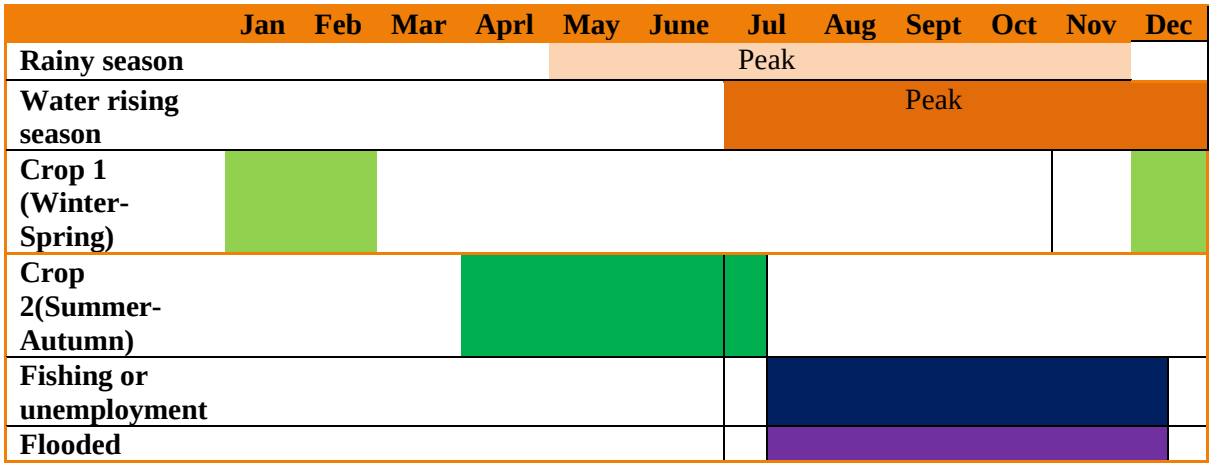
2.2.1.1. Double rice cropping

Although in An Giang many areas have full diked (high dikes for 3-rice crops) but some areas are still not fully diked.

3 communes in eastern of Hau River

In the double rice cropping system, the first crop (the Winter-Spring crop) is from December to end of February. After about a 4-week break, the second crop, (the Summer-Autumn crop, alternatively Spring-Summer) starts in early April and is harvested in the middle of July. In this system, land plots are also surrounded by dykes, with low ones at about 2 meters from the ground that allow floodwater to flow into the floodplain field after the harvest of the second crop. In the past, the second crop usually ended in August, so the low dykes became known as early flood protection dykes. The land is let to lie fallow and inundated for almost the entire flood season. At the end of November, when the water-levels recedes and the surface of the low dykes are exposed, farmers pump water out of their land plots to sow the Winter-Spring crop.

Table 7. Seasonal calendar of double rice cropping outside dykes



In this system, the field receives nutrient-rich sediments from the Mekong floodwater to replenish the soil. As floodwater overtops the low dykes, it flows in a sheet-flow regime, effective for flushing out toxins from the previous crops from the field. The sediments help reduce the use and cost of fertilizers and pesticides for the next crops, as the sediments act as natural fertilizers. Also in this system, rice stems tend to be stronger and less subject to diseases and pest attacks. The flooded field during the flood season is used for fishing for household consumption by the better off and for income by the poor or landless. Fishery resources in the flood season are considered common property and everyone has free access to it. This setting has socio-economic implications that enable the poor and landless to make a living. In this cropping system, water is pumped out from the field during the early part of the first crop (Winter-Spring crop) and pumped in after that at 2-week intervals. During the second crop

(Summer-Autumn crop), water is pumped in at every 2 week intervals as well. Water shortages and hot temperatures are the main issues with this crop.

This system has several drawbacks. Each farming household has to arrange water pumping on their own, something that is relatively inconvenient compared to the triple cropping system where large electric pump stations take care of irrigation for the entire large field inside a polder. The timing of crops in this cropping system needs to be flexible depending on floodwater fluctuations, especially at the start of the Winter-Spring crop, which has to wait for water to recede in order to pump water out of the field. The roads that are not heightened might be inundated at this time of the flood season, hindering transportation activities. The land is typically inundated annually, so households cannot develop fruit tree orchards behind their houses. When not protected by high dykes, the farmers either build their houses on stilts or dig a pond and use the soil to build a high mound for the foundation of the house. Household aquaculture and fish ponds require high dykes around them to protect from flooding.

2.2.1.2. Triple Rice Cropping

The actual timing of the crops varies several weeks from one place to another and from year to year. To visualize this calendar, **Error! Reference source not found.** presents a typical schedule for the triple cropping system.

Table 8. Seasonal calendar of My Quy commune, Thap Muoi district

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
Rainy season							Peak					
Water rising season							Peak					
Crop 1 (Winter-Spring)												
Crop 2 (Summer-Autumn)												
Crop 3 (Autumn-Winter)												

As shown in the Table 3 above, the timing of the three crops is as follows:

Crop 1 (Winter-Spring). In the second half of October, when water starts receding, farmers pump rainwater out of the polders to prepare the land and to sow seeds for the Winter-Spring crop.

Crop 2 (Summer-Autumn). After the harvest of the first crop in January, there is a break time of about 2 weeks before the second crop is sown. During this crop, water has to be pumped in from the surrounding canals into the field for an average seven times, at 2-week internals. The second crop is harvested at the end of May.

Crop 3 (Autumn-Winter). After a 2 week break, in mid-June the third crop is sown to be harvested at the end of September, coinciding with the peak of the annual flood. During this crop, rainwater also has to be pumped out of the field for an average 7 times, at 2-week intervals. Towards the end of the crop, the risk of dyke breakage and leakage increases with the rise of the water level. In Thap Muoi district, after the harvest of the third crop, water is released into the field until there is a layer of standing water about 60cm in low lying parts for about 20 days before it gets pumped out for planting the next crop. The higher grounds are,

however, not flooded. In Tan Hoi commune, Hong Ngu Township, no water is released into the field.

2.2.1.3. Floating Rice

Floating rice used to be a main staple food crop in the Plain of Reeds and Long Xuyen Quadrangle. The area of floating rice dwindled rapidly after 1975 due to the rapid expansion and intensification of short-term, high yield rice. From 0.5 million hectares before 1975, in 2012 the extent of floating rice shrank to about 60 ha in An Giang. The diversity of floating rice variety has also reduced from five to a single remaining variety at present. The 60 hectares in Vinh Phuoc commune, Tri Ton district, An Giang, the main place where floating rice is still being cultivated is an acidic low-lying area that is not suitable for short-term, high-yield rice. Research on floating rice farming system is being carried out by the Research Center for Rural Development (RCRD), An Giang University for restoration purposes.

According to RCRD (2014), soil in the floating rice field is softer and less heavy than the surrounding soils as it contains more organic material. In the 2014 flood season, the researchers found 49 plant species and 35 fish species, mainly white migratory fish, many of which are of high commercial value. The results show that floating rice field is rich in biodiversity[4].

The main reason for the disappearance of floating rice is its low yield and the long growth duration. A floating rice crop lasts for 6 months which is twice as long as the duration of common rice fetching a yield of 2.5-3.0 tons/ha, half of that of common rice.

In Vinh Phuoc commune, Tri Ton district, An Giang Province, the economic outcome for floating rice farming can be higher than that of triple rice cropping if floating rice is combined with other crops such as using the straws from floating rice for planting Chinese onion (*Allium chinense*). Similar conclusions on the financial advantages of combining floating rice with other cash crops were documented in a GIZ study (2014).

2.2.1.4. Giant Freshwater shrimp

Giant freshwater shrimp is raised in the floodplain fields that are without dykes or with low dykes during the flood season. Farmers consider shrimp aquaculture highly profitable, almost 3 times that from the flood season crop of rice, but at the same time risky. It requires a large investment to buy seed, feed, and building low dykes, which poorer households cannot afford. The profit fluctuates greatly with the market price from year to year and depends on the quality of seed and price of inputs. The yield of shrimp depends on the behavior of the floodwater. High floodwater saves farmers on the cost of feed, as shrimp can derive food from the floodwater. The length of the flood season is of crucial importance to shrimp yield. If floodwaters recede early, there is not enough time for shrimp to mature (5 months is required).

A closed low dyke system is required for retaining water at the end of the flood season. For shrimp farmers, the longer the inundation period the better as rice farmers want to pump water out to sow the next rice crop right after the floodwater recedes in order to expose the dykes. Although shrimp aquaculture is being encouraged by provincial and local authorities as an alternative to triple rice cropping, farmers still hesitate due to the risk and because of the large capital required for building the enclosing low dyke system (for retaining water) as well as buying seed and feed.

Aquacultured shrimps are fed with manufactured pellets and wild captured fish and snail. Farmers indicate that at present, there is no observable water pollution caused by effluent from shrimp aquaculture yet, as the area under shrimp aquaculture is small and floodwater can still flow freely during peak time. But they warned that scaling up might cause pollution in the future. At the end of the flood season when water levels are lower and the floodwater flow is weak, disease outbreaks can occur as water becomes polluted with the accumulated residues of feed and waste from shrimp farming. Shrimp aquaculture land plots downstream of other plots can be affected by the ones located upstream.

Social condition

The subproject area shall cover 14 administrative localities in the Phu district with a total population of 180,293, of which, urban population and rural population account for 88.1%, and 11.9%, respectively.

In terms of labor, this area has an abundant labor force with over 61% of the population is of working age. Although the population of working age is quite large, many workers have not been adequately trained. Only about 19.68% of the population in the working age has been trained. The rest have not been trained or have learnt by doing (*Table 29*).

Table 29: Summary of social information in the subproject area

N^0	Commune	Population	HH	Ethnic minorities	The rate of trained laborers (%)	Number kindergartens	Secondary schools	The number of health workers
1	TT. An Phu	11,765	2,925		15.49	1	2	8
2	TT. Long Binh	9,760	2,444		26.6	1	2	8
3	Khanh An	11,961	3,061		43.28	1	2	9
4	Khanh Binh	7,282	1,803	154	19.31	1	2	8
5	Quoc Thai	14,395	3,378	548	11.48	1	3	7
6	Nhon Hoi	13,449	3,238	444	14.27	1	2	9
7	Phu Huu	18,579	4,634		5.29	1	4	9
8	Phu Hoi	13,412	3,199		6.87	1	3	7
9	Phuoc Hung	10,992	2,759		29.19	1	2	8
10	Vinh Loc	11,627	3,133		46.07	1	2	8
11	Vinh Hau	9,478	2,457		14.94	1	2	9
12	Vinh Truong	14,309	3,871	549	28.02	1	2	6
13	Vinh Hoi Đong	13,560	3,455		9.36	1	2	8
14	Da Phuoc	19,724	4,719	453	17.48	1	2	8
	Total	**180,293**	**45,076**	**2.148**	**19.68**	**14**	**32**	**112**

Source: Statistical Yearbook of An Phu Distric in 2014

In terms of ethnic minorities, the subproject area has 8,138 people, accounting for 4,5% of the total. In the three communes East of the River Hau, there are no ethnic minorities. In Da Phuoc commune selected for model 5, there are 1,982 people. Basically, the influence of model 5 on ethnic minorities is negligible if the deployment of these models is thoroughly considered and prepared.

In terms of education, the subproject area has kindergartens, secondary schools and the district has 4 high schools (An Phu town has 2, and 2 others are located in Quoc Thai commune and Vinh Loc Commune).

Healthcare: All localities in the subproject area have healthcare centers (14 centers) and this area has 1 hospital, 1 regional healthcare center.

Technical infrastructure for agricultural production

In An Phu district, to protect the production, the dike embankment system is divided into two areas: area with the full-dike (Triple rice crops) and area with low dike (double rice crops)

Figure 39: Curent using land in An Phu District

Figure 40: The inundation status at main flood season (the righ area which full dike and the left which low dike)

a. Current status of the irrigation infrastructure in the three communes East of the Hau River

+ Culvert system cannot meet the requirements of early flood control. Most pile culverts are temporary without an opening or closing system or if this system is available, its operation is very difficult.

+ Embankments are not sufficient in terms of the elevation. Most of them have the elevation of +3,00 to +3,50m with small surface area of around 2.0m. Many segments are broken, eroded (especially after flooding sweeps through). They must be reinforced every year, and some are not strong enough to protect the land, causing the loss of farming land. Unclosed embankments require a lot of resources to reinforce after flooding sweeps through.

+ The main canal system has been eroded and some sections are deposited, affecting the stability of agricultural production (*Figure 41*).

Figure 41: Erosion in the subproject area

b. Transportation infrastructure

Transport system in the subproject area is underdeveloped due to the flood's impacts. Currently, only the road from Vinh Hau to Phu Huu commune East of the Hau River and the road in the South of Nhanh Tay canal are bituminous. Other roads can be used only in the dry season. Bridges on the main route are made of concrete and only small cars can cross. Others are mainly wood bridges used for primitive vehicles. The bridge's vertical height clearance is high, as they must exceed flood peak. Pedestrian circulation routes along the horizontal canals

linking from Hau River to Bay Xa commune is totally fragmented submerged during the flood season.

Traveling for the local people in the flooded areas is difficult, and it's not safe using waterway transport during the flood season due to high flow velocity and waves.

Figure 42: The trail belong to Vinh Loc canal

c. Erosion in the area

Due to the impact of flows annually, especially during the flood season when flow velocity is high, the erosion of embankments and dikes located near the edge of the canal with small clear zones occurs regularly and it has been more and more severe throughout most of the canals (*Figure 43* and *Figure 44*)

Figure 43: Erosion on Vinh Loc canal

Figure 44: Erosion on Vinh Loi canal

General comments: The data shows that infrastructure conditions remain very poor in the subproject area which cannot meet the production's effectiveness, therefore, the people's base incomes remains low. In addition, people must pay for the maintenance of the embankments and the roads after each flood season. The solution that solidifies infrastructure to stabilize the people's production is the necessary work that people will learn and apply which will also improve their incomes. And while production models consider floodwaters a natural resources, the works will transfer that advantage to benefit not only production quotas, but also to make improvements so that people can live better with the floods. It also helps people adapt to climate change and sea level rises in the risk of the regional flooding conditions which will increase in future years.

2.3. AFFECTED BY CLIMATE CHANGE AND SEA LEVEL RISE

Together with the Mekong Delta, the An Giang province is also heavily affected by climate change and sea level rise. The diking to control floods and the floods upstream flood will increase the water levels in the regional canals. If uncontrolled, the radical diking along with the complexity of sea level rises, the upstream floods will impact very negatively on the flooding conditions in the An Giang region in general and in the three subproject communes in particular.

The impact of the flood control embankment dike

2.3.1.1. Impact of low and high flood control dikes

As of 2012 in An Giang province, 617 areas of embankment cells were built which are responsible for the flood control of more than 254,210 hectares of rice fields, with then 281 sub-regions full dykes which control the flooding of more than 133,023 hectares, and for the 2- rice crop land an additional 336 sub-regions were full diked to control floods of 2,121,488 hectares (*Figure 45* and *Table 30*).

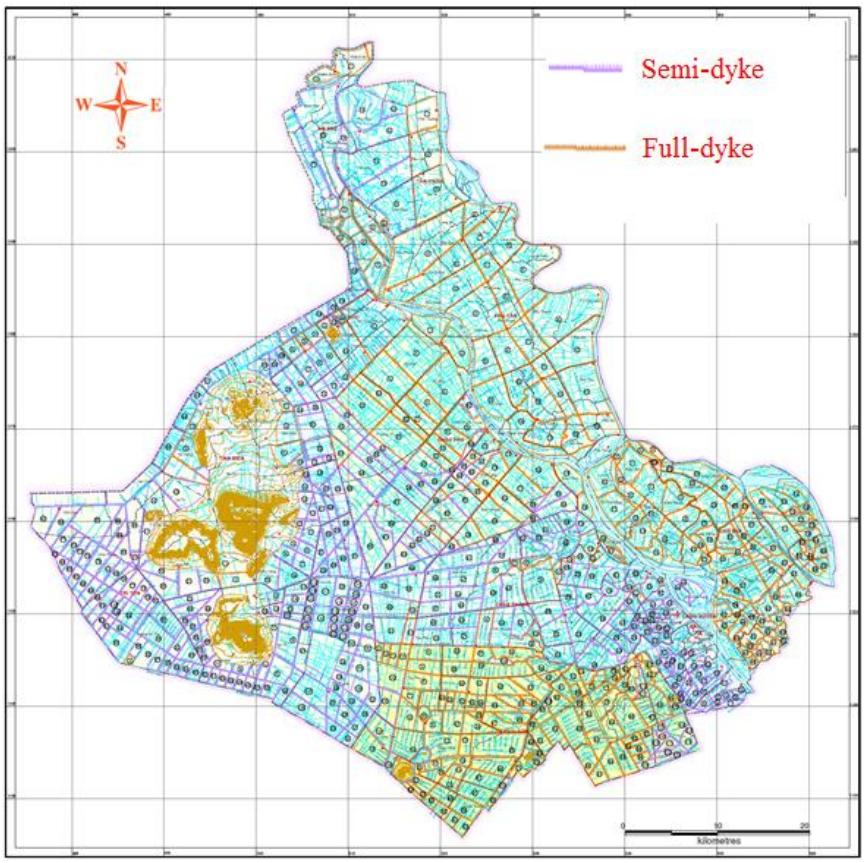


Figure 45: The dyke status in An Giang province in 2011 (SIWRR, 2012)

Table 30: The dyke status in An Giang province in 2011

N0	Distric	Number		Sum	Area (ha)		Sum
		Full dyke	Low dyke		Full dyke	Low dyke	
1	An Phu	8	9	17	2.367	12.196	14.563
2	Tân Chau	8		8	13.252		13.252
3	Phu Tan	20		20	27.030		27.030
4	Cho Moi	81		81	27.788		27.788
5	Tri ton	3	128	131	860	45.453	46.313
6	Tinh Bien	5	39	44	2.348	12.909	15.257
7	Chau Doc	7	12	19	4.229	3.657	7.886
8	Chau Phu	32	34	66	19.957	15.140	35.097
9	Chau Thanh	17	49	66	3.852	21.500	25.352
10	Long Xuyen	0	45	45		6.266	6.266
11	Thoai Son	100	20	120	31.340	4.367	35.707
Total		**281**	**336**	**617**	**133.023**	**121.488**	**254.510**

Source: SIWRR, 2012

The research of the Southern Institute of Water Resources Research in 2014 on the scenario that evaluates the effects of flood control dikes reveals that there are impacts of the flood control embankment dike, especially radical dikes on the flow regimes across the Mekong Delta, especially in flood-prone areas as deep as An Phu district.

The water levels at Chau Doc in the case of 2000 flood has increased from 2.68 m (SC25) to 4.78 m (SC4) and 4.87 m (SC16). The rise of water levels at Chau Doc is slower than at Tan Chau because the dike development will prevent water flow from the Mekong River to the Bassac River, making the water-levels of these two rivers increasingly different (*Table 31* and *Table 32*)

Table 31: The water-levels in Chau Doc according to the assumptions of the dike embankment development

Scenarios	Description	Water level in Chau Doc (m)
SC16	Water level in 2000, flood flow in 2000 and Dike system in 2000	4.78
SC4	Water level in 2000, 100% full dike system	4.87
SC25	Water level in 2000, 50% full dike system	2.68

Source: SIWRR, 2012

Table 32: The scenario assumptions on the effects of flood control dikes

Scenarios	**Description**
SC1 Baseline	Water level in 2000, flood flow in 2011 and Dike system in 2010–2011
SC13	Water level in 2000, flood flow in 2011 and Dike system in 100% full dyke
SC 25	Water level in 2000, flood flow in 2011 increased by 20%, and Dike system in 100% full dyke
SC 37	Water level in 2000, flood flow in 2011 and Dike system in An Giang and Dong Thap are 100% full dyke
SC1 Baseline	Water level in 2000, flood flow in 2011 and Dike system in 2010–2011

Scenario calculations show that the impact of the flood control dike (including low dike and high dike system) to the flow regime on the MD is considerable, especially in deep flooded areas in *Figure 46.*

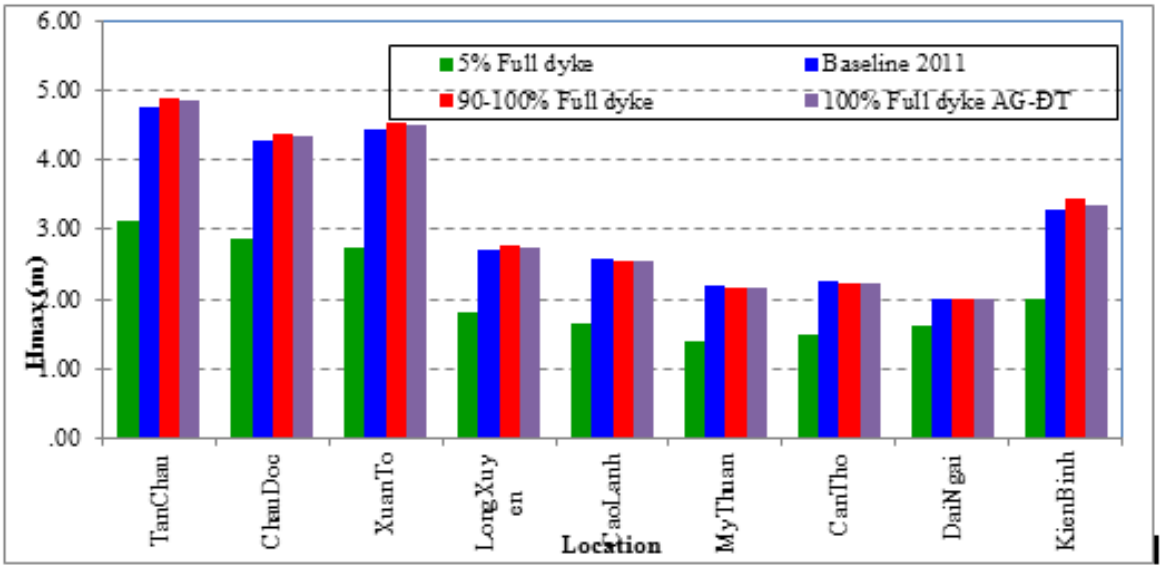


Figure 46: Max simulated water level at stations

Impact of Sea Level Rise

The impact of sea level rise on flood flow of the Mekong Delta is clear. With a sea level rise of 25 cm, the water levels of the entire delta tended to increase from 0.05 to 0.28 m as in the flood of 2011, and to increase from 0.03 to 0.28 m in the flood of 2000. With the sea level rise of 50 cm, the water levels of the entire delta tended to increase from 0.11 to 0.57 m in the flood of 2011, and an increase from 0.10 to 0.56 m in the flood of 2000. The water levels in the area of Tan Chau and Chau Doc increased about 0.04 to 0.07 m with the sea level rise scenarios of 25 cm, and increased from 0.11 to 0.16 m with the sea level rise scenario of 50cm (*Table 33*)

Table 33: The scenario assumptions on the effects of sea level rise

Scenarios	Description
SC1 Baseline	Water level in 2000, flood flow in 2011 and Dike system in 2010–2011
SC2-25cm	Water level in 2010, flood flow in 2011 and Dike system in 2010–2011 and the sea level rise scenario of 25 cm
SC3-50cm	Water level in 2010, flood flow in 2011 and Dike system in 2010–2011 and the sea level rise scenario of 50 cm

The simulation results of the water-levels in the Mekong Delta under the scenarios shown in *Figure 47*. The flood risk duration in the flood-prone areas increases when considering the sea level rise. One might consider the case of the sea level rise of 50 cm (SC3), flood duration of 1 m depth or higher in Chau Doc for about 127 days. It increased about 4 days in the current conditions. Going downstream, then the flood duration will be increased because of the sea level rise affecting this area. At Tri Ton, the center of the Long Xuyen Quadrangle, total flooded days of the depth over 1 m are as many as 92 days, but increased 25 days compared to the current time.

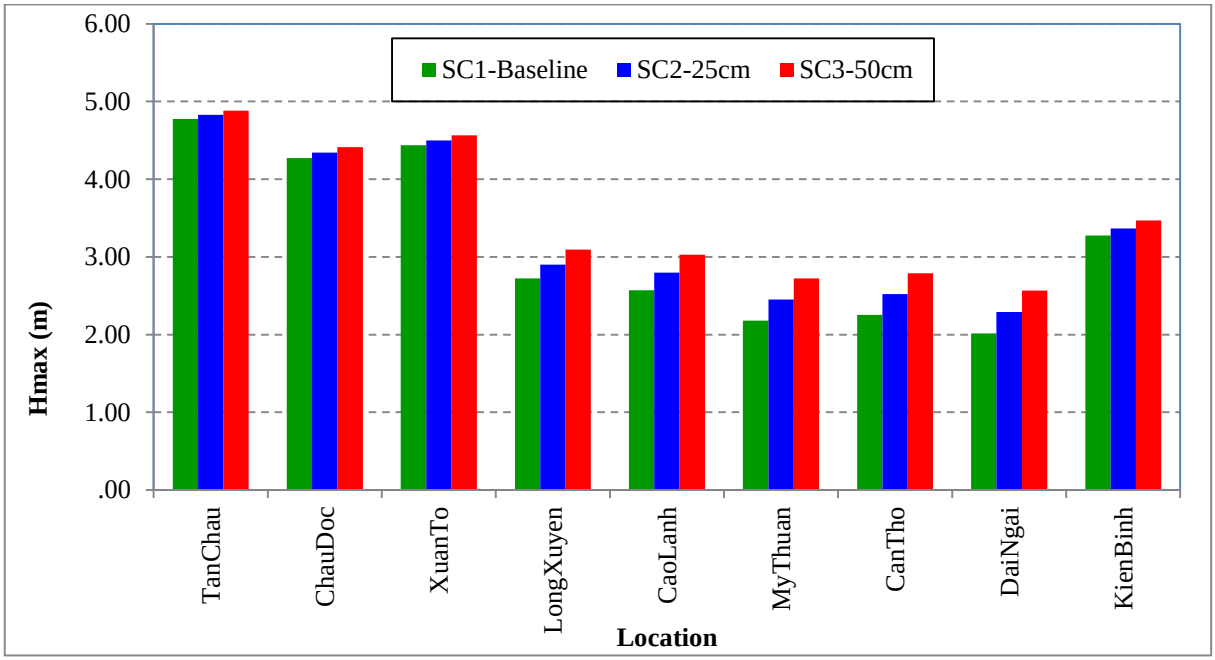


Figure 47: The water-levelss in some areas in Me Kong Delta in 2011 and the flood scenarios in 2011 + sea level rise of 25 cm and 50 cm

Figure shows that the effects of sea rise level on the subproject area is not much and only result in an increase in the water level in this area from 2-4 cm. This is quite consistent with the fact that the subproject areas far from the sea (250km far from the East sea).

Impact of upstream flood

Calculation results show the upstream flood impact to water level of the deeply flooded areas. When the flood flow in 2000 and 2011 increased by 20%, the water level at the border area from Tan Chau to Xuan To tended to increase from 0.75 to 0.95 m for the flood of 2011, and to increase from 0.85 to 1.14 m for the flood of 2000 (*Table 34*).

The flood risk area increased in deeply flood-prone areas while increasing the upstream flow. In the case of a 20% volume increase during the flood of 2011. The total area of 1 m depth throughout the MD increased 1,401,911 ha, up 23% compared to the current condition

Table 34: The scenario assumptions on the effects of upstream flood

Scenarios	Description
SC1 Baseline	Water level in 2000, flood flow in 2011 and Dike system in 2010–2011
SC4	Water level in 2011, flood flow in 2000 and Dike system in 2010–2011
SC7	Water level in 2011, flood flow in 2011 increased by 20%, Dike system in 2010–2011
SC10	Water level in 2011, flood flow in 2011 increased by 20%, Dike system in 2010–2011 and the sea level rise scenario of 50 cm

The simulation results of water-levels in the Mekong Delta under the scenarios are shown in *Figure 48.*

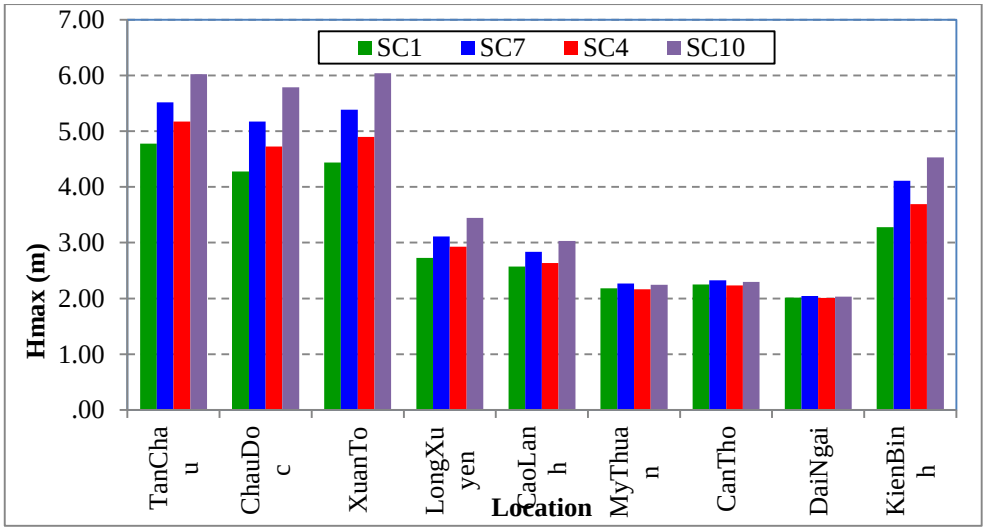


Figure 48: Water levels in the Mekong Delta under the scenarios

Figure shows the flood level of the subproject area (Tan Chau and Chau Doc stations) will be higher about 30 cm in case of increase upstream flow and about 1.2m in case of combination of increase upstream flow and sea level than the flood level in the big floods in 2000 and 2011.

Effects of combined sea level rise and full dike and flood upstream

The factors to be considered above which may happen in the coming years will cause a very strong impact to the flow regimes in the region. To forecast this for the Delta, the scenarios

are simulated in *Table 35*. Results show the water level rise across the delta compared with the current topography (baseline) from 0.57 to 1.35 m. At Tan Chau, the water level rise of 1.02 m reached the elevation of 6.2 m; at Chau Doc, the water level rise of about 1.27 m reached the elevation of 5.99 m. At Xuan To, the water levels rise around 1.35 m to reach the elevation of 6.25 m. At Long Xuyen, the water level rose to 0.88 m and reached the elevation of 3.78 m. At these levels, most of the current levee system cannot control the floods. Even if areas of the city along the river are flooded, the damage has not been calculated in this study, but might also be forecast. Solutions to cope should be proposed before this scenario occurs.

Flood time will last longer across the Mekong Delta, consideration at Chau Doc the flood duration of 1 m or more deep approximated 145 days, increased to 22 days compared to the current conditions. At Tri Ton, flood duration of 1m or more deep is about 110 days, increased by 43 days compared to current conditions.

Table 35: Some scenarios that assess the influence increase of upstream flood on the water-levels in the Mekong Delta

Scenarios	Description
SC1 Baseline	Water level in 2000, flood flow in 2011 and Dike system in 2010–2011
SC4	Water level in 2011, flood flow in 2000 and Dike system in 2010–2011
SC21	Water level in 2011, flood flow in 2011, the sea level rise scenario of 50 cm and 100% full Dike system
SC24	Water level in 2011, flood flow in 2011 increased by 20%, the sea level rise scenario of 50 cm and 100% full Dike system

The simulation results of the water levels in the Mekong Delta under the scenarios shown that: the flood risk area increased strongly throughout the MD. For the case of SC21, the total flooded area of the whole delta increased 3,798,106 ha, an increase of 10% compared to SC1. The total area of 1 m deep throughout the delta increased 2,378,319 ha, an increase of 109% compared to SC1 (*Figure 49*).

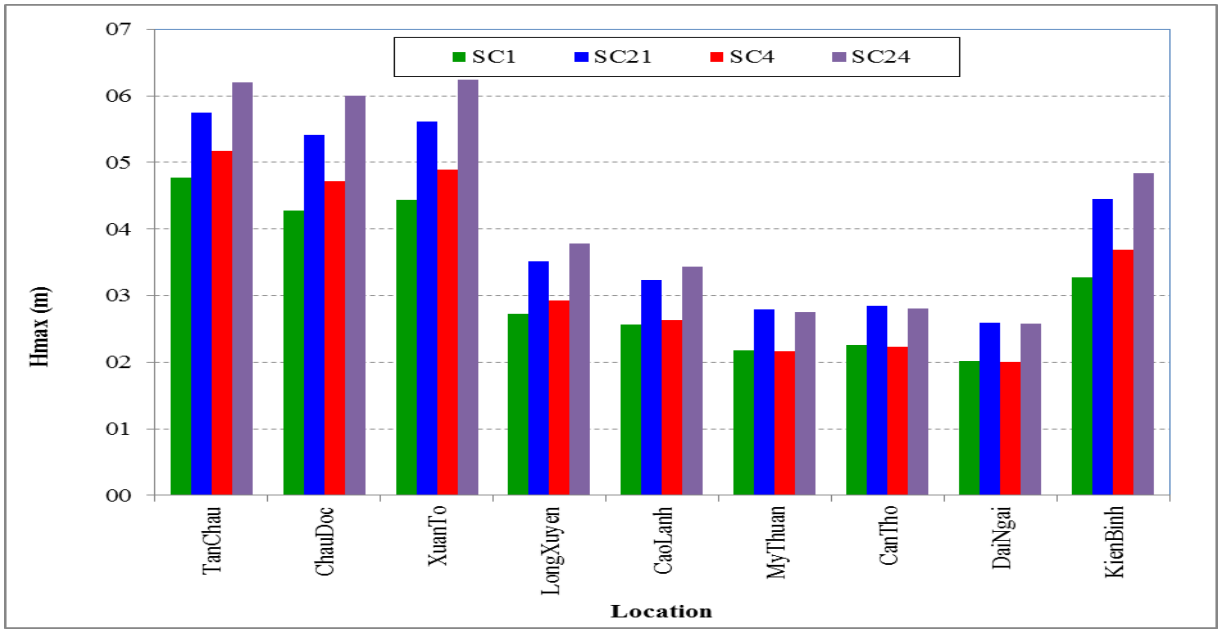


Figure 49: Water levels in the Mekong Delta under the scenarios

Conclution:

The above data shows that embankment will increase the level of flooding in the subproject area, especially in case of combination of increase upstream flow and sea level. In extreme conditions, the level of flooding in this area may be higher than 1.2 m compared to the big flood years (2000, 2011). With the water levels, the embankment will not ensure protection against flooding and all the area will be flooded. So the proposed livelihood models in the subproject will be feasible and consistent with changes from upstream flooding and sea level rise.

CHAPTER 3. ANALYSIS OF ALTERNATVIES

This chapter aims to provide justification on how and why this subproject is selected based on the approach recommended by the Regional Environmental Assessment (REA) and the Resional Social Assessment (RSA) for the MDICRSL project (the Project) for the estuary and coastal region (Section 3.1) as well as the alternative analysis considered during the design of the subproject (Setion 3.2). The ESMP (Chapter 6) has explicitly incorporated a technical assistance to ensure that extensive consultation is made during the development of the sustainable livelihoods models of this subproject and that DARD will have adequate capacity to manage and control future development and possible scale up of the proposed livelihood models. The technical assistance will plan and implement the mitigation measures to address the potential impacts during operation phase of the subproject.

3.1. NEED FOR THE SUBPROJECT

Need for implementation of the subproject has been identified in the REA and RSA prepared for the Project. It has been concluded that overall the proposed subprojects are designed to have positive environmental and social impacts and monitoring changes during construction and operation of water control infrastructure and livelihood models is required. The additional surface and groundwater monitoring and assessing changes in coastal and riverbank erosion under Component 1 of the Project will be important for measuring and managing the long term regional impacts of the Subprojects 2, 3 and 4 and the implementation of subprojects in Phase I will provide important insights into the design and safeguard instruments for the Phase II subprojects.

The proposed subproject will be implemented under Component 2 of the Project. Below highlights justification for the subproject and measures to mitigate potential negative impacts as recommended in the REA and RSA and they have been considered during the preparation of Chapters 4, 5, and 6.

Impacts of installing water/flood control structures in the upper delta

- Flooding in the delta is a natural process that maintains productivity and drives the dynamic evolution of the Mekong Delta. The annual flood event is responsible for replenishing the fertile sediments that is vital to agricultural productivity. Climate change is expected to bring higher and more pronounced season flood regimes, the key challenges are to retain the natural flood based agriculture and protect downstream provinces from flooding.
- The subprojects in the upper delta involve the upgrading of existing low embankments/dykes and the construction of culverts and sluices to expand flood retention capacity in the wet season. The culverts and sluices will allow annual floodwaters to pass through embankments and dykes, expanding the floodplain agriculture of the POR and LXQ in Dong Thap, An Giang and Kien Giang provinces. This infrastructure will support the conversion of triple rice to double cropping plus floating vegetables or aquaculture (i.e. freshwater fish or shrimp farming). The new embankments will reduce impacts to cropping associated with failure of existing embankments during the flood season. Upgrading low embankments (August dikes) from earthen to concrete material will also reduce yearly maintenance costs and facilitate waterway transportation. The project will protect high value agriculture (i.e. fruit trees) and downstream provinces from flood damage.

- The construction of the sluices under the subproject would provide water for farming during the wet season. Currently, the high dikes constructed for flood control and rice intensification prevent water from entering the floodplains to allow for planting of the third crop. The operation of the sluice gates will control the water levels in the project areas and promote floating vegetables, aquaculture and freshwater shrimp farming. Conflicts over water use could occur between farmers of different crops, and areas where increased flood retention does not provide benefits. Some of the positive impacts will be that the increased flood retention will replenish the floodplains with sediments and nutrients from the Mekong River and may reduce the amount of fertilisers and pesticides used in agricultural activities. Climate smart farming and sustainable agricultural practices should be included to support the transition to new agriculture and aquaculture.
- The subprojects may change the hydrological flow from the upper delta affecting natural resources and habitats of aquatic species. However, the August dikes fragmented the floodplains and reduced ecosystem connectivity leading to a decline in capture fisheries. Improving flood retention may increase biodiversity in the floodplain ecosystems.

Impacts of new livelihood models in the upper delta

- The development of livelihood models in the upper delta will support farmers to transition from triple rice cropping. Providing support measures to farmers so they have alternatives to the wet season rice crop is an important measure to transition from triple rice cropping to double rice plus floating vegetables, flowers, aquaculture and freshwater shrimp farming. Triple cropping in the upper delta ahs lower total yield and higher rice production costs. Rice intensification has also driven farmers to apply more pesticides and fertilisers, reducing the cost benefits of the winter-autumn crop and increasing surface water pollution. Farmers have also reported that their rice fields are less fertile from reduced alluvial deposition from the high dykes and flood control structures.
- Appropriate livelihood support during flooding season in retention areas including diversifying agriculture and aquaculture models with strengthening of the value chains and linking farmers to business and markets. The transition to high value agriculture will provide many positive social benefits to local communities and households involved in the livelihood models. To ensure sustainability the project must also consult with communities in the surrounding areas to enable all farmers to transition to alternative farming mechanisms.
- Restoring flood retention will provide more nutrients and sediments during the flood season, however the impacts of the possible increase in the use of pesticides and fertilisers from more diversified cropping needs to be considered. The livelihood models for high-value agriculture (i.e. fruit trees, flowers, vegetables, mushrooms, watermelons) may require higher inputs of fertilisers and pesticides. The potential environmental impacts of aquaculture (i.e. catfish) and freshwater shrimp farming including the release of organic wastes, agro-chemicals, antibiotics, the transmission of diseases and the ecological impact on endemic fish species in the Mekong Delta and floodplains will also need to be considered. In order to mitigate these environmental impacts, an integrated pest management plan (IPM) program will be implemented for each applicable subproject as a part of the ESMP. Surface water quality monitoring will also need to be established in the project areas.

3.2. ASSESSING "WITHOUT SUBPROJECT" AND "WITH SUBPROJECT"

The agricultural production of people living in the zone of the three subproject communes depends on fragile levees. Lack of solid investments, these levees were constituted of fractured embankments that were spontaneously constructed by farmers working along the side. As dikes are situated closed to the water, what happens then is landslides at many places after floods each year. The repaired ones need to be moved into the agricultural fields.

It is the fragility of the existing dike system that makes the production of people living in this zone unstable. It costs people and the local government a lot of expenses each year to strengthen the dikes; however, they remain unstable, and do not meet requirements for a stable regular production.

In the surrounding zone of the subproject (on the east side of seven communes and a part of Phu Huu commune), the three-harvest-levee has been built, people can actively manage their production of rice and vegetables during the flood season. It does not cost them much to maintain the levee. This fact makes people living in floods-damaged zones feel abandoned by the government. In 2013, people living in the zone of three communes made plan to transform the existing levee (early flood protection levee) into a solid one against floods. However, the plan could not be realized for lack of investment resource and an approval of this levee is considered as important as a flood discharged place. Consequently, if this zone is protected completely by a solid levee, it will affect directly the flood discharged capacity especially in a strong flood year.

In order to maintain the floods discharged capacity for upstream areas while ensuring a regular production, limiting damages in harvests and expenses in repairing and strengthening dikes due to each flood season, as well as, to build production methods adapted to floods, consider floods as a resource for development that the subproject "Reinforce the adaptability and the water control for Mekong upstream area" is submitted.

In this part, we will focus on analysis of environmental and social impacts of the alternative "without subproject" or "with subproject" as follows (*Table 36*):

- "Without subproject": Do not implement infrastructure items as well as measures to support the productive activities of the people (the production remains unchanged compared to the existing one)
- "With subproject": Compound 3 parts: development of the socio-economical models, technology investments and non-infrastructure solutions, and production infrastructure investments.

Table 36: Impacts assessment

Impact factors	Without the subproject	With the subproject
Socio-economical impacts		
Land acquisition	No land acquisition	Permanent acquisition of 110 ha for infrastructure construction, and of 15 ha for temporary construction sites
Soil lost due to erosion, and dikes strengthening activities.	Annually, people lose their soil due to erosion: the water flows erode	The reinforced structure is shifted away from water,

Impact factors	Without the subproject	With the subproject
	production soils, the volume of soil needed to maintain the existing levee.	into the soil limit the risk of erosion.
Stabilize production conditions	The production is unstable due to damages caused by dikes broken risks before floods season, and to the need of strengthening dikes at eroded places after floods season.	Actively manage the production thank to strengthened levee; the risks before flood season eliminated mostly. After floods season, people can manage actively the timing to water rice fields of winter-spring harvest earlier that limit the impact of floods the next year.
Economical damages	Annnually, people and local government have to spend 4 – 10 billions VND to maintain the levee for production	The strengthened dikes permit saving of maintaining expenses
Damages due to floods	The dike is not strong enough that can be broken at times. It can damage the harvest that cost much for recovery	Almost no risks of broken dikes before floods season.
Increase incomes	Incomes from rice harvest are about 25 millions VND/ha	The model combined rice and Giant freshwater shrimp would bring incomes up to 50 - 100 millions VND/ha
Develop socio-economical models	People cultivate mostly rice thus low economical effectiveness	Livelihood model development, eliminate the rice monoculture, switch to other production methods which fit the water sources condition (shrimp, rice floating fishing combines natural flood season); Production of mushrooms (uses agricultural residues or byproduct (straws) for growing mushrooms), cultivated vegetables crops (meet the market demand). Diversify the object to be manufactured and produced contributing to

Impact factors	Without the subproject	With the subproject
		stability and increase the income. People switch to the new production methods adapted to flood conditions, can live with floods and benefit from floods resource to develop productions.
Create employments in floods seasons	People cannot work or have to go to other regions to be employed	People run the socio-economical model adapted to floods seasons can earn money at during the floods, that helps for social stabilization
Enhance values of regional products	Actual products do not have a stable output	The regional products are promoted, labeled in order to create added values, and benefices for farmers.
Environmental impacts		
Floods - discharged capacity impacts	No impacts on floods – discharged capacity in the main season	No impacts on floods – discharged capacity in the main season.
Environmental impacts	Lack of multiple production skills, people overuse fertilizer and pesticides compared to real requirements Overuse of fertilizers and pesticides would increase sometimes pests and pests resistence	The IPM program, the subproject "1 must 5 reduced" are widely applied in whole An Phu district, constituted to reduce by 30% fertilizer in production. Pesticides are also reduced. The organic rice model, and the rice-cray fish model without fertilizer and particularly no pesticides would reduce polluted residues to the environment.
Intention to build high dikes to control floods	People have intention to build spontaneously the high dikes to control floods, affecting the floods discharge capacity for the upstream areas.	People have a stable production method adapted to floods that become resources for development but natural disasters

Impact factors	Without the subproject	With the subproject
Support the floods discharged at the beginning of the annual flood season when they come earlier, stronger	The existing low dikes are close to water, when floods come earlier than the harvest, the production area could not be served for flood discharge.	The new low dikes will be moved up into the field side at 10 – 100m compared to the existing dikes. Annually, this zone can be served to support as flood discharge corridor when they come earlier
Future support the floods discharged in the main floods season	In the future, it is probably that the upstream floods discharge capacity would be reduced due to spontaneous constructions of three-harvests-levee for their production.	In the future, with the contagion of the socio-economical models, the actual zones that built three-harvest –dikes may chanel flood flows for fisheries production instead of a third rice crop, increasing the flood discharge capacity for upstream areas and reducing flood impacts on the downstream areas

3.3. ANALYSIS "WITH SUBPROJECT" TECHNICAL ALTERNATIVES

While planning the subproject, 3 plans are proposed to consider:

(i) Plan 1: Strengthening the low dikes and the borders based on their existing borders;

(ii) Plan 2: Moving the dikes: For the existing horizontal canals (Bay Truc, Vinh Loc, Vinh Loi, Vinh Hau, Co Lau) the dikes are considered to be moved into rice fields at least 10m from water borders. At the residential areas, the dikes should be moved behind the villages to avoid compensations (*Figure 50*). The dikes along Bay Xa canal and Xang canal need to be moved into rice fields at least 50m and at most 130m (*Figure 51*)

(iii) Plan 3: Moving the dikes: For the existing horizontal canals (Bay Truc, Vinh Loc, Vinh Loi, Vinh Hau, Co Lau) the dikes are considered to be moved into rice fields at least 10m from water borders. At the residential areas, the dikes should be moved behind the villages to avoid compensations. The dikes along Bay Xa canal and Xang canal need to be moved into rice fields at least 100m but at most 130m.

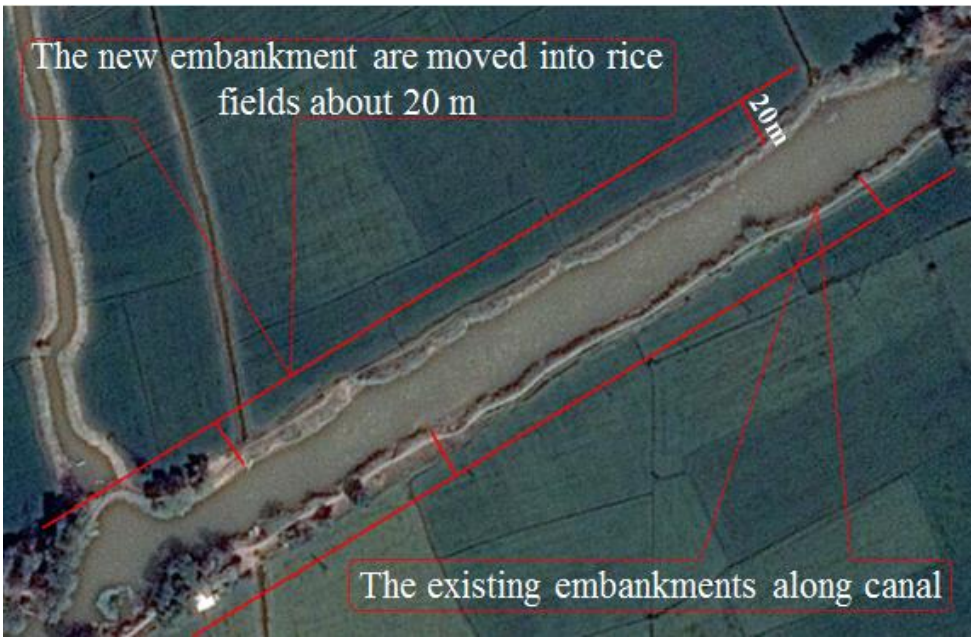


Figure 50: Plan of dikes on horizontal canals compared to the existing dikes

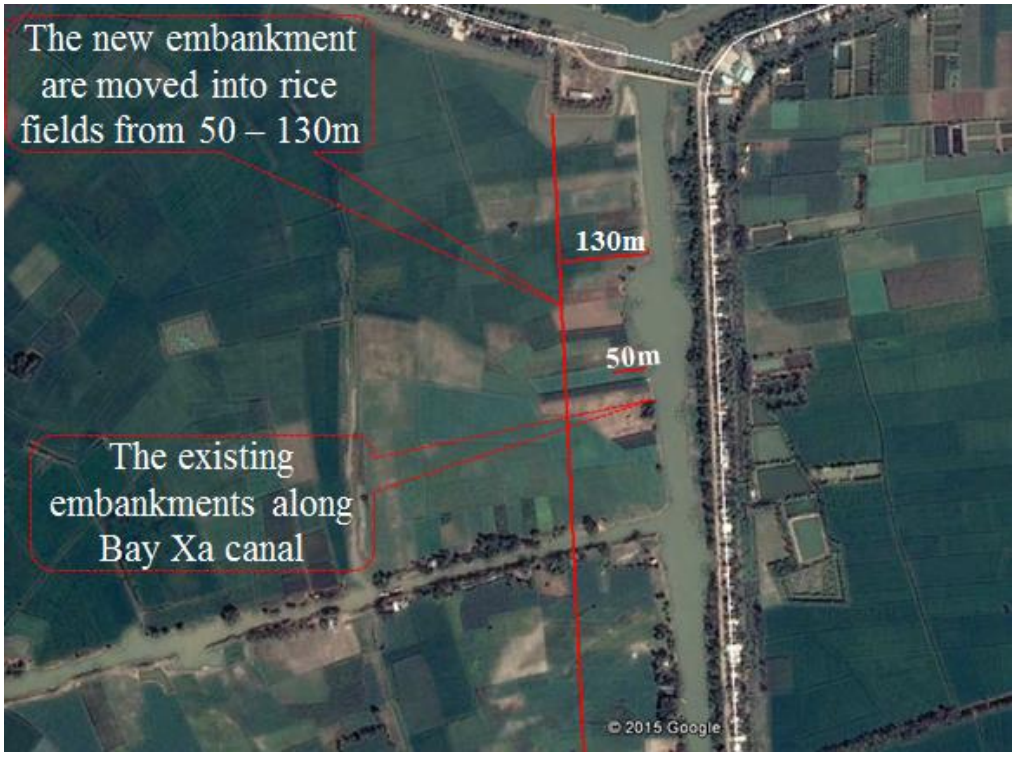


Figure 51: Plan of dikes along the 7 communes canal compared to the existing dikes

Table 37: Optional analyses of 3 plans for the dikes

Issues	**Plan 1**	**Plan 2**	**Plan 3**
Land acquisition	The land acquisition needs to be covered about 20 – 30 ha as the existing dikes are quite small (and constituted mostly by embankments)	The land acquisition of 110 ha covers mostly rice fields	The land acquisition of 110 ha covers mostly rice fields

Issues	**Plan 1**	**Plan 2**	**Plan 3**
Resettlement	About 25 households building their houses closed to the water needed to be resettled	No relocation of households	No relocation of households
Stability of the dikes after construction	The existing dikes constituted by embankments built by people living along the water side is eroded every year. If the new construction is built based on the existing dikes, the risk of erosion will be high	The dikes are displaced far into the rice field side, ensuring the stability, mostly no risk of erosion when floods arrive	The dikes are displaced far into the rice field, ensuring the stability, mostly no risk of erosion when floods arrive
Floods discharged capacity at the beginning of the floods season (when they come earlier and stronger)	Floods discharged capacity reside only in the existing canals. Dikes risk being broken before the Summer-Autumn harvest.	Enlarge the space on both sides, increase floods discharged capacity of horizontal canals and Bay Xa canal.	Increase floods discharge capacity like plan 2, Bay Xa canal and Xáng canal have their flood discharge capacity increased thank to spaces outside the dikes
Floods discharged capacity in the main season	The floods discharge capacity unchanged for the main season compared to the existing situation. In the main season, the dikes and rice fields are covered by water	The floods discharge capacity unchanged for the main season compared to the existing situation. In the main season, the dikes and rice fields are covered by water	The floods discharge capacity unchanged for the main season compared to the existing situation. In the main season, the dikes and rice fields are covered by water
Materials used to strengthen the dikes	The transport costs are expensive, while using material on site, the subproject estimate compensations covered 40 ha	Use the soil of the existing dikes to build the new ones	Use the soil of the existing dikes to build the new ones

CHAPTER 4. ANALYSIS OF ENVIRONMENTAL AND SOCIAL IMPACTS

Implementation of the subproject will also create some negative impacts (temporal and permanent impacts) on the environment and the society. This chapter will analyze in details the positive and negative impacts that may occur during the entire subproject implementation.

It is noted that although the potential negative impacts of works (dyke reinforcement and construction of under dyke culverts) to be conducted under Components 1 this subproject is in line with the key findings of the REA for the MDICRSL that it will generally increase the level of air, noise, vibration, and water pollution as well as increasing local traffic congestion including road safety risks and disturbance to local residents and they could be mitigated by (a) ensuring that contractors apply good construction practices and initiate/maintain close consultation with local authorities and communities throughout the construction period and (b) close supervision of field engineers and/or environmental officer as recommended in the REA. However, to comply with Government's expectation for the EIA analysis, the ESIA also included the results of the analysis related to air/noise and water pollution in Section 4.4.3. As suggested by the REA, these impacts will be mitigated through the application of the Environmental Code of Practices (ECOP) which has been prepared in lien with the ESMF.

Potential negative impacts of the subproject activities during operation of the livelihood models have also been found to be small to moderate, and they can be mitigated through a technical assistance to be provided during the preparation and implementation of the livelihood development models (Component 2 of this subproject). The technical assistance will also address the need for extensive consultation with water users and key staekholders during the development and possible impacts due to expansion of the livelihood model without adequate management and control.

CLASSIFICATION AND SCALE OF IMPACTS

Based on the plans and progress of the subproject implementation, the data on natural conditions, the stakeholder's analysis, and the negative impacts from the implementation of subproject to the natural, socio-economic and ecological environments will be analyzed and clarified in this section.

In the implementation of the subproject, there will be some potential impacts on the environment of the subproject area and the surroundings. The impacts may be temporary in each phase of the subproject or may be recurring during the subproject lifespan. During the environmental assessement process, the significance of the impact on the environment will be determined based on the following criteria:

Significant impact (S)

- Significant changes, over a significant area, to key characteristics or features or to the landscape's character or distinctiveness for more than 2 years.
- The impact goes beyond regulatory standards or long-lasting and widespread impacts
- Altering the ecosystems or ecological functions on a large area causing losses at the moderate scale (lasting over 2 years) but having the ability to restore within 10 years;
- Tentatively affect human health;
- Causing financial damage to the users or communities.

Moderate impact (M)

- Noticeable but not significant changes for more than 2 years or significant changes for more than 6 months but less than 2 years, over a significant area, to key characteristics or features or to the landscape's character or distinctiveness.
- Altering the ecosystems or ecological functions locally in a short time with potentially good recovering capacity. The impact level is similar to the changes at present but potentially causing accumulated impact.
- Possibly (unlikely) affect human health; may causes difficulties to some users.

Small Impact (L).

- Noticeable changes for less than 2 years, significant changes for less than 6 months, or.
- Changes occur only in the current variation range or barely discernible changes for any length of time, within acceptable standards and their impacts can be totally controlled.
- The impacts may affect the operation but does not hinder the users or the public.
- Mild impact on the human health or quality of life.

No impact (Insignificant/Negligible) N

- Any change would be negligible, unnoticeable or there are no predicted changes -
- Changes that are not perceivable or can be measurable based on the basic operation;
- No mutual influence and therefore no changes occurred.

4.1. POSITIVE IMPACTS

Positive socio-economic impacts

- The livelihood models applied in the region help to generate higher income for the local people than the current rice production model.
- Diversify production options, minimizing the risk of income losses for the people in the areas as shown in the devaluation in the price of the products at the big harvest recently.
- Creating jobs for people in the flooded areas, minimizing the negative impacts to social order and welfare.
- People apply the the Integrated Pest Management (IPM) and the "One Must 5 Reductions" programs in production helping to reduce the production cost, thus increasing income for people.
- Development of logistics services for shrimp farming, creating jobs for many people who are not directly involving in shrimp farming activities.
- The trade promotion activities, strengthening the operations of the cooperatives, brand development are the foundation for the higher price of production outputs, resulted in an income increase for people.
- The people on the East side of the Hau river can now rest assured to produce two rice crops thanks to the solid low embankment system, water supply and drainage culverts in the area of the three communes.
- Reducing damages to the Summer-Autumn rice for the people suffering from the influence of early floods.
- Reducing the maintenance costs of the embankments systems after each flooding season.
- Reducing the impact of waves and floods to the shrimp farming compartments.

Positive environmental impacts

- The livelihood models being proposed in line with reducing the use of fertilizers and plant protection agrichemicals.
- Diversify production options helping to reduce the spread of disease transmission.
- Combining aquaculture with rice cultivation to reduce the use of plant protection chemicals and fertilizers.
- The Integrated Pest Management (IPM) and the "One Must 5 Reductions" programs applied will help to reduce plant protection chemicals and fertilizer usages in production.
- Limit the situations of soil erosion and sediment accumulation after each flood in the region.
- Maintain the flood diversion space for the upstream area.
- Developing the aquatic species from aquaculture cultivation, reducing the pressures from harvesting natural fisheries.

Positive overall impact

Installing water/flood control structures in the upper delta will change the hydrological flow and is likely to have major positive overall impacts by increasing flood retention and restoring floodplain ecosystems and agriculture. Hydrological and hydraulic modeling may be needed to determine the extent of flood protection in wet and average years. Flooding will provide nutrients and sediment in the wet season reducing the use of fertilizers and pesticides. Under the new livelihood models farmers will be transitioning from triple rice cropping to double rice plus crops and aquaculture. This will be a step-by-step process that includes agricultural extension, access to markets and sustainable agricultural practices. Surface water monitoring will be important to detect whether the use of agro-chemicals, fertilizers and pesticides has increased or reduced in the project areas.

4.2. NEGATIVE IMPACTS

Based on the actual production in the region, based on natural conditions, the construction plan and the actual construction works of the subproject, the environmental impacts that may arise from activities of the subproject are presented in the section below:

Table 38: Level of Potential Negative Impacts of subproject

Subproject Phase	Physical			Biological		Socio				Others	Remarks
	Air, noise	Land, soil, water	Solid waste, Sludge	Forest, natural habitats	Fish, aquatic life	Land acquisition, resettlemnt	Indigenous peoples	PCR	Livelihood, community disturbance, land use	Local flood, traffic (land and water), safety	Overall impact
Construction of 11 dykes and 15 slucies (Component 1)											
Pre-const.	N	N	N	N	N	M	N	N	L	N	L
Construction	L	M	M	L	L	N	N	N	L	L	M
Operation	L	L	L	N	N	N	N	N	N	N	N
Livelihood demonstations											
Detailed design of the models	N	N	N	N	N	N	N	N	N	N	N
Construction of the small facilities for the models	L	L	L	N	N	N	N	N	L	L	L
Operation of the models	N	L	L	N	N	N	N	N	L	L	L

Socio-economic Impacts

The subproject acquires permanently 110 ha of production land and acquires temporarily 15 ha of production land in 3 communes of the subproject.

4.2.1.1. Potential differential impacts on women and vulnerable in particular landless HH to be relocated

There is no particular disadvantage to the vulnerable groups or the landless owners and women.

4.2.1.2. Other impacts

The impact on the people in the process of constructing the embankment especially the horizontal canals include: (i) Accidents on construction sites without adequate safety measures; and (ii) Increase in the social order problems if there are no rehabilitation programs and appropriate livelihoods options for the people affected by land acquisition.

Sensitive receptors in the Subproject Area

The whole construction sites within the subproject area are located on the fields of rice cultivation so the land acquisition process will not affect any historical heritages, relics, schools, or healthcare clinics. However, during the construction phase the transportation of construction materials do by passing some residential areas along the riverside and canals. The majority of these residential clusters are away from the river transportation route for a minimum of 20-30m. The sensitive points include: The residential clusters at the beginning of the Bay Xa canal: Xang canal; the residential cluster along the Vinh Hau canal and Bay Xa canal. Paddy rice production areas along the dikes and canals of the surrounding and adjacent areas can also be affected during the construction period (*Figure 52* and *Table 39*).

Figure 52: The sensitive areas that need attention in the region

Table 39: List of sensitive facilities in the subproject area

N^0	Name of sensitive facilities	Location	Distance to the dykedyke	The sensitivity characteristics
1	Vinh Loc Primary school	Next to Vinh Loc canal, Vinh Loc commune	It is 15m from beginning of the dykedyke route to the school	The dykedyke route will connect to the school (elevation of the school is already higher than base flood level) with the closest distance to the classroom is 15m. However, the construction of the dyke route relating to the schools will last only 2-3 days.
2	The residential clusters at the beginning of the Vinh Hau canal connecting the Hau river.	Mainly belonging to the Vinh Hau commune area	The dyke route is 5-20m away from the residential houses.	These residential clusters is about 800m long with approximately 90 HH living along the canal. The canal will be executed behind the HH, with estimated construction progress of 10 days. This residential route is not close to the materials transportation route.
3	The residential cluster at the beginning of the Vinh Hau canal connecting with the Bay Xa canal	Belonging to the Vinh Hau commune area	The dyke route will connect with the residential route	The dyke route will connect with this residential route (the elevation of the residential route is higher than the base flood level) though the dyke route will directly connect to the residential route however the impact scope will only occure within 2-3 days. This route is 20-30m away from the Bay Xa canal, which is the waterway route for transportation of the construction materials.
4	The residential cluster at the beginning of the	In the Vinh Hau commune area	The dyke route will connect with the	The dyke route will connect to this residential area (the elevation of the residential cluster is higher than the base flood level). Though the dyke route will connect directly

	Xang canal connecting with the Bay Xa canal.		residential area clusters.	with the residential route however, the impact scope will only last for 2-3 days. This route is about 20-30m away from the Bay Xa route, which is the waterway route for transportation of construction materials.
5	Rice harvest production activities along the dyke	Paddy field along the protection dike	The dike will be built partial on paddy rice field land	When construction of dikes, it can have effects on local people's rice harvest production. Because it is agricultural production then the impact is considered to be small, if before construction, the contractor organizes the separate dike embankment so as to prevent loss of water from rice fields as well as not to scatter the waste soil or dust into paddy fields

4.3. IMPACT ASSESSMENT DURING PRE-CONSTRUCTION PHASE

Activities in this phase are carried out as follows: After determining the positions of the culverts and the embankment/dyke routes, the subproject owner proceed with demarcating the subproject and procedures to negotiate with the residents for compensation on the loss of land and crops. The subproject owner will work on the clearance of landmines and unexploded ordnances. Upon completion of the land acquisition compensation, the investment owner will hand over the construction sites to the contractors under the approved technical design.

Land Acquisition

The subproject will conduct sland acquisition to serve the following purposes: (i) To serve for the enhancement of the flood controlling embankment at the same time to create a protection corridor for construction works within three communes on the East side of the Hau river; and (ii) To create premises for the execution works.

4.3.1.1. Impacts on land

The subproject acquires permanently 110 ha of production land and acquires temporarily 15 ha of production land in 3 communes of the subproject. All of these lands are agricultural land with main crops of rice. Quantities of land acquisition in each commune are shown in *Table 40*.

Table 40: Scope of land acquisition

No.	Commune	No. of AHs	Permanent production land acquisition (ha)	Permanent residential land acquisition (ha)	Temporary production land acquisition (ha)
1	Phu Huu	199	29.1	0	4
2	Vinh Loc	294	43.0	0	5.8
3	Vinh Hau	259	37.9	0	5.2
	Total	**752**	**110**	**0**	**15**

Source: FS Subproject

4.3.1.2. Potential resettlement impacts

According to the inventory of losses, there are 752 affected households. Because there is no ethnic minorities in the area of 3 affected communes, no ethnic minority person is affected by this subproject. Area of permanent land acquisition is 110 ha. Area of temporary land acquisition is 15 ha. Because the location of embankment in the design can be adjusted to avoid acquisition of residential area or displacement of house, no household will be displaced physically and no house/structures will be affected by the subproject. The impact is moderate. Overall estimates of land acquisition and resettlement are shown in *Table 41*.

Table 41: Summary of estimated land acquisition impacts of subproject

Total	Ethnic minorities	Permanent impacts					Temporary impacts	
No. of AH	No. of EM AH	No. of AH	No. of physically displaced HH	Production land acquisition (ha)	Residential land acquisition (ha)	No. of affected graves	No. of AH	Land acquisition (ha)
752	0	752	0	110	0	23	153	15

Source: Resettlement action plan for Suproject

4.3.1.3. Grave relocation impacts

According to the survey, to provide land for the subproject, there are 23 graves will be relocated. To Vietnamese people, grave is the spiritual matters which should be respected carefully. Household and individual graves are considered physical cultural resources (PCR), and the Bnak's OP/BP 4.11 applies for this subproject. However, this is not a very big problem, people are still willing to move the graves to another location to give land for construction if the subproject owner supports sufficiently to ensure the grave relocation. The level of this impact caused by this activity is only small and localized.

4.3.1.4. Impacts on crops

Due to that all of acquired area is agricultural land; the main affected crops are paddy rice and some other crops such as bean, peanut, banana, coconut, mango. Detail of affected crops by commune is shown in *Table 42*.

Table 42: Affected crops of households

No.	Crops	Unit	Commune			
			Phu Huu	Vinh Loc	Vinh Hau	Total
1	Paddy rice	ha	28.7	41.9	37.9	**108.5**
2	Paddy rice (temporary acquisition)	ha	4	5.8	5.2	**15**
3	Bean	ha	0.4	0	0	**0.4**
4	Peanut	ha	0	1.1	0	**1.1**
5	Banana	Tree	0	0	45	**45**
6	Coconut	Tree	3	0	5	**8**
7	Mango	Tree	4	4	12	**20**

Source: Resettlement action plan for Suproject

4.3.1.5. Severely affected households due to land acquisition

The number of severely AHs due to acquisition of over 20% of production land area of their HHs is 52 HHs. Affected production areas are agricultural land of HHs. Detail of ratios of affected production land in comparison with the total of land area of HHs is shown in

Table 43.

Table 43: Identification of AHs lost more than 20% of production land area

No.	Commune	Percentage of affected land compared with total production land area of HH		Total
		Under 20%	Over 20%	
1	Phu Huu	189	10	199
2	Vinh Loc	281	13	294
3	Vinh Hau	230	29	259
	Total	700	52	**752**

Source: Resettlement action plan for Suproject

4.3.1.6. Vulnerable households

Among affected households, there are 71 vulnerable HHs, including 63 poor HHs and 8 single female-headed HHs. These households, besides compensation for lands, assets and crops losses, they will receive further supports for vulnerable subjects as regulations of the state and the province. The level of this impact is small and localized.

Impacts by unexploded ordnances (UXOs)

Although production activities and embankment dredging and refilling have been implementing for years, there has never been detected any war unexploded remnants. However, the subproject is located in an area that was affected by military operations during the war period, it is necessary to clear any remaining UXOs to avoid the potential threat to the works and safety for local people and workers. The impact is considered moderate. For the subproject components, UXOs need to be carefully considered and removed before construction activities can commence.

Conclusions: The impacts of UXOs in the project area represent significant negative impacts if mitigation measures are not applied, with high risk to human health, life, and also infrastructure. UXOs removal must be completed before starting civil works. The level of this impact is small.

4.4. IMPACT ASSESSMENT DURING CONSTRUCTION PHASE

The investment works within the three subproject commune area include: (i) Construct 11 low dykes (the early flood protection dyke) for flood control and communal roads in the dry season with a total length of 60,953m, the height to the dyke top from +3 to + 4.5m, slope on tailings of 1.5, dyke width of 3m, except for the dyke route on the south of Vinh Loi canal with the width of 6.5 m; (ii) Construct 15 culverts serving water drainage and water transportation for production within and outside the embankment area with the width, B = 3.0 m, and the bottom depth of -1,50m.

Sources of environmental impacts

The activities in the construction phase include: Clean surface area before embankment work and culvert construction, excavation of earth materials from old dikes to backfill on new dikes, building the culverts and operation of the construction machines. The sources of environmental impacts are presented in *Table 44*.

Table 44: The activities and sources of environmental impacts during the construction phase

No.	Activities	Scopes of impact	Time of impact	Sources of impacts	
				Related to waste	Not-related to waste
1	Site clearance for dike construction work	Linear source: *Along the proposed embankment route*	At every construction section from 50-100m, less than 1 day	Dust from the construction equipment, blowing of top soils Low level impact	Noise from the operation of construction equipment.
2	Waterway transportation of construction materials	Linear source *Along the transportation route*	At every construction work, lasting less than 5 months	Material dusts, engine exhausts, Low level impact	Noise from material transportation vehicles, Vehicles for loading and unloading materials, causing water turbidity in the canals
3	Earth excavation for embankment backfilling work	Along the execution route	At every execution section from 50-100m, execution time not exceeding 5 days.	Emission of dust and engines' gas exhaust, loading-unloading, storm water, engine oils, and extra wastes. Gas exhaust from excavators, water runoff, and erosion risks after excavation/backfilling. Low level impact.	Noise from the excavator, execution machines; labor accidents; unusual weather affecting execution works, causing erosion, breaking the construction works. Affecting the road transportation. Affecting the production of the households along the embankment routes.
4	Execution work on concretizing the embankment route	Along the execution route	At each and every execution section from 50-100m, execution not exceeding 3 days.	Spreading out of material dust during the concrete mixing process, engine gas exhaust, storm water, cement packages	Noise from the concrete mixer, labor accidents, road traffics on the horizontal canals, social order

No.	Activities	Scopes of impact	Time of impact	Sources of impacts	
				Related to waste	**Not-related to waste**
				when executing the embankment route. Low impact level.	
5	Backfilling, leveling	Along the execution route.	At each execution section not exceeding 3 days.	Spreading out of material dust	Labor accident
6	Culvert construction	Mainly at the 15 culvert construction sites *	At each execution section not exceeding 5 months	Formworks, debris, used cement bags, dust, fumes	Social order, public health, noise
7	Piloting livelihood model	Point source at 5 livelihood models	During production time in flood season?	Wastes generated from the livelihoods models.	Creating jobs, increasing incomes. Other social impacts caused by water use conflicts from the flood diversion models

** Construction of embankment without building temporary shelters because the construction workers will be staying at the residential houses.*

Impact sources not related to wastes

4.4.1.1. Noise pollution

Due that the size of the embankments is relatively small (the dike width is generally 3m) there is no need for many construction machineries.

For the horizontal canal routes: at each construction site, it needs only a backhoe loader with shovel bucket volume of 0.8 m^3, a compactor and a concrete mixer of 500 liter capacity. These machines will not operate simultaneously. Activities will not only take place at one site for the entire construction period, but at one specific time (3-5 days while filling up the embankment and 1-2 days for surface hardening), then moving on to the next section.

For the embankment route along the Bay Xa canal: The embankment is moved back into the infield from 50-130m so the excavator will dig soils from the old dike and load onto the 3.5-5 ton trucks then transfer to the new dike area. The transportation distance is from 150-500m.

Table 45 indicates that the noise level from the vehicles is not too high for the subproject activities, within the 20m range, noise from the construction equipment will be around 55 to 65dB which is within the regulatory standard on the noise pollution level (QCVN 26:2010/BTNMT). Moreover, the execution activities mostly occur on the field without residential areas nearby, the noise impact from construction equipment is low in this case. Particularly for the construction areas being near residential areas (*Figure 52*, *Table 39* identified specifically in the sensitive area), the construction contractors need to control the operation of the construction equipment as well as informing the people about construction time for mitigation measures.

Table 45: The maximum noise level of some vehicles and equipment

No.	Vehicles	Noise level with 1m distance from the source (dBA) (1)		Noise level within 20m distance from source (dBA) (2)	Noise level within 50m distance from source (dBA) (2)
		Range	Average		
1	Backhoe loader	72.0 - 84.0	78.0	52.0	44.0
2	Bull dozers	-	93.0	67.0	59.0
3	Rollers	72.0 - 74.0	73.0	47.0	39.0
4	Truck	82.0 - 94.0	88.0	62.0	54.0
5	Concrete mixer	75.0 - 88.0	81.5	55.5	47.5
QCVN 26:2010/BTNMT standard applied for a normal area from 6 AM to 9 PM		**70 dBA**			

Source: (1) Mackemize, L.Da, 1985. (2) Air polution, Pham Ngoc Dang, 1997.

4.4.1.2. Vibration impacts

Due to the nature of the work of the subproject construction building dikes and small water regulating culverts without using large construction machinery, any vibration source appears to be small. The impact from this source to the people and works in the area is considered small.

4.4.1.3. Impacts on road traffic and safety

The building work is not related to the main traffic routes. While the infrastructure conditions to be utilized in the subproject area is of poor quality, some people still have to move along the two banks of the horizontal Phu Huu, Vinh Loc, Vinh Loi, Vinh Hau, and Xang canals (Figure 51).

During construction, the soil from the existing embankments will be taken to backfill onto the new embankments. Although, these are trails that not so many people use to travel in the dry season, during construction if there is no detour solutions or appropriate guidance to local people there may be some traffic disturbance and safety issues. For the people to move smoothly and throughout the whole construction period on the horizontal canals, the investor and the constructor must have a transportation coordinating plan in details on every segment of the embankment to ensure that movement of the local people are not adversely affected. This impact can be assessed as moderate.

Figure 53: The existing embankment is also the trail in along Vinh Hau canal

4.4.1.4. Impact on waterway traffic and safety

There are no roads connecting to the construction area. Therefore, all transportation of materials must rely on waterway transportation. Based on the volume of materials for construction everyday, there will be an addition of four barges for transporting construction materials into waterway traffic (*Figure 18*, pp.39).

The local people use the route along the Hau river, Bay Xa canal and on the trails for their travelling but not using the waterway routes (the horizontal canals) which are to use for materials transportation of the subproject. Actual observation shows that there are rare boats on the horizontal canals and even though just a few boats on Bay Xa canal.

As such, the increase of transportation vehicles in the region is only around four more barges/day, which will not greatly affect the water navigation on the Bay Xa canal and Xang canal. For the horizontal canals, there is just a scarce movement on these routes, the impact to the water navigation is therefore small. However, the horizontal canals are quite narrow (width is about 20-30m); therefore, material transportation using barges without proper control can cause a negative effect on the transportation especially the risk of collision. Therefore, impact on the waterway traffic and safety can be considered as minor.

Figure 54: The current status of waterway traffic on the canal

4.4.1.5. Impacts on socio-economic conditions

- **Impacts on security, culture and customs of the people in the subproject area.** The concentration of workers on the construction sites can lead to conflicts between the workers and local communities and social evils (drugs, prostitution, etc.), thus causing difficulties to control security, order and social management as follows:
  - Impact of spreading infectious disease from the workers to local the communities and vice versa.
  - Impact of prostitution, drugs and gambling.
  - Conflict between the workers and the local communities because of differences of culture, behavior.

The execution work of the subproject is simple, and mostly utilizing the local workforce, only some drivers of excavators, rollers and technical staff will be mobilized from other places, this number is just around 20-30 people. The execution work of the embankment will be fragmented with small amount of workload at each segment. There is no worker's camp setup during the construction of the embankment.

For these 15 culvert gates, construction will not be carried out constantly but broken down for 5 culverts a year. Because the culverts are of small scale, located out in the field with construction time around 4-6 months for each and the work will only be conducted in the dry season. With such conditions, the workers' tents to be set up will serve for 1-3 guards to keep an eye on the construction materials and for workers to take time break. As such, the camps will be very small only to ensure for social order especially at the border areas, the checking on temporary residence declaration will be strictly maintained to limit any potential negative impacts.

Since most workers will be hired in the communities, there will be low demands for resources such as water supply the area. For the same reason, the impact of spreading infectious diseases, prostitution, drugs, gambling, and conflict between the workers and the local communities would also be minor.

4.4.1.6. Inpacts on hydrology

The new embankment routes are all in land and are all low dikes (Early flood protection dikes). During the construction phase there is no river training activities on the horizontal canals. The construction sites of the 15 culverts are all infield canals so the execution work will not affect the hydrology in the region.

Impact sources related to waste

4.4.1.7. Air pollution

During the construction phase of the subproject, the activities causing harm to the air environment includes: transporting of soil, steel, cement materials for construction work of the embankment and the culverts all can spread out dust; and dust generated from construction machineries namely the excavator of 0.8m^3 capacity, compactor and concrete mixer. These machines are all small types, operated not at the same time so the impact has been identified as small. The source and type of air pollutants generated during the construction phase of the subproject are shown in *Table 46*.

Table 46: The source of air pollution and air pollutants identified in the construction phase of subprojects

No.	Sources of pollution	The generated air pollutants
1	Transporting embankment soils, materials and mobilizing construction equipment	Dust, noise, vibration, toxic gaseous emission (SO_x, CO, NO_x, VOC,...)
2	Constructions of the items	Soil dusts, cement dust, noise, toxic gaseous emissions (CO, NO_x, SO_x, VOC,…), from the vehicles, construction machineries

a. Transportation of construction materials

The technical design shows that there will be big volume of materials including stones, sand, cement, and steel to be brought from outside into the construction sites. The volume of stones, sand, and cement amounts up to 406,554m^3. The total volume of construction steel are 2,943 tons.

The materials serving the embankment hardening and constructions of the culverts are brought in by waterway transport. The distance from the materials suppliers to the construction sites is about 10-20km, and the means of transportation will be the 50T barges. As such the total number of barge shipments of sand, stone and cement will be approximately 800 and 600 for steel.

The process of transporting raw materials into subprojects generating source of pollution mainly comes from fuel combustion.

Pollution coefficient and the air pollutant loads caused by the materials carriage barges are presented in *Table 47* and *Table 48*.

Table 47: The dispersion coefficient of barge powered by diesel engines

No.	Pollutant	Unit	Dust	SO_2 *(kg)*	NO_x *(kg)*	CO *(kg)*	VOC *(kg)*
1	Barge	1,000 km	0.68	13.6	9.07	0.0036	0.41

Source: Assessment of Sources of Air, Water and Land pollution, WHO, 1993

Notes: S is the sulfur content in the diesel, S = 0.25% (Source: Petrolimex)

Table 48: Estimated amount of pollutants barges transporting raw materials

No.	Pollutant	Unit	Dust (kg)	SO_2 *(kg)*	NO_x *(kg)*	CO *(kg)*	VOC *(kg)*
Pollutant load	Barge with 1 trip back and forth	20 km	0.0136	0.272	0.1814	0.000072	0.0082
	Barge with 8000 trips	160,000km	108.8	2,176	1451.2	0.576	65.6

The construction will take place within 3 years (6 months for each year) and the supply of sand, stone and cement stretches during construction. On average, daily trips will be 3.7 barges transporting construction materials. With linear dispersion characteristics of pollutants, with a discontinuity operation in the water way conditions, and with low traffic on the canals the impacts from transportation activities are considered low, not increasing the air pollutants compared to that of the current situation.

b. Construction machines

The construction of the embankments will be conducted by separate teams, each team spreads within approximately 3 km.

The equipment used by each team on the horizontal embankment includes: 1 excavator of $0.8m^3$; 1 compactor and 1-2 concrete mixer type 500 liters.

The equipment used by each team along the Bay Xa canal includes: 1 excavator of $0.8m^3$; 3 trucks for soil transportation with capacity from 3.5 to 5 tons; 1 compactor and 1 concrete mixer type 500 liters.

The equipment used by each culvert includes: 1 front shovel bucket loader of $0.8m^3$ and 1 concrete mixer type 500 liters.

Figure 55: The contruction area of culvert in the subproject

Raw materials used for the construction equipment is diesel oil with a sulfur content of 0.25%.

Typically, combustion residual fuel gas is 30%. When the exhaust fumes temperature is 200^0C, the combustion emissions of 1kg DO is $38m^3$.

Comparison of the concentration of pollutants in emissions from the operation of construction equipment with the QCVN 19: 2009/BTNMT standards (column B) shows that the concentration of pollutants are within permissible limits moreover the construction sites are located out in the field of agricultural production therefore these emissions will quickly

disperse into the surrounding environment. The above characteristics suggest that the impact of emissions from construction machines on the construction site is considered low, equivalent to the operation of 1-2 cars.

Table 49: Machinerys use for horizontal embankment construction

No.	Machinery	Number	Fuel consumption (liter/shift)	Total Fuel consumption (liter/shift)
1	Excavator	1	35,1	35,1
2	Roller	1	19,2	19,2
3	Concrete-mixer 500 lit	1	28,8 (33,6 kwh)	28,8
	Total			**83,1**

Table 50: Machinerys and vehicles use for the Bay Xa canal embankment

No	Machinery	Number	Fuel consumption (liter/shift)	Total Fuel consumption (liter/shift)
1	Excavator	1	35,1	35,1
2	truck (5 ton)	3	25	75
3	Roller	1	19,2	19,2
4	Concrete-mixer 500 lit	1	28,8 (33,6 kwh)	28,8
	Total			**158,1**

Table 51: Emission loads coming from the use of oil for machinery

No	Parameter	Fuel consumption (kg/Ton Diezen)
1	Aldehyde	0,24
2	CO	0,24
3	Hydrocarbon	0,24
4	NO_x	8,56
5	SO_2	4,67
6	SO_3	0,07
7	Dust	1,78

Source: Dinh Xuan Thang, 2007

Based on the emissions and the fuel use, the emissions from construction equipment are shown in the *Table 52*.

Table 52: The concentration of pollutants generated by construction equipment

No.	Pollutant	Concentration (mg/m^3)	Concentration (mg/Nm^3)	QCVN19:2009/BTNMT (mg/Nm^3)
1	Dust	18.67	-	200
2	SO_2	26.30	33.14	500
3	NOx	253.00	318.78	850
4	CO	57.60	72.57	1.000
5	THC	20.80	26.21	-

Note: (i) Nm^3: The volume of gas to be converted into the standard conditions; and (ii) QCVN 19:2009/BTNMT (Column B): National Technical Regulation on Industrial Emissions for Dust and Inorganic Substances.

Comparing the concentration of pollutants in emissions from the operation of construction machines and equipment with QCVN 19:2009/BTNMT (Column B), we found that the concentrations of pollutants are within the standards. Moreover, the construction sites are located in the fields of agricultural production, so the emissions are quickly dispersed into the surrounding environment. With these characteristics, impact of emissions from construction machines and equipment on the construction sites is considered small. They are equal with the operation of 1-2 trucks.

c. Spreading dust due to soil excavation

Excavation during the construction phase mainly takes soil from the old embankments to backfill onto the new routes. The soil in this area typically is saturated with water from 4-5 months in the flood season. The construction will take place immediately after the floods recede. Inside the field there are still rice production activities so a relative moisture is still maintained for the soil at the embankment area. With such conditions as described above, the excavation work seems not to disperse dust into the environment or if it does, the dust emissions would be around 3-5m. Therefore, the influence of dust emission upon soil excavation along the embankment route is viewed as low and segmented not prolonged.

d. Dust from mixing plants

Dust from the process of concrete mixing can be defined as a potential contaminant source. According to the design, the total volume of concrete used in the subproject is 37,826m^3. The emission coefficient when mixing concrete is 0.5-5g/m^3 and as such the total volume of the cement dust may arise about 19-190kg of dust. However, most of the construction area is located in the agricultural field and away from households, the blending range extends about 60 km along the embankment, the mixing time in each area is only 1-2 days, so the impact by cement dust is considered moderate.

Because the concrete mixing method is to use a small mixer (500lit) the dust impact is only on the proximity around the concrete mixer with a radius of 5 - 10m, the impact from dust is mainly on the people who directly participate in the mixing process. At the embankment area near the households, mixing concrete can affect people's houses so the construction company must pay attention in these work area to avoid healt impact on the local people.

For the workers participating in the concrete mixing process who will have to endure a longer time contacting dust, which is very fine, in the long term their health may be directly affected by the dust. Therefore, contractors have to provide their workers with protection uniforms and working guideline for dust protection measures and for locating the mixing positions appropriately to prevent the inhalation of the dust.

4.4.1.8. Impact on Water Environment

a. Workers' domestic wastewater

The construction of the embankment routes is mobile, finishing this segment then starting the next, so there are no camps for the workers. The construction works is mainly earthworks, concrete mixing and simple concrete hardening so the construction unit can hire unskilled workers locally. The technical staff will be staying in local resident's homes near the construction sites so the wastewater will be treated within the residential area.

Culverts in the subproject are very small (the aperture is only 3 m), located in the fields with the construction period from 4-6 months for each with 1 camp for a materials guard and for the workers to stay at break time. It is expected to build such 5 culverts within 1 year hence the number of workers on site would be 5 culverts x 3 workers/culverts = 15 workers. The wastewater then generated at each culvert will be calculated as follows:

Q= 45 liter/person/day x 15 persons/day = 675 liters/day

Based on the pollution coefficient established by WHO and the number of workers at the subproject approximately 15 people, the pollutants load from the waste water on site are calculated and presented as in *Table 53*.

Table 53: Loads and Pollutants Concentration Of Domestic Wastewater (untreated)

STT	Pollutants	Unit	Pollution	QCVN 14:2008/BTNMT colum B (k=1,2)
1	BOD_5	mg/l	563 - 675	60
2	COD	mg/l	900 - 1.275	-
3	TSS	mg/l	875 - 1.813	120
4	Grease	mg/l	125 - 375	24
5	TN	mg/l	75 - 150	-
6	Ammonia (N-NH4)	mg/l	30 - 60	12
7	TP	mg/l	10 - 50	11
8	Coliform	MPN/100ml	106 - 109	6.000

Source: Hoang Hue, 2002

Based on the pollution coefficient established by WHO and the number of workers at the subproject approximately 15 people, the pollutants load from the waste water on site are calculated and presented as in *Table 54*.

Table 54: Pollutant load in domestic waste water

No.	Pollutant	WHO coefficient (g/person. day)	Pollutant Load (kg/day)
1	BOD_5	45 - 54	1.08 – 1.30
2	COD	72 - 102	1.73 – 2.45
3	Suspended solids (SS)	70 - 145	1.68 – 3.48
4	Free minerals lubricant	10 - 30	0.24 – 0.72
5	Total nitrogen (N)	6 - 12	0.14 – 0.29
6	Ammonium ($N\text{-}NH_3$)	2.4 - 4.8	0.03 – 0.12
7	Total phosphorus (P)	0.8 - 4.0	0.02-0.1

Source: Rapid Environmental Assessment, WHO, 1995

This shows the waste load from the workers is not much, moreover this amount is distributed in 5 positions so the risks of creating an impact to the environment is low when the construction units can meet the sanitation environment conditions including the mobile toilets.

b. Impacts of storm water runoff

By nature, rainwater is considered clean water, however if it flows through the soil spillage area, containing waste, diesel oil, or household waste it will affect the receiving water.

The execution of works is scheduled during the dry season with the embankments hardened before the floods during the rainy season. The soil from the old embankments will be used to backfill onto the new embankments. Analysis of the soil samples in the area indicates low to a mild acidic level. Therefore, the risk of soil acid washing into the environment from the

excavated areas is considered low, or if any, it's only temporary and will be neutralized by the receiving water.

At the culvert areas, each culvert construction is from $50m^2$. The construction activities are mainly the mixing of cement to construct the culvert items, therefore the impact to the environment from the works if any will be at a moderate level and localized at the site.

b. Construction equipment washing water

After each shift the concrete mixing equipment must be cleaned. Waste from this washing water is mainly cement powder and sand being stuck in the rotating drum. The amount of wash water is not much, from 30 - 50 liters/equipment/time. This wash water source if poured directly into the canals may have a small effect to aquatic fauna at the receiving point. Due to the very small amount of water containing non-pollutants this wastewater can be poured directly into the grounds around the dike without causing any detrimental effect on the environment.

Overall Assessment: The above assessment shows that any negative impact to the surface water quality in the construction phase of the subprojects is low, temporary, locally onsite, and are completely under control by the construction team who can fully implement solutions for environmental pollution control.

4.4.1.9. Impacts of solid wastes

Sources of solid waste include construction waste, household waste, earthworks material, and all kinds of material scattered during the construction process. Also there are twigs from bushes appropriately cut at the old embankment routes.

a. domestic wastes

According to the above analysis, there are only 15 workers living directly onsite while the other staff to reside with people in homes near the construction sites. The amount of domestic waste for 1 worker is 0.3kg/person/day so the total amount of waste on the site will be: 0.3 kg x 15 people = 4.5kg/day. Domestic garbage includes mainly biodegradable organic elements (roots and fauna) along with a small amount of packaging (plastics, glass...).

For organic garbage, if it is not well managed and handled, it will cause a smelly odor in the area or if discharged directly into the canals it will affect the water quality, as well as, obstruct the water flow. For other garbage (plastic bags and packaging...), although at a very small volume, due to its long half-life and decay time, it must be collected and processed without being discarded into the water canals.

The amount of municipal waste from the workers dispersed from 5 culvert sites, which are all out in the field, is estimated to be about 4.5 kg/day that is mostly of organic matter. If the workers in the camps appropriately control this waste without discharging any into canals then the impact is considered very low.

b. Construction solid wastes

The process of excavating, backfilling and reinforcing the embankment surface will generate construction solid wastes as soil, cement bag, iron and steel scraps, stone, debris, etc...

The soil dropping during the embankment backfilling: the volume of backfill soil droppings during the excavation and covering is not much and the impact from this waste to the environment is identified as insignificant.

Construction waste: includes cement bags, iron and steel scraps, construction stones and sand, is the waste from up to 200,000 cement bags, all is to be collected and not littered in the environment especially the canals.

Clearing of shrubs and plants on the old embankment route: this is carried out for soil excavation. The plants in this area are mostly shrubs and are not much in quantity so the construction units must proactively clear and clean the old embankment surface for soil extraction. Though the risk of any environmental impact of the materials is low, the construction teams must treat the waste properly never dumping any into the canals to cause flow clogging or to affect the water environment.

4.4.1.10.Hazardous waste

Sources of hazardous wastes in the subproject are determined to be at risk of fuel spillage, oil and diesel of construction equipment and material handling.

+ Composition: including used oil and lubricant residue, oily rags...

+ Time: Mostly sporadic, the waste is only generated when conducting emergency repairs or routine maintenance on the site.

+ Volume: infrequent, depending on machinery repair time.

For motor oil of the equipment consumption is about 7 liters/recharging time with a frequency of 3-6 months/ oil change/time. This source is completely controllable at the discharge point basing on the awareness of the workers, particularly those who operate the material transportation barges through waterways.

Impact of used oil residues: Although the oil residues are not much (7 liter/charge), however if leaked into the environment the harmful impact to the environment is huge. Assuming a spillage of the entire 7 liters of lubricant oil occurs, due to the light density of the oil and its low degradation, the affected surface area would be tens of thousands of square meters. If spillage oil becomes waterborne, it floats on the surface water causing oxygen deficiency in the water that can directly affect the aquatic species. A large oil spill if severe can stick on the aquatic species and cause death, for this, the construction teams need to pay special attention to control any oil residues and avoid any leakage into the environment under any circumstances.

The possibility of oil/diesel leakage from the construction equipment to the environment should be monitored. For the construction machinery, any leaked fuel could penetrate into the soil and make contact with water following rainwater runoff affecting the aquatic environment and aquatic fauna. This risk will not be high due to the limited quantity of equipment being used in the construction, the machinery must also be ensured for the compliance with the technical standard requirements and furthermore if there's leakage the fuel cost of the construction unit will be directly impacted.

Equipment cleaning rags: This source of waste contains oil and grease. This is not much in quantity and becomes a risk only upon equipment repairs or maintenance. Once the workers are aware of the risk of waste discharge then the control of this is not difficult and the impact on the environment is low.

With the spread of the subproject, the construction machinery and all major work activities will be performed inland. The environmental risk of used oil residue from construction equipment is minimal and considered insignificant, especially when there are measures to control the sources thereof. The inpact is considered moderate.

4.4.1.11.Soil erosion and sedimentation

When the floods arrive, the newly constructed embankment will be submerged under water. Due to the infield flows and the long flood period the embankments will stay wet (4-5 months), there may be erosion at the new embankment. If the dike reinforcement works will not be completed before the flood arrives, the impact will be damaging. Therefore, appropriate construction schedule and progress need to be carefully considered.

The construction will take place in land with a distance away from the canals of at least 10m. For the horizontal canals, the earth materials for the new embankments will be taken from that of the old ones. The process of excavation materials if not handled with appropriate methods may cause soil dropping down to the canals, or the remaining soils at the old embankment may be flushed down to the canals when flood arrives, causing sedimentation in the canals.

The execution work of the new embankment route may also spread soil to the infield irrigation canals and paddy rice fields causing sedimentation in the canals and arable agricultural land if there is no strict erosion and sedimentation management measures. The above-mentioned risks are assessed as moderate.

4.4.1.12.Impacts on agricultural activities

Construction activities may cause disruption of the local agricultural cultivating and havesting activities, damages to the paddy rice fields, vegetable crops, and fruit trees. However, given that construction scale is small, at different sections, and with a limited number of workers, this impacts is considered small.

4.4.1.13.Impacts on Biological Environment

a). Impacts on terrestrial ecosystems

The construction activities of the subproject mainly include excavation and backfilling work of the canals serving the longstanding agricultural production, cutting down trees and clearing bushes on the existing embankment routes to extract soil for making the new embankments will be no impact to the terrestrial ecosystems.

As discussed in the section 0, the ground flora and fauna ecosystem in the area not endemic, the crops and wild plants, animals or domestic animals are just normal animals. When doing the construction site clearance, it is considered as the regular weeding of the people; construction activities is not on a large scale therefore it does not affect the nature much. It is discontinuity and locally, it has the ability to recover after 1-2 months so this impacts is considered small.

The habitat protected areas are located very far away from the subproject area therefore it will not have any impact on the habitat.

For migratory birds: being the agricultural harvest production area, this is not the destination of migratory birds passing through naturally, moreover, the construction of the subproject is locally, simply a small embankment, not concentrated construction equipment so it will not affect the operation of natural migration of birds.

b). Impacts on aquatic ecosystems

The subproject activities related to water transportation pertain to the shipping of the construction materials. The transportation of these materials is spread out during the extended construction period with the number of transports on average at around 4 times/day. With such small a volume, the likelihood of any negative impact on the water ecosystems is very small.

The survey results also show that aquatic fauna and flora in areas are not endemic. The fish species are not much in terms of composition and productivity. Overexploitation and fertilizers, herbicides utilization causes a low and poor level biodiversity of aquatic fauna and flora ecosystem. The wastes generated during construction including construction spoils, construction debris, cement packing, formwork, domestic waste, hazardous wastes from construction and transportation machines may affect the aquatic ecosytemt in the immediate canals. Therefore, the overall impact on the aquatic ecosystem can be assessed as small.

4.4.1.14.Impacts on Physical Cultural Resources

There are no physical cultural resources in or within proximity of the subproject areas that can be affected during construction. However, during construction there might be chances that historical or cultural artifacts would be found. The procedures for addressing these situations are included in the chance find procedures in Chapter 6.

Impacts due to safty risks and accidents during construction of dykes and slucies

4.4.1.15.The labor accident

The characteristics of the subproject are to construct embankments and canals that do not require any highly skilled workforce; this will utilize unskilled laborers at the local level. There are also disadvantages in using the local labor such as: most are unskilled, uneducated, and with limited knowledge of safety and protection measures, all of those may be a cause for an accident or incident. Such labor accidents can easily occur such as: falling from the embankment down to the canal due to being careless while working, being electrocuted due to carelessness when using power, performing mechanical repairs, or electrical wiring. The impact from other workers on the construction site directly. Personal injuries, occupational health problems, or the chance of the loss of human life are all looming issues. Any impact on the surrounding communities is insignificant.

4.4.1.16.The water traffic accidents

Waterway traffic accidents caused by a lighter boat sinking, or from another collision leading to the sinking of a boat. An accident caused due to the lack of traffic regulations, the incompetence of the boat operator, or lack of technical operation guidelines on the waterways. The barge shell is cracked, defected or not durable after a period of use. Material transportation carried out in adverse weather conditions. Boat collides with unexpected obstacles not yet being cleared in the river. Traffic accidents as a result from an oil spillage in the canal, etc.

4.5. IMPACT ASSESSMENT DURING OPERATION PHASE

Dykes and culverts operation

The subproject embankment will only improve from the existing one for local production stability and this embankment can be stable during flood season, and erosion of the embankment will not occur, therefore, impacts of embankment on local environment and people are negligible and there is no need to propose mitigation measures for this structure.

The subproject culverts are only small and will replace the function of the dregraded ones for uptake and drain water for local people in their rice cultivation, thus the impacts of culverts on local environment and people are negligible, and there is no need to propose mitigation measures for these culverts as well.

Nonetheless, these impacts should be addressed comprehensively at the provincial and local levels.

Impact assessment for implementation of livelihiood models

4.5.1.1. Potential positive impacts of the subproject on socio-economic environment

4.5.1.1.1 Positive impacts on socio-economic from organic rice farming

In the production model No.1, 2 and 5, there includes organic rice farming activities. The rice production in this model is oriented towards organic rice production, restricting the use of herbicides and fertilizers, technical solutions applied to rice production including applicable measures of Integrated Pest Management (IPM), applicable solutions of "one must - five reduce" in rice production. This is the condition for the development of production models reducing production costs, reducing the use of fertilizers and plant protection chemicals and bringing economic benefits to the people as well as reducing waste disposals into the environment.

Experience in implementing the "1 Must 5 Reductions" program began in An Giang in 2009

Table 55: The benefits from model one Must five Reductions in sumer-Autom rice at An Giang in 2009

	Unit	**Model "one Must five Reductions"**	**Nomal production**	**Difference**
Rice seeds	kg/ha	125	149.5	24.5
Fertilizer				
+ Urea	kg/ha	110.6	117.5	6.5
+ Phosphate	kg/ha	58.0	66.4	8.4
+ Potassium	kg/ha	53.3	53.6	0.3
Pesticides				
+ Pesticides	Times of crop	0.9	3.3	2.4
+ Fungicide	Times of crop	2.5	3.8	1.3
Pumping water	Times of crop	5.8	7.8	2.0
The falling rate		8.5%	20.0 %	11.5
Yield	Ton/ha	5.66	5. 47	0.19
Profit	**(VND/ha)**	**11,508,000**	**7,768,000**	**3,740,000**

Source: DARD An Giang, 2009

Farming 1 hectare of rice has a positive yield by decreasing the following; 24.5 kg of rice seeds, 6.5 kg of urea, 8.4 kg of phosphate, 0.3 kg potassium, 2.4 applications of the pesticides per crop, of 1.3 sprays of fungicide per crop, 2.0 times of pumping water /crop and 11.5% of the falling rate and an increase of 190 kg of rice in yield and a profit of 3.74 million dong/ha compared with normal farming practices of the people.

Thus only 50% of the land's production in the three communes (5.000ha) on the East side of the Hau river is applying a good practice of the "One Must 5 Reductions" in their rice production. The one-year operating profit from their production will be 37 billion dong. This operation can reduce 6.5 tons of urea fertilizer, 8.4 tons of phosphate, and 0.3 tons of potassium, decreasing all that waste discharge into the environment.

Regarding pesticides, because each pesticides a different dosage e.g. the hoppers insecticide in powder form is usually applied about 30-150 g/ha/time or the liquid form is applied from 0.25 to 2 liters/ha/time depending on the type. However, if calculating only the powder pesticides with an average of 50 grams/ha/application then in 1 year alone the threee communes on the East side of the Hau River could reduce 120 kg of pesticide and 65 kg of

fungicides. This is a significant number that needs special attention and concern for the environment, and for the health of all people, farmers, and consumers.

4.5.1.1.2 Positive impacts on socio-economic from shrimp farming

In Dong Thap, the giant freshwater shrimp farming activities has developed quite well in the flood areas and the aquaculture model is viewed as an economically viable model for all local farming during the flood season (*Table 56*).

Table 56: Performance from giant freshwater shrimp farming on rice -shrimp model in Dong Thap province

No	District	Price (VND/kg)	Total cost (mil. VND)	Yield (ton/ha)	Gross (mil. VND)	Net profit (mil. VND)	Rate of return (%)
1	Tan Hong	113,636	75	0.66	102.3	27.3	36.4
2	Hong Ngu town	132,479	155	1.17	187.2	32.2	20.8
3	Hong Ngu district	125,455	138	1.1	165	27	19.6
4	Tam Nong	139,844	179	1.28	217.6	38.6	21.6
5	Thanh Binh	128,000	128	1.00	155	27	21.1
6	Cao Lanh	129,032	160	1.24	198.4	38.4	24
7	Lap Vo	131,126	198	1.51	241.6	43.6	22
8	Lai Vung	133,333	140	1.05	170.1	30.1	21.5
10	Thap Muoi	130,000	130	1.00	160	30	23.1
	Average	**129,212**	**145**	**1.29**	**177**	**32.69**	**23**

Source: IUCN, 2015. An Giang 1 Field Report Part 1

The economic benefits from giant freshwater shrimp models from the flood areas of Dong Thap reveal that only one shrimp crop during the flood season can bring economic values 2 to 3 times higher than of rice crop cultivation. However, this is an activity that requires farmers to be trained for the technical knowledge, as well as, to mobilize a large capital investment of 145 million/ha. Therefore, in addition to the field farming school, the financing policies to support the local people at the early stage to implement farming development are essential to the success on a wide scale.

4.5.1.1.3 Positive impacts on socioeconomic from floating rice farming

The model of floating rice farming during the flood season is also a climate resilient option in the context of climate change and sea level rise. The economic effectiveness from the floating rice farming shows that the profit from just 1 floating crop is twice or three times as a normal crop. However, cultivating floating rice does not require plant protection chemicals and almost no fertilizers required, hence this model is not only significant in term of an economic value, but also in term of environmental protection. Other livelihood models such as chili cultivation also show a very high economic return (10 times higher compared with rice) or the scallion cultivation can also bring about economic returns 20 times higher compared with rice (*Table 57*).

Table 57: Costs and Returns of Floating Rice Farming System per 1,000m^2 (0,1 hectares)

No	Farming method	Cho Moi	Tan Long	Vinh Phuoc
I	*Only floating rice*			
1.1	Cost (VND)	670	600	630
1.2	Yield (Kg)	300	300	240-260
1.3	Price (VND/Kg)	10,000-16,000	10,000-16,000	12,000-16,000
1.4	Sale of straw and rice tops.	200,000-300,000	200,000-300,000	200,000-300,000
1.5	Gross income	3,200,000-5,100,000	3,200,000-5,100,000	3,080,000-4,460,000
1.6	**Profit**	**3,133,000-4,430,000**	**3,140,000-5,500,000**	**2,450,000-3,830,000**
II	*Allium chinense crop*			
2.1	Cost (VND)	14,000,000	14,000,000	14,000,000
2.2	Gross income (VND)	35,000,000-37,000,000	35,000,000-37,000,000	35,000,000-37,000,000
2.3	**Profit**	**21,000,000-23,000,000**	**21,000,000-23,000,000**	**21,000,000-23,000,000**
III	*Chilly crop*			
3.1	Yield (Kg)		1923	
3.2	Price (VND/Kg)		15	
3.3	Gross income (VND)		28,945,000	
3.4	Cost (VND)		14,407,692	
3.5	Profit	**N/A**	**14,437,308**	**N/A**

Source: IUCN, 2015. An Giang 1 Field Report Part 1

4.5.1.2. Changing land use

Currently, land use in this region is mainly 2 and 3 rice crops production (*Figure 39, pp. 74*). The activities of sub-project is to change some of the production activities in order to improve and increase the income of the local residential people. This activity will change the land use purpose in the region; however, this is the process which requires time. Based on the result of some livelihood models which have been piloted in the sub-project, project owner will step by step prepare the schedule planning and time to change the land utilization to be suitable, avoid the case that local residential people will self study and self develop not following the plan, avoid the conflict during the operation and utilization of the land which is not suitable with the natural features and utilization condition of the water resource.

Table 58: Change the land use in the region

Model	Changing area (ha)	Existing Land use purpose		Land use purpose in the future					
		1	2	3	4	5	6	7	8
Model 1	1.000		*	*			*		
Model 2	500		*		*			*	
Model 4	500		*	*		*			*
Model 5	1.000	*		*		*			*

Note:

1. *Rice crop production whole year (3 crops);*
2. *Rice crop production from December to August (2 crops) and flood discharge from August to November;*

3. *Rice crop production from November to February;*
4. *Vegetation crop production from December to April;*
5. *Vegetation crop production from March to June;*
6. *Shrimp production in flood water time from May to December (flood discharge time);*
7. *Floating rice crop production and aquaculture production from May to December (flood discharge time);*
8. *Natural flood discharge time from August to December*

From the *Table 58*, it is figured out that:

Regarding Model No.1: the current condition of 2 rice crops production in 1 year, and natural flood discharge will be changed of about 1,000 ha to 1 crop production in 1 year and 1 shrimp production in 1 year targeting at using the net to cover the raising parcel. This model changes the time of production in shrimp cropping production from controlling of flood water toward letting the flood water coming into the field sooner, then increase the space of water storage and flood water discharge for the region.

Regarding Model No. 2: changing about 500 ha land from 2 rice crops production in 1 year into 1 rice crop production in 1 year and vegetation crop production together with floating rice crop production and combination with aquaculture production. This model changes the time of production in floating rice crop production from the flood water control into letting flood water coming into the field sooner, then then increase the space of water storage and flood water discharge for the region.

Regarding Model No. 4: change from 2 rice crops production in 1 year into 1 rice crop production in 1 year and vegetation crop production and flood water discharge. This model in principal only changes the plant from rice into vegetation crop production and it will not change the land use as well as not change the time of taking flood water into the field.

Regarding Model No. 5: Change from 3 rice crops production in 1 year into 2 rice crops production in 1 year and taking the flood water back into the field. The purpose of land use will not change, however, the time of crop production in the land will decrease and there will be 3 months of flooding season (August to December) when the land is covered with flood water which create the condition for the land to recover after 2 rice crops production and increase the capability of flood water storage for the region.

Regarding Model No. 3: This model will not change the land use purpose much due to the production of mushroom during the flood season, it only utilizes the banks of the channel, the garden or the yard of the house to produce mushroom.

As there are many purposes to change the land use utilization, the form of utilization and exploitation with the time of water usage are different. Therefore, the planning of land use purpose should be detailed, specific to avoid the self development and causing conflict in water resource utilization or having adverse and negative impacts on the environment.

4.5.1.3. The potential negative impacts during implementation of livelihood models

Although the subproject has many positive impacts for the environment, it presents many risks to the environment and the society. There may be some potential negative impacts during construction given that implementation of the proposed livelihood models may require some improvement of on-farm systems to ensure achievement of good production practices. However potential impacts of these works will be small, localized, and limited to each farm, and it will be made with technical assistance to be provided by the subproject to ensure that

the system has the right design to implement the demonstration activities. The main indirect impacts will be limited to operation of the models and they are discussed below.

4.5.1.3.1 Negative effects are not related to wastes

The development of large product outputs while not having a market may negatively impact the livelihood models of subprojects. If not forecast the needs of the market well and not well supported consumption for products, the risk of producers produce over demand which could lead to devaluation. The risk of this impact appears at moderate level, and the level of social impact will be low. However, the impact on the producers will be moderate. This is the issue which the investor, the state administrative management agencies/ authorities in An Phu district should prepare a production plan and consumption of products suitable to ensure stable production.

The famers have been accustomed to rice production farming for many years with that technical expertise. When shifting to new farming models, an inadequate technical guidance can lead to unsuccessful production, limiting the model to scale up to the broader scale. The risk of this impact is considered to be moderate since most farmers are poor and have low education. Technical assistance will be provided to minimize this risk incldung undertaking socioeocnoic sruvery before and after the implementation of the models.

Conflicts over the use of water resources can arise if the boundaries between production models are not built appropriately.

- Regarding Model No. 1 (rice crop and cray fish) and Model No. 2 (vegetation crop and floating rice crop), the time that flood water storage in the field is from June to December which is different with the current existing crop production or Model No. 4 (only taking flood water into the field from August to December)
- Regarding Model No. 5: this is the area where having 3 rice crops production in 1 year without flood water discharge, therefore, when changing, it is needed to change totally for the whole new parcel to avoid the conflict in water consumption and utilization.

The risk of conflict is considered to be low thanks to the model arrangement has been planned and designed in detail.

4.5.1.3.2 The negative impact related to waste

a). Wastes from aquaculture cultivation

A very important goal of this subproject is to develop livelihood models which are not too heavily focused on rice production, but gradually shifting from rice production of current 2 or 3 crops/year into the model of 1 rice crop coupled with 1 aquaculture crop or a cash crop for higher economic efficiency.

Depending on each aquaculture farm model, there will be environmental impacts associated at different levels.

<u>Model 1.</u> Spring rice farming season (Biosafety, do not use plant protection chemicals) + giant freshwater shrimp

If the fingerling density is from 1-5 pcs/m^2: This is an extensive farming activity due to the low density applied. During the beginning period, the shrimp are fed mainly from natural feedstuff and only during the pre-harvesting months are additional feeds used in small quantities at only about 20-40% compared with that of intensive farming. Due to the scarce density of fingerlings, there is no need for using chemicals or biological products to treat the

water and sediments. The impact from this kind of activity to the environment therefore is considered modarate.

According to FS report it is expected that the yield of shrimp in the subproject model will be from 1.3 to 1.5 tons/ha. Farming the shrimp with not so high a yield is also a factor that brings economic benefits.

Table 59: Emissions from 1 ha of shrimp with yields of 1.5 tons / ha

No.	Item	Calculation method	Quantity (Ton)
1	Shrimp yield (ton/ha)		1.5
2	Feeding stuff	FCR (Feed Conversion Ratio) =1,4	2.1
3	Waste generated (mainly organic waste)	Amount of feeding stuff*80% (shrimps uptake 20%, waste 80%)	1.68
4	Nitrogen containing waste (feeding stuff with 6%N =39% raw protein)	Amount of feeding stuff*5%*63% (Shrimp uptake 37% N, waste 63%)	0.06615
5	Phosphorous containing waste (feeds with 1,2%P content)	Amount of feeding stuff *1,2%* 55% (Shrimp uptake 45% P, waste 55 %)	0.01134

Table 59 shows that one shrimp crop (6 months) of 1 ha with yield of 1.5 tons of shrimps will generate into the environment around 1.68 tons of organic waste (0.16 kg / m^2), 66.15 kg N (approximately equivalent to the urea amount used for 0.5 hectares of rice). With the above calculation of generated waste, it is obvious that the level of impact is not significant and is within a limit that the water environment can easily self-purificate and impacts on environment is modarate

If only count the scale of water surface area inside the aquaculture parcel and assume that the worst condition is the total waste to be discharged only in 2 months at the end of the raising season then the amount of organic waste discharged from the shrimp raising production will be 5.3 g organic waste/m^2/day. This is a quite low discharge load in comparison with the self cleaning capability of the natural environment (the self cleaning capability of the natural environment is from 5-40 gram organic waste/m^2/day). Therefore, with the form of extensive farming as mentioned in the sub-project, then the possibility of pollutant dispersement to the outer environment is estimated to be very small. If it is strictly compliance with the shrimp raising density then with the scale of 100 ha in the time of sub-project implementation and with the estimation of expansion up to 1,000 ha in the region of 10,000 ha area (eastern region of Hau river) then the impacts caused by the shrimp raising production on the environment is small and negligible; the waste discharged from the shrimp raising production activities is within the self cleaning capability of the natural environment.

Assuming the shrimp farmer will want to cultivate intensively at a greater density with higher production yields, expectedly the 4 ton/ha/crop develops the risk of a high waste discharge (*Table 60*). At that level, producing 1ha of shrimp generates 4.4 tons of organic waste (0.44kg/m^2), 176.4kg of Nitrogen (equivalent to 1.5ha of rice production) and impact on environment is high. These are the figures that need serious consideration for issuing proper guidance and direction to the farmers to apply the most appropriate model.

Table 60: Emissions from 1 ha of shrimp with yields of 4 tons / ha

No.	Item	Calculation method	Quantity (Ton)
1	Shrimp yield (ton/ha)		4
2	Feeding stuff	FCR (Feed Conversion Ratio) =1,4	5,6
3	Waste generated (mainly organic waste)	Amount of feeding stuff*80% (shrimps uptake 20%, waste 80%)	4,48
4	Nitrogen containing waste (feeding stuff with 6%N =39% raw protein)	Amount of feeding stuff*5%*63% (Shrimp uptake 37% N, waste 63%)	0,1764
5	Phosphorous containing waste (feeds with 1,2%P content)	Amount of feeding stuff *1,2%* 55% (Shrimp uptake 45% P, waste 55 %)	0,03024

Most aquaculture process is a natural breeding process, but there is a risk that farmers/households chasing profit with increase of density or antibiotic treatment for breeding, or feeding redundantly leads to water pollution. Depending on the form or type of farming that will have certain impacts on the environment at different levels. If extensive scale is adopted, the impact on the environment is small. However, if industrial-scale farming, which is not the case in this subproject, is to be employed, the environment would be significantly affected.

+ Solid waste from feed stuff packaging:

Packaging waste: generated from the feeding process from the fisheries, disease treatment, etc. The main compositional elements of the packaging thereof are plastic, textiles, organic compounds and the leftover feed sticking on the packages. The used chemicals packages are left with the antibiotics and chemical residues. According to data from the aquaculture household survey with 2ha model this kind of trash is about 1kg/day.

Although the volume of waste generated from each model is small, it is a pilot model for replication in the region. Therefore, all subproject owner should have training programs of how to efficiently and environmentally manage this waste.

+ The impact of the epidemic disease and the utilization of antibiotics from aquaculture activities:

Aquaculture following the incorrect or inaccurate technique can cause diseases which affect the quality of water supplies and spread diseases very quickly for the surrounding and downstream areas. If the large-scale farming, the effect of it would be serious.

<u>Model 2:</u> Floating rice in combination with aquaculture (gurami, featherback, etc.) + crops

In the flood season farming floating rice combined with aquaculture to apply a density from 0.5 to 1 fingerlings per m^2 + a cash crop during the dry season (scallion, maize or sesame). Aquaculture fisheries could include snakeskin gourami, clown featherback (clown featherfin, clown knife) and when farmed in a low and loose density, the fish can find food in the natural environment between rice stems. If farming as a low-density fishery there is not much demand for food, and if the rice farming does not use a high level of farming chemicals this model also has no impact on the environment compared with the current rice planting activities. Therefore, it also helps to improve the environment compared with the current 2-crop of rice

production. Additionally, this model of aquaculture does not add any new fish species because the fish is already available naturally in the area and can breed easily and be locally produced.

Floating rice creates large amounts of straw which in the dry season is used as a mulch to cover soils on which vegetables are grown. This conserves soil moisture that is then utilized by these crops. It also adds to soil organic matter and thereby returns nutrients to the soil. Furthermore, this agro-ecological system can both reduce greenhouse gas emissions and sequester carbon, because farmers do not burn the straw. Finally, maintaining the floating rice keeps a unique soil and biodiversity system alive and maintains a valuable gene pool. It can be concluded that this model has no adverse impacts on the environment.

Models 4: Winter spring rice + crap crop + natural fisheries

The activity of the fishery in this situation is natural without feeds, and is also organic without spraying chemicals. Fishery in this model has no impact and actually helps to improve the environment compared with the current rice production method, as well as, helps to maintain the native aquatic species.

b). Waste from rice production activity

There is always need to use a certain amount of fertilizers and agriculture products during intensive rice farming. Due to the fact that rice farming practices are normally intensive, the rice can easily catch diseases hence the farmers need to use plant protection chemicals to protect the crop. Both of these farming activities effect the environment. Residual fertilizers in agricultural production is the cause of eutrophication in the water, and plant protection chemicals are the causes of environmental pollution and the residues in products will surely affect the product quality.

Model 1: Production of winter-spring rice + giant freshwater shrimp farming.

Production of winter-spring rice: To operate shrimp farming effectively the producers must minimize the usage of fertilizers and pesticide during the rice crop. It is this kind of activity that helps to reduce the discharge of the pollutants caused by the rice production, thus also reducing hazardous waste thereof. Rice production in this model reduce impacts on the environment than the current.

Model 2.

The floating rice crop, is being produced during the flood season. Due to the floating rice production, the farming does not use any fertilizers and no pesticide. This model helps to enhance the environment quality as compared to normal rice production of most farms today.

Model 4 and 5

Model 4: Planting one winter-spring rice crop + cash crop; The rice production in this model is not different from the current rice production, however, applying the integrated pesticide management (IPM) and Model "*one must five reductions*" program will help to reduce the use of fertilizers and plant protection chemicals and lessens the impact of the rice production activity on the environment compared to the current farming methods.

Reduce one rice crop which helps to reduce 50% of the waste from the current rice crop production model.

Table 61: The benefits from model one Must five Reductions in sumer-Autom rice at An Giang in 2009

	Unit	Model "one Must five Reductions"	Nomal production	Difference
fertilizer				
+ Urea	kg/ha	110.6	117.5	6.5
+ Phosphate	kg/ha	58.0	66.4	8.4
+ Potassium	kg/ha	53.3	53.6	0.3
Pesticides				
+ Pesticides	Times of crop	0.9	3.3	2.4
+ Fungicide	Times of crop	2.5	3.8	1.3

c). Mushrooms growing in the flood season (Model 3)

This is a common activity that is occurring in the Mekong Delta. This activity uses agricultural residues or byproduct (straws) for growing mushrooms (without the use of chemicals, fertilizers) which should be absolutely no negative impacts on the environment.

Mushroom production activities also work partially decomposed straw and straw mushroom cultivation can then continue to make compost fertilizer for the rice, reduce the use of fertilizers in the harvesting production of the future following crops as well as increasing fertility for the soil. This model has no impacts on the environment.

4.5.1.4. Induced Impacts due to implementation of the livelihoods models

Given that aquaculture farming could bring more benefits to farmers, it is likely that expansion of the aquaculture activities and/or the proposed models could occur quickly without inadequate management and/or control. From the environmental and social perspectives, implementation of these models may trigger induced impacts which include (i) changes in land use from rice cultivation to aquaculture; (ii) disease spread; (iii) degradation of natural habitats, and (iv) increasing water pollution. These in turn would negatively affect biodiversity, water supply, and income of the poor who may not afford aquaculture farming. These induced impacts should be addressed comprehensively at the provincial and local levels. While changing land use is assessed in section 4.7.1 and the remaining issues are assessed below.

There is a risk of mass production posing a threat of disease spread on a wide scale especially in the expansion of aquaculture farming areas. In production, concentration development poses risk of infectious diseases to the aquatic species due to a variety of breeds or due to cross-infection of a disease from one farm to the others. The quenching of an epidemic in a large farm is also difficult because it is unable to find and kill the pathogen simultaneously on a large area. Therefore, sometimes the disease is stopped affecting in one place but is still inactive at another place therefore this source of disease continues to spread out to the environment. This is the popular pattern among the shrimp farming areas. The shrimp farming is not constant throughout the year as there are 4-5 months off in the dry season but there is still a risk of spreading a disease to the area from an affected fish pond/ shrimp farming compartment.

The risk of water use conflicts in the production model. It is unable to immediately transfer the whole production area in the region into the new model "1 rice crop and 1 fishery crop" which is highly expected by the subproject however this cannot be implemented completely within the next 10 years. This means that in the coming time once the subproject finishes the model "2 rice crops and 1 rice crop + 1 fishery crop" will still be in practice at the same time.

Apparently, the use of the flood water for these 2 production models is different. The model 1 rice crop – 1 fishery crop needs water from the beginning till the end of the flood season 6 month) while the model 2 rice crops needs to control/prevent the water from entering the field at the beginning of the flooding season to protect the summer-autumn crops soon to be harvested (flood only 3 month). Apparently the difference in using water sources leads to a need of having a boundary work between the two production areas strong enough to avoid a breakage of the embankment when the floods arrive causing water overflows from the aquaculture zone into the rice production area.

In many regions, when the production model is effective then the local residential people will expanse the production not following the plan, including the areas as well as raising scale. In the model of rice crop production – giant freshwater shrimp (Model No. 1) the possible risk may happen.

When developing the aquaculture area outside of the planned area will cause the conflict in water resource utilization and the infrastructure.

Regarding the raising scale not following the plan, the local resident people develop the industrial raising which may lead to the risk of environmental pollution, not only degrade the raising environment but also having impacts on the raising activities in the same region.

Regional impacts

A Regional Environmental Assessment (REA) has been prepared for the whole MDICRSL project. The REA analysed the regional impacts of the subprojects under Components 2 of the MDICRSL are summarized in the Table below. Most of the regional impacts of the subproject are positive due to re-enforcement of the low dykes and implementation of the livelihood models, including: Increased flood retention in the upper Delta; Increased nutrients and sediments during flood season; Reduced flood risk to downstream provinces; Protection of high value agriculture (fruit trees); Improved ecosystem connectivity from changes in hydrological flow; Increased income from converting from triple rice to rice + aquaculture; and Reduced use of groundwater.

The REA indicates that the subproject may have negative regional impacts due to installing water/flood control structures in the upper delta and implementation of the livelihood models and include: Surface water quality issues from conversion to aquaculture and freshwater shrimp; Conflict over water use; Increased surface water pollution from freshwater shrimp and aquaculture; and Increased fertiliser and pesticide use for new vegetable crops. The REA, however, suggests that these impacts can be mitigated at the subproject level by implementation of the ESMP, and by (a) ensuring that contractors apply good construction practices and initiate/maintain close consultation with local authorities and communities throughout the construction period and (b) close supervision of field engineers and/or environmental officer as recommended in the REA.

The regional negative impacts of the subproject activities during operation of the dykes and culverts and application of the livelihood models can be mitigated through a technical assistance to be provided during the preparation and implementation of the livelihood development models (Component 2 of this subproject). The technical assistance will also address the need for extensive consultation with water users and key staekholders during the development of sluice operations and possible impacts due to expansion of aquaculture farming the livelihood model without adequate management and control. In addition, the water resources monitoring program and MARD real time operations system for hydraulic infrastructure under Component 1 of the MDICRSL project will informed information for management of these regional impacts.

Table: Summary of regional impacts for Components 2 of the MDICRSL Project

Activity	Demand on natural resources	Significant impacts Intensity/Extent/Duration	Impact Rating
Installing water/flood control structures in the upper delta	Increased flood retention in project area. Changes in hydrological flow and land use.	• Surface water quality issues from conversion to aquaculture and freshwater shrimp ***M/Sr/Mt***	**Moderate**
		• Increased flood retention in the upper Delta ***H/R/Mt***	**Moderate**
		• Increased nutrients and sediments during flood season ***M/Lo/Mt***	**Moderate**
		• Reduced flood risk to downstream provinces ***H/R/MT***	**Moderate**
		• Protection of high value agriculture (fruit trees) M/Lo/Mt	**Moderate**
		• Conflict over water use ***M/Lo/St***	**Moderate**
		• Improved ecosystem connectivity from changes in hydrological flow ***M/Sr/Mt***	**Moderate**
New livelihood models in the upper delta	Pilot areas of land (ha) for alternative farming.	• Increased income from converting from triple rice to rice + aquaculture ***M/Lo/Mt***	**Moderate**
		• Increased surface water pollution from freshwater shrimp and aquaculture M/Sr/Mt	**Moderate**
		• Increased fertiliser and pesticide use for new vegetable crops ***M/Sr/St***	**Moderate**
Expanding aquaculture and shrimp farming	Conversion of land for sustainable shrimp farming.	• Reduced income for intensive shrimp farmers ***M/Lo/St***	**Moderate**
		• Conflict between fresh and brackish water uses ***M/Lo/St***	**Minor**
		• Improved surface water quality from reduced intensive shrimp ***M/Sr/Lt***	**Moderate**
		• Reduced use of groundwater ***M/Sr/Mt***	**Moderate**

Note:

- **Impact intensity is** evaluated as high (H), medium (M), or weak (W)
- **Spatial extent** is evaluated as regional (R), subregional (Sr), or local (Lo)
- **Duration** is evaluated as long-term (Lt), medium term (Mt), or short term (St)
- **Color codes:** Blue for positive regional impacts; Grey for negative regional impacts

CHAPTER 5. PROPOSED MITIGATION MEASURES

The impact analysis conducted in Chapter 4 suggested that the potential negative impacts of the subprojects are considered low to moderate and most of them would be localized, temporary, and reversible. These impacts can be prevented and/or mitigated through the application of the Environmental Code of Practice (ECOP) that has been developed as part of the ESMF as well as the site-specific measures that have been developed to address site-specific issues during the preparation of this ESIA. In this context, this chapter presents the measures to mitigate the site-specific impacts of the subproject activities while the Environmental and Social Management Plan (ESMP) covering the ECOP and site specific measures is presented in Chapter 6.

5.1. MEASURES FOR PREVENTION AND MITIGATION OF NEGATIVE IMPACTS IN PREE CONTRUCSTION PHASE

As the negative impacts arising in the site preparation stage are analyzed in Section 4.2, during the site clearance, the focal issues to be resolved to prevent bad impacts include: (i) Impact on households whose land is acquired permanently and temporarily; (ii) Impact due to relocation of graves; and (iii) Impact from landmines and explosives which still persist in the ground (UXO).

For the subproject to be implemented but prevent the above risks on permited provisions, and all people support as well as ensure the safety when performing the construction, during the site clearance, the subproject owner shall perform the following tasks:

Organization of compensation for households whose land and houses are lost and support for their livelihood restoration

Get local community opinions on the land acquisition and resettlement plan for residents who give production land for the construction of the subproject works and complete the compensation plan to meet the aspirations of people.

Organize the compensation for households whose land and houses are lost under the Resettlement Policy Framework (RPF) and the Resettlement Action Plan (RAP) the World Bank and the Ministry of Agriculture and Rural Development MARD) approved as follows:

All subproject affected people (PAP) who have assets within or reside within the area of subproject land-take before the cut-off date are entitled to compensation for their losses. Those who have lost their income and subsistence will be eligible for livelihood rehabilitation assistance based on the criteria of eligibility defined by the subproject in consultation with the PAPs. If, by the end of the subproject, livelihoods have been shown not to be restored to project levels, additional measures will be provided.

The compensation rates will be determined based on the results of independent appraisal of the land/crops/assets (associated with the land) in a timely and consultative manner. All fees and taxes on land will be waived or otherwise included in a compensation package for land and structures.

Land will be compensated "land for land", or in cash, according to PAP's choice whenever possible. The choice of land for land must be offered to those loosing 20% or more of their productive land. If land is not available, Project Management Unit (PMU) must assure itself, that this is indeed the case. Those loosing 20% or more of their land will have to be assisted to restore their livelihood. The same principles apply for the poor and vulnerable people losing 10% or more of their productive landholding.

PAPs who prefer "land for land" will be provided with land plots with the equivalent productive capacity for lost lands or a combination of land (a standard land plot) in a new residential area nearby for residential land, and cash adjustment for difference between their lost land and the land plots provided.

PAPs who prefer "cash for land" will be compensated in cash at the full replacement cost. These PAPs will be assisted in rehabilitating their livelihoods.

For annual and perennial standing crops, trees or aquaculture products, regardless of the legal status of the land, cash compensation at full replacement cost will be paid to the affected persons who cultivate the land. The compensation will be sufficient to replace the lost standing crops, trees or aquaculture products at local market rates. Perennial crops or trees will be compensated at a rate calculated on their life time productivity. Where affected trees can be

removed and transported, compensation will be paid for the loss of the tree plus the transportation cost.

Households whose income generation activities, or livelihoods are affected as a result of construction (temporary impact) will be compensated for at replacement costs principle.

Compensation and rehabilitation assistance must be provided to each PAP at least 30 days prior to the taking of the assets for those who are not to be relocated

Exceptions should be made in the case of vulnerable groups who may need more time.

Additional efforts, such as economic rehabilitation assistance, training and other forms of assistance, should be provided to PAPs losing income sources, especially to vulnerable groups, in order to enhance their future prospects toward livelihood restoration and improvement.

Compensation for all affected assets/investments made on the land, including trees, crops etc., at full replacement cost.

Cash compensation for rental loss, which is at least equivalent to the net income that would have been derived from the affected property during the period of disruption;

Mitigation measures for impacts on Physical Cultural Resources

Compensation for the removal of the 23 graves is included in the RAP of the subproject and will include the cost for buying of land for re-burial, excavation, relocation, reburial and other related costs which are necessary to satisfy customary religious requirements. Compensation in cash will be paid to each affected family or to the affected group as a whole as is determined through a process of consultation with the affected community. The level of compensation will be decided in consultation with the affected families/communities. These mitigation measures will be included the Environmental and Social Management Plan (ESMP) of the subproject and enforced by the subproject owner during implementation. All costs of excavation, relocation and reburial (6,000,000 VND/grave) will be reimbursed in cash. Graves to be exhumed and relocated in culturally sensitive and appropriate ways.

During implementation the Subproject Owner will make early announce to the households whose graves are affected so that they can arrange their embodiment in consistence with the spiritual practices of the people and compensate to the affected household as required in the subproject RAP and ESMP.

Mitigation measures for safety risks of unexploded ordnances (UXOs)

To address safety risks associated with unexploded materials, the subproject will allocate fund for clearance of the UXO remained after the war at the construction areas. The subproject owner will sign a contract with the specialized military unit in An Giang province to carry out the UXO clearance at the construction sites. This activity will be implemented right after completing land acquisition and compensation and before any dismantling, demolition or ground levelling takes place.

5.2. PREVENTIVE MEASURES TO MINIMIZE SUBPROJECT NEGATIVE IMPACTS ON DURING CONSTRUCTION PHASE

Mitigation measures which are not involving waste

5.2.1.1. Measures to minimize impacts of noise, vibration

The results of the baseline environment monitoring in the region show that the noise level is within the standard value (QCVN 26:2008/BTNMT), the mobilization of machinery and equipment to the construction site may increase noise in the region, however, as discussed in

Chapter 4 the number of construction machinery and equipment to the construction site is not many (each construction cluster needs 01 bucket excavator 0.8m^3, 01 compactor and 01 concrete mixer for reinforcing the dyke), so potential noise in the region is considered small. However, the construction companies should comply with the noise vibration for machinery and equipment, particularly in sensitive areas. The solutions are as follows:

- All equipment used in the construction site must be inspected, ensuring the standard noise level.
- The construction companies must commit to maintain machinery and equipment regularly, especially mounting silencers to minimize noise for construction machines.
- The material suppliers must commit to regularly maintain barges to ensure the noise level relating the transportation within the standard.
- At the construction sites with Sensitive receptors (adjacent to the residential areas at the beginning of Bay Xa canal - Xang canal, Vinh Hau canal – Bay Xa canal to Hau River and near Vinh Hau Primary School, the Contractors must choose suitable construction time to avoid nuisance to people. In particular: i) at the location near Vinh Hau Primary School, the construction time must be in Saturday and Sunday, or must not be organized at school time. ii) at the construction sites near residential areas, the construction must be organized in daytime but not at night.
- Do not operate construction equipment at the same time near the susceptible areas mentioned above.
- Barges must carry materials to the construction site at day time; no construction at night to avoid noise that affects people's sleep.

5.2.1.2. Mitigation measures to road traffic impacts

Although at the construction sites there is not much people's movement, some existing sides of canals are also trails that people move, so to limit the impact on this traffic during the construction, the Contractors should implement the following measures:

- In both sides of canals where there are trails, the construction will not take place simultaneously at both sides, only in 1 side to let people go.
- In the sections where there is only 1 side of canal trail, when filling the dike embankment the construction companies must build temporary road for people to move.
- In case of no temporary roads, the construction companies must inform to people about the construction schedule that the construction site has no temporary route and guide alternate way for people to choose appropriate direction.
- At the canal sections where temporary roads are not possible, the construction companies must install signboards at beginning of construction canal sections and organize staff in charge to guide alternate ways for people.
- The construction companies must quickly connect the ring dike sections which are completed so that people can travel conveniently.

5.2.1.3. Measures to mitigate impacts to water transport

In order to mitigate impacts to water transport, the measures will be implemented as follows:

- The material transporters must survey fairways before shipping to ensure the suitable choice of barge capacity.
- Transport managers must organize adequate signboards on shipping canals.

- The barges must be tested to meet the standard when shipping.
- The barges must carry on proper loads as regulated.
- As the canals and ditches are not large, specially cross-canals canal, vessels are not circulated in cross-canals canal at night to prevent accidents and reduce the noise impact on the residential people in resting time.
- The means of transport that anchor at night must have signal lights to warn other traffic means.

5.2.1.4. Measures to mitigate socio-economic impacts

As discussed in Chapter 3, the construction activities in canal ring dike routes are at risk of affecting the daily lives of people around although the impacts are small. However, to control the negative impacts, the subproject owner and the construction companies must take the following management plan:

- The staff involved in the technical supervision and construction on the site must declare their temporary residence and respect the local cultures and beliefs. Do not cause dislikes, especially local beliefs.
- When conflicts occur, the subproject owner and the construction companies must coordinate with the local authorities to resolve conflicts, especially what is related to cultures, interests of people.
- Gambling in workers' camps is prohibited. The site commanders must monitor and ensure that there is no over-drinking in workers' camps and construction sites.
- Social evils in workers'camps are strictly prohibited.
- Take advantages of local workers engaged in the construction activities as mixing concrete, doing earthworks etc. to increase income for local people on the one hand and create intimate relationships between immigration staff and local people.

5.2.1.5. Measures to mitigate impacts on production activities of local people

To minimize impacts on people's production, the construction companies must perform the following:

- Use field topsoil where the ring dike pass to fill shore to separate the ring dike with the production area of people, which must be firm enough so as water is not lost from the rice fields.
- At the locations where there are people's water pumps, when carrying out the construction, the construction companies must establish new water lines to ensure that the water supply for the rice fields inside ring dike is maintained.
- When setting up new water lines, the construction companies must coordinate with local people to choose suitable locations and directions in conformity with their needs and aspirations.

5.2.1.6. Measures to minimize sedimentation and erosion

a. Measures to mitigate the risk of erosion:

As discussed in Chapter 3, the most important risk during the construction period is the erosion of new ring dike eroded by the flood. To minimize the risk of erosion, the Subproject Owner and the construction companies should implement the following measures:

- The ring dike sections where filling embankment requires must be filled as soon as flood

drains away to ensure that the ring dike embankment and structure are strong enough in dry reason.

- When the ring dike embankment is strong enough, the construction companies must reinforce its surface in order that it can withstand erosion during flood season.
- The construction companies must arrange working plan to ensure that the new ring dike embankment is hardened when flood appears (before August).

b. Measures to mitigate the risk of sedimentation

Chapter 3 analyzes the risk of sedimentation as soil is excavated from the former ring dike and the new ring dike embankment is not reinforced. To mitigate this risk, the subproject owner and the construction companies should perform the following:

- When taking land from the former dike, the construction companies must organize orderly section by section and make clean them timely. When excavators that scrap soil work inward fields, the construction companies must avoid dispersing soil into canals. Do not let the excavated soil near canals susceptibly swept by flood waters.
- The newly built ring dike must hardened up in dry season before flood appears.
- When the newly built ring dike has not hardened, the construction companies must use geotextile sheets to cover it to avoid erosion by flood.

Mitigation measures related to waste

5.2.1.7. Mitigation measures to air pollution

As analyzed, during the construction of dike, the number of construction machines on site is not many (1 bucket excavator, 1 roller and 1 concrete mixer 500 liters). In fact when machines and equipment are calibrated at properly exhaust specifications, their air pollution impacts when carrying out the embankment earthworks on site is small. However to avoid negative impacts when construction machines work on site, which do not ensure the technical specifications, the Subproject Owner is required to manage the construction companies as follows :

- All earthwork construction equipment before mobilized on the construction sites, must pass the technical certification to ensures the emission parameters regulated by the Registration Department (Circular No.30 - BGTVT dated 15/4/2011).
- Materials barges must have calibrating time. Materials must be covered to avoid spillage. This measure will decrease by 60 to 70% of dust pollution compared with the means of transport which are not covered.
- Construction machines must use low-sulfur fuel (no more than 0.5%S), the Contractors are encouraged to use diesel fuel with the sulfur content of 0.25%.
- It should focus on the construction sites which are near sensitive locations as addressed in Section 4.2.3.

5.2.1.8. Measures to reduce pollution of water quality

As analyzed above, the construction took place in dry season mainly and the construction activities are on shore, so construction impacts on the water environment are identified as small. However in the construction process, some factors may insignificantly affect the water environment which should be noted as follows: Wastewater, stormwater runoff and wastewater from washing concrete mixing equipment. To minimize them at the regulations, the Subproject Owner with the construction companies must implement the following

measures:

- For wastewater: At the workers' camps where there are culvert construction, mobile toilets must be installed and the construction companies must contract with the Urban Management Department of An Phu district to periodically suck cesspool away in accordance with the regulations.
- Wastewater from washing concrete mixing equipment can be reused to irrigate soil surface of ring dike to reduce dust emissions in the construction site. The small content of cement in washing water may increase the soil cohesion on the new dike.
- For the soil surface where there is the excavation of the former dike, the vegetation should be covered soon after the excavation completes.
- Soil scattered on the sites must be collected and compacted to avoid rain runoff.
- Domestic waste must be collected according to the regulations on the construction site; do not let domestic waste disperses into the constructions surface as well as down the canals.
- Construction equipment must be controlled to avoid dropping oil in the construction site.

5.2.1.9. Measures to manage solid waste:

In order to limit solid waste into the environment, the Subproject Owner and the construction companies should implement the following measures:

- For domestic wastes: In construction areas, workers must be equipped with waste containers; (ii) For recyclable waste, categorize for recycling; and (iii) for organic waste, coordinate with local people nearby the construction site for composting.
- For construction solid waste: (i) All construction waste must be collected for treatment as regulated, not to let it dispersed into the natural environment, especially the canals; (ii) Construction formworks must be taken out of site when the construction completes; (iii) Cement bags must be collected and sent to recycling or sold for scrap collectors to be reusable, prohibit disperse bags into the natural environment, especially do not put down the canals; (iv) Arrange material yards on construction locations, not to dispese materials to the surrounding environment; (v) At the end of the construction, the site must be cleaned up, surplus materials must be moved out of to serve other construction sites; and (vi) Excess sand and stones must be collected and taken out of construction sites.

5.2.1.10.Measures for hazardous waste management:

The Subproject Owner commits to control Contractors' construction hazardous waste according to Circular No.36/2015/TT-06 BTNMT dated 30/06/2015 on the management of hazardous waste including:

- The construction companies, the transport companies that provide construction materials must organize collecting lubricate for each changing time and sent to recycling storage as properly defined in Circular No.36.
- Lubricate, fuel containers must be collected as regulated for hazardous waste treatment and must not be discharged directly into the environment as well as sold as scraps.
- Sign contract with the companies which are capable of hazardous waste treatment to collect and treat it periodically.
- The Contractors must notify the Supervision Consultant and PMU any runoff incidents or accidents and deploy measures for such runoff incidents or accidents;
- Provide accountability report for spills or incidents, corrective actions,

consequences/damages from the spill, remedies.

5.2.1.11.Measures to manage worker safety:

- All officers and workers are health checked and trained about labor safety - sanitation as stipulated in Circular No.37/2005/TT –BLDTBXH dated 29/12/2005 of the Ministry of Labor - Invalids and Social Affairs and labor safety measures as stipulated in TCVN 5308 - 91. The training includes local people to be involved in the construction. After the training is complete, the list of labor safety cards are made to grant for each employee.
- All laborers working on construction sites are obliged to comply with the labor safety regulations as stipulated in TCVN 5308-91 on safety technical specifications in construction.
- Equip adequate safety tools as anti-dust masks, boots, gloves, helmets on working to meet TCVN 2287-78.
- Workers are strictly forbidden to leave equipment when it is operating.
- Provide adequate sanitation water for workers on construction sites.
- Practice to cope and handle bad situations of labor safety on construction sites, means of rescue, first aid etc.

* For construction equipment:

- All construction equipment on sites must meet Standard 2290-78 - Manufacturing Equipment.
- Construction machinery and facilities are registered and are calibrated by the competent authorities.
- The salvage activities for sunken boats, barges and materials, goods which are on boards, barges must not obstruct waterways. The rescue to chemical leaks must be under the national regulation: QCVN 17: 2011/BGTVT - National Technical Standard on Regulations for Pollution Prevention by Inland Waterway Vessels.
- Transport regulation must be arranged at two ends of construction sites; signboards in incident areas and forbidden areas must be plugged. Regulatory stations are required to guide vessels run safely through fairways.

5.2.1.12.Waterway traffic safety management:

- Vehicle and equipment involved in material transport must meets the technical requirements.
- Material transporters must survey canal before shipping to arrange suitable means of transport on fairways.
- Organize to fully install traffic guidance signs in waterways.
- As the waterways are narrow, transport at night is prohibited, especially in the cross-canals.

5.2.1.13.Management of chance finds:

* Finding cultural, archaeological artifacts: the contractors are required to protect the construction status and report to the construction supervisors and PMU, local museums and local Department of Culture and Information; deliver artifacts for local museums or cultural management authorities; consider whether the excavation is continued or stopped for the survey. The Director of the local Department of Culture and Information will be responsible

for managing artifacts under Article 21 of Decree 92/2002 - Executable Instructions for Cultural Heritage Law.

* When graves are found in excavation area: The Subproject Owner will require the Contractors to protect the status quo and notify local authorities; determine how to resolve and duties of involved individuals, relocation time and exhumation site (if available); implement proposed measures.

5.3. PREVENTIVE MEASURES TO MINIMIZE SUBPROJECT NEGATIVE IMPACTS ON OPERATION PHASE

Adjust the land use plan to address scaling up of the proposed models in the sub-project

As analyzed in item 4.5.1.1 pp. 117 , when the project comes into operation, it will change the land use purpose of some areas which are under the specific rice crop production planning into the combination of rice crop production together with aquaculture production or vegetation crop production. To have the legal basis for the exploitation and utilization of land, in the management and orientation development, the project owner who is the An Giang province Department of Agriculture and Rural Development (DARD) shall conduct the land use planning for the project region. The planning needs to guarantee the orientation of land use for the different livelihood models proposed in the sub-project in which focus on:

- Determine clearly the region, area and purpose of land use toward rice crop production together with giant freshwater shrimp which is estimated to be developed to about 1,000 ha (Model No. 1).
- Determine clearly the region, area and purpose of land use toward vegetation crop production together with floating rice crop production in combination with exploitation of aquaculture (Model No. 2).
- Determine clearly the region, area and purpose of land use toward 2 crops in 1 year (Model No. 5).

The local government/ authority needs to manage the adjusted land use purpose planning to manage the production activities to be suitable with the plan as well as the production scale which is proposed in the sub-project.

Based on the result of the demonstration model, the actual need and demand as well as the capability of expansion of the market, especially the production demand of the local residential people, then the local government/ authority will propose to the project owner to have the orientation to maintain or continue expansion of the suitable production model with the water resource condition and the infrastructure condition.

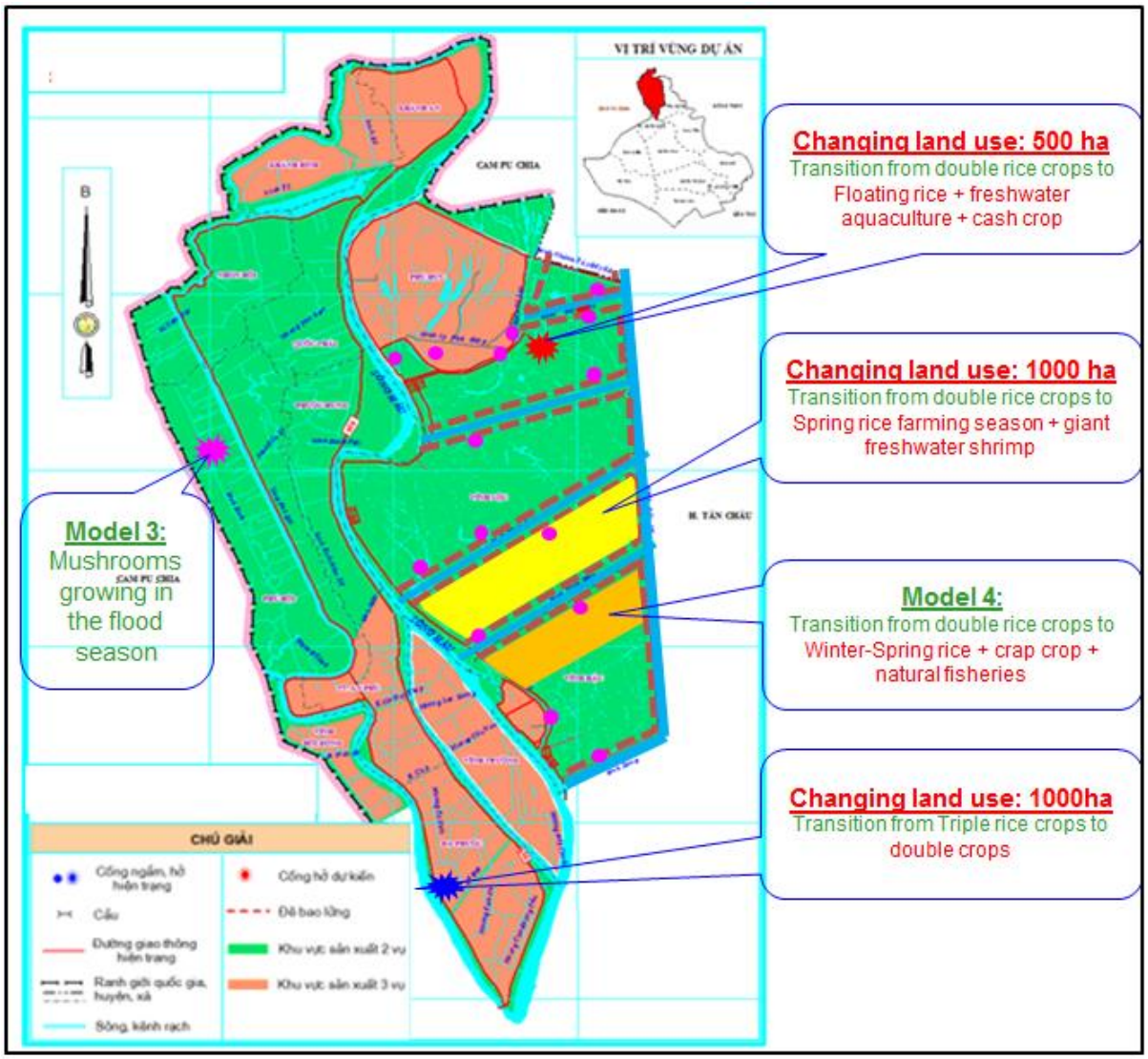


Figure 56: Orientation of land use purpose change when the project comes to operation

Preventive measures to minimize subproject negative impacts due to implementation of livelihood models

As discussed in Chapter 4 that implementation of this component could create both positive and negative impacts on socio-economic and financial conditions of local farmers depending on many uncontrollable factors including various technical risks. However, to minimize the potential negative effects the Subproject Owner and the concerned authorities of An Giang province should implement the following comprehensive measures by providing tehnical assistance for:

- *Development and expansion of trade for organic aquaculture and rices products* including developing a market forecasts and brands and establishing stable market through promotion of product introduction on the domestic and international fairs;
- *In-depth knowledge on technical aspects on production by* applying the Field Farming School (FFS) approach with local farmers on technical knowledge as well as hand-on training on ways to convert to new livelihood models. Key activities will include, but not limited to, (i) undertaking a series of technical workshops to provide basic knowledge on technical issues related to on-farm management as well as clear explanation on ways to convert to the new models; (ii) setting up a group of qualified

agricultural/aquacultural extension officers who can provide direct guidance to local famers when they require through a "Training-of-Trainer or TOT" program including preparation of technical guidelines and/or manual that could be used to equip local farmers people enough knowledge and techniques when new models are introduced in the area; and (iii) establishing farmer networks through a series of study visits to appropriate areas so that farmers could have opportunities to exchange knowledge and implementation experience that could help enhancing quality of the model application.

5.3.1.1. Mitigation measures not involving waste

To minimize negative effects as described (*in Section 4.5.1.3.1 pp. 121*), the Subproject Owner and the concerned authorities of An Giang province should implement the following comprehensive solutions:

- Brand development and expansion of trade for products: (i) Organize market forecasts for such products as macrobrachium rosenbergii, clean rice, organic rice, floating rice without the use of plant protection products to meet the demand of the consumption market; (ii) Develop brand for such products as macrobrachium rosenbergii, clean rice, organic rice, floating rice as the impetus for this production development; and (iii) Find out stable output for macrobrachium rosenbergii, clean rice, organic rice, floating rice through product introduction on the domestic and international fairs.
- In-depth technical guidance for production: Organize field farming school to guide people to convert to new livelihood patterns through the introduction of theory, models and sending agricultural/aquacultural extension offices who directly guide people on site when they require. The guidelines must ensure to equip people enough knowledge and techniques when new models are introduced in the area.
- Infrastructure planning and consolidation to delineate areas of similarity in the use of water resources: The production conversion may rise conflicts in the use of water in the 2-crop and 3-crop areas. To minimize conflicts, besides developing production models, the solutions for the areas where there are the same time of water use to avoid conflicts in the use of water should be planned. The 1-rice crop and aquaculture areas in flood season should be planned separately. The 2-crop areas or other crop areas combining flushing water to reserve natural fisheries should be planned separately to avoid conflicts in the use of water.

5.3.1.2. Mitigation measures related to waste

a. Wastes from aquaculture operations

As discussed (*in Section 4.5.1.3.2 pp.121*), if the local people comply strictly with the raising density (giant freshwater shrimp for extensive shrimp farming), then the impacts caused by the shrimp raising production activities on the environment will be small and negligible; in contrast, if the local people raise with high density (industrial scale) then the impacts on the environment may be significant. To reduce impact of *Macrobrachium rosenbergii* farming on the environment, the Subproject Owner - An Giang DARD should implement the following actions:

- Based on the result of the pilot model in the sub-project (from 2017 to 2020), the detailed procedure will be developed for the giant freshwater shrimp raising production in the region on the principle of matching with the actual condition of the water resource, investment capability of the local residential people, having stability and less impacts on natural environment. The first step should be applied only for 1,000 ha with the planned orientation of the sub-project.

- Based on the developed procedure from the actual production condition in the sub-project, project owner shall plan the suitable raising region and area as well as the raising scale so that the local government/ authority may implement and manage.
- To mitigate the impacts on the environment, suitable with the investment capability and the technical condition of the local residential people, the raising scale is determined to be extensive farming (the density of raising is less than 5 heads/m^2)
- Continue to maintain the demonstration models which cover rice and giant freshwater shrimp done in the sub-project to guide and train the local residential people who prepare for raising to learn and implement.
- Local government/ authority will supervise and manage the shrimp raising activities of the local residential people in order to guarantee that the raising activities complies with the approved plan; the raising activities is extensive farming (the density of raising is less than 5 heads/m^2).
- Manage the utilization of food and chemicals for the shrimp raising activities in compliance with Circular No.08/VBHN-BNNPTNT dated 25/02/2014 by MARD.

b. Waste from rice planting

As discussed in Section 4.5.1.3.2, the rice growing of the livelihood models mainly produce organic rice, floating rice which have good effects on improving the environment in comparison with the current production. However, most of the local residential people in the project region are still familiar with the rice crop production similar with the existing condition if without training, comprehensive guidance to have enough skill to apply the production procedure as being proposed in the sub-project. To ensure the proper operation as expected, which reduce pesticides, fertilizers in agricultural production, the Subproject Owner - the Department of Agriculture and Rural Development of An Giang province must fully implement the following solutions:

- Organize the public information disclosure of the rice crop production procedure in the proposed models.
- Inform clearly that the producer to comply with during the rice crop production when combine with aquaculture production so that the local residential people can understand before application.
- The local government and authority should utilize the pilot models implemented in the sub-project to organize the field training course for the local residential people in the project region to train and guide the production procedure for the people.
- Organize widely agriculture extension classes to introduce people the integrated pest management measures (IPM) and "One Must, Five Reductions" program (follow ESMF) so that people understand as well as practice in reality.
- Form the production groups/ teams following the proposed models so that the local residential people attend the training and to apply the production procedure
- Local government/ authority supervise the rice crop production activities by the local people to guarantee the compliance with the transferred technology.
- Local government/ authority control the sale and purchase activities of the herbicides in the region to guarantee that all the forbidden herbicides are not in circulation in the project region

Management of induced impacts

* Reduce the risk of spreading diseases:

- The Department of Agriculture and Rural Development of An Giang province and the local veterinary offices must organize tight control of variety sources of *Macrobrachium rosenbergii* to be traded in the region.
- Produce high quality male lavae of *Macrobrachium rosenbergii* which are quarantined to provide farming areas.
- Do not develop too focal farming areas, especially in an farming area the feeding density is not exceeding 50% of water surface.
- When disease virus is detected, immediately destroy diseased shrimps to cut off the spread of infection.
- Minimize potential impact due to possible expansion of farming without propoer management and control. Establishment of the database for aquaculture farming in the subproject and nearby area could also help addressing the risks related to diseases and possible water use and land use conflicst that may occur

* Limit conflicts of water sources:

- For production models 5: it needs to build solid embankments to prevent flood for main crops, which will not affect the triple rices crop areas.
- For models: 1, and 2 as the time for water use is fairly similar, therefore they can be arranged in the same area.
- The crop models should be arranged in double rices crop areas.
- For the floating rice and *Macrobrachium rosenbergii* areas, mezzanine dike must be strengthened to minimize impacts on the year without flood like 2015, then, producers can pump water from canals to their floating rice production and *Macrobrachium rosenbergii* areas to maintain their production.

* Supporting the producer

- Before application in the production, local residential people need to be provided with full information about the production procedure, potential risk as well as the prevention solution to mitigate the risk of loss due to the ./ shrimp raising production activity.
- Social Policy Bank supports the local residential people in the region to have the investment capital for the production activities as well as re-production when facing with risk.
- Form the production corporatives to have the stable capital and techniques for production

CHAPTER 6. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

Based on the assessment of the potential negative impacts discussed in Chapter 4 and the mitigation measures proposed in Chapter 5, this chapter presents the Environmental and Social Management Plan (ESMP) for the subproject. The ESMP identifies actions to be carried out under the subproject including the environmental monitoring program and the implementation arrangements, taking into account the need to comply with the Government's EIA regulations and the WB's safeguard policies, including those of the World Bank Group's Environmental, Health, and Safety Guidelines.

6.1. BASIC PRINCIPLES

As a part of the ESIA, an Environmental and Social Management Plan (ESMP) is a safeguards instrument that is typically used in many projects and which consists of information on and guidance for the process of mitigating and managing adverse environmental impacts throughout project implementation. Typically in Vietnam, an ESMP comprises a list of typical mitigation measures to be carried out by contractors, an environmental monitoring program, organization arrangements, and an estimated monitoring cost.

There is a comprehensive regulatory framework in Vietnam related to ESIA preparation, environmental standards, protection and management of forest and cultural property, and other aspects related to construction and operation of facilities and infrastructures in Vietnam. This ESMP is consistent with these regulations.

To facilitate effective implementation of the ESMP, PPMU will: (a) Establish an Environment and Social Unit (ESU) responsible for ensuring timely implementation of the ESMP, including monitoring, reporting, and capacity building related to safeguards; (b) Assign the Construction Supervision Consultant (CSC) to also be responsible for supervision of the contractor's safeguard performance as part of the construction contract and this requirement will be included in the CSC's terms of reference; and (c) Hire qualified national consultants as the Independent Environmental Monitoring Consultant (IEMC) to assist the ESU in performing its task.

DARDs of An Giang will be responsible for implementation of the mitigation measures during the operation stage of the project and they will ensure that the mitigation measures are implemented and adequate budget is provided. MARD will provide the overall policy guidance and oversight of the subproject implementation. Roles and responsibilities of the specialized agencies and the DONRE will also be critical.

Activities to be carried out to mitigate impacts due to land acquisition and resettlement are presented separately (RAP and RPF) and they will be carried out and monitored separately.

6.2. SUMMARY OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

Positive impacts

6.2.1.1. Positive socio-economic impacts

- The livelihood models applied in the region help to generate higher income for the local people than the current rice production model.

- Diversify production options, minimizing the risk of income losses for the people in the areas as shown in the devaluation in the price of the products at the big harvest recently.
- Creating jobs for people in the flooded areas, minimizing the negative impacts to social order and welfare.
- People apply the the Integrated Pest Management (IPM) and the "One Must 5 Reductions" programs in production helping to reduce the production cost, thus increasing income for people.
- Development of logistics services for shrimp farming, creating jobs for many people who are not directly involving in shrimp farming activities.
- The trade promotion activities, strengthening the operations of the cooperatives, brand development are the foundation for the higher price of production outputs, resulted in an income increase for people.
- The people on the East side of the Hau river can now rest assured to produce two rice crops thanks to the solid embankment systems, water supply and drainage culverts in the area of the three communes.
- Reducing damages to the summer-autumn rice for the people suffering from the influence of early floods.
- Reducing the maintenance costs of the embankments systems after each flooding season.
- Reducing the impact of waves and floods to the shrimp farming compartments.

6.2.1.2. Positive environmental impacts

- The livelihood models being proposed in line with reducing the use of fertilizers and plant protection agrichemicals.
- Diversify production options helping to reduce the spread of focused disease transmission.
- Combining aquaculture with rice cultivation to reduce the use of plant protection chemicals and fertilizers.
- The Integrated Pest Management (IPM) and the "One Must 5 Reductions" programs applied will help to reduce plant protection chemicals and fertilizer usages in production.
- Limit the situations of soil erosion and sediment accumulation after each flood in the region.
- Maintain the flood diversion space for the upstream area.
- Developing the aquatic species from aquaculture cultivation, reducing the pressures from harvesting natural fisheries.

Negative impact

The implementation of the subproject would mainly cause land acquisition, increase dust generation, air pollution, domestic waste, and health and safety issues. Site investigation and document review were conducted for identifying and assessing these potential negative impacts, including consultation with the local communities and affected people.

The potential negative impacts of the subproject are identified in and could be minimized by applying the proposed mitigation measures developed for the subproject, which are described in *Table 62*. The negative impacts of subproject could be summarized as follows:

- Impacts on the environment due to changing from rice farming in to aquaculture.
- Impact on water quality of the downstream area due to intensive shrimp farming.

- Disease spread from shrimp farming.
- Conflicts over the use of water resources can arise if the boundaries between production models are not built appropriately.
- Social impacts because the famers have been accustomed to rice production farming for many years with that technical expertise. When shifting to new farming models, an inadequate technical guidance can lead to unsuccessful production, limiting the model to scale up to the broader scale.
- Increase in other negative impacts on environment during construction and operation phases.

Table 62: Potential Negative Impacts of the Subproject

No	Impacts/ Issues	Impact Description	Location / Affected Object	Significance of impacts	Impact duration
A	**Construction of dykes and culverts (Component 1)**				
I	**Pre-construction phase** (Dykes and culverts)				
1	Permanently and temporarily acquired land	The subproject acquires permanently 110 ha of production land and acquires temporarily 15 ha of production land in 3 communes of the subproject. All of these lands are agricultural land with main crops of rice, leading to there are 752 affected HHs, in which 71 vulnerable HHs, including 63 poor HHs and 8 lonely female-headed HHs; 52HHs loss over 20% of their production land area and 23 graves will be relocated	- Residents in Phu Huu, Vinh Loc and Vinh Hau communes	High	Long-term
2	Land clearance	Land clearance will small impact on local people and environment because most demolition waste materials are suitable as fill materials for embankment and the remaining wastes of demolition will be sold and no waste materials left in the construction sites	- Affected households in Phu Huu, Vinh Loc and Vinh Hau communes - Workers at the construction site.	Small	Short-term
3	Impact due to UXO	Although production activities and embankment dredging and refilling have been implementing for many years, there has never been detected any war unexploded remnants. However, the subproject is located in an area that was affected by military operations during the war period, it is necessary to clear any remaining UXO to avoid the potential threat to the works and safety for local people and workers.	- Local people along the embakment - Workers at the construction site.	Moderate	Short-term
II	**Construction stage** (Dykes and culverts)				

1	Dust generation/ Air pollution	Transporting construction materials: All materials will transported by waterway and this activity will take place with 4 years (6 months a year) and with linear dispersion characteristics of pollutants, with a discontinuity operation in the water way conditions, and with low traffic on the canals the impacts from transportation activities are considered low, not increasing the air pollutants compared to that of the current situation.	- Resident along the transportation route - Workers for load and unloading materials. - Workers at the construction sites.	Low	Short-term
		Using construction machines for embankment and building culverts will 144eveling dust and gas 144eveling but the embanking activities will divided into sections, each section is about 3km and implemented by "rolling" method and the construction sites are located in the field of agricultural production therefore these emissions will quickly disperse into the surrounding environment	- Residents living near the embankment routes and culvert sites - Workers at the construction sites.	Low	Short-term
		Soil excavation from the old embankment to backfill onto the new route will cause dust and air pollution. The soil in this area typically is saturated with water from 4-5 months in the flood season. The excavation will take place immediately after the floods recede so the impact will be low	- Residents living near the embankment routes and culvert sites - Workers at the construction sites.	Low	Short-term
		Dust from embankment surface hardening mainly from concrete mixing. Most of the construction area is located in the agricultural field and away from households, the blending range extends about 60 km along the embankment, the mixing time in each area is only 1-2 days, so the impact by cement dust is considered low.	- Residents living near the embankment routes. - Workers at the construction sites.		
2	Impacts from noise and vibration	Due that the size of the embankments and culvert is relatively small, 3m wide there is no need for many	- Residents living near the embankment routes and culvert sites	Small	Short-term

		construction machinery. Embanking activities will not only take place at one site for the entire construction period, but at one specific time (3-5 days while filling up the embankment and 1-2 days for surface hardening), then moving on to the next section. So the impact from embankment	- Workers at the construction sites.		
		For a mixing station with capacity of about 30m^3/h, the operation of the mixing station will generate noise pollution at a distance of about 45 meters (in day-time) and 90 meters (in night-time).	- Residents living near the embankment routes and culvert sites - Workers at the construction sites.	Small	Short-term
3	Surface water pollution from excavation and filling activities, worker's camp and construction equipment.	- Wastewater from concrete mixing equipment: After each shift the concrete mixing equipment must be cleaned. Waste from this washing water is mainly cement powder and sand. Due to the very small amount of water containing non-pollutants this wastewater can be poured directly into the grounds around the dike without causing any detrimental effect on the environment. - Run-off water at the culvert areas, each culvert construction is from 50-100m^2. The construction activities are mainly the mixing of cement to construct the culvert items, therefore the impact to the environment from the works if any will be at a low level and localized at the site. - Run-off water from embankment: The execution of works is scheduled during the dry season with the embankment routes hardened before the floods of the rainy season; any impact will be low from rainwater overflow on the newly built and hardened embankments. - Wastewater from worker's camps. It is expected to build such 5 culverts within 1 year thus 5 camps will be built each year and 675lit/day of wasterwater of	- Residents living near the embankment routes and culvert sites - Surrounding 5 workers' camps	Small	Short-term

		worker, it contains organics easy to decompose, so if this kind of wastewater is directly discharged into the environment it would make the receiving water sources polluted.			
4	Risk of erosion and sedimentation	- The risk of erosion to be considered is for the new embankment routes during flood season. When the floods come, the newly constructed embankment will be below the flood level. Due to the infield flows and the long period the embankments will stay wet (4-5 months), there may be erosion at the new embankment if the strengthening works will not be carried out before the flooding. These are the factors that the contractors should take into consideration to schedule a suitable execution timetable for the actual situation. - In fact, the construction work will take place in land with a distance away from the canals of at least 10m. For the horizontal canals, the earth materials for the new embankments will be taken from that of the old ones. The process of excavation materials if not handled with appropriate protocols may cause soil dropping down to the canals or the remaining soils at the old embankment may be flushed down to the canals when flood arrives, causing sedimentation in the region.	- New embankment routes - The horizontal canals	Small	Short-term
5	Solid waste	- Solid waste includes construction solid waste and domestic solid waste. - Construction wastes include soil, cement bag, iron and steel scraps, stone, debris. All wastes are to be collected and not littered in the environment especially the canals. The soil dropping during the embankment backfilling: the volume of backfill soil droppings during the excavation and covering is not	- At the construction sites and worker's camps.	Small	Short-term

		much and the impact from this waste to the environment is low. - Domestic waste and rubbish (domestic solid waste) generated from workers' camps includes mainly biodegradable organic elements (roots and fauna) along with a small amount of packaging (plastics, glass). The average generation volume of the domestic solid waste is about 0.3 kg/person/day and 4.5kg/day for 5 camps. This domestic waste will be collected to avoid environmental pollution. Due to the volume of this kind of waste is not big, they can be collected into the rubbish collection system along the subproject			
6	Hazardous wastes	- Other wastes as used oil and lubricant residue, oily rags. The amount of oil discharged each time is 07 litters with a frequency of 3-6 months/oil change/time. They could cause adverse impacts to the environment, insanitary, source of diseases on the site. Therefore, it is necessary to collect, transport and treat appropriately.	At the areas of equipment storages, maintenance.	Moderate	Short-term
7	Impact on waterway navigation	The increase of transportation vehicles is only around four more barges/day, which will not greatly affect the water navigation on the Bay Xa canal and Xang canal but the horizontal canals. However, there are just few boats on these routes; impact on the water navigation is therefore small.	In the routes for materials transportation	Moderate	Short-term
	Worker and public safety	Workers and local people could be at risk if they travel around or closed to construction sites, or fall to the open pit, buried in the material, etc.	At the construction area.	Moderate	Short-term
8	Waterwat traffic safety	Waterway traffic accidents caused by a lighter boat sinking, or from another collision leading to the			

		sinking of a boat. Traffic accidents as a result from an oil spillage in the canal, etc.			
9	Communication with local communities	Lack of communication and consultation with local communities can lead to an opposition to the subproject delays in the construction process, increased costs and unsatisfactory solutions.	Communities and local authorities in the construction area	Low	Short-term
10	Workforce management	Worker concentration will cause the following impacts: - Increased demand for infrastructure and utilities. - Pollution caused by waste and domestic wastewater. - Increase risk of communicable diseases, such as malaria, HIV/AIDS, etc threaten health of workers and local people. - Affect local social secure, increase crime rate, drug use, prostitution, social conflict, etc. But most workers are local people, so impacts due to workforce management	Communities and local authorities in the construction area	Low	Short-term
11	Cultural impacts	No adverse impacts on other historical and cultural heritage features are expected during the construction phase of the subproject	At any location in the subproject area if cultural work findings.	Low	Short-term
12	Fire risk	The storage of fuel poses a potentially serious fire risk; therefore, safety measures must be in place to prevent an accident from occurring, as well as, forethought in regards to controlling a fuel fire at the storage area if that would become an incident.	In the whole of construction area	Moderate	Short-term
13	Impact on production of local people	Impacts from construction activities on the local production may include (i) embankment will happen on a part of paddy fields, before land clearance if the contractors will not embank for the remaining parts of the fields leading to water drain out from the fields. This is considered as low and temporary negative	The fields along the embankment routes	Low	Short-term

		impact, but contractors need to have proper mitigation to avoid conflicts with local people; and (ii) the fields are located along the canals banks, local people to just place their pumps on the bank of the canals to pump water into the their fields. But the new embankment route will be moved 20 meters toward infield compared with the old route causing local people will have difficulties in pumping water			
B	**Implementation of livelihood models (Component 2)**				
	In preconstruction phase	These activities require no land acquisition and resettlement, as well as public infrastructure encroachment because they are developed on the existing farm land/ponds.	Farmland/ponds using for demonstrations	Low	Long - term
	Construction phase	Induced impacts due to possible expansion of the models in the subproject and nearby area without proper control and management	Farmland/ponds using for demonstrations	Low	Long - term
	Operation stage				
1	Waste generation from shrimp farming	One shrimp crop (6 months) of 1 ha with yield of 1.5 tons of shrimps will generate into the environment around 1.68 tons of organic waste (0.16 kg / m^2), 66.15 kg N (approximately equivalent to the urea amount used for 0.5 hectares of rice), with this amount of waste is within a limit that the water environment can easily self-purificate and impacts on environment is small. In case of the shrimp farmer will want to cultivate intensively at a greater density with higher production yields, expectedly the 4 ton/ha/crop. At that level, producing 1ha of shrimp generates 4.4 tons of organic waste (0.44kg/m^2), 176.4kg of Nitrogen (equivalent to 1.5ha of rice production) and impact on environment is high. There need serious consideration for issuing	In the demonstration sites	Moderate	Long term

		proper guidance and direction to the farmers to apply the most appropriate model.			
2	Impact of the epidemic disease and the utilization of antibiotics from aquaculture activities	Most aquaculture process is a natural breeding process, but also can not control all farmers/households. Chasing profit with increase of density or antibiotic treatment for breeding, or feeding redundantly leads to water pollution. Depending on the form or type of farming that will have certain impacts on the environment at different levels. If adopted extensive scale, the impact on the environment is small, but if the development of industrial-scale farming, the environment is affecting high.	In the demonstration sites	High	Long - term
3	Impact on socio-economic development due to livelihood model demonstration	The famers have been accustomed to rice production farming for many years with that technical expertise. When shifting to new farming models, an inadequate technical guidance can lead to unsuccessful production, limiting the model to scale up to the broader scale. The risk of this impact is considered to be low and can completely control through the training schedule for residential people.	In the demonstration sites	Low	Short-term
		Socio-economic conditions of poor farmers may be affected negatively due to risks associate with technical and management at on-farm level as well as financial capacity of farmers.	Farmers who participate in the pilot models and nearby areas who may apply them by theself.	Moderate	Cab be short or long term
4	Impact of expanding area of demonstration site	The development of large product outputs while not having a market may negatively impact the livelihood models of subprojects. If not forecast the needs of the market well and not well supported consumption for products, the risk of producers produce over demand which could lead to devaluation. The risk of this impact appears at average level and the level of social	In the demonstration sites and expanding area	Moderate	Long term

		impact will be at a low level but for the producers, the impact will be moderate.			
6	Induced impacts due to possible expansion of the models in the subproject and nearby area without proper control and management	This may cause degration of natural habitats and/or change in land use which may later create potential conflict in land and water uses. This is possible if there is no regulatory measures and means to apply them effectively.	In the subproject and nearby areas	Moderate	Long term

6.3. MITIGATION MEASURES

This section presents the measures to be carried out by the subproject owner (An Giang DARD) during the implementation of the subproject to mitigate the potential negative impacts of the subproject activities considered to be general impacts and the site-specific impacts. Section 6.3.1 (*Table 63*) presents the potential negative impacts of the subproject activities (2 components) considered as general impacts and they could be mitigated through ECOP while Section 6.3.2 (Table 64) presents site-specific impacts that require special attention. If the on-farm construction under Component 2 is involved the simplified ECOP shown in Annex 4 will be applied.

For works of Component 1 during the preparation of bidding documents, the An Giang project management unit (PPMU) will incorporate both the mitigation measures identified under the preconstruction and construction phases under the ECOP and site-specific requirements into the bidding and contract documents and ensure that the contractor are well aware of these obligations. During construction, the PPMU will assign the Construction Supervision Consultant (CSC) to also be responsible for the day-to-day supervision and monitoring of contractor performance in compliance with these measures.During contruction, the contractor will be required to prepare and implement a Contractor Environmental and Social Management Plan (CESMP) in line with these requirements. The An Giang PPMU will also include results of contractor performance in the subproject monthly progress report to be submitted to the Cetral Project Management Unit (CPMU) of the Central Project Management Office (CPO) to be established in CanTho.

During operation of the Components 1 and 2 activities, the subproject owner (An Giang DARD) will be responsible for ensuring that the responsible agencies of the province will take actions to implement the activities identified the site-specific requirements (Table 64). One technical assistance will be provide for safeguard training as well as ensuring that the sluice operation procedure will be developed in close consultation with water users and key stakeholders. For the Component 3, in additional to the technical assistance to be provided during the planning and implementation of the 5 models, one additional technical assistance will be needed to mitigate the potential negative socio-economic impacts on poor farmers and the potential negative impacts that may occur due to possible expansion of the models in the future.

General impacts and mitigation measures

The mitigation measures of general impacts during pre-construction, construction, and operation phases, the environmental codes of practices, related to the general construction activities of the three culverts are presented in *Table 63.*

Table 63: Mitigation Measures (ECOP) of General Impacts related to Subproject's Activities

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
A Construction of dykes and culverts (Component 1) **I. In pre-construction**				
1. Complaints due to subproject implementation	– Prior to commencement of site works, the contractor will develop a grievance redress mechanism (GRM) or system that will allow for receiving/recording and immediate response to and resolution of construction-related complaints. The GRM shall be consistent with the GRM described in the ESIA. – The Contractor will inform the communities along the alignment and other stakeholders affected by the subroject about the GRM in place to handle complaints and concerns about the subproject. – The Contractor will also install notice boards at the construction sites to publicize the name and telephone numbers of the representatives of the Contractor, DDIS and PPMU who are designated to receive and document complaints.		– Contractor – PPMU	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang
2.Inadequate disclosure of subproject information prior to construction	– Prior to site preparation and commencement of site works, the Contractor will meet stakeholders such as district and local authorities, e.g. DONRE; officers in charge of irrigation, navigation and transport; owners of utilities (water, electricity, communication, etc.) and community leaders in affected communities to provide relevant Project information (e.g. activities, schedules, etc.) and to ensure that various concerns that may affect stakeholders are discussed and addressed.		– Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang
II. In construction phase				
1. Dust generation and air pollution	– The Contractor is responsible for compliance with relevant Vietnamese legislation with respect to ambient air quality. – The Contractor shall ensure that the generation of dust is minimized and is not perceived as a nuisance by local residents and shall implement a dust	– TCVN 6438-2005: Road vehicles. Maximum permitted emission limits of exhaust gas. – No. 35/2005/QD-BGTVT on inspection of quality,	– Contractor	– Supervision reports of CSC – Supervision and monitoring

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	control plan to maintain a safe working environment and minimize disturbances for surrounding residential areas/dwellings. - The Contractor shall implement dust suppression measures (e.g. covering of material stockpiles, etc.) as required. - Material loads shall be suitably covered and secured during transportation to prevent the scattering of soil, sand, materials, or dust. - Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. - Dust masks should be used by workers where dust levels are excessive - All vehicles must comply with Vietnamese regulations controlling allowable emission limits of exhaust gases. - Vehicles in Vietnam must undergo a regular emissions check and obtain certification: "Certificate of conformity from inspection of quality, technical safety and environmental protection" following Decision No. 35/2005/QD-BGTVT. - There should be no burning of waste or construction materials on site. - Cement processing plants should be far from residential areas.	technical safety and environmental protection; - QCVN 05:2013/BTNMT: National technical regulation on ambient air quality.		reports of PPMU An Giang
2. Impacts from noise and vibration	- The contractor is responsible for compliance with the relevant Vietnamese legislation with respect to noise and vibration. - All vehicles must have appropriate "Certificate of conformity from inspection of quality, technical safety and environmental protection" following Decision No. 35/2005/QDBGTVT, to avoid exceeding noise emission from poorly maintained machines. - When needed, measures to reduce noise to acceptable levels must be implemented and could include silencers, mufflers, acoustically dampened panels or placement of noisy machines in acoustically protected areas. - Avoiding or minimizing transportation through community areas and avoiding as well as material processing areas (such as cement mixing).	QCVN 26:2010/BTNMT: National technical regulation on noise QCVN 27:2010/BTNMT: National technical regulation on vibration	Contractor	- Supervision reports of CSC Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
3. Water pollution	– The Contractor must be responsible for compliance with Vietnamese legislation relevant to wastewater discharges into watercourses. – Portable or constructed toilets must be provided on site for construction workers. Wastewater from toilets as well as kitchens, showers, sinks, etc. shall be discharged into a conservancy tank for removal from the site or discharged into municipal sewerage systems; there should be no direct discharges to any waterbody. – Wastewater containing pollutants over standards set by relevant Vietnamese technical standards/regulations must be collected in a conservancy tank and removed from site by licensed waste collectors. – Make appropriate arrangements for collecting, diverting or intercepting wastewater from households to ensure minimal discharge or local clogging and flooding. – Before construction, all necessary wastewater disposal permits/licenses and/or wastewater disposal contracts have been obtained. – At completion of construction works, wastewater collection tanks and septic tanks shall be safely disposed or effectively sealed off.	– QCVN 09:2008/BTNMT: National Technical Standard on underground water Quality; – QCVN14:2008/BTNMT: National technical regulation on domestic wastewater; – QCVN 40: 2011/BTNMT: National technical regulation on industrial wastewater; – TCVN 7222: 2002: General requirements on centralized wastewater treatment plant;	Contractor	– Supervision reports of CSC Supervision and monitoring reports of PPMU An Giang
4. Drainage and sedimentation control	– The Contractor shall follow the detailed drainage design included in the construction plans, intended to prevent storm water from causing local flooding or scouring slopes and areas of unprotected soil, resulting in heavy sediment loads affecting local watercourses. – Ensure the drainage system is always maintained cleared of mud and other obstructions. – Areas of the site not disturbed by construction activities shall be maintained in their existing conditions. – Earthworks, and fill slopes shall be properly maintained, in accordance with the construction specifications, including measures such as installation of drains, use of plant cover. – To avoid sediment-laden runoff that could adversely impact watercourses, install sediment control structures where needed to slow or redirect runoff	– TCVN 4447:1987: Earth works-Codes for construction; – Decree No. 22/2010/TT-BXD on regulation of construction safety; – QCVN 08:2008/BTNMT – – National technical regulation on quality of surface water	– Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	and trap sediment until vegetation is established. Sediment control structures could include windrows of logging slash, rock berms, sediment catchment basins, straw bales, storm drain inlet protection systems, or brush fences. – The amount of excavated soil will be stored along the route at the locations agreed upon with the local authorities and people. At the same time, the contractor will try to avoid construction plansor earthworks in the rainy season to avoid leaching and water pollution problems. In the case of construction during the rainy season, the contractors should have appropriate construction methods to prevent local flooding such as embankments, shielding excavated land by canvas, digging temporary drainage ditches and pumping for drying the construction site and limit flooding.			
5. Management of stockpiles, quarries and borrow pits	– Large scale borrows pits or stockpiles will need site-specific measures that go beyond those in these ECOPs. – All locations to be used must be previously identified in the approved construction specifications. Sensitive sites such as scenic spots, areas of natural habitat, areas near sensitive receptors, or areas near water should be avoided. – An open ditch shall be built around the excavated soil storage area to intercept wastewater. – Stockpile topsoil when first opening a borrow pit and use it later to restore the area to near natural conditions. – If needed, disposal sites shall include a retaining wall. – If the need for new sites arises during construction, they must be pre-approved by the Construction Engineer. – If landowners are affected by use of their areas for stockpiles or borrow pits, they must be included in the subproject resettlement plan. – If access roads are needed, they must have been considered in the environmental assessment.		Contractor	– Supervision reports of CSC Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	– PPMU's Environment Officer should conduct due diligence to make sure that borrow pits and quarries are legally operating, with licensed and that sound environment and social standards are being practiced. – Include the requirement that the contractors shall be required to buy materials from licensed borrow pit and quarry operators into the civil work contractual documents. – PPMU's Environment Officer should undertake a rapid review of quarry sites to assess if operations are in compliance with Vietnamese laws and Bank requirements prior to construction. – Include monitoring of borrow pits and quarries.			
6. Solid waste	– Before construction, a solid waste control procedure (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) must be prepared by the Contractors and it must be carefully followed during construction activities. – Before construction, all necessary waste disposal permits or licenses must be obtained. – Measures shall be taken to reduce the potential for litter and negligent behavior with regard to the disposal of all refuse. At all places of work, the Contractor shall provide litter bins, containers and refuse collection facilities. – Solid waste may be temporarily stored on site in a designated area approved by the Construction Supervision Consultant and relevant local authorities prior to collection and disposal through a licensed waste collector, for example, URENCO. – Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. – No burning, on-site burying or dumping of solid waste shall occur. – Recyclable materials such as wooden plates for trench works, steel, scaffolding material, site holding, packaging material, etc shall be collected	– Decree No. 59/2007/ND-CP on solid waste management – Decision No. 23/2006/QD-BTNMT with list of hazardous substance – Circular No. 36/2015/TT-BTNMT on management of hazardous substance	– Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	and separated on-site from other waste sources for reuse, for use as fill, or for sale. - If not removed off site, solid waste or construction debris shall be disposed of only at sites identified and approved by the Construction Supervision Consultant and included in the solid waste plan. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas, such as in areas of natural habitat or in watercourses.			
7. Chemical or hazardous wastes	- Chemical waste of any kind shall be disposed of at an approved appropriate landfill site and in accordance with local legislative requirements. The Contractor shall obtain needed disposal certificates. - The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers. - Used oil and grease shall be removed from site and sold to an approved used oil recycling company. - Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. - Used oil or oil-contaminated materials that could potentially contain PCBs shall be securely stored to avoid any leakage or affecting workers. The An Giang DONREs must be contacted for further guidance. - Unused or rejected tar or bituminous products shall be returned to the supplier's production plant. - Relevant agencies shall be promptly informed of any accidental spill or incident. - Store chemicals appropriately and with appropriate labeling - Appropriate communication and training programs should be put in place to prepare workers to recognize and respond to workplace chemical hazards - Prepare and initiate a remedial action following any spill or incident. In this case, the contractor shall provide a report explaining the reasons for the spill	Circular No.36/2015/TT-BTNMT on management of hazardous substance	Contractor	- Supervision reports of CSC - Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions.			
8. Management of excavated soil	– Characteristics of excavated soil should be determined by sampling and analysis if not already fully evaluated during the ESIA. Excavated soil that is heavily contaminated would require measures that go beyond the scope of these ECOPs. – Collected excavated soil has to be processed, as per Vietnamese regulations on waste collection, to ensure safe and environmentally secure transportation, storage, treatment and management.	– Decision No. 23/2006/QD-BTNMT with list of hazardous substance – Decree No. 59/2007/ND-CP dated 09 April 2007 on solid waste management – Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and scrabs.	– Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang
9. Disruption of vegetative cover and ecological resources	– The Contractor shall prepare a Clearance, Revegetation and Restoration Management Plan for prior approval by the Construction Engineer, following relevant regulations. The Clearance Plan shall be approved by the Construction Supervision Consultant and followed strictly by the contractor. Areas to be cleared should be minimized as much as possible. – Site clearance in a forested area is subject to permission from An Giang DARD. – The contractor shall remove topsoil from all areas where topsoil will be impacted by construction activities, including temporary activities such as storage and stockpiling, etc; the stripped topsoil shall be stockpiled in areas agreed to by the Construction Supervision Consultant for later use in re-vegetation and shall be adequately protected. – The application of chemicals for vegetation clearing is not permitted. – Trees cannot be cut down unless explicitly authorized in the vegetation clearing plan.	Law on Environment protection No. 55/2014/QH13	Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	– When needed, temporary protective fencing will be erected to efficiently protect the preserved trees before commencement of any works within the site. – No area of potential importance as an ecological resource should be disturbed unless there is prior authorization from CSC, who should consult with PPMUs, IEMC and the relevant local authorities. This could include areas of breeding or feeding for birds or animals, fish spawning areas, or any area that is protected as a green space. – The Contractor shall ensure that no hunting, trapping, shooting, poisoning of fauna takes place.			
10. Traffic management	– Before construction, carry out consultations with local government and community and with traffic police. – Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. – Installation of lighting at night must be done, if necessary, to ensure safe traffic circulation. – Place signs around the construction areas to facilitate traffic movement, provide directions to various components of the works, and provide safety advice and warnings. – Employ safe traffic control measures, including road/rivers/canal signs and flag persons to warn of dangerous conditions. – Avoid material transportation for construction during rush hours. – Passageways for pedestrians and vehicles within and outside construction areas should be segregated and provide for easy, safe, and appropriate access. Signposts shall be installed appropriately in both water-ways and roads where necessary.	– Law on traffic and transportation No. 23/2008/QH12 – Law on construction No. 50/2014/QH13 – Circular No.22/2010/TT-BDX dated 03 Dec., 2010 on labor safety duringthe construction of civil works	– Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang
11. Interruption of	– Provide information to affected households on working schedules as well as planned disruptions (at least 5 days in advance).	Decree No. 73/2010/NDCP on administrative	Contractor	– Supervision reports of CSC

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
utility services	– Interruptions of water supply to agricultural areas must be avoided. – The contractor should ensure alternative water supply to affected residents in the event of disruptions lasting more than one day. – Any damages to existing cable utility systems shall be reported to the authorities and repaired as soon as possible.	penalization security and society issues		– Supervision and monitoring reports of PPMU An Giang
12. Restoration of affected areas	– Cleared areas such as borrow pits which are no longer in use, disposal areas, site facilities, workers' camps, stockpiles areas, working platforms and any areas temporarily occupied during construction of the subproject works shall be restored using landscaping, adequate drainage and revegetation. – Start revegetation at the earliest opportunity. Appropriate local native species of vegetation shall be selected for the planting and restoration of the natural landforms. – Spoil heaps and excavated slopes shall be re-profiled to stable conditions, and grassed to prevent erosion. – All affected areas shall be landscaped and any necessary remedial works shall be undertaken without delay, including green-spaces, roads, bridges and other existing works. – Trees shall be planted at exposed land and on slopes to prevent or reduce land collapse and keep stability of slopes. – Restore all damaged roads and bridges caused by subproject activities.	Law on Environment protection No. 55/2014/QH13		
13. Worker and public Safety	– Contractor shall comply with all Vietnamese regulations regarding worker safety. – Prepare and implement an action plan to cope with risk and emergency. – Preparation of emergency aid service at the construction site. – Training workers on occupational safety regulations. – If blasting is to be used, additional mitigation measures and safety precautions must be outlined in the ESMP.	– Circular No. 22/2010/TT-BXD dated 03 December 2010 on regulation of construction safety – Directive No. 02 /2008/CT-BXD on safety and sanitation issues in construction agencies	– Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	– Ensure that ear pieces are provided to and used by workers who must use noisy machines such as piling, explosion, mixing, etc., for noise control and workers protection. – During demolition of existing infrastructure, workers and the general public must be protected from falling debris by measures such as chutes, traffic control, and use of restricted access zones. – The contractor shall provide safety measures such as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to people. – Contractors' contracts to include conditions to ensure occupational health and safety; do not differentiate payment between women and men, and those who belong to local ethnic Khmer groups, for work of equal value; prevent use of child labor; and comply with the government's labor laws and related international treaty obligations. – Maximize employment of women and poor HH during construction.	– TCVN 5308-91: Technical regulation on safety in construction – Decision No. 96/2006/QD-TTg dated 04 May 2006 on management and implementation of bomb mine explosive material disposal.		
14. Communication with local communities	– Maintain open communications with the local government and concerned communities; the contractor shall coordinate with local authorities (leaders of local wards or communes, leader of villages) for agreed schedules of construction activities at areas nearby sensitive places or at sensitive times (e.g., religious festival days). – Copies in Vietnamese of these ECOPs and of other relevant environmental safeguard documents shall be made available to local communities and to workers at the site. – Reduced playground space, loss of playing fields and car parking: The loss of amenities during the construction process is often an unavoidable source of inconvenience to users in sensitive areas. However, early consultation with those affected provides the opportunity to investigate and implement alternatives. – Disseminate subproject information to affected parties (for example local authority, enterprises and affected households, etc) through community	Decree No. 73/2010/ND-CP on administrative penalization security and society issues	Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
	meetings before construction commencement, focusing on female headed households, poor and vulnerable populations. - Provide a community relations contact from who interested parties can receive information on site activities, subproject status and subproject implementation results. - Provide all information, especially technical findings, in a language that is understandable to the general public and in a form useful to interested citizens and elected officials through the preparation of fact sheets and news releases, when major findings become available during the subproject phase. - Monitor community concerns and information requirements as the subproject progresses. - Respond to telephone inquiries and written correspondence in a timely and accurate manner. - Inform local residents about construction and work schedules, interruption of services, traffic detour routes and provisional waterway routes, blasting and demolition, as appropriate. - Provide technical documents and drawings to PC's community, especially a sketch of the construction area and the ESMP of the construction site. - Notification boards shall be erected at all construction sites providing information about the subproject, as well as contact information about the site managers, environmental staff, health and safety staff, telephone numbers and other contact information so that any affected people can have the opportunity to voice their concerns and suggestions.			
15. Workers'camp	- The Contractor will consult with local authority regarding the location of the worker camps and will provide appropriate water supply, garbage collection, toilets, mosquito net, and other health protection measures to all workers. Fishing, wildlife hunting, and other social disturbance to local societies are prohibited. Training of workers on safety, good hygiene, and prohibitions activities	- Law on Labor No.10/2012/QH13	Contractor	- Supervision reports of CSC - Supervision and monitoring reports of PPMU An Giang

Environmental – social issues	Mitigation measure	Vietnam code/regulation	Responsibility	Verification to determine effectiveness of measures
16. Chance find procedures	If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall: - Stop the construction activities in the area of the chance find. - Delineate the discovered site or area. - Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Department of Culture, Sports and Tourism takes over. - Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property of Viet Nam (within 24 hours or less). - Relevant local or national authorities are in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This will require a preliminary evaluation of the findings to be performed. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; including the aesthetic, historic, scientific or research, social and economic values. - Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remains of cultural or archeological importance) conservation, preservation, restoration and salvage. - If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relic's authority, the Subproject's owner will need to make necessary design changes to accommodate the request and preserve the site. - Decisions concerning the management of the finding shall be communicated in writing by relevant authorities. - Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage.	- Law on Cultural Heritage 32/2009/QH12 - Decree No. 98/2010/ND-CP dated 21/09/2010 of the Government on implementing a number of articles of Law on cultural heritage and Law on amendment and supplementation of a number of articles of Law on cultural heritage.	- Contractor	- Supervision reports of CSC - Supervision and monitoring reports of PPMU An Giang

Site-specific Impacts and Mitigation Measures

Table 64 presents site-specific impacts and mitigation measures that could not addressed through the application of the ECOPs. This may be because the impacts are very site-specific in nature and thus require very site-specific mitigation measures.

Table 64: *Site -specific Mitigation Measures*

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
	Construction of dykes and culverts (Component 1)				
I	***During construction phase***				
1	**Land acquisition and resettlement**	Land acquisition and resettlement will comply with approval Resettlement Policy Framework (RPF) and Resettlement Action Plan (RAP), specifically: - Compensate for all losses at replacement costs and provide replacement land within their village or commune satisfactory to them so that their cultural and social cohesion could be maintained. - Support to relocating HHs to restore their livelihood and living conditions. - To be recruited for the subproject.	- Law on Land No. 45/2013/QH13; - Decree No. 43/2014/ND-CP; - Decree No. 44/2014/ND-CP; - Decree No. 47/2014/NĐ-CP; - Circular No. 36/2014/TT-BTNMT; - Circular No. 37/2014/TT-BTNMT;	- Compensation, support and resettlement councils of An Giang - PPMU An Giang	Supervision reports of PPMU An Giang and Independent resettlement monitoring consultant
2	**Clearance of UXOs**	- The subproject will allocate fund for clearance of the UXO remained after the war at the construction areas. The subproject owner will sign a contract with the specialized military unit in An Giang province to carry out the UXO clearance at the construction sites. This activity will be implemented right after completing land acquisition and compensation and before any dismantling, demolition or ground 166eveling takes place. - Coordinate with the appropriate agencies at the design stage to identify if UXO is a potential threat to works. - Ensure that the contractors shall only commence site works after the subproject areas are already been cleared.		- Contractor implementing the package of searching and emoving/destroying UXO - PPMU An Giang	- Implementation report - Supervision reports of the PPMU An Giang

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
3	**Relocation of graves**	– Compensation for the removal of the 23 graves is included in the RAP of the subproject and will include the cost for buying of land for re-burial, excavation, relocation, reburial and other related costs which are necessary to satisfy customary religious requirements. Compensation in cash will be paid to each affected family or to the affected group as a whole as is determined through a process of consultation with the affected community. The level of compensation will be decided in consultation with the affected families/communities. All costs of excavation, relocation and reburial (6,000,000 VND/grave) will be reimbursed in cash. Graves to be exhumed and relocated in culturally sensitive and appropriate ways. – During implementation the Subproject Owner will make early announce to the households whose graves are affected so that they can arrange their embodiment in consistence with the spiritual practices of the people and compensate to the affected household as required in the subproject RAP and ESMP.	– Policy for grave relocation will be compliance with approval Resettlement Policy Framework (RPF) and Resettlement Action Plan (RAP)	- PPMU An Giang	– Implementation report - Supervision reports of the PPMU An Giang - No complaints received.
II	***During Construction phase***				
1	***Sensitive receptors***				
1.1	**Vinh Loc secondary school** 	– Sprey sufficient water during dry days to avoid dust around the school. – Prohibit use of construction methods that cause noise during school learning hours. – Ensure traffic safety by installing safety fence and warning sign, providing traffic instruction when school children go to and leave the school around construction area.	– QCVN 05:2013/BTNMT – QCVN 06:2008/BTNMT – QCVN 08:2008/BTNMT – QCVN 26:2010/BTNMT	Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
		- Provide good drainage avoid water run-off to the school area. - Prohibit construction of workers camps within 2 km from the school. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Immediately address any issue/complaint raised by the school.	- QCVN 27:2010/BTNMT - Circular 36/2015/BTNMT		
1.2	**Residential clusters at the beginning of the Vinh Hau canal connecting with Bay Xa canal** 	- Sprey sufficient water during dry days to avoid dust around the residential area. - Do not allow construction activities before 6:30 am and after 8:00 pm. If night shift is unavoidable, prohibit use of construction methods that cause noise at night. - Ensure traffic safety by installing safety fence and warning signs, traffic instruction around construction area that adjacent to the residential area. - Provide good drainage to avoid water run-off to residential area. - Immediately collect any domestic wastes and construction spoils caused by the construction activities around the residential area and dispose in a designated site. - Hold monthly meeting with the community on construction progress and issues and immediately address any issue/complaint raised by the community.	- QCVN 05:2013/BTNMT - QCVN 06:2008/BTNMT - QCVN 08:2008/BTNMT - QCVN 26:2010/BTNMT - QCVN 27:2010/BTNMT Circular 36/2015/BTNMT	Contractor	- Supervision reports of CSC - Supervision and monitoring reports of PPMU An Giang
1.3	**residential clusters at the beginning of the Xang canal connecting with the Bay Xa canal**	- Sprey sufficient water during dry days to avoid dust around the residential area. - Do not allow construction activities before 6:30 am and after 8:00 pm. If night shift is unavoidable, prohibit use of construction methods that cause noise at night.	- QCVN 05:2013/BTNMT - QCVN 06:2008/BTNMT	Contractor	- Supervision reports of CSC - Supervision and monitoring

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
		– Ensure traffic safety by installing safety fence and warning signs, traffic instruction around construction area that adjacent to the residential area. – Provide good drainage to avoid water run-off to residential area. – Immediately collect any domestic wastes and construction spoils caused by the construction activities around the residential area and dispose in a designated site. – Hold monthly meeting with the community on construction progress and issues and immediately address any issue/complaint raised by the community.	– QCVN 08:2008/BTNMT – QCVN 26:2010/BTNMT – QCVN 27:2010/BTNMT Circular 36/2015/BTNMT		reports of PPMU An Giang
1.4	**Residential clusters at the beginning of the Vinh Hau canal connecting the Hau river** 	– Sprey sufficient water during dry days to avoid dust around the residential area. – Do not allow construction activities before 6:30 am and after 8:00 pm. If night shift is unavoidable, prohibit use of construction methods that cause noise at night. – Ensure traffic safety by installing safety fence and warning signs, traffic instruction around construction area that adjacent to the residential area. – Provide good drainage to avoid water run-off to residential area. – Immediately collect any domestic wastes and construction spoils caused by the construction activities around the residential area and dispose in a designated site. – Hold monthly meeting with the community on construction progress and issues and immediately address any issue/complaint raised by the community.	– QCVN 05:2013/BTNMT – QCVN 06:2008/BTNMT – QCVN 08:2008/BTNMT – QCVN 26:2010/BTNMT – QCVN 27:2010/BTNMT Circular 36/2015/BTNMT	Contractor	– Supervision reports of CSC – Supervision and monitoring reports of PPMU An Giang
2.	**Risk of erosion and sedimentation**	– The ring dike sections where filling embankment is required must be filled as soon as flood drains away to	– QCVN 08:2008/BTNMT	Contractor	– Supervision reports of CSC

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
		ensure that the ring dike embankment and structure are strong enough in dry reason. - Immediately re-enforce the surface and slope of the low dike embankment when it is strong enough so that the dyke withstand erosion during flood season. - Plan for work schedules to ensure that the new ring dike embankment is hardened when flood appears (before August). - When the newly built ring dike has not hardened, the construction companies must use geotextile sheets to cover it to avoid erosion by flood. - Arrange drainage along the two sides of the dyke to ensure no soil erosion and sedimentation to the rice fields and canals. - When taking land from the former dike, the construction companies must organize orderly section by section and make clean them timely. When excavators that scrap soil work inward fields, the construction companies must avoid dispersing soil into canals. Do not let the excavated soil near canals susceptibly swept by flood waters.			- Supervision and monitoring reports of PPMU An Giang
3	**Impact on local paddy rice fields and on-field irrigation canals**	- Arrange drainage along the two sides of the dyke to ensure no soil erosion and sedimentation to the rice fields and irrigation canals. - Provide alternative water diversion from canals to the locations of people's water pumps, if they are affected. - Regularly check the affected on-field irrigation canals to ensure they are not blocked by construction spoils and wastes. - Immediately rehabilitate irrigation canals if they are damaged by construction activities to ensure that water supply for the rice fields inside ring dike is maintained.		Contractor	- Supervision reports of CSC - Supervision and monitoring reports of PPMU An Giang

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
		– Closely consult with the local community to ensure that suitable sollutions to problems are taken and communities concerns related to construction activities are addressed.			
A (II)	– ***Operation of dykes and culverts (Component 1)***				
1	*Safety of local people*	– Safety measures will be implemented by local authorities responsible for maintenance and operatons of dykes and culverts	*1*	Local authority	– Safety measures implemented by local authorities
2	Possible impacts on water users and other key stakeholders due to operation of the culverts	– Development of the culvert operational plan through close consultation with water users and key stakeholder (starting 2017) so that the final plan acceptable to stakeholders will be finalized before operation of the culverts.	2	An Giang DARD, local authorities, and local communities	– The culvert operational plan developed and used
B	– ***Implementation of 5 Livelihood Models (Compoment 2)***				
B (I)	– ***During preconstruction and construction phase***				
	On-farm Improvement may have some impacts on local environment	– The farm owners will be advised on how to do the on-foram improvement to avoid negative impacts on local environment	On-farm area	An Giang PPMU	– Subproject progress report
III	***During operation phase (Component 2) – Detailed description of mitigation measures provided in Section 5.3***				
1	**Wastes from aquaculture raising**	– Define *Macrobrachium rosenbergii* scale to suit the water conditions in the region. – Do not focus on large-scale farming except maintaining the water surface area as max as 50% in order that waste can disperse and dilute in floodwaters. – Do not develop *Macrobrachium rosenbergii* in the industrial scale but in the improved extensive scale (the maximum density is 3-4 lavae/m^2). With this density, impacts from *Macrobrachium rosenbergii* farming on the environment is	– Circular No.08/VBHN-BNNPTNT dated 25/02/2014 by MARD	Provincial Division of Aquaculture	– Supervision reports of CSC – Supervision and monitoring reports of DARD An Giang

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
		small. – Do not use of antibiotics for *Macrobrachium rosenbergii*, especially banned antibiotics in accordance with Circular No.08/VBHN-BNNPTNT dated 25/02/2014 by MARD.			
2	**Waste from rice planting**	– Organize widely agriculture extension classes to introduce people the integrated pest management measures (IPM) and "One Must, Five Reductions" program following Annex 5 on Integrated Pest Management in the project ESMF) so that people understand as well as practice in reality.		Provincial Division of agriculture	– Supervision reports of CSC – Supervision and monitoring reports of DARD An Giang
3	**Disease from shrimp farming**	– Low stock density of shrimp – Waste treatment		Farmers	– Supervision reports of CSC – Supervision and monitoring reports of DARD An Giang
4	**Impact on farmers Ensure adequate measures to mitigate potential negative impacts on poor farmers due to implementation of the 5 livelihood models**	– Provide technical assistance to brand development and expansion of trade for products: (i) Organize market forecasts for such products as macrobrachium rosenbergii, clean rice, organic rice, floating rice without the use of plant protection products to meet the demand of the consumption market; (ii) Develop brand for such products as macrobrachium rosenbergii, clean rice, organic rice, floating rice as the impetus for this production development; and (iii) Find out stable output for macrobrachium rosenbergii, clean rice, organic rice, floating rice through product introduction on the domestic and international fairs. – In-depth technical guidance for production: Organize field farming school to guide people to convert to new livelihood patterns through the introduction of theory, models and sending agricultural/aquacultural extension offices who directly guide people on site when they require. The		Provincial Center of Argiculture Extension	– Supervision reports of CSC – Supervision and monitoring reports of DARD An Giang

No	Sensitive Area or Activity	Mitigation Measures	Vietnam code/regulation	Responsibility	Verification of effectiveness of measures
		guidelines must ensure to equip people enough knowledge and techniques when new models are introduced in the area. – Infrastructure planning and consolidation to delineate areas of similarity in the use of water resources: The production conversion may give rise to conflicts in the use of water in the 2-crop and 3-crop areas. To minimize conflicts, besides developing production models, the solutions for the areas where there are the same time of water use to avoid conflicts in the use of water should be planned. The 1-rice crop and aquaculture areas in flood season should be planned separately. The 2-crop areas or other crop areas combining flushing water to reserve natural fisheries should be planned separately to avoid conflicts in the use of water. – Conduct socio-economic survery; – Developother measures to improve knowledge of farmers including building farmer networks.			
2	Reduce potential negative impacts due to possible expansion of aquculture farming and/or the models	– Provide technical assistance to establish a registration system for aquaculture farming.	-	– Division of Aquaculture of An Giang province – Agriculture and Fishery Extension Center of An Giang province – An Giang PPMU	– Supervision reports of CSC – Supervision and monitoring reports of An Giang DARD

Addressing Regional Environmental Impacts

The report systematically and qualitatively assesses the regional impacts of the proposed subprojects. The regional impacts, both positive and negative, are generally mild and moderate for two reasons: i) the scale of the investments, from a regional perspective, are small; and ii) the investments are designed to be low-regret and conform with the 2013 Mekong Delta Plan strategies for sustainable development. In addition to addressing the regional environmental impacts at the subproject level through satisfactory implementation of the subproject ESMP, a Technical Assistance (TA) will be provided to help address regional issues. A well-designed Component 1 ($48 million) of the MDICRSL supports the following initiatives through technical assistance activities in the Project:

- **Formulation of a Mekong Delta Climate Sustainability Assessment**: This will be comprehensive assessment of Delta sustainability issues, including status, trends, and recommendations on how to adaptively manage the Delta in context of rapidly changing environmental conditions. It will be a document that informs the government's next five year regional, local, and sectoral planning in the Delta. The Assessment should be completed by 2019 and will help to inform planning exercises in the Vietnam government, including the Ministry of Planning and Investment's (MPI) "Socio-Economic Development Plan for the Mekong Delta", provincial socio-economic development and land use plans, and sector master plans for the next planning cycle (2021-2025). The Assessment will develop a set of key environmental and socio-economic indicators related to MD sustainability taking into account the regional environmental impacts of the MD development, and then assess the status, trends, and driving factors related to those indicators. The Assessment will also identify any data or knowledge gaps which need to be addressed for the next Assessment process, which ideally should take place every five years. Finally, the Assessment will provide a set of recommendations related to the next planning cycle in order promote adaptive management of the Delta.
- **Upgrading Monitoring Programs:** Including remote sensing, land use, water quantity and quality, groundwater, coastal and river morphology, coastal zone protection, etc. to provide better information. These programs will help produce better tools and information for both planning and management purposes, including informing design of phase II subprojects to address the regional environmental impacts. The results of the programs will be shared with the project provinces and broader MD stakeholders, and other relevant capacity building activities will be developed and carried out during project implementation.
- **Establishment of the Mekong Delta Center:** Several research institutes and departments are involved in gathering and analyzing data and information on the Delta; however, there are no current mandates for data sharing which would contribute to the integrated and multi-sectoral solutions that are often needed. The Center is envisioned to serve as a hub for Delta-wide information, including water, land use, environmental and climate change information, education and outreach, and provide support to specialized studies and research projects that inform decisions and investments in the Mekong Delta. For addressing regional environmental impacts the provinces will benefit from data provided by the center.
- **MARD Real Time Operations System for Hydraulic Infrastructure:** This will be a decision support center to provide real-time information on salinity, floods, and droughts to allow for better operation of infrastructure, especially the sluice gates, to meet real-time

conditions and demands. Under the system a database on MD sea dykes and mangrove forests will be established for a systematic assessment and monitoring of sea dykes and mangrove belts, which will allow for better monitoring, maintenance, and investments for these critical coastal assets.

6.4. ENVIRONMENTAL MONITORING PROGRAM

The main objective of the environment monitoring program is to ensure that (a) the potential negative impacts of the project are minimized; (b) the ESMP is effectively implemented; and (c) the ESMP is adequate to mitigate the potential negative impacts. Given that monitoring the implementation of the RAP will be conducted separately, the environmental monitoring program will comprise: (a) monitoring the safeguard performance of the contractor during site clearance and construction; (b) environmental quality monitoring; (c) community-based monitoring; and (d) monitoring effectiveness of the ESMP.

6.4.1. Monitoring of Contractor's Safeguard Performance

Three levels of safeguard monitoring will be implemented: routine monitoring, periodic monitoring, and community monitoring, as follows:

- Routine monitoring: The routine monitoring will be made by the Construction Supervision Consultant (CSC) as assigned by PPMU An Giang. The CSC will include the monitoring results in the project progress reports.
- Periodic monitoring (every six months): As part of the overall monitoring of the ESMP, the ESU assisted by the Independent Environmental Monitoring Consultant (IEMC) will also monitor the contractor performance every 6 months and the results will be reported to the An Giang PPMU and the WB.
- Community monitoring: Monitoring by local communities will be conducted following the Government practices with the technical and management support from the ICMB10.

6.4.2. Environmental Quality Monitoring

To ensure an acceptable level of environmental quality, monitoring of dust, noise, vibration, air quality, and water quality will be made at project specific locations that are likely to be significantly affected by the construction activities, or requested by local authorities and communities for specific purposes. ESU/IEMC will be responsible for the monitoring of the program.

Below is a list of the key issues and scope of monitoring that will be considered in the implementation of the monitoring program:

- General Construction Impacts: To include local flooding; traffic management especially in residential areas; air, noise, and dust levels in residential areas; and water quality upstream and downstream of construction sites, with specific attention on impacts to local residents;

- Others: As agreed with local agencies and communities during the preparation of the monitoring program.

Table 65 provides general guidance on the monitoring program and estimated cost considering that the activities will be carried out during construction (assumed 4 years), and during the first 2 years of subproject operation. Detailed monitoring programs will be prepared during the detailed design stage, map of monitoring site is figured out in *Table 65* and detail of monitoring sites are described in Annex 3. An estimated cost for monitoring is incorporated into the ESMP cost (Section 7.7). Many of these measurements are required by Vietnamese regulations and would need to be done even if not directly related to expected subproject impacts.

Table 65: Scope of environmental monitoring during construction and operation phase

No	Contents	Specific requirements	Applied standard
I	**Construction phase**		
1	Air/noise, vibration		QCVN 05:2013/BTNMT, QCVN 26:2010/BTNMT; QCVN 27:2010/BTNMT
a	Parameters	TSP, NO_2, SO_2, CO, noise, vibration	
b	Locations	5 Sites	
c	Frequency	03 months/time x 48 months	
2	Water + micro organism + aquatic life		QCVN 08:2008-BTNMT
a	Parameters	pH, Tur., DO, TSS, BOD_5, TN, TP, oil & grease, coliform, phytoplankton, zooplankton, zoobenthos	
b	Locations	10 Sites	
c	Frequency	03 months/time x 48 months	
3	Sediment - Soil		QCVN 03:2008/BTNMT; QCVN 43:2012/BTNMT;
a	Parameters	pH_{KCl}, Cu, Pb, Zn, Cd, As, TP, TN, TC	
b	Locations	8 Sites	
c	Frequency	03 months/time x 48 months	
II	**Operation phase** (1 year before operation and 1 year after operation)		
1	Water + micro organism + aquatic organism		QCVN 08:2008-BTNMT
a	Parameters	pH, Tur., Salinity, DO, TSS, BOD_5, TN, TP, oil & grease, coliform, phytoplankton, zooplankton, zoobenthos	
b	Locations	10 Sites	
c	Frequency	03 months/time during the first 2 years of operation	

2	Sediment - Soil		QCVN 03:2008/BTNMT; QCVN 43:2012/BTNMT;
a	Parameters	pH_{KCl}, Cu, Pb, Zn, Cd, As, TP, TN, TC	
b	Locations	8 Sites	
c	Frequency	03 months/time during the first 2 years of operation	

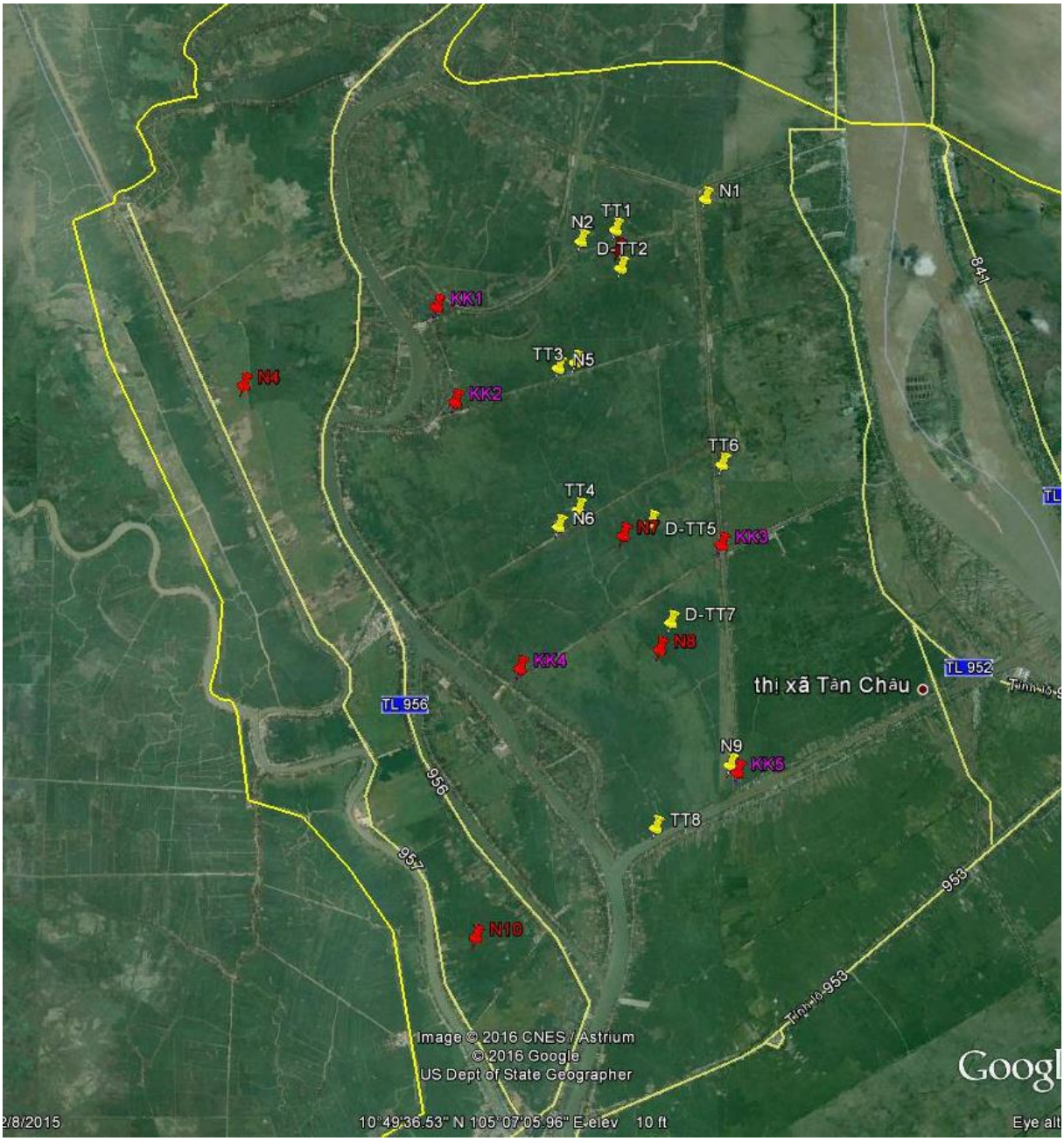


Figure 57: *Environmental monitoring site during construction and operation phase*

(note: N: surface water; TT: sediment; D-TT: sediment/soil; KK: air) final stations may be adjusted as needed)

6.4.3. Community-based monitoring

Community-based monitoring is a voluntary activity of people living in commune/ ward areas. Community Supervision Board will be established by Decision No. 80/2005/QD-TTg and others relevant regulations. Community Supervision Board will be responsible for:

- Monitoring and assessing the observance of investment management regulations by agencies competent to decide on investment, investors, project management unit, contractors and project-implementing units in the investment process (including environmental issues);
- Detecting and recommending to the competent state agencies on violations of regulations on investment management (including environmental issues) so as to promptly prevent and handle acts that violate regulations, cause wastage and/or loss of state capital and properties or infringe the interests of the community

6.4.4. Monitoring Effectiveness of the ESMP

The ESU assisted by IEMC will monitor performance of the ESMP implementation during the detailed design/bidding stage as well as during construction and first year operation of the facilities to ensure that (a) appropriate dredging and disposal of drainage sludge is properly carried out, in accordance with the DMMP; (b) other impacts identified in the ESMP are effectively managed and mitigated; and (c) traffic management is adequate and the level of impacts is acceptable (no complaints or outstanding cases). Results are to be properly kept in the subproject file for possible review by ICMB10 and the WB. Cost for the monitoring will be part of the ICMB10 cost.

6.5. ROLE AND RESPONSIBILITIES FOR ESMP IMPLEMENTATION

6.5.1. Implementation arrangement

Role and responsibilities for ESMP implementation are described in *Figure 58* and *Table 66*.

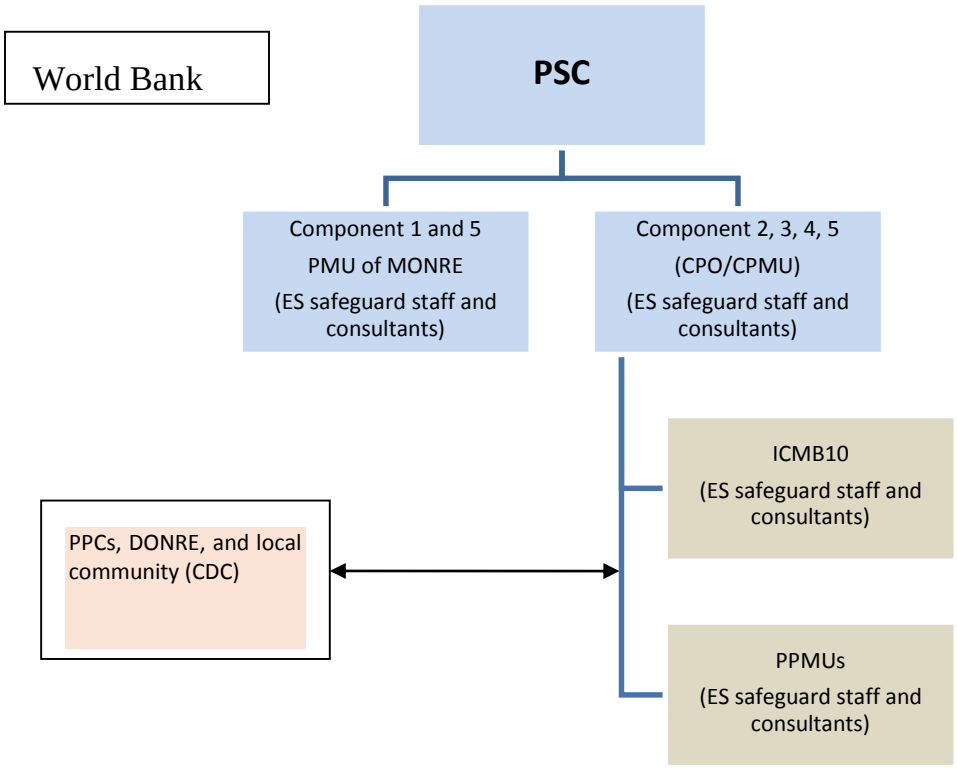


Figure 58: Organization structure for safeguard monitoring

Table 66: Institutional Responsibilities for the Project and Subproject Safeguard Implementation

Community/ Agencies	**Responsibilities**
Project Implementing Agency (IA) and PMU (The IA means MARD and MONRE while PMU here means the PMU of MONRE and CPMU and ICMB10 of MARD and PPMUs of the provinces)	- The IA will be responsible for overseeing the Project implementation including ESMF implementation and environmental performance of contractors. - PMU, representative of the IA, will be responsible for monitoring the overall Project implementation, including environmental compliance of the Project. PMU will have the final responsibility for ESMF implementation and environmental performance of the Project during the construction and operational phases. - Specifically the PMU will: (i) closely coordinate with local authorities in the participation of the community during project preparation and implementation; (ii) monitor and supervise ESMP implementation including incorporation of ESMP into the detailed technical designs and bidding and contractual documents; (iii) ensure that an environmental management system is set up and functions properly; (iv) be in charge of reporting on ESMP implementation to the IA and the World Bank. - In order to be effective in the implementation process, PMU will establish an Environmental and Social Unit (ESU) with at least two safeguard staff to help with the environmental aspects of the Project.

Environmental and Social Unit (ESU) under PMU	- The ESU is responsible for monitoring the implementation of the World Bank's environmental safeguard policies in all stages and process of the Project. Specifically, this unit will be responsible for: (i) screening subprojects against eligibility criteria, for environment and social impacts, policies triggered and instrument/s to be prepared;(ii) reviewing the subproject EIAs/EPPs and ESIAs/ESMPs prepared by consultants to ensure quality of the documents; (iii) helping PMU incorporate ESMPs into the detailed technical designs and civil works bidding and contractual documents; (iv) helping PMU incorporate responsibilities for ESMP monitoring and supervision into the TORs, bidding and contractual documents for the Construction Supervision Consultant (CSC) and other safeguard consultants (SSC, ESC, IMA, and EMC) as needed; v) providing relevant inputs to the consultant selection process; (v) reviewing reports submitted by the CSC and safeguard consultants; (vi) conducting periodic site checks; (vii) advising the PMU on solutions to environmental issues of the project; and viii) preparing environmental performance section on the progress and review reports to be submitted to the Implementing Agency and the World Bank.
PPMUs, DARDs, ICMB10, PMU of MONRE	- As the subproject/activity owner, PPMU/ICMB10/PMU of MONRE is responsible for implementation of all the ESMP activities to be carried out under the Project, including fostering effective coordination and cooperation between contractor, local authorities, and local communities during construction phase. PPMU/ICMB10/PMU of MONRE will be assisted by the environmental staff, safeguard consultants, and CSC/or field engineer. - Division of Aquaculture of An Giang province DARD and Agriculture and Fishery Extension Center of An Giang province are responsible for livelihoods models. - During operation, the responsibility to operate the embankment routes and culvets will be transferred to the An Phu DPC and they will be responsible for monitoring of water quality and ecosystem before and after the operation of the culverts and submit water quality report to the DONRE one time per three months.
Construction Supervision Consultant (CSC) and/or Field Engineer	- The CSC will be responsible for routine supervising and monitoring all construction activities and for ensuring that Contractors comply with the requirements of the contracts and the ECOP. The CSC will engage sufficient number of qualified staff (e.g. Environmental Engineers) with adequate knowledge on environmental protection and construction project management to perform the required duties and to supervise the Contractor's performance. - The CSC will also assist the PMU/PPMU/ICMB10/PMU of MONRE in reporting and maintaining close coordination with the local community.
Contractor	- Based on the approved environmental specifications (ECOP) in the bidding and contractual documents, the Contractor is responsible for establishing a Contractor ESMP (CESMP) for each construction site area, submit the plan to PPMU/ICMB10/PMU of MONRE and CSC for review and approval before commencement of construction. In addition, it is required that the Contractor get all permissions for construction (traffic control and diversion, excavation, labor safety, etc. before civil works) following current regulations. - The Contractor is required to appoint a competent individual as the contractor's on-site *Safety and Environment Officer (SEO)* who will be responsible for monitoring the contractor's compliance with health and safety requirements, the CESMP requirements, and the environmental specifications (ECOP).

	- Take actions to mitigate all potential negative impacts in line with the objective described in the CESMP. - Actively communicate with local residents and take actions to prevent disturbance during construction. - Ensure that all staff and workers understand the procedure and their tasks in the environmental management program. - Report to the PPMU/ICMB10/PMU of MONRE on any difficulties and their solutions. - Report to local authority and PPMU/ICMB10/PMU of MONRE if environmental accidents occur and coordinate with agencies and keys stakeholders to resolve these issues.
Independent Envionmental Monitoring Consultants (IEMC)	- IEMC will, under the contract scope, provide support to PPMU/ICMB10/PMU of MONRE to establish and operate an environmental management system, offers suggestions for adjusting and building capacity for relevant agencies during project implementation and monitor the CESMP implementation in both construction and operation stages. IEMC will also be responsible to support PPMU/ICMB10/PMU of MONRE to prepare monitoring reports on ESMP implementation. - The IEMC will have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the Project.
Local community	- Community: According to Vietnamese practice, the community has the right and responsibility to routinely monitor environmental performance during construction to ensure that their rights and safety are adequately protected and that the mitigation measures are effectively implemented by contractors and the CPMU/PPMU/ICMB10/PMU of MONRE. If unexpected problems occur, they will report to the CSC and/or CPMU/PPMU/ICMB10/PMU of MONRE.
Social organizations, NGOs and civil society groups	- These organizations could be a bridge between the PPC/DPC, communities, Contractors, and the CPMU/PPMU/ICMB10/PMU of MONRE by assisting in community monitoring. - Mobilizing communities' participation in the subproject, providing training to communities and Participating in solving environmental problems, if any.
Province and District People's Committees (PPCs/DPCs), Provincial DONRE	- Oversee implementation of subprojects under recommendations of DONRE and PPMU/ICMB10/PMU of MONRE to ensure compliance of Government policy and regulations. DONRE is responsible for monitoring the compliance with the Government environmental requirements.

6.5.2. Environmental Compliance Framework

6.5.2.1. Environmental Duties of the Contractor

The contractor firstly shall adhere to minimize the impact that may be result of the project construction activities and secondly, apply the mitigation measures under ESMP to prevent harm and nuisances on local communities and environment caused by the impacts in construction and operation stages.

Remedial actions that cannot be effectively carried out during construction should be carried out on completion of the works (and before issuance of the acceptance of completion of works)

The duties of the Contractor include but not limiting to:

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

6.5.2.2. Contractor's Safety and Environment Officer (SEO)

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

- Carry out environmental site inspections to assess and audit the contractors' site practice, equipment and work methodologies with respect to pollution control and adequacy of environmental mitigation measures implemented;
- Monitor compliance with environmental protection measures, pollution prevention and control measures and contractual requirements;
- Monitor the implementation of environmental mitigation measures;
- Prepare audit reports for the environmental monitoring data and site environmental conditions;
- Investigate complaints and recommend any required corrective measures;
- Advise the contractor on environment improvement, awareness and proactive pollution prevention measures;
- Recommend suitable mitigation measures to the contractor in the case of non-compliance. Carry out additional monitoring of noncompliance instructed by the ECO/ES;
- Inform the contractor and ECO/ES of environmental issues, submit contractor's ESMP Implementation Plan to the ECO/ES, and relevant authorities, if required;
- Keep detailed records of all site activities that may relate to the environment.

6.5.2.3. Independent Environmental Monitoring Consultant (IEMC)

In order to minimize the environmental impacts during construction stage of the Project, the Project owner shall ensure that environmental quality monitoring requirements are established for the project. An Independent Environmental Monitoring Consultant (IEMC) appointed by CPMU shall carry out the monitoring.

- IEMC will be responsible for carrying out environmental sampling, monitoring and marking report during all stages of the Project. Environmental quality monitoring will be report periodically to PPMU (every 06 months in construction stage and in operation stage).
- IEMC will also supply specialized assistance to CPMU and ECO in environmental matters.

6.5.2.4. Environmental Supervision during Construction

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

- Review and assess on behalf of the PPMU whether the construction design meets the requirements of the mitigation and management measures of the ESMP,
- Supervise site environmental management system of contractors including their performance, experience and handling of site environmental issues, and provide corrective instructions;
- Review the ESMP implementation by the contractors, verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results;
- Report ESMP implementation status to PPMU and prepare the environmental supervision statement during the construction stage; and
- Approve invoices or payments.

6.5.2.5. Compliance with Legal and Contractual Requirements

The constructions activities shall comply not only with contractual environmental protection and pollution control requirements but also with environmental protection and pollution control laws of the Socialist Republic of Viet Nam.

All the works method statements submitted by the Contractor to the ECO for approval shall also be sent to the ES to see whether sufficient environmental protection and pollution control measures have been included.

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

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

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

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

6.5.2.6. Environmental Claims and Penalty System

In the compliance framework, if non-compliance with environmental regulations are discovered by ECO/CSC/ES/IEMC during the site supervision, 2% values of interim payment of the contractor of this month will be held back. The Contractor will be given a grace period (determined by CSC/ES) to repair the violation. If the Contractor performs the repairs within the grace period (confirmed by CSC/ES), no penalty is incurred and keeping money will be pay. However, if the Contractor fails to successfully make the necessary repairs within the grace period, the Contractor will pay the cost for a third party to repair the damages (deduction from keeping money).

In case of IEMC/CSC/ES not detected of non-compliance with environmental regulations of the contractor, they will be responsibility payment to repair the violation.

6.5.3. Reporting Arrangements

ESMP monitoring and reporting requirements are summarized in *Table 67*.

Table 67: Regular Reporting Requirements

No.	Report Prepared by	Submitted to	Frequency of Reporting
1	Contractor to the Employer	PPMU	Once before construction commences and monthly thereafter
2	Construction Supervision consultant (CSC)	PPMU	Weekly and monthly
4	Community Monitoring	PPMU	When the community has any complaint about the subproject safeguards implementation
5	PPMU An Giang	CPMU	Monthly
6	CPMU	WB	Every six-month

6.6. CAPACITY BUILDING PROGRAM

6.6.1. Technical assistance support for the implementation of safeguards

An assessment of safeguards implementation capacity of existing PPMU An Giang staffs indicates the staffs have limited knowledge on WB safeguard requirements as well as limited knowledge of environmental and social issues. Such lack of capacity represents a risk to project implementation of safeguards requirements contained in the ESMP and, as required by the WB policy, is to be addressed through capacity building. Therefore, it is proposed to provide capacity building through

technical assistance that will support the PPMU An Giang during the implementation of the safeguards requirements. The technical assistance will provide the necessary technical support for the PPMU in its work with contractors as well as other entities involved in the implementation of the ESMP.

The scope of the technical assistance would cover support from experts and training that would include knowledge on safeguards requirements and procedures for the subproject as well as training that covers both specific knowledge on safeguard procedures and requirements for the subproject staff, consultants, and national contractor. More specifically, the support would include, for example, assistance in the preparation of documents and implementation of training programs on environmental management and environmental monitoring for contractors, CSC and relevant staff of PPMU (environmental staff and coordinators of packages) to do their tasks. It would also include assisting the PPMUs' environmental staff with the review of contract documents on the bidding packages for construction items of the subproject to ensure compliance with environmental protection policies and impact mitigation and monitoring requirements; as well as provide general environmental guidance as requested by the PPMU to enhance overall project implementation and performance.

Given the nature, locations, and scale of construction, it is anticipated that the safeguard technical assistance support and training will be provided at least during the first 3 years of the project implementation. The WB safeguard specialists will participate in the capacity building, in particular in the training activities as appropriate.

Special technical assistance: Additional technical assistance will be necessary for ensuring that (a) the potential negative impacts during sluice operations will be minimized and accepted by key stakeholders, (b) the mitigation measures for potential impacts on socio-economic conditions of poor farmers is adequate and farmers have improved knowledge to minimize technical and marketing risks, and (c) regulatory measures to control and manage possible induced impacts due to possible expansion of the livelihood models is inplace before the subproject closing. It is expected that 2 national firms will be mobilized to provide these technical services: for (1) for development and consultation of the operation plan for the sluice gates including meetings and workshops for 2 years during 2017-2019 and (2) (i) the planning and undertaking socio-economic survey for the farmers in the pilot sites and nearby areas for 3 years during (2017-2020) to assess effectiveness of the pilots models, (ii) development of a registration program on aquacutlure farming in the subproject and nearby areas, and (iii) development of FFS application and implementation of a series of technical workshops, TOT, and development of guidelines and awareness materials, and study visits and building farmer network etc. to be implemented during 2017-2020. TORs for these technical assistances will be prepared by the subproject owner in close consultation with CPMU.

6.6.2. Training programs proposed

Table 68 provides the basic training programs for safeguards during subproject implementation. The training programs will be developed and delivered by the Technical Assistance team for the implementation of safeguards for the PMU training. The PMU/IEMC with the support of the the Technical Assistance team for the implementation of safeguards will provide the training to

contractors, CSC and other groups. In addition, given limited safeguard capacity of the main stakeholders of the project, The Bank will provide a training on Preparation of ESIA and Integration of Cumulative Impact Assessment (CIA) into ESIA which is part of the safeguards capacity program to develop during implementation while identifying and agreeing on one of the specific training or capacity building activities. The Bank consultant will provide a five-day training on integration of CIA into ESIA and on how to address the quality and the implementation of the EIAs in conjunction with other safeguards instruments.

Other more specific and tailored training will be developed and agreed upon between PPMUs, IEMC and the Technical Assistance team for the implementation of safeguards during project implementation based upon a reassessment of needs and the status of safeguards implementation with the following contents (*Table 68*):

- Target groups for the training include PPMU staff, ESU staff, safeguards consultant, field engineers, CSC, construction contractors.
- Training schedule: At least 1 month before the implementation of the first contract. The training can be adjusted in line with the implementation schedule of the subproject/contracts.
- Training frequency: The basic training programs proposed in will take place every six months on a yearly basis and its content updated and adapted to implementation issues. Training frequency and content will be reassessed during implementation depending on needs.

Table 68: Training Programs for Capacity Building on Environmental Supervision and Management

1. Objects	**CPO, CPMU, PPMUs, ESIA Consultants**
Training course	Preparation of Environmental and Social Impacts Assessment and integration of cumulative impact assessment (CIA) into ESIA.
Participants	**CPO, CPMU, PPMUs technical staff and ESIA Consultants**. The week long or so training referred to integrates CIA but goes beyond to address the quality and the implementation of the EIAs in conjunction with other safeguards instruments.
Course duration and time	A five-day training to be conducted in June 2016, before implementation of the MDICRSL project
Content	–World Bank requirements for ESIAs –Preparation of ESIA –Intergation of CIA into ESIA –Quality requirements and quality control of ESIA –Implementation of the EIAs in conjunction with other safeguards instruments.
Responsibilities	The World Bank
2. Objects	**PROVINCE PROJECT MANAGEMENT UNIT**
Training course	Environmental supervision, monitoring and reporting.
Participants	Environmental staff and technical staff.
Training Frequency	At least 1 month before implementation of the first contract. The follow-up training will be scheduled as needed.
Time	Four days of training twice a year to be repeated on a yearly basis.
Content	–General environmental management relating to the subproject including requirements of WB, DONRE, and cooperating with relevant enterprises.

	–Requirements on environmental supervision. –Supervision and implementation of mitigation measures; community participation in environmental supervision. –Guide and supervise contractor, CSC and community representatives in implementation of environmental supervision. –Forms used in environmental supervision. –Risk response and control. –Reporting and submit forms.
Responsibilities	PPMU, IEMC with support of the Technical Assistance team for the implementation of safeguards.
3. Objects	**CSC, CONTRACTOR**
Training course	Implementation of mitigation measures.
Participants	CSC; on-site construction management staff; environmental staff of contractor.
Training frequency	After bidding, update based on requirements.
Time	three days of training twice a year to be repeated on a yearly basis
Content	–Overview of environmental monitoring. –Requirements of environmental monitoring. –Role and responsibilities of contractors and CSC. –Content and methods of environmental monitoring. –Response and risk control. –Propagate monitoring forms and guide how to fill in the forms and risk reports. –Preparation and submission of reports.
Responsibilities	PPMU, IEMC with support of the Technical Assistance team for the implementation of safeguard policies.

6.7. ESTIMATED ESMP COST

The ESMP cost will comprise: (a) cost for resettlement and land acquisition; (b) cost for implementation of the mitigation measures by the contractor; (c) cost for supervision by the CSC; (d) cost for the Environmental Management Consultant (EMC) including monitoring of environmental quality; (e) cost for water quality/ecology monitoring during operation for at least 2 years; and (f) supervision and safeguard management costs incurred by PPMU and CPMU. All the costs will be included as the subproject cost as shown in *Table 69*.

- Cost for the implementation of the mitigation measures during construction will be part of the contract costs while the costs for monitoring by the CSC will be provided for in the construction supervision contracts.
- Cost for EMC and monitoring of environmental quality during construction is included in the subproject cost (*Table 70*).
- Costs for PPMU operations related to the ESMP will be provided for in the subproject management budget of the PPMU.

- Cost for technical assistance to be provided to mitigate the potential negative impacts during construction and operations of the sluice gates including the development of operational plan for sluices in consultation with water users and key stakeholders.
- Cost for technical assistance for mitigation of potential negative impacts due to the implementation of the 5 livelihood models especially (a) on poor farmers including undertaking socioeconomic survey, promoting aquaculture products, and implementation of the FFS on aquaculture models in the subproject areas and building farmers networks, and (b) for establishment of a registration system for aquaculture farmings to mitigate potential negative impacts due to possible expansion of the models in the future.

It is estimated that the ESMP implementation cost (excluding those to be included in civil works contract and CSC contract and RAP) will be about 4,023,248,000VND ($178,811**)** over a 6 years period. Estimation cost for ESMP is shown in *Table 69*.

Table 69: Cost for ESMP in the entire subproject (VND)

Activity	Source of fund	Total cost (VND)
(a) Resettlement and land acquisition	Part of subproject cost	78.941.000.000
(b) Mitigation measures during the construction phase	Part of contract cost	
(c) Safety monitoring during the construction phase (48months x 10 millions VND/months)	Part of subproject cost	480,000,000
(d) PPMU environmental staff	Part of subproject cost	480,000,000
(e) Environmental monitoring in the entire subproject (see in *Table 70*)	Part of subproject cost	823,248,000
(f) Environmental monitoring consultant (EMC)	Part of subproject cost	240,000,000
(g) Technical assistance (national consultant) for (i) planning and undertaking socio-economic survey for the farmers in the pilot sites and nearby areas for 3 years during (2017-2020) to assess the effectiveness of the pilot models, (ii) development of a registration program on aquacutlure farming in the subproject and nearby areas, and (iii) development of FFS application and implementation of a series of technical workshops, TOT, and development of guidelines and awareness materials, and	Part of subproject cost	2,000,000,000

study visits and building farmer network etc. (to be implemented during 2017-2020)		

Table 70: Cost for environmental monitoring (VND) in the entire subproject

TT	Activities	Unit	Quantity	Unit price	Total
I	**Construction phase**				**566,272,000**
1	Total of sampling (48 months x 3 months/time = 16 times)	Time	16		
2	Air/noise (5 stations x 16 times)	Sample	80	654,000	52,320,000
3	Water + micro organism + aquatic life (10 stations x 1samples/station) x 16 times	Sample	160	2,177,000	348,320,000
4	Sediment - Soil (8 stations /time x 16 times)	Sample	128	1,294,000	165,632,000
II	**Operation phase (during the first 2 years of operation)**				**256,976,000**
1	Total of sampling (24 months x 3 months/time)	Time	8		
2	Water + micro organism + aquatic life (10 stations x 1 samples/station) x 8 times	Sample	80	2,177,000	174,160,000
3	Sediment - Soil (8 stations /time x 8 times)	Sample	64	1,294,000	82,816,000
	Total = I+II				**823,248,000**

6.8. GRIEVANCE REDRESS MECHANISM (GRM)

Within the Vietnamese legal framework citizen rights to complain are protected. As part of overall implementation of the subproject, a grievance redress mechanism (GRM) will be developed by ESU of the PPMU which will identify procedures, responsible persons and contact information. It will be readily accessible, handle grievances and resolve them at the lowest level as quickly as possible. The mechanism will provide the framework within which complaints about environmental and safety issues can be handled, grievances can be addressed and disputes can be settled quickly. The GRM will be in place before the subproject construction commences.

During construction, the GRM will be managed by the contractor under supervision of the CSC. The contractor will inform the communities and communes affected by the contract about the GRM in place to handle complaints and concerns about the subproject. This will be done via the Information Disclosure and Consultation Process under which the contractor will communicate with the affected communities and interested authorities on a regular basis:. Meetings will be held

at least quarterly, a monthly information brochure will be published, announcements will be placed in local media, and notices of upcoming planned activities will be posted, and so on.

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

- Verbally: direct to the CSC and/or the contractor safeguard staff or representative at the subproject office.
- In writing: by hand-delivering or posting a written complaint to the address specified.
- By telephone, fax, e-mail: to the CSC, the contractor safeguard staff or contractor's representative.

On receipt of a complaint, the CSC, contractor safeguard staff or representative will register the complaint in the complaints file and maintain alog of events pertaining to it thereafter, until its resolution. Immediately after receipt, three copies of the complaint will be made. The original will be kept in the file, one copy will be used by the contractor's safeguard staff, one copy will be forwarded to the CSC, and the third copy to the PPMU within 24 hours of the complaint being made.

Information to be recorded in the complaints log will include:

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

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

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

World Bank Grievance Redress Mechanism: Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to adddress project-related

concerns. Subproject affected communities and individuals may submit their complaints to the WB's independent Inspection Panel which determines whether harms occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at anytime after concerns have been brought directly to the WB's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit www.worldbank.org/grs. For information on how to submit complaints to the World Bank Inspecition Panel, please visit www.inspectionpanel.org.

CHAPTER 7. PUBLIC CONSULTATION AND DISCLOSURE

In the ESIA process, information disclosure and public consultation on environment ensures the acceptance of local authorities, local NGOs and local affected people in the subproject area. Public participation is one of basic conditions that ensure the local authority and community's support for the subproject and take their view into account. Through public consultation, unidentified environmental adverse impacts and mitigation measures can be recognized and included in ESIA report. In fact, if community takes part early in the subproject preparation, the relationship between community and subproject officials becomes closer. Thereafter, the community can continue to contribute their feedback and any concerns they may have during subproject implementation.

7.1. OBJECTIVES OF PUBLIC CONSULTATION

The World Bank's policy (OP/BP 4.01) on environmental impact assessment requires that the Project Affected People (PAPs) and local authorities to be provided with notification and consultation during the preparation of ESIA report.

Public consultation (in the preparation of ESIA report for the subproject) must comply with the requirements in the Government's Decree No. 18/2015/ND-CP dated 14 February 2015 on environmental protection planning, strategic environmental ssessment, environmental impact assessment and environmental protection plan, and Circular No. 27/2015/TT-BTNMT dated 29 May 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan.

Objectives of public consultation:

- The consultation with the participation of local authorities and local people in the subproject site during the preparation and implementation of EMP and ESIA is to provide essential information for further understanding about the subproject, impacts of the subproject implementation and potential mitigation measures for the subproject;
- Clarify issues discussed in the beginning period of the subproject;
- Inform benefits achieved when the subproject is implemented;
- State responsibilities and awareness of stakeholders, beneficiary people in the subproject site during the subproject implementation;
- Encourage the community participation in determining the environmental impacts of the subproject.
- Collect information about demands as well as correspondences of local people and authorities in the construction and recommendation in order to mitigate environmental impacts or considering adjustment in the technical design stage.

7.2. IMPLEMENTATION METHODS

The MDICRSL Project is a Category A project, thus it was required by WB policies to carry out the public consultation at least twice during the ESIA process. Technical consultants and environmental consultants collaborated closely with PMU conducted public consultations with local authorities and communities and the affected people in the subproject areas. The first round

of public consultation was carried out September 14, 2015 after the project environmental and social screening and before TOR for ESIA report is finalized. The second consultation was done on January 27, 2016 after the first draft of ESIA report is prepared.

To implement the ESIA report of the subproject, the CPO organized consultation meetings with the People's Committees and Vietnam Fatherland Front of 4 communes in An Phu districts.

Before consulting at communes, CPO held general meetings at An Giang province to introduce the project, the subproject and collect opinions for the subproject. The meeting was held at the office of An Giang DARD. The participants at these meetings consist of representatives of DPC, provincial deparments as DONRE, DOST, DOIT, etc.

After holding the general meetings at the province, CPO carried out consultations at affected communes to introduce the subproject, collect information about the status of environmental sanitation at the locality, discuss potential environmental impacts and mitigation measures as well as coordinate with the local authorites in holding public consultation in the subproject area.

All the comments from the public consultations have been seriously taken into account by the subproject owners and the consultants and have been incorporated into the subproject design and the final draft ESIA.

7.3. PUBLIC CONSULTATION RESULTS

During the consultations, all the participants agreeded with the subproject implementation and its investment items and had the following comments

- In preconstruction phase:
  - Planned resettlement area should be located near the production area of the affectd HHs to facilitate in their production.
  - Support to EMs for their sustainable development consistent with the subproject activities
- In construction phase:
  - Add waterway incidents during transportation of materials.
  - Add risk of flooding threaten the lives and property of people (especially children) in the subproject area and its surroundings
  - Should coordinate with local authorities to public information on the responsibility of the contractor during construction
- In operation phase:
  - Assess the impact of endemic animal and plant species in the food chain during flood season.
  - Focus on safety for people, especially children during flood season
  - Add the impact of erosion and landslides for the area outside the dyke the subregion No.5.
  - Impacts on infrastructure in the subproject area and its vicinity in the flood season
  - Consider the consensus of the local people in the process of implementing a new production model simultaneously.

- Study proper production planning for each subregions to avoid conflict in production in the same subregion.

The livelihood patterns suitable for local conditions: 1rice + snakehead fish (during floods); double crops of rice; 1 lotus + 1 floating rice

7.4. Environmental information disclosure

The draft ESIA in Vietnamese has been locally disclosed as per the government regulation and the Bank requirements at the CPO office, the office of An Giang PPC and CPC of the subproject communes. The draft ESIA in English has also been disclosed at the Bank InfoShop prior to project appraisal.

CONCLUSIONS, RECOMMENDATIONS AND COMMITMENTS

1. CONCLUSIONS AND RECOMMENDATIONS

Overall, the subproject is feasible and consistent with the socio-economic development plans of An Giang province as well as with the rural development sector in MKD both in current situation and in context of climate change. The subproject meets the needs for socio-economic development in An Phu. Based on the assessment and preparation of this ESIA, it is considered that the proposed mitigation measures designed on the monitoring program during construction and operation, are adequate for mitigating the potential negative impacts of the subproject. The positive impacts of the subproject include improving living conditions of the residents in the provinces, promotion of socioeconomic development, and addressing climate change and sea level rise impacts in the moderate and long term.

During subproject implementation, some negative impacts will affect the local environment and local populations in the project areas. Land acquisition and resettlement of subproject affected households will be required.

During the construction phase, there will be negative impacts including equipment exhaust emissions, dust and noise from construction equipment during the construction of trail and culverts, wastewater from construction workers and construction activities, construction solid waste, dredged sludge and some contaminated waste, among others. These have been identified in the ESMP and included in ECOP.

These impacts can be mitigated by ensuring that the subproject contractors comply with the provisions of their contracts, including those which relate to environmental impacts. The PPMU and their CSC and EMC will be responsible for ensuring that this compliance occurs. In accordance with their contracts, contractors will be required to prepare the Contract Specific Environmental Plan (CSEP) describing detailed environmental safeguard actions. The CSEP will be approved by PPMUs and supervised by CSCs prior to the work commencing. Periodic monitoring reports will be prepared by the EMC and the results will be submitted to CPMU and the World Bank (as needed).

Environmental monitoring will be carried out to ensure that the project activities do not create adverse impacts. The monitoring results will be periodically reported to CPMU and the World Bank (as needed).

2. COMMITMENTS

- General Commitments:
  - The Client and PPMU commit to complying with Vietnam Laws on Environmental protection: Law on Environmental protection 2014, Laws and legal documents (Decree No. 18/2015/ND-CP dated 14 February 2015 of the Government on environmental protection assessment, strategic environmental assessment, environmental impact assessment and environmental protection plan; Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and scrabs; Decree No. 88/2007/ND-CP dated 28 May 2007 of the Government on urban drainage and urban areas, etc.) and WB‘s safeguard policies during the project implementation.

- The Client commits to complying with the mitigation measures of adverse impacts of the subproject on environment during the construction preparation, construction and operation according to contents as mentioned in Chapter 6 of this Report.
- Project's activities shall be under the inspection of the competent authorities in charge of environmental management of DONRE of An Giang and relevant functional agencies to ensure the project development and environmental protection
- The Client commits to disclose contents of approved ESIA report approved at the subproject locality to monitor the compliance with environmental protection commitments in the approved ESIA report.

– Commitment To Complying With Environmental Standards And Regulations: the Client commits to complying strictly with environmental standards and regulations:

- Exhaust gas: In accordance with Vietnam standard QCVN 19:2009/BTNMT – National Technical Regulation on Industrial Emission of Inorganic Substances and Dusts
- Waste water: Commit to implementing mitigation measures and operation of waste water treatment system to ensure waste water treatment according to QCVN 14:2008/BTNMT (column B): National technical regulations on domestic waste water quality;
- Noise: Control noise in accordance with QCVN 26:2010/BTNMT – National technical regulation on noise.
- Solid waste: Solid waste will be collected and treated properly to ensure not drop down and exposure to ambient environment to ensure requirements for environmental sanitation and regulations in Decree No.59/2007/ND-CP dated 09 April 2007 of the Government on solid waste management.
- Hazardous waste: Commit to complying with Circular No. 12/2011/TT-BTNMT dated 14 April 2011 of MONRE on hazardous waste management.

– Commitment To Management And Control Of Environmental Pollution

- The environmental management and control of environmental pollution will be given top priority during the construction and operation;
- The Client commits to coordinating with the functional agencies during designing, construction and operation of the treatment system and environmental protection;
- During the operation, the Client commits to implementing the environmental pollution management and control program in the project area as mentioned in this report and periodically reporting to the DONRE of An Giang province.
- The Client commits for compensation and remedy of environmental pollution in case of environmental incidents and risks due to the project implementation;
- The Client commits to completing planned works, especially completion of the environmental treatment works after the ESIA report is approved.

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ANNEX 1. ANALYSIS RESULTS OF EXISTING ENVIRONMENTAL QUALITY

Annex 1.1: Analytical Results Of Air samples

No	Locations	T°C	Humidity	TSP	NO_2	SO_2	CO	Noise		
								Avag	Max	Min
		^0C	*%*	*$\mu g/m^3$*				*dB*		
1	**KK1**	30.6	81	86	22	17	830	60.4	72.1	46.4
2	**KK2**	31.9	83	140	24	29	1300	61.4	76.4	47.3
3	**KK3**	31.1	85	80	31	17	950	56.5	73.1	42.5
4	**KK4**	31.9	81	160	34	25	1200	64.2	78.6	46.4
5	**KK5**	30.7	83	94	21	22	1300	58.7	70.4	41.1
6	**KK6**	30.4	79	110	27	28	1400	58.4	76.8	47.2
7	**KK7**	30.9	77	140	43	24	1400	61.7	80.3	50.7
8	**KK8**	30.6	82	82	22	22	1200	60.1	76.4	45.2

Annex 1.2: Analytical results of surface water samples

No	Locations	Tide	Tur.	pH	EC	DO	BOD_5	COD	TSS	$N\text{-}NH_4^+$	$N\text{-}NO_2^-$	$N\text{-}NO_3^-$	$P\text{-}PO_4^{3-}$	Fe_{TS}	Cl^-	Ttotal Coliform
			NTU		µS/cm	mgO_2/L				mg/L						MPN/ 100mL
1	N1	Low	79.3	6.69	122	5.6	4.7	9.1	95.1	0.097	<0,01	1.225	<0,01	1.33	11.0	3300
2		High	64.1	6.86	137	5.9	4.9	9.7	72.5	0.094	<0,01	1.318	<0,01	1.24	12.4	2600
3	N2	Low	99.4	6.36	130	6.6	5.3	10.8	116.2	0.177	0.015	1.128	<0,01	1.53	9.0	4900
4		High	71.3	6.75	123	5.9	7.0	14.5	85.9	0.223	<0,01	1.188	<0,01	0.78	9.0	24000
5	N3	Low	87.3	6.70	141	6.1	2.3	4.5	104.8	0.149	<0,01	1.170	<0,01	1.16	11.0	1700
6		High	68.4	6.91	152	5.9	2.2	4.2	80.1	0.024	<0,01	1.275	<0,01	1.32	13.7	1700
7	N4	Low	63.8	6.62	144	5.7	7.0	14.1	76.1	0.120	<0,01	0.754	<0,01	1.19	11.0	3300
8		High	68.4	6.72	134	5.4	4.2	7.1	78.4	0.174	<0,01	0.864	<0,01	1.62	10.5	2800
9	N5	Low	75.0	6.68	154	6.0	4.6	8.7	89.9	0.313	<0,01	1.233	<0,01	1.03	11.0	3300
10		High	62.1	6.78	124	5.5	6.0	12.1	74.9	0.141	<0,01	0.751	<0,01	0.91	11.0	1300
11	N6	Low	73.4	6.53	131	6.8	3.4	5.4	87.0	0.109	<0,01	0.856	<0,01	1.10	11.0	1100
12		High	72.7	6.62	128	6.0	5.3	10.9	86.7	0.102	<0,01	1.181	<0,01	0.81	11.0	2700
13	N7	Low	63.4	6.86	118	5.8	5.4	10.7	82.1	0.103	<0,01	1.370	<0,01	0.84	10.8	1800
14		High	58.1	6.94	126	5.4	5.8	11.4	70.6	0.124	<0,01	1.240	<0,01	1.37	11.7	1500
15	N8	Low	60.1	6.71	123	6.2	4.2	8.4	72.4	0.092	<0,01	1.050	<0,01	0.84	10.2	2400
16		High	55.4	6.82	127	5.5	5.1	10.1	60.7	0.131	<0,01	1.270	<0,01	1.25	11.8	3500
17	N9	Low	101.0	6.55	136	5.2	6.4	12.9	119.8	0.165	<0,01	1.177	<0,01	1.39	11.0	4900
18		High	95.2	6.77	131	5.9	5.3	10.5	80.6	0.153	<0,01	1.640	<0,01	1.61	12.1	7200
19	N10	Low	159.0	6.52	118	5.2	5.7	11.5	188.1	0.122	<0,01	1.850	<0,01	2.59	11.0	2700
20		High	92.7	6.62	129	5.6	4.8	9.3	115.3	0.147	<0,01	1.520	<0,01	1.33	9.4	1300

Annex 1.3: Analytical Results Of soil samples

No	Locations	Layer	pH_{KCl} (1:5)	EC (1:5)	OM	TN	TP	SO_4^{2-}	Fe_{TS}	Cl^-	Cd	Hg	Pb	As	Cu	Zn
				mS/cm	*%*			*mg/kg*								
1	**Đ1**	**T1**	5.18	108.5	1.63	0.15	0.03	10.6	51.5	4.7	0.014	ND	1.02	0.25	5.2	52
2		**T2**	5.19	82.5	2.03	0.17	0.03	8.5	70.5	3.1	0.027	ND	0.84	0.31	6.4	41
3		**T3**	4.92	76.9	1.52	0.16	0.03	8.2	71.0	2.6	0.011	ND	0.57	0.22	8.1	67
4	**Đ2**	**T1**	4.46	186.3	3.25	0.16	0.03	13.8	236.1	8.3	0.028	ND	0.61	0.27	7.4	34
5		**T2**	4.88	120.7	1.63	0.21	0.04	11.4	154.2	5.2	0.013	ND	0.55	0.34	6.8	26
6		**T3**	5.12	93.9	0.93	0.17	0.04	9.3	68.5	3.1	0.007	ND	0.81	0.24	7.4	51
7	**Đ3**	**T1**	4.34	238.0	4.55	0.15	0.03	31.8	206.2	8.3	0.015	ND	0.73	0.41	5.8	43
8		**T2**	4.62	195.1	3.75	0.15	0.03	33.2	155.0	9.9	0.018	ND	1.21	0.22	6.3	29
9		**T3**	4.79	150.4	2.17	0.13	0.02	14.4	115.3	6.8	0.022	ND	0.37	0.37	7.1	51
10	**Đ4**	**T1**	6.36	178.5	2.24	0.16	0.05	22.1	73.5	6.8	0.037	ND	0.24	0.41	8.6	64
11		**T2**	4.96	247.0	2.37	0.16	0.03	35.4	87.5	7.8	0.041	ND	0.61	0.56	5.7	27
12		**T3**	4.88	221.0	2.87	0.13	0.02	30.7	96.0	5.2	0.054	ND	0.53	0.42	9.2	35
13	**Đ5**	**T1**	5.24	121.8	3.84	0.11	0.03	9.9	55.6	10.4	0.021	ND	0.68	0.56	3.6	46
14		**T2**	5.29	129.3	4.65	0.16	0.04	13.7	32.7	7.8	0.017	ND	0.52	0.27	4.4	29
15		**T3**	5.53	99.2	1.15	0.16	0.03	12.2	60.1	5.2	0.033	ND	0.61	0.38	5.9	41
16	**Đ6**	**T1**	4.74	103.0	2.81	0.18	0.03	14.1	55.2	7.4	0.019	ND	0.55	0.21	7.2	34
17		**T2**	4.61	127.0	2.64	0.11	0.02	16.4	47.6	7.2	0.022	ND	0.37	0.64	3.8	71
18		**T3**	5.17	114.0	1.16	0.13	0.03	13.7	58.1	8.6	0.017	ND	0.64	0.54	6.2	52
19	**Đ7**	**T1**	5.88	181.3	2.49	0.19	0.04	22.8	43.0	8.8	0.024	ND	0.53	0.26	7.2	48
20		**T2**	5.69	146.7	3.72	0.14	0.02	14.3	36.9	8.8	0.041	ND	0.38	0.24	5.9	64
21		**T3**	5.62	165.9	1.63	0.17	0.03	21.9	57.5	8.3	0.034	ND	0.24	0.31	6.3	73

Annex 1.4: Analytical Results Of wastewater samples

No	Locations	TºC	pH	EC	DO	Tur.	TDS	H_2S	Total hardness	TSS	Fe_{TS}	BOD_5	COD	TN	$N\text{-}NH_4^+$
		^OC		*µS/cm*	*mg/L*	*NTU*	*mg/L*		*mg$CaCO_3$/L*	*mg/L*					
1	**N1**	29.4	6.21	386	1.87	12.40	171	0.105	51.0	232.0	0.270	35	58.9	6.77	2.880
2	**N2**	9.8	6.84	412	0.92	18.26	184	0.047	85.0	122.8	0.080	72	119.4	4.18	0.870
3	**N3**	30.4	6.56	374	2.35	31.08	157	0.082	102.0	177.0	0.150	88.4	173.8	7.34	3.960

Annex 1.4-1: Analytical Results Of wastewater samples

No	Locations	$N\text{-}NO_2^-$	$N\text{-}NO_3^-$	TP	$P\text{-}PO_4^{3-}$	SO_4^{2-}	Cl^-	Cd	Hg	Pb	As	Cu	Zn	Coliform
		mg/L												*MPN/100mL*
1	**N1**	0.184	2.69	0.52	0.13	13.5	18.3	ND	ND	ND	ND	ND	0.050	34,000
2	**N2**	0.143	0.85	0.47	0.27	15.7	19.1	ND	ND	ND	ND	ND	0.065	7,200
3	**N3**	0.137	2.00	0.76	0.31	16.4	17.4	ND	ND	ND	ND	ND	0.042	22,000

Annex 1.5: Analytical Results Of Sediment samples

No	Locations	pH_{KCl} (1:5)	Fe_{TS}	Cd	Hg	Pb	As	Cu	Zn
			mg/kg						
1	**TT1**	5.89	39.5	0.3	ND	0.59	0.27	6.13	62.1
2	**TT2**	5.91	33.5	0.4	ND	0.47	0.35	7.31	74.5
3	**TT3**	5.58	46.7	0.3	ND	0.54	0.42	5.20	47.9
4	**TT4**	5.80	35.9	0.4	ND	0.61	0.25	8.17	55.3

Annex 1.6: Phytoplankton in the subproject area (from location 1 to 5)

No	Species	Locations/tide									
		N1		N2		N3		N4		N5	
		High	Low	High	Low	High	Low	High	Low	High	Low
I	**EUGLENOPHYTA**										
1	*Trachelomonas volvocina*	*							*		
2	*Euglena acus*				*						
3	*Euglena oxyuris*	*		*							*
4	*Euglena spyrogyra*	*		*					*		
5	*Trachelomonas dubia*					*		*			
II	**Chrysophyta**										
6	*Dinobryon sertularia*	*							*		
7	*Mallomonas sp.*				*	*					
III	**CYANOPHYTA**										
8	*Anabaena variabilis*	*	*		*			*			
9	*Arthrospira gomontiana*			*	*		*				
10	*Desmidium sp.*					*			*		
11	*Dictyosphaeryum pulchellum*			*							
12	*Lyngbya sp.*					*			*		*
13	*Microcytis aeruginosa*									*	
14	*Oscillatoria acuta*		*	*							
15	*Oscillatoria irrigua*				*	*		*			
16	*Oscillatoria rubescens*	*		*		*					
17	*Phormidium mucicola*		*								*
III	**CHLOROPHYTA**										
18	*Ankistrodesmus gracilis*						*			*	
19	*Arthrodesmus convergens*	*			*	*		*			*
20	*Closterium gracile*		*		*	*			*	*	*
21	*Coeocytis sp*										*

No	Species	Locations/tide									
		N1		N2		N3		N4		N5	
		High	Low	High	Low	High	Low	High	Low	High	Low
22	*Desmidium baileyi*	*	*	*	*		*	*	*	*	
23	*Dictyosphaerium pulchellum*							*			*
24	*Eudorina elegans*	*		*		*		*		*	
25	*Kirchneriella lunaris*		*		*			*	*		
26	*Kirchneriella sp.*										
27	*Pandorina charkoviensis*			*		*				*	*
28	*Pediastrum duplex*										
29	*Scenedesmus arcuatus*	*		*			*	*		*	*
30	*Scenedesmus quadricauda*										*
31	*Staurastrum apiculatum*	*	*			*			*		*
32	*Staurastrum paradoxum*									*	
33	*Staurastrum smithii*			*		*	*				*
34	*Volvox aureus*	*	*						*	*	
35	*Xanthidium sp.*	*		*	*						
IV	**BACILLARIOPHYTA**										
36	*Coscinodiscus gigas*	*			*						
37	*Hantzschia amphioxys*		*			*		*			*
38	*Melosira undulata*	*	*	*						*	
39	*Pinnularia major*	*	*				*		*		
40	*Surirella elegens*										
41	*Synedra amphicephala*		*			*			*		*
42	*Synedra ulna*			*							
	Quantity (species/location)	**16**	**12**	**14**	**11**	**14**	**6**	**10**	**12**	**10**	**14**
	Density *(10^3Cell/m^3)*	**12,5**	**28,0**	**61,4**	**17,3**	**24,7**	**16,4**	**17,8**	**15,3**	**6,1**	**11,3**

Annex 6-1: Phytoplankton in the subproject area (from location 6 to 10)

No	Species	Locations/tide									
		N6		N7		N8		N9		N10	
		High	Low	High	Low	High	Low	High	Low	High	Low
I	**EUGLENOPHYTA**										
1	*Trachelomonas volvocina*										*
2	*Euglena acus*								*		
3	*Euglena oxyuris*			*						*	
4	*Euglena spyrogyra*						*		*		
5	*Trachelomonas dubia*		*								
II	**Chrysophyta**										
6	*Dinobryon sertularia*							*	*	*	
7	*Mallomonas sp.*	*						*			
III	**CYANOPHYTA**										
8	*Anabaena variabilis*			*							
9	*Arthrospira gomontiana*	*				*	*	*		*	
10	*Desmidium sp.*	*							*		*
11	*Dictyosphaeryum pulchellum*		*		*						
12	*Lyngbya sp.*			*			*	*	*		
13	*Microcytis aeruginosa*					*				*	*
14	*Oscillatoria acuta*	*									
15	*Oscillatoria irrigua*		*	*				*			*
16	*Oscillatoria rubescens*					*					
17	*Phormidium mucicola*										
III	**CHLOROPHYTA**										
18	*Ankistrodesmus gracilis*		*				*			*	*
19	*Arthrodesmus convergens*	*					*	*	*		
20	*Closterium gracile*		*	*	*	*			*	*	*
21	*Coeocytis sp*	*	*		*			*			

No	Species	Locations/tide									
		N6		N7		N8		N9		N10	
		High	Low	High	Low	High	Low	High	Low	High	Low
22	*Desmidium baileyi*		*		*	*	*		*	*	*
23	*Dictyosphaerium pulchellum*			*		*		*	*		
24	*Eudorina elegans*	*	*		*	*	*	*			
25	*Kirchneriella lunaris*							*	*		*
26	*Kirchneriella sp.*	*		*		*	*			*	
27	*Pandorina charkoviensis*	*	*							*	
28	*Pediastrum duplex*						*	*	*		
29	*Scenedesmus arcuatus*	*	*	*	*				*		
30	*Scenedesmus quadricauda*						*			*	*
31	*Staurastrum apiculatum*	*			*			*	*		
32	*Staurastrum paradoxum*			*		*	*				
33	*Staurastrum smithii*		*					*	*	*	
34	*Volvox aureus*	*			*	*	*		*		*
35	*Xanthidium sp.*		*	*				*			*
IV	**BACILLARIOPHYTA**										
36	*Coscinodiscus gigas*								*		
37	*Hantzschia amphioxys*										*
38	*Melosira undulata*		*	*	*		*	*			
39	*Pinnularia major*										
40	*Surirella elegens*		*					*		*	
41	*Synedra amphicephala*		*		*	*		*		*	
42	*Synedra ulna*					*					
	Quantity (species/location)	**12**	**15**	**11**	**10**	**12**	**13**	**17**	**16**	**13**	**12**
	Density *(10^3Cell/m^3)*	**18,3**	**14,7**	**19,7**	**16,8**	**4,8**	**6,3**	**8,5**	**17,4**	**7,6**	**7,9**

Annex 7: Zooplankton in the subproject area (from location 1 to 5)

No	Species	Locations/tide									
		N1		N2		N3		N4		N5	
		High	Low	High	Low	High	Low	High	Low	High	Low
I	***CLADOCERA***										
1	*Alona davidi*			*							
2	*Alona rectangula*	*		*		*				*	*
3	*Biaperturakarua*			*							
4	*Bosmina longirostris*					*		*			*
5	*Bosminopsis deitersi*		*								
6	*Ceriodaphnia laticaudata*								*		
7	*Ceriodaphnia megalops*				*				*	*	
8	*Ceriodaphnia reticulate*				*			*			
9	*Ceriodaphnia rigaudii*	*				*					
10	*Diaphanosoma brachyurum*				*	*					*
11	*Kurzia latissima*	*									
12	*Moina brachiata*										
13	*Moina dubia*							*			
14	*Moina macrocopa*			*			*				
15	*Moina rectirostris*	*	*				*				*
16	*Moinodaphnia macleayii*			*				*			
17	*Oxyurella longicaudis*		*								
II	***COPEPODA***										
18	*Allodiaptomus gladiolus*		*			*	*		*		
19	*Dentodiaptomus javanus*	*	*								
20	*Eodiaptomus dracosinignvomi*	*				*			*	*	
21	*Eodiaptomus lumboltzi*		*	*						*	

No	Species	Locations/tide									
		N1		N2		N3		N4		N5	
		High	Low	High	Low	High	Low	High	Low	High	Low
22	*Eucyclops serruatus*						*				
23	*Heliodiaptomus serratu*								*		
24	*Limnoithona sinensis*	*			*		*				
25	*Limoncaea genuine*	*			*				*		
26	*Mesocyclops leuckarti*										
27	*Mongolodiaptomus formosanus*			*		*	*				
28	*Neodiaptomus botulifer*									*	
29	*Neodiaptomus handeli*							*	*		*
30	*Neodiaptomus visnu*	*	*								
31	*Paracyclops serrulatus*			*			*			*	
32	*Phyllodiaptomus tunguidus*						*				
33	*Thermocyclops hyalinus*		*		*			*			
	Quantity (species/location)	***9***	***8***	***8***	***6***	***7***	***8***	***6***	***7***	***6***	***5***
	Density (individual/m^3)	**1734**	**2016**	**1371**	**1653**	**792**	**1741**	**1520**	**1684**	**1205**	**1947**

PL 7-1: Zooplankton in the subproject area (from location 6 to 10)

No	Species	Locations/tide									
		N6		N7		N8		N9		N10	
		High	Low	High	Low	High	Low	High	Low	High	Low
I	***CLADOCERA***										
1	*Alona davidi*					*				*	
2	*Alona rectangula*	*			*						*
3	*Biaperturakarua*						*		*		
4	*Bosmina longirostris*			*		*				*	
5	*Bosminopsis deitersi*		*				*				
6	*Ceriodaphnia laticaudata*				*				*		
7	*Ceriodaphnia megalops*			*					*		
8	*Ceriodaphnia reticulate*					*	*			*	
9	*Ceriodaphnia rigaudii*	*					*	*			*
10	*Diaphanosoma brachyurum*			*							
11	*Kurzia latissima*					*			*		
12	*Moina brachiata*			*		*		*		*	
13	*Moina dubia*	*									*
14	*Moina macrocopa*	*					*				
15	*Moina rectirostris*	*			*				*		
16	*Moinodaphnia macleayii*		*					*			*
17	*Oxyurella longicaudis*		*				*			*	
II	***COPEPODA***										
18	*Allodiaptomus gladiolus*		*				*			*	
19	*Dentodiaptomus javanus*			*							
20	*Eodiaptomus dracosinignvomi*			*			*			*	
21	*Eodiaptomus lumboltzi*	*								*	*

No	Species	Locations/tide									
		N6		N7		N8		N9		N10	
		High	Low	High	Low	High	Low	High	Low	High	Low
22	*Eucyclops serruatus*				*		*		*		
23	*Heliodiaptomus serratu*	*		*							
24	*Limnoithona sinensis*				*		*		*		
25	*Limoncaea genuine*		*				*				*
26	*Mesocyclops leuckarti*		*				*			*	
27	*Mongolodiaptomus formosanus*	*		*	*				*		
28	*Neodiaptomus botulifer*						*				
29	*Neodiaptomus handeli*						*				
30	*Neodiaptomus visnu*	*			*				*		*
31	*Paracyclops serrulatus*						*				
32	*Phyllodiaptomus tunguidus*				*					*	
33	*Thermocyclops hyalinus*	*							*		
	Quantity (species/location)	***10***	***6***	***8***	***8***	***5***	***15***	***3***	***10***	***10***	***7***
	Density *(*individual/m^3*)*	538	724	1031	872	916	1091	1632	8752	1087	7921

Annex 8: Zoobenthos in the subproject area (from location 1 to 5)

No	Species	Locations/tide									
		N1		N2		N3		N4		N5	
		High	Low	High	Low	High	Low	High	Low	High	Low
I	**OLIGOCHAETA**										
1	*Aulodrilus prothecatus*			*					*		
2	*Branchiodrilus semperi*									*	
3	*Branchiura sowerbyi*	*	*		*	*	*				
4	*Branchiura sowerbyi*				*				*		
5	*Limnodrilus hoffmeisteri*										
II	**GASTROPODA**										
6	*Antimelania swinhoei*										
7	*Bellamya filosa*			*			*		*		
8	*Filopaludina filosa*				*		*				
9	*Melanoides tuberculatus*	*					*				*
10	*Sinotaria reevei*									*	
11	*Stenothyra messageri*										
12	*Thiana scabra*	*		*		*	*				
III	**BIVALVIA**										
13	*Corbicula leviuscula*		*				*				
14	*Corbicula baudoni*			*					*		
15	*Corbicula cyreniformis*				*						
16	*Corbicula bocourti*	*									
IV	**CRUSTACEA**										
17	*Macrobrachium mammilodactylus*	*				*	1				
18	*Macrobrachium pilimanus*		*				*		*		
19	*Macrobrachium rosenbergii*										
V	**INSERTA**										

No	Species	Locations/tide									
		N1		N2		N3		N4		N5	
		High	Low	High	Low	High	Low	High	Low	High	Low
20	*Deiellia phaon*	*					*				
21	*Chironomus sp*	*		*			*		*	*	
22	*Ablabesmya sp*	*		*			*			*	
23	*Nannophya pygmea*			*			*				
24	*Graptocorixa sp*				*		*				*
	Quantity (species/location)	8	3	7	5	3	11	0	6	4	2
	Density (invidual/m^2)	**76**	**108**	**131**	**105**	**94**	**137**	**48**	**71**	**36**	**84**

Annex 8-1: Zoobenthos in the subproject area (from location 6 to 10)

No	Species	Locations/tide									
		N6		N7		N8		N9		N10	
		High	Low	High	Low	High	Low	High	Low	High	Low
I	**OLIGOCHAETA**										
1	*Aulodrilus prothecatus*		*		*				*		*
2	*Branchiodrilus semperi*		*								
3	*Branchiura sowerbyi*						*	*		*	
4	*Branchiura sowerbyi*		*						*		*
5	*Limnodrilus hoffmeisteri*					*					
II	**GASTROPODA**										
6	*Antimelania swinhoei*										
7	*Bellamya filosa*			*							
8	*Filopaludina filosa*									*	
9	*Melanoides tuberculatus*				*		*				
10	*Sinotaria reevei*			*							
11	*Stenothyra messageri*				*				*		
12	*Thiana scabra*								*		*
III	**BIVALVIA**										
13	*Corbicula leviuscula*						*				
14	*Corbicula baudoni*	*									
15	*Corbicula cyreniformis*			*				*	*		*
16	*Corbicula bocourti*										
IV	**CRUSTACEA**										
17	*Macrobrachium mammilodactylus*						*			*	
18	*Macrobrachium pilimanus*		*	*							
19	*Macrobrachium rosenbergii*					*				*	
V	**INSERTA**										

No	Species	Locations/tide									
		N6		N7		N8		N9		N10	
		High	Low	High	Low	High	Low	High	Low	High	Low
20	*Deiellia phaon*									*	
21	*Chironomus sp*	*			*		*	*		*	*
22	*Ablabesmya sp*										
23	*Nannophya pygmea*		*		*	*			*		*
24	*Graptocorixa sp*										
	Quantity (species/location)	2	5	4	5	3	5	3	6	6	6
	Density (invidual/m^2)	**172**	**137**	**105**	**62**	**71**	**84**	**192**	**117**	**82**	**76**

ANNEX 2. SOME PICTURES OF CONSULTATION MEETINGS


CỘNG SẢN VIỆT NAM QUANG VINH MUÔN NĂM

ANNEX 3. LOCATIONS OF SAMPLING

A3.1. Location of sampling for environmental status

Table A3.1.1: Coordinates of surface water sampling location

No	Locations	Coordinates		Description of sampling location
		Latitude	Longitude	
1	N1	10°55'7.89"N	105° 5'42.13"E	at upstream of Hau River
2	N2	10°52'24.00"N	105° 5'43.97"E	at Co Lau canal, section near Hau river
3	N3	10°53'20.80"N	105° 8'28.06"E	at Bay Truc canal
4	N4	10°52'13.13"N	105° 9'12.61"E	at Bay Xa canal, section in Vinh Loc commune
5	N5	10°51'34.18"N	105° 6'56.33"E	at Vinh Loc canal
6	N6	10°49'26.27"N	105° 5'19.75"E	at Hau river
7	N7	10°49'54.53"N	105° 7'28.35"E	at between of Vinh Loi canal
8	N8	10°48'51.10"N	105° 7'59.26"E	at between of Vinh Hau canal
9	N9	10°48'24.47"N	105° 9'27.19"E	at Bay Xa canal, section in Vinh Hau commune
10	N10	10°46'25.07"N	105° 8'38.85"E	at Xang canal

Table A3.1.2: Coordinates of groundwater sampling location

No.	Locations	Coordinates		Description of sampling location
		Latitude	Longitude	
1	GK1	10°52'20.60"N	105° 5'52.74"E	at residential area of Phu Huu commune
2	GK2	10°51'10.92"N	105° 6'0.46"E	at residential area of Vinh Thanh hamlet, Vinh Loc commune
3	GK3	10°49'2.89"N	105° 5'44.99"E	at residential area of Vinh Loi hamlet, Vinh Hau commune

Table A3.1.3: Coordinates of wastewater sampling location

No	Locations	Coordinates		Description of sampling location
		Latitude	Longitude	
1	NT1	10°52'23.61"N	105° 5'54.90"E	at residential area of Phu Huu commune
2	NT2	10°51'0.74"N	105° 9'15.91"E	at residential area along Bay Xa canal
3	NT3	10°49'0.05"N	105° 5'49.02"E	at residential area of Vinh Loi hamlet, Vinh Hau commune

Table A3.1.4: Coordinates of soil sampling location

No.	Locations	Coordinates		Description of sampling location
		Latitude	Longitude	
1	Đ1	10°53'4.21"N	105° 7'39.76"E	at infield of Bay Truc canal area
2	Đ2	10°53'10.34"N	105° 8'59.30"E	at infield of Bay Xa canal area, section near Bay Truc canal
3	Đ3	10°51'44.57"N	105° 7'45.46"E	at infield of Vinh Loc canal area
4	Đ4	10°50'2.98"N	105° 7'50.14"E	at infield of Vinh Loi canal area
5	Đ5	10°48'59.18"N	105° 8'21.83"E	at infield of Vinh Hau canal area
6	Đ6	10°48'11.69"N	105° 9'25.23"E	at infield of Bay Xa canal area, section belong to Vinh Hau commune
7	Đ7	10°46'31.63"N	105° 8'37.92"E	at infield of Xang canal area

Table A3.1.5: Coordinates sediment sampling location

No.	Locations	coordinates		Description of sampling location
		Latitude	Longitude	
1	TT1	10°51'46.82"N	105° 7'37.27"E	at Vinh Loc canal
2	TT2	10°50'4.41"N	105° 7'43.38"E	at Vinh Loi canal
3	TT3	10°49'1.69"N	105° 8'15.98"E	at Vinh Hau canal
4	TT4	10°46'32.72"N	105° 8'54.86"E	at Xang canal

Table A3.1.6: Coordinates of air sampling location

No	Locations	Coordinates		Description of sampling location
		Latitude	Longitude	
1	KK1	10°52'20.74"N	105° 5'53.36"E	at residential area of Phu Huu commune
2	KK2	10°51'12.90"N	105° 6'2.57"E	at residential area of Vinh Thanh hamlet, Vinh Loc commune
3	KK3	10°52'9.06"N	105° 9'10.25"E	near Phu Loc Administrative Region
4	KK4	10°48'59.17"N	105° 5'49.05"E	at residential area of Vinh Loi hamlet, Vinh Hau commune
5	KK5	10°49'39.98"N	105° 9'21.62"E	at residential area of Vinh Hau commune
6	KK6	10°48'10.66"N	105° 6'51.44"E	at residential area of Vinh Hung hamlet, Vinh Loc commune
7	KK7	10°46'34.16"N	105° 7'58.45"E	at residential area of Vinh Linh hamlet, Vinh Hau commune
8	KK8	10°46'59.18"N	105° 9'36.14"E	at residential area near Nam Xa canal bridge

A3.2. Location of environmental monitoring

Table A3.2.1: Coordinates of surface water sampling location

No	Locations	Coordinates		Description of sampling location
		Latitude	Longitude	
1	N1	10°53'41.32"N	105° 9'9.23"E	at Bay Xa canal
2	N2	10°53'11.61"N	105° 7'41.63"E	at Bay Truc canal
3	N3	10°53'5.47"N	105° 8'7.69"E	Infield of Bay Truc canal area
4	N4	10°51'31.25"N	105° 3'43.85"E	Infield ofPhuoc Hung commune
5	N5	10°51'43.86"N	105° 7'25.96"E	at Vinh Loc canal
6	N6	10°49'53.94"N	105° 7'26.33"E	at Vinh Loi canal
7	N7	10°49'47.86"N	105° 8'11.85"E	Infield of Vinh Loi canal area
8	N8	10°48'29.01"N	105° 8'37.90"E	Infield of VinhHau canal area
9	N9	10°47'9.11"N	105° 9'27.93"E	Infield of Bay Xa canal, section in Vinh Hau commune
10	N10	10°45'9.28"N	105° 6'28.65"E	Infield of An Phu town

Table A3.2.2: Coordinates sediment sampling location

No.	Locations	Coordinates		Description of sampling location
		Latitude	Longitude	
1	TT1	10°53'19.62"N	105° 8'5.97"E	at Bay Truc canal
2	TT2	10°52'53.18"N	105° 8'9.81"E	infield of Bay Truc canal area
3	TT3	10°51'47.74"N	105° 7'37.77"E	at Vinh Loc canal
4	TT4	10°50'5.80"N	105° 7'40.33"E	at Vinh Loi canal
5	TT5	10°49'56.99"N	105° 8'31.58"E	infield of Vinh Loi canal area
6	TT6	10°50'37.25"N	105° 9'21.56"E	at Bay Xa canal
7	TT7	10°48'47.77"N	105° 8'45.67"E	infield of Vinh Hau canal area
8	TT8	10°46'25.56"N	105° 8'35.41"E	at Xang canal

Table A3.2.3: Coordinates of air sampling location

No	Locations	coordinates		Description of sampling location
		Latitude	Longitude	
1	KK1	10°52'26.02"N	105° 5'59.89"E	at residential area of Phu Huu commune
2	KK2	10°51'20.14"N	105° 6'13.12"E	at residential area of Vinh Thanh hamlet, Vinh Loc commune
3	KK3	10°49'41.59"N	105° 9'21.17"E	at residential area of Vinh Hau commune
4	KK4	10°48'15.56"N	105° 6'59.25"E	at residential area of Vinh Loi hamlet, Vinh Hau commune
5	KK5	10°47'4.08"N	105° 9'32.90"E	at residential area near Nam Xa canal bridge

ANNEX 4. SIMPLIFIED ECOP

1. This annex presents the Environmental Codes of Practice (ECOP) to be applied in the proposed subproject when small works are involved. The content and requirements following the WB guideline described in (the ESMF tool kit -annex 5).

A3.1 Objectives

2. The Environmental Codes of Practice (ECOP) is prepared to manage small environmental impacts during construction. The ECOPs will apply to manage small scale infrastructure investments subproject. ECOP will be a mandatory part of construction contract or bidding documents so that contractor complies with environmental covenants. The subproject owner (An Giang PPMU) and construction supervisors will be responsible for monitoring of compliance with ECOP and preparing the required reports.

3. There are a number of national technical regulations related to environmental, health and safety that apply to construction activities. Some of them are listed below:

- *Water Quality*: (QCVN 01:2009/BYT, QCVN 02:2009/BYT, QCVN 08-MT:2015/BTNMT, QCVN 09:2008/BTNMT, QCVN 10:2008/BTNMT, QCVN 14:2008/BTNMT, TCVN 5502:2003; TCVN 6773:2000, TCVN 6774:2000, TCVN 7222:2002)
- *Air and Soil Quality* (QCVN 05:2008/BTNMT, QCVN 06:2008/BTNMT, QCVN 07:2008/BTNMT
- *Solid Waste Management* (QCVN 03:2008/BTNMT, TCVN 6438:2001, TCVN 6696:2009, QCVN 07:2009)
- *Vibration and Noise* (QCVN 27:2010/BTNMT, QCVN 26:2010/BTNMT, TCVN 5949: 1998)
- *Labor Health and Safety*: Decision No.3733/2002/QĐ-BYT issued by Ministry of Healthcare dated on 10/10/2002 about the application of 21 Labor health and safety standards that concerned about microclimate, noise, vibration, Chemicals – Permitted level in the working environment
- The World Bank Group Environmental Health and Safety Guidelines which available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines

A4.2 Responsibilities

4. The subproject owner (An Giang PPMU) and Contractors are the key entities responsible for implementation of this ECOP. Key responsibilities of the PPMU and the contractors are as follows:

(a) An Giang PPMU

- PPMU is responsible for ensuring that the ECOP is effectively implemented. The PPMU will assign a qualified staff to be responsible for checking implementation compliance of Contractors, include the following: (a) monitoring the contractors' compliance with the environmental plan, (b) taking remedial actions in the event of non-compliance and/or adverse impacts, (c) investigating complaints, evaluating and identifying corrective measures; (d) advising the Contractor on environment improvement, awareness, proactive pollution prevention measures; (e) monitoring the activities of Contractors on replying to complaints; (f) providing guidance and on-the-job training to field engineers on various aspects to avoid/mitigate potential negative impacts to local environment and communities during construction.

(b) Contractor

- Contractor is responsible for carrying out civil works and informs PPMU/ICBM10, local authority and community about construction plan and risks associated with civil works. As such, contractor is responsible for implementing agreed measures to mitigate environmental risks associated with its civil works.

- Contractor is required to obey other national relevant legal regulations and laws.

Part 1 – Contractor's Responsibilities

7. This is an example and is not necessarily a full treatment of all requirements for a specific project. For example, there might be reason to have contractor deal with sexually transmitted diseases, medical and hazardous waste s (e.g., oil from vehicle or furnace repair and similar, oily rags).

Issues/Risks	Mitigation Measure
1) Dust generation/ Air pollution	• The Contractor implement dust control measures to ensure that the generation of dust is minimized and is not perceived as a nuisance by local residents, maintain a safe working environment, such as: – Water dusty roads and construction sites; – covering of material stockpiles; – Material loads covered and secured during transportation to prevent the scattering of soil, sand, materials, or dust; – Exposed soil and material stockpiles shall be protected against wind erosion.
2) Noise and vibration	• All vehicles must have appropriate "*Certificate of conformity from inspection of quality, technical safety and environmental protection"* following Decision No. 35/2005/QD-BGTVT; to avoid exceeding noise emission from poorly maintained machines.
3) Water pollution	• Portable or constructed toilets must be provided on site for construction workers. Wastewater from toilets as well as kitchens, showers, sinks, etc. shall be discharged into a conservancy tank for removal from the site or discharged into municipal sewerage systems; there should be no direct discharges to any water body. • Wastewater over permissible values set by relevant Vietnam technical standards/regulations must be collected in a conservancy tank and removed from site by licensed waste collectors. • At completion of construction works, water collection tanks and septic tanks shall be covered and effectively sealed off.
4) Drainage and sedimentation	• The Contractor shall follow the detailed drainage design included in the construction plans, to ensure drainage system is always maintained cleared of mud and other obstructions. • Areas of the site not disturbed by construction activities shall be maintained in their existing conditions.
5) Solid waste	• At all places of work, the Contractor shall provide litter bins, containers and refuse collection facilities. • Solid waste may be temporarily stored on site in a designated area approved by the Construction Supervision Consultant and relevant local authorities prior to collection and disposal. • Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. • No burning, on-site burying or dumping of solid waste shall occur. • Recyclable materials such as wooden plates for trench works, steel, scaffolding material, site holding, packaging material, etc. shall be collected and separated on-site from other waste sources for reuse, for use as fill, or for sale. • If not removed off site, solid waste or construction debris shall be disposed of only at sites identified and approved by the Construction Supervision Consultant and included in the solid waste plan. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas, such as in areas of natural habitat or in watercourses.

Issues/Risks	Mitigation Measure
6) Chemical or hazardous wastes	• Used oil and grease shall be removed from site and sold to an approved used oil recycling company. • Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. • Unused or rejected tar or bituminous products shall be returned to the supplier's production plant. • Store chemicals in safe manner, such as roofing, fenced and appropriate labeling.
7) Disruption of vegetative cover and ecological resources	• Areas to be cleared should be minimized as much as possible. • The Contractor shall remove topsoil from all areas where topsoil will be impacted on by rehabilitation activities, including temporary activities such as storage and stockpiling, etc; the stripped topsoil shall be stockpiled in areas agreed with the Construction Supervision Consultant for later use in re-vegetation and shall be adequately protected. • The application of chemicals for vegetation clearing is not permitted. • Prohibit cutting of any tree unless explicitly authorized in the vegetation clearing plan. • When needed, erect temporary protective fencing to efficiently protect the preserved trees before commencement of any works within the site. • The Contractor shall ensure that no hunting, trapping shooting, poisoning of fauna takes place.
8) Traffic management	• Before construction, carry out consultations with local government and community and with traffic police. • Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. • Installation of lighting at night must be done if this is necessary to ensure safe traffic circulation. • Place signs around the construction areas to facilitate traffic movement, provide directions to various components of the works, and provide safety advice and warning. • Employing safe traffic control measures, including road/rivers/canal signs and flag persons to warn of dangerous conditions. • Avoid material transportation for construction during rush hour. • Signpost shall be installed appropriately in both water-ways and roads where necessary.
9) Interruption of utility services	• Provide information to affected households on working schedules as well as planned disruptions of water/power at least 2 days in advance. • Any damages to existing utility systems of cable shall be reported to authorities and repaired as soon as possible.
10) Restoration of affected areas	• Cleared areas such as disposal areas, site facilities, workers' camps, stockpiles areas, working platforms and any areas temporarily occupied during construction of the project works shall be restored using landscaping, adequate drainage and revegetation. • Trees shall be planted at exposed land and on slopes to prevent or reduce land collapse and keep stability of slopes. • Soil contaminated with chemicals or hazardous substances shall be removed and transported and buried in waste disposal areas.

Issues/Risks	Mitigation Measure
11) Worker and public Safety	• Training workers on occupational safety regulations and provide sufficient protective clothing for workers in accordance with applicable Vietnamese laws. • Install fences, barriers, dangerous warning/prohibition site around the construction area which showing potential danger to public people. • The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to people and sensitive areas. • If previous assessments indicate there could be unexploded ordnance (UXO), clearance must be done by qualified personnel and as per detailed plans approved by the Construction Engineer.
12) Communication with local communities	• The contractor shall coordinate with local authorities (leaders of local communes, leader of villages) for agreed schedules of construction activities at areas nearby sensitive places or at sensitive times (e.g., religious festival days). • Copies in Vietnamese of these ECOPs and of other relevant environmental safeguard documents shall be made available to local communities and to workers at the site. • Disseminate project information to affected parties (for example local authority, enterprises and affected households, etc) through community meetings before construction commencement. • Provide a community relations contact from whom interested parties can receive information on site activities, project status and project implementation results. • Inform local residents about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition, as appropriate. • Notification boards shall be erected at all construction sites providing information about the project, as well as contact information about the site managers, environmental staff, health and safety staff, telephone numbers and other contact information so that any affected people can have the channel to voice their concerns and suggestions.
13) Chance find procedures	• If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall: • Stop the construction activities in the area of the chance find; • Delineate the discovered site or area; • Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Department of Culture and Information takes over; • Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property of Viet Nam (within 24 hours or less); • Relevant local or national authorities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values; • Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;

Issues/Risks	Mitigation Measure
	• If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Project's Owner will need to make necessary design changes to accommodate the request and preserve the site; • Decisions concerning the management of the finding shall be communicated in writing by relevant authorities; • Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage.

Part 2 – Contractor's Workers Environmental Code of Conducts

8. This is an example for typical project.

Do:	Do not
• Use the toilet facilities provided – report dirty or full facilities • Clear your work areas of litter and building rubbish at the end of each day – use the waste bins provided and ensure that litter will not blow away. • Report all fuel or oil spills immediately & stop the spill from continuing. • Smoke in designated areas only and dispose of cigarettes and matches carefully. (littering is an offence.) • Confine work and storage of equipment to within the immediate work area. • Use all safety equipment and comply with all safety procedures. • Prevent contamination or pollution of streams and water channels. • Ensure a working fire extinguisher is immediately at hand if any "hot work" is undertaken e.g. welding, grinding, gas cutting etc. • Report any injury of workers or animals. • Drive on designated routes only. • Prevent excessive dust and noise	• Remove or damage vegetation without direct instruction. • Make any fires. • Poach, injure, trap, feed or harm any animals – this includes birds, frogs, snakes, etc. • Enter any fenced off or marked area. • Drive recklessly or above speed limit • Allow waste, litter, oils or foreign materials into the stream • Litter or leave food lying around. • Cut trees for any reason outside the approved construction area • Buy any wild animals for food; • Use unapproved toxic materials, including lead-based paints, asbestos, etc.; • Disturb anything with architectural or historical value • Use of firearms (except authorized security guards) • Use of alcohol by workers during work hours • Wash cars or machinery in streams or creek • Do any maintenance (change of oils and filters) of cars and equipment outside authorized areas • Dispose trash in unauthorized places • Have caged wild animals (especially birds) in camps • Work without safety equipment (including boots and helmets) • Create nuisances and disturbances in or near communities • Use rivers and streams for washing clothes • Dispose indiscriminately rubbish or construction wastes or rubble • Spill potential pollutants, such as petroleum products • Collect firewood • Do explosive and chemical fishing • Use latrines outside the designated facilities; and • Burn wastes and/or cleared vegetation.