

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT  
VIETNAM NATIONAL UNIVERSITY OF AGRICULTURE

**SUPPORT FOR AUTONOMOUS HIGHER EDUCATION  
PROJECT (SAHEP)**

Project code: P156849

**SUBPROJECT**

**STRENGTHENING THE SCIENTIFIC AND TECHNOLOGICAL CAPACITY AND  
HUMAN RESOURCES TRAINING FOR AGRICULTURE RESTRUCTURING AND  
NEW RURAL DEVELOPMENT**

**SOCIAL AND ENVIRONMENTAL  
MANAGEMENT PLAN (ESMP)**

**(Final)**



January, 2017

# TABLE OF CONTENTS

<b>1. INTRODUCTION .....</b>	<b>1</b>
<b>2. SUBPROJECT DESCRIPTION .....</b>	<b>5</b>
2.1. Subproject location.....	5
2.2. Subproject's components .....	5
2.3. Main constructions .....	6
2.4. Auxiliary works.....	9
2.5. Material supplies and disposal sites .....	9
2.6. Subproject implementation progress .....	11
2.7. Total investment cost .....	11
<b>3. NATURAL, ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS .....</b>	<b>11</b>
3.1. Topographical conditions.....	11
3.2. Climate conditions .....	11
3.3. Hydrological conditions .....	12
3.4. Current status of the infrastructure and social conditions .....	12
3.4. The existing components of natural environment .....	13
3.5. Current status of the construction locations .....	14
3.6. Material transport routes .....	19
3.7. Waste transport route .....	20
3.8. Sensitive locations affected by the subproject construction process.....	20
<b>4. ENVIRONMENTAL AND SOCIAL IMPACTS .....</b>	<b>21</b>
4.1. Environmental impacts.....	21
4.1.1. Pre-construction phase .....	21
4.1.2. Construction phase .....	23
4.1.3. Operation phase.....	34
4.2. Social impacts .....	38
<b>5. IMPACT MITIGATION MEASURES .....</b>	<b>40</b>
5.1. Environmental impact mitigation measures .....	40
5.1.1. Preconstruction phase and Construction Phase .....	40
5.1.3. Operation phase.....	66
5.2. Social impact mitigation measures.....	77
5.2.1 Impacts on livelihood and income sources.....	77
5.2.2. Impacts by construction activities .....	78
5.2.3. Impacts on cultural heritages.....	78
5.2.4. Impacts on community safety and health .....	79
5.2.5. Impacts on worker safety and health.....	79
<b>6. ESMP IMPLEMENTATION ARRANGEMENT.....</b>	<b>80</b>
<b>7. RESPONSIBILITIES FOR THE IMPLEMENTATION .....</b>	<b>80</b>
<b>8. ENVIRONMENTAL COMPLIANCE FRAMEWORK .....</b>	<b>82</b>
8.1. Environmental Duties of the Contractor .....	82
8.2. Contractor's Safety, Social and Environmental Officer (SEO).....	83
8.3. Environmental and Social Supervision during Construction (CSC) .....	83
8.4. Compliance with legal and contractual requirements .....	83
8.5. Environmental Claims and Penalty System .....	84
8.6. Reporting Arrangements .....	84
<b>9. ENVIRONMENTAL MONITORING PROGRAM.....</b>	<b>85</b>
9.1. Monitoring Location, Parameters and Frequency .....	85
9.2. Estimated cost for environmental sample collection and analysis .....	86
<b>10. CAPACITY BUILDING PROGRAM.....</b>	<b>88</b>
10.1 Technical Assistance support for the implementation of safeguards .....	88

10.2 Training programs proposed .....	88
<b>11. ESMP COST ESTIMATION .....</b>	<b>90</b>
<b>12. GRIEVANCE REDRESS MECHANISM (GRM).....</b>	<b>90</b>
<b>13. PUBLIC CONSULTATION AND INFORMATION DISLCOSURE .....</b>	<b>93</b>
13.1. Objectives.....	93
13.2 Public Consultation Results .....	93
13.3 Responses and Commitments of Subproject Owner .....	95
13.4. Information Disclosure.....	95
<b>14. CONCLUSIONS, RECOMMENDATIONS AND COMMITMENT .....</b>	<b>95</b>
14.1 Conclusions .....	95
14.2 Recommendations .....	97
<b>APPENDIX .....</b>	<b>98</b>

## LIST OF TABLES

Table 1. Summary of construction works .....	7
Table 2. Construction volume for roads in the subproject .....	9
Table 3. Amount of dredged material and levelling material.....	9
Table 4. Available borrow pits .....	10
Table 5. Estimated concentration of dust and emissions in preparation phase .....	21
Table 6. Estimated emission concentration of transport vehicles ( $\mu\text{g}/\text{m}^3$ ).....	22
Table 7. Concentration of dust and emissions during the construction phase.....	23
Table 8. Concentration of dust and exhaust emission on the transport route to disposal sites.....	24
Table 9. Estimated concentration of dust and exhaust emission on the roads for transporting.....	24
Table 10. Resonant noise generated from active vehicles and machines .....	25
Table 11. Vibration attenuation with distance from construction machines .....	25
Table 12. Estimated pollutant concentration in the runoff.....	27
Table 13. List of sensitive receptors under the subproject .....	31
Table 14. Residual time of pesticides in soil.....	37
Table 15. The half-decay time of POP group pesticides .....	37
Table 16. Environmental Codes of Practice (ECOPs) .....	41
Table 17. Site-specific mitigation measures in the construction phase.....	53
Table 18. Impact mitigation measures on sensitive receptors at the construction site.....	60
Table 19. Measures to mitigate impacts of material transport activities on sensitive receptors at construction.....	63
Table 20. Framework of social action plan for the subproject .....	77
Table 21. Measures to minimize other impacts.....	79
Table 22. Roles and responsibilities of key parties .....	81
Table 23. Regular Reporting Requirements .....	84
Table 25. Estimated numbers for soil, water, and air sampling .....	85
Table 26. Estimated cost for sampling and analysis .....	86
Table 27. Training Programs for Capacity Building on Environmental Supervision and Management .....	89
Table 28. Cost estimation for ESMP implementation (million USD) .....	90
Table 29. Summary of public consultation results .....	94

## LIST OF FIGURES

Figure 1. Location map of subproject's construction works .....	5
Figure 2. Location of construction waste disposal sites.....	11
Figure 3. The garden adjacent to the construction site of the main lecture hall building.....	14
Figure 4 Construction site of building for faculty of agricultural mechanical engineering .....	14
Figure 5. Site of building for faculty of food technology and post-harvest technology .....	15
Figure 6. Construction site of building for faculty of environment .....	15
Figure 7. Planned construction site of building for faculty of biotechnology.....	16
Figure 8. Planned construction site of building for faculty of veterinary medicine.....	16
Figure 9. Planned area for foreign language training building.....	17
Figure 10. Planned location for construction of building for institutional and policy research .....	17
Figure 11. Construction location of the physical education center .....	17
Figure 12. The construction location is currently being used as experimental field.....	18
Figure 13. Construction location is currently experimental field area of agricultural crops.....	18
Figure 14: Overall investment and construction locations of the subproject .....	19
Figure 15. Description of subproject's material transport routes .....	20
Figure 16. Planned areas as waste disposal sites.....	20
Figure 17. The harmful effects of pesticides on humans .....	38
Figure 18. Diagram of sewage system .....	66
Figure 19. Location of the proposed wastewater treatment plant .....	67
Figure 20. Proposal wastewater treatment process at VNUA .....	68
Figure 21. Chemical fume hood, ceiling-mounted fume hood and chemical fume extractor .....	69
Figure 22. Organization chart for ESMP Implementation .....	80

## **ABBREVIATIONS**

CSCs	Construction Supervision Consultants
DONRE	Departments of Natural Resources and Environment
EA	Environmental Assessment
ECOP	Environmental Codes of Practices
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
MARD	Ministry of Agriculture and Rural Development
PMU	Project Management Unit
PPE	Personal protective equipment
QCTĐHN	Hanoi Capital standard
QCVN	Vietnamese standard
TOR	Terms of Reference
VND	Vietnam Dong
VNUA	Vietnam National University of Agriculture
WB	World Bank
WHO	World Health Organization
WWTP	Wastewater Treatment Plant

## 1. INTRODUCTION

Established in 1956, Vietnam National University of Agriculture (VNUA) has become an autonomous institution for tertiary training and scientific research, after nearly 60 years of development. It comprises 14 Faculties, 5 research institutes and 9 centers for specialized and multi-disciplinary research in the fields of agriculture and rural development. As of 2015, the total number of teachers and school personnel is 1,406 people, including 52.5% of teachers (739/1406), 19.6% of doctors (276/1406), 36.1% of masters (508/1406) and 6.6% of professors and associate professors. VNUA has 27 under-graduate training programs, 6 college training programs, 19 master programs and 16 doctoral programs.

The Development Strategy for VNUA, which was approved by Ministry of Agriculture and Rural Development in 2015, targets to develop VNUA as a multi-disciplinary, internationally recognized research University in agriculture and rural development. However, to this end, the investment in upgrading, renovating and developing facilities for training and scientific research should be prioritized. Therefore, the “Strengthening the scientific and technological capacity and human resources training for agriculture restructuring and new rural development project” under the "Support for Autonomous Higher Education Project" funded by World Bank at Vietnam National University of Agriculture is of crucial significance.

The World Bank financed subproject will be approved by Prime Minister (under MARD’s management). The proposed subproject consists of three components: Component 1-Training Development; Component 2-Research Development; Component 3-University Administration, Information Sharing and Subproject Management.

ESMP is an important subproject document prepared to control any environmental and social impacts that might arise; be the guideline framework for environmental management activities; and fully includes environmental principles to be applied in the subproject.

Together with this ESMP, a EIA report is also prepared to present all arising environmental impacts, proposed mitigation measures and a comprehensive environmental management plan. The EIA report will be approved by the GoV and expected to complete in January 2017.

### **Project’s objective**

**The project development objective (PDO)** is to improve teaching, research and institutional capacity at selected autonomous universities and to strengthen national higher education system.

### **Subproject’s objectives**

The subproject’s general objective is to increase quality in training and scientific research, satisfying local and regional demands as well as supporting agricultural industrialization and modernization and the GoV’s integrated agricultural restructuring plan for new rural development.

Specific objectives of the subproject include:

1. To increase capacity in scientific research and policy advocacy in agricultural sector, make significant breakthrough in agricultural scientific technologies and technology transfer for the restructuring and fostering Vietnam’s agricultural production to participate in global value chains;
2. To develop a high-quality human resource for integration of Vietnam’s agriculture and provision for regional labor market;
3. To enhance social responsibility so that agricultural communities are able to better benefit from the development and international integration achievements;
4. To upgrade facilities for researches and training.

## **Legal and technical basis for ESMP**

### *(i). Legal and national technical basis*

1. The 2014 Law on Environmental Protection approved on 23rd June 2014 by 7th National Assembly of the Socialist Republic of Vietnam.
2. The Law on Capital No. 25/2012/QH13 approved on 21 November 2012 by 13th National Assembly of the Socialist Republic of Vietnam at its 4th session.
3. The Law on Construction No. 50/2014/QH13 approved on 18th June 2014 by 7th National Assembly of the Socialist Republic of Vietnam
4. Chemicals Law No. 06/2007/QH12 dated 21 November 2007.
5. The Law on Water Resources No. 17/2012/QH13 approved on 21st June 2012 by 10th National Assembly of the Socialist Republic of Vietnam at its 8th session.
6. Decree No. 18/2015/ND-CP of the Government on defining the environmental protection plan, strategic environmental assessment, environmental impact assessment and environmental protection plan promulgated on 14th February 2015.
7. Decree No. 19/2015/ND-CP of the Government on defining the details of a number of Articles of the Law on Environmental Protection promulgated on 14th February 2015.
8. Decree No. 03/2015/ND-CP of the Government on defining the environmental damage assessment promulgated on 6th January 2015.
9. Decree No. 155/2016/ND-CP of the Government: sanctioning of administrative violations in the field of environmental protection, promulgated on 18th November 2016.
10. Decree No. 38/2015/ND-CP of the Government: on management of waste and discarded materials, promulgated on 24th April 2015
11. Decree No. 16/2016/ND-CP dated 03/16/2016 of the Government on the management and use of official development assistance (ODA) and preferential loans from donors
12. Decree No. 201/2013/ND-CP dated November 27, 2013 of the Government detailing the implementation of some articles of the Law on Water Resources.
13. Decree No. 127/2007/ND-CP dated August 1, 2007 of the Government stipulating the implementation of some articles of the Law on Standards and Technical Regulations.
14. Decree No. 80/2014/ND-CP dated August 6, 2014 of the Government stipulating drainage and waste water treatment.
15. Circular No. 27/2015/TT-BTNMT of the Ministry of Natural Resources and Environment dated 29th May 2015 on strategic environmental assessment, environmental impact assessment and environmental protection commitment.
16. Circular No. 36/2015/TT-BTNMT of the Ministry of Natural Resources and Environment dated 30th June 2015 on management of hazardous wastes.
17. Circular No. 03/2016/TT-BNNPTNT of Ministry of Agriculture and Rural Development dated 21<sup>st</sup> April 2016 on List of permissible and banned plant protection substances in Vietnam and HS codes thereof
18. Circular No. 21/2015/TT-BNNPTNT of Ministry of Agriculture and Rural Development dated 21<sup>st</sup> April 2016 on Pesticide product administration
19. Joint- Circular No. 63/2013/TTLT-BTC-BTNMT of the Ministry of Finance and Ministry of Natural Resources and Environment on guiding the Government's Decree No. 25/2013/ND-CP of 29th March 2013 on environmental protection charge for wastewater.

20. Decision No. 609/QD-TTg dated 25th April 2014 on approving the master plan on solid waste disposal of Hanoi Capital to 2030 with vision to 2050.
21. Decision No. 02/2005/QD-UBND of Hanoi City's People's Committee dated 10th January 2005 on dust minimization in construction.
22. Decision No. 16/QD-UBND of Hanoi City's People's Committee dated 3rd June 2013 on general waste management in Hanoi City.

*Applicable standards and codes*

1. QCVN 03-MT: 2015/BNTMT National technical regulation on the allowable limits of heavy metals in the soils.
2. QCVN 05-MT: 2013/BTNMT: National technical regulation on ambient air quality
3. QCVN 06:2009/BTNMT: National technical regulation on hazardous substances ambient air;
4. QCVN 08-MT:2015/BTNMT - National technical regulation on surface water quality.
5. QCVN 09-MT:2015/BTNMT - National technical regulation on ground water quality.
6. QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater
7. QCVN 26: 2010/BTNMT: National technical regulation on noise
8. QCVN 27: 2010/BTNMT: National technical regulation on vibration
9. QCVN 01:2008/BXD: National technical regulation on construction planning
10. QCTĐHN 01:2014/BTNMT: Technical regulation on industrial emissions in Hanoi Capital
11. QCTĐHN 02:2014/BTNMT: Technical regulation on industrial wastewater in Hanoi Capital.
12. QCVN 50:2013/BTNMT: National Technical Regulation on Hazardous Thresholds for Sludge from Water Treatment Process.
13. TCVN 6707:2009/BNTMT - CTNH - Warning and preventative signs.
14. TCVN 6706:2009/BNTMT on classification of hazardous wastes.
15. TCVN 5007:2002 - Hazardous chemicals – Code of practice for safety in production, commerce, use, handling and transportation

*(ii) The World Bank (WB) safeguards policies*

***a. Project level***

An environmental and social screening of the subproject was undertaken in line with the OP 4.01 and it showed that the World Bank's policy on Environmental Assessment (OP/BP 4.01) is triggered for the project. Physical Cultural Resources (OP/BP 4.11), Involuntary Resettlement (OP/BP 4.12), and Pest Management (OP 4.09) are triggered for the Project. The screening has also resulted in categorizing the project as a Category B subproject due to its moderate, site-specific, and reversible impacts which can be mitigated with readily designed measures. In addition, the Bank's requirements on public consultation and information disclosure were followed.

***b. Subproject level***

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

and trans-boundary and global environmental aspects. EA considers natural and social aspects in an integrated way.

*Pest Management (OP 4.09):* The subproject may finance procurement of small amounts of pesticides for agriculture research purposes, posing potential health risks for researchers. Therefore, this policy is triggered. The ESMP prepared has included national guidelines for pesticide purchases and uses for research purposes, including occupational and community health and safety requirements, safe handling, management and disposal of synthetic chemical pesticides and trainings of farmers/farm workers and researchers.

*Physical Cultural Resources (OP/BP 4.11):* The ESMP has included ECOP which covers a chance find procedure to address issues related to PCRs encountered during construction.

*(iii) World Bank Group Environmental, Health, and Safety Guidelines*

World Bank-financed projects should also take into account the World Bank Group Environmental, Health, and Safety Guidelines<sup>1</sup> (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 subproject-or site-specific requirements. This subproject should conform to the General EHS Guidelines.

*(iv) Sustainable Design Guide*

The subproject is encouraged to apply the Sustainable Design during engineering design for buildings and other facilities to help protect the human health and the environment. The main objectives of sustainable design are to reduce, or completely avoid, depletion of critical resources like energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create built environments that are livable, comfortable, safe, and productive.

Buildings use resources (energy, water, raw materials, and etc.), generate waste (occupant, construction and demolition), and emit potentially harmful atmospheric emissions. Building owners, designers, and builders face a unique challenge to meet demands for new and renovated facilities that are accessible, secure, healthy, and productive while minimizing any negative impacts on society, the environment, and the economy. Ideally, building designs should result in net-positive benefits to all three areas (Source: EPA, USGBC – Leadership in Energy and Environmental Design (LEED)). See Appendix 3 for detailed guide on Sustainable Design.

*(v) International standard for laboratory*

**ISO 17025:2005.** The laboratories will be constructed towards achieving ISO 17025:2005. ISO/IEC 17025:2005 specifies the general requirements for the competence to carry out tests and/or calibrations, including sampling. It covers testing and calibration performed using standard methods, non-standard methods, and laboratory-developed methods.

It is applicable to all organizations performing tests and/or calibrations. These include, for example, first-, second-, and third-party laboratories, and laboratories where testing and/or calibration forms part of inspection and product certification.

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<sup>1</sup>The EHS Guidelines can be consulted at [www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines](http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines).

ISO/IEC 17025:2005 is applicable to all laboratories regardless of the number of personnel or the extent of the scope of testing and/or calibration activities. When a laboratory does not undertake one or more of the activities covered by ISO/IEC 17025:2005, such as sampling and the design/development of new methods, the requirements of those clauses do not apply.

ISO/IEC 17025:2005 is for use by laboratories in developing their management system for quality, administrative and technical operations. Laboratory customers, regulatory authorities and accreditation bodies may also use it in confirming or recognizing the competence of laboratories. ISO/IEC 17025:2005 is not intended to be used as the basis for certification of laboratories. Compliance with regulatory and safety requirements on the operation of laboratories is not covered by ISO/IEC 17025:2005.

## 2. SUBPROJECT DESCRIPTION

### 2.1. Subproject location

The subproject area is located within VNUA's campus in the east of Hanoi's center, as a center of Gia Lam - Sai Dong new urban area. It is bound by:

- Long Bien district's agricultural land to the north,
- Cau Bay River, An Lac village to the east,
- Da Ton commune's agricultural land to the south,
- Trau Quy Town's residential area to the east.

The subproject area is 82.034 ha out of the total of 190.2ha of VNUA's campus. This area is being used as experimental gardens, aquaculture ponds and experimental fields etc. under VNUA's management. There is no requirement for site clearance which is an advantage for construction.

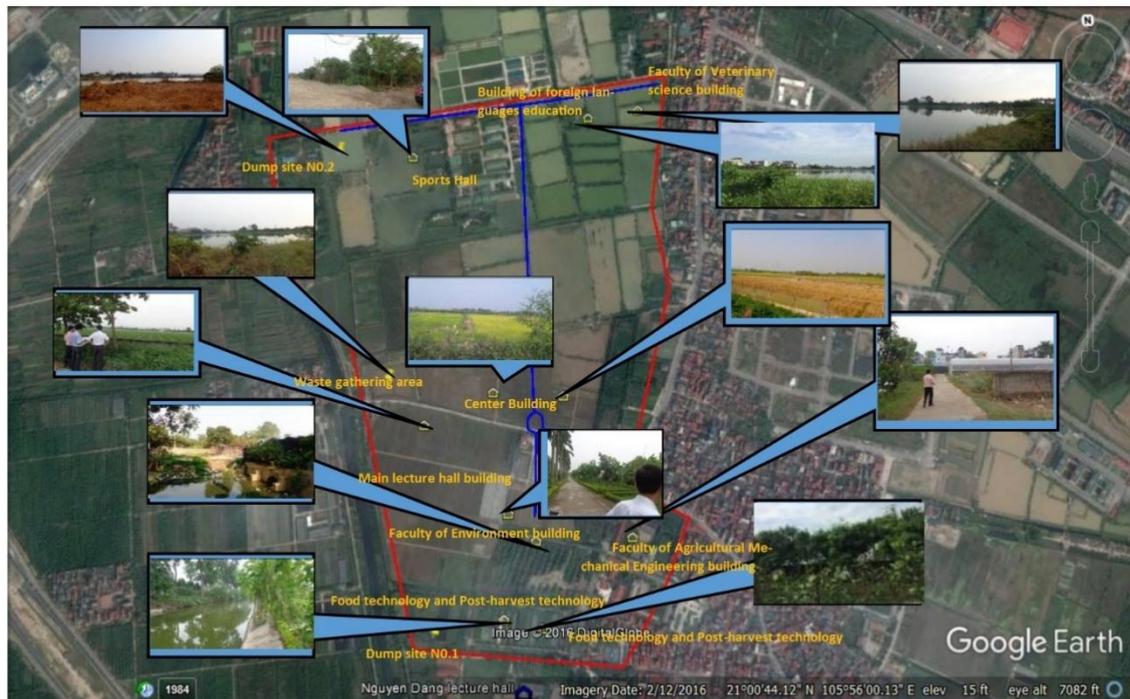


Figure 1. Location map of subproject's construction works

### 2.2. Subproject's components

The subproject is designed with four major components: Component 1 - Education Development; Component 2 - Scientific Research Development; Component 3 - Undergraduate Administration, Information Sharing and Component 4 - Project Management.

#### a. Component 1: Improved teaching

- *Sub-component 1.1. Increased teaching capacity:* The activities in this component aim to increase training capacity and innovate training programs in accordance with employment orientation. There is no construction work related, therefore, this component is not addressed in the ESMP.

- *Sub-component 1.2. Developing teaching facilities:* In consideration of this subproject's content and its scope of work, this component has biggest volume of work in terms of construction, laboratory's equipment/instrument procurement. The potential environmental and social impacts mostly arise upon this component, and will be assessed subsequently in the report. More details of assessment will be presented in the following sections.

#### **b. Component 2: Improved Research**

- *Sub-component 2.1: Increasing research capacity:* This component's outcome will be strengthened scientific and technical potential through studies and capacity building, its environmental and social impacts are positive. There is no construction work related.

- *Sub-component 2.2: Fostering technology transfer and business association.* There is no construction work included, which results in no environmental impacts from construction. Its impacts are mostly positive to not only teachers, students but also farmers and businesses in the fields of agriculture, rural development.

- *Sub-component 2.3: Constructing physical facilities for scientific research:* Specific activities include:(i) Construction of Center of agricultural and life sciences research building: (1)Center of medical plants and herbs research, (2) Center of genetic technology and new generation vaccines research, (3) ISO certificated Center of diagnosis, testing, accreditation and analysis. (ii) Procurement of office stationery; (iii) Procurement of specialized laboratory instruments. In which the construction work related to activity (i) and the operations of research centers and laboratories will generate negative social and environmental impacts. Thus, this will also be carefully addressed in the report.

#### **c. Component 3: Improved institutional management**

- *Sub-Component 3.1: Undergraduate administration, information sharing and subproject management:* There is no associated construction activity in this component and social and environmental impacts are primarily positive.

- *Sub-component 3.2: Undergraduate administration supporting facilities:* The associated construction works include construction of a building and roads and their social and environmental impacts in will assessed in the respective sections below.

**d. Component 4: Project management:** There is no construction included and the impacts are considered positive for subproject management and operation capacity.

### **2.3. Main constructions**

Within the three above mentioned components, aside from increased Science and Technology potential of university through education, training and technology transfer, there are a number of construction works to be built as infrastructure for the subproject. The related construction works are presented in Table 1

In addition to the construction of the buildings as described in Table 1, in Component 3 of the subproject there will be construction of a number of roads to connect faculties. The volume and size of traffic categories are shown in Table 2:

**Table 1. Summary of construction works**

No.	Item	Scale (storey)	Construction area/total area (m <sup>2</sup> )	No.of rooms	IT rooms	Labs/experimental rooms	Description
<i>Component 1. Education development.</i>							
<i>Sub-component 1.2. Construction of physical facilities serving training</i>							
1	Main lecture hall building	4	1338/15977	61	6	0	The auditorium size: 200 seats (2 rooms), 150 seats (12 rooms), 150 seats (12 rooms), 75 seats (15 rooms) and 20 seats (20 rooms). 6 IT rooms are equipped with 400 computers for training of students
2	Faculty of Agricultural Mechanical Engineering building	3	1226.7/3405.3	35	0	25	Labs including 4 labs for the Department, 8 mechanic dynamic labs, 17 labs for equipment for storage and processing of agricultural products. The practice rooms do not use chemicals but oily and greasy waste should be considered.
3	Food technology and Post-harvest technology building	3	859.5/2465.5	26	0	16	Labs including: 5 labs for biochemistry, food postharvest technology, 3 practice rooms for postharvest storage techniques, 2 practice rooms for processing technology, 2 microbiology labs, 4 labs for biochemistry, chemistry and food safety. Environmental issues of concern in the labs include: chemical safety management, experimental samples management and wastewater
4	Faculty of Environment building	4	810.2/2985	23	0	20	Labs including 4 environmental technology labs, 2 agricultural meteorology labs, 2 labs for spatial modeling and analysis, 4 microorganisms labs, 8 chemistry labs Environmental issues of concern to the labs include: chemical safety management, experimental samples management and wastewater, especially for microbiological labs and chemical labs
5	Faculty of Biological technology building	3	859.5/2465.5	21	0	20	Labs includes: 3 labs for molecular biology and biotechnology applications, 4 labs for plant biotechnology, 3 labs for general biology and Nano-biology, 7 microbiology technology labs, 3 labs for animal biotechnology. Environmental issues of concern in the labs include: chemical safety management, experimental samples management and wastewater
6	Faculty of Veterinary science building	5	4955	28	0	44	Labs includes: 8 labs for internal med-diagnosis-pharmaceutics-toxics, 7 labs for infectious microorganisms, 5 veterinary practice rooms, 9 practice room for veterinary anatomy, 2 parasites labs, 7 practice rooms for veterinary obstetric surgery, 6 practice rooms for Animal Health community Environmental issues of concern in the labs include: chemical safety

No.	Item	Scale (storey)	Construction area/total area (m <sup>2</sup> )	No.of rooms	IT rooms	Labs/experimental rooms	Description
							management, experimental samples management and wastewater
7	Building of foreign languages education	4	896.6/3274.2	16	14	0	14 IT rooms including 4 rooms equipped with 25 PCs/each, 6 rooms with 30 PCs/each and 4 rooms with 45 PCs/each
8	Building of institutional and policy research	4	4095/5424	63	2	0	2 IT rooms with 50 PCs/each for research and training
9	Sports hall	1	1930/1930	14	0	0	It consists of staffs room, sitting room, 02 changing rooms, 2 physical exercise rooms
<b>Component 2. Research development</b>							
<b>Sub-component 2.3. Constructing physical facilities for scientific research</b>							
1	Center of Agricultural and Life Sciences Research	6	7445	62	0	31	The Center consists of three units: 1. Center of diagnosis, testing, inspection and analysis - ISO certificated with 6 labs for plant and pet diseases diagnosis and testing, 5 labs for biological testing of veterinary vaccines, 5 labs for environmental analysis, 6 labs for food quality and safety and 2 chemical storages); 2. Center of Genetic technology and new generation vaccines, medicines and treatment preparations research (03 labs and 02 storage rooms for chemicals, vaccines and biological products); 3. Center of Plants and medical herbs research with 13 plant labs, 6 pharmaceutical plant labs, 2 chemical storages, 1 high tech greenhouse (no use of chemical fertilizers and plant protection chemicals) and insect house.
<b>Component 3. Undergraduate administration, information sharing and subproject management</b>							
<b>Sub-component 3.2. Constructing physical facilities for undergraduate administration</b>							
11	Center building	5	12.196	148	0	0	This is used for administration, research offices, meeting rooms, conference hall, archives and foreign partners' offices, etc.

**Table 2. Construction volume for roads in the subproject**

Planned line	Alignment	Construction scope				
		Roadbed (m)		Sidewalk	Separator (m)	Total area (m <sup>2</sup> )
		Length	Width			
54m	From Ngo Xuan Quang Street to the central roundabout	166.14	2x7m	2 x 7m	3	7182
30m	Around the roundabout	502.08	7m	2x4m	0	63883
	From the Guest House to the roundabout	435.27	7m	2x5m	0	
	From Faculty of Aquaculture to the central roundabout	548.36	7m	2x5m	0	
22m	From Ngo Xuan Quang Street to Faculty of Husbandry	1048.46	7m	2x5m	0	22550
	From Faculty of Agronomy to the approach road	460.23	7m	2x5m	0	

## 2.4. Auxiliary works

Beside buildings listed above, the following auxiliary works will also be constructed, including:

### *Sewage system*

The sewage system is designed and built in sync with the buildings, ensuring all wastewater and rainwater as incurred will be collected and conveyed to the treatment facility (details of the system is described in section 5 of the report).

### *Water supply system*

The water supply system is designed to meet technical requirements and practical demands. Water will be supplied from Hanoi City clean water supply system. Water is conveyed to tanks and water use facilities in construction sites by domestic pipelines.

### *Other auxiliaries*

Some of those will be carried out along with main buildings such as power system, lighting control system, air conditioners, fire alarm/firefighting system, etc. (described in FS and EIA reports). The construction of these auxiliaries will meet all applicable Vietnamese standards.

## 2.5. Material supplies and disposal sites

### *2.5.1. Material supplies*

Due to particular topographic features, the organic sludge will be dredged out and transferred to the disposal site then the site will be levelled by other materials to an elevation of 4.2m-5.0m. The calculation results of the excavated and backfill volume are presented in Table 3:

**Table 3. Amount of dredged material and levelling material**

No	Constructions	Amount of dredged material (m <sup>3</sup> )	Amount of levelling material (m <sup>3</sup> )
1	Main lecture building	3974	22553
2	Faculty of Agricultural Mechanical Engineering	2434	13830
3	Food Technology and Post-harvest Technology	1290	7160
4	Faculty of Environment	1608	8886
5	Faculty of Biological technology	1608	7160
6	Faculty of Veterinary science	2214	14112
7	Institutional and Policy Research	2310	18480
8	Foreign Languages Education	1131	6240
9	Sports Hall	5052	35880
10	Center of Agricultural and Life Sciences Research	3600	24177
11	Center Building	4319	30070

No	Constructions	Amount of dredged material (m <sup>3</sup> )	Amount of levelling material (m <sup>3</sup> )
12	54m road	1931	12045
13	30m road	15354	86109
14	22m road	7055	41757
	<b>Total</b>	<b>53880</b>	<b>328459</b>

The above Table 3 that the subproject requires an amount of 328459m<sup>3</sup> for backfilling to elevate the level. The backfilling material will include sand, procured from Duong River, in Dang Xa Commune, Gia Lam District (Hanoi), which is located 4km from the construction site, from Ngo Xuan Quang Street to Co Bi Street and to Duong River dike.

Other borrows pit that have been surveyed and ready to use, are presented in the following:

**Table 4. Available borrow pits**

No	Material	Borrow pit	Reserves/ Production	Location	Distance (km)
1	Backfill soil	Hang Ho	1 000 000 m <sup>3</sup>	Hoang Tien, Chi Linh, Hai Duong	45
2	Backfill and leveling sand	Cau Duong	150 000 m <sup>3</sup> /year	Loi village, Dang Xa, Gia Lam Hanoi	4
3	Stone	Dong Ao quarry	22 000 000 m <sup>3</sup> 1 000 000 m <sup>3</sup> /year	Thuy, Thanh Liem, Ha Nam	65

Concrete for road surfacing, and other material such as steel, cement, brick etc. will be procured and provided by suppliers nearby and concrete mixing plants near Duong River dike.

### **2.5.2. Disposal sites**

The waste materials will be reused since there are three low-lying selected spots inside university's site need to be filled up. Specifically,

- Waste materials as organic dredge sludge: to be transported to 2 disposal sites in the northwest and southwest of the university with total area of more than 9000 m<sup>2</sup>. These sites are low-lying and frequently flooded after rain and planned to be an experimental garden. Their storage capacity is more than 10000m<sup>3</sup> and suffices for the excavated waste of 53880m<sup>3</sup>.
- Waste materials as inorganic (sand, brick, gravel, etc.): to be gathered in the west site of the university with an area of more than 2000m<sup>2</sup>. This is a low-lying spot frequently flooded after rain and planned to be a parking lot for students.

The disposal sites are noted in Figure 2.



**Figure 2. Location of construction waste disposal sites**

## 2.6. Subproject implementation progress

The Subproject implementation period is from Quarter 3, 2017 to Quarter 4, 2022, in which construction works will be carried out from Quarter 2, 2018 and Quarter 4, 2021.

## 2.7. Total investment cost

The estimated total investment of the subproject is US\$ 54,200,000 (In words: *Fifty two million, eight hundred and twenty two thousand US dollars*).

**Capital (rounded):**

- World Bank loan : US\$50,000,000
- IDA : US\$45,000,000
- On-lending capital : US\$5,00,000
- Counterpart fund : US\$4,200,000

## 3. NATURAL, ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS

### 3.1. Topographical conditions

- Terrain: the terrain of the subproject area is relatively flat and low. The existing elevation of subproject area is lower than the average by approximately 2.0 m ÷ 2.6 m. The experimental field has an elevation from 3.3m ÷ 3.8m; lakes, ponds, ditches and rice fields from 2.0 m ÷ 2.6 m. By design, the entire area will be elevated to the level 4.2m ÷ 5.0m for flood prevention. Therefore, the subproject will have to use a substantial amount of material for backfilling in the subproject area.

- Geological conditions: According to the master-plan of the Vietnam National University of Agriculture (VNUA), the subproject area has geological structure split into six different layers, the top layer of backfill soil and arable land; followed by a layer of gray-brown loam clay, and dark gray loam clay and bottom layer of golden brown sand mixed with gravel and gray yellow and dark gray sand. In which the gray-brown loam clay layer and layer of golden brown sand mixed with gravel and gray yellow and dark gray sand are appropriate for work foundation.

### 3.2. Climate conditions

The subproject area is located in the tropical monsoon climate, the average annual humidity from 2006 to 2015 ranged from 78-79%. The average annual temperature ranges from 23.4 - 24.40C. The highest average monthly temperature is usually from May to September fluctuates from 27-30°C; The lowest average monthly temperature fluctuates from 12.2-19.9oC and concentrates October to March.

The average annual rainfall ranges from 1400-1600mm, focusing on the rainy season from May to September, mostly in July and August (with rainfall amount accounts for from 60-70% of the annual rainfall)

The prevailing wind direction is southeast monsoon from May to October and Northeast monsoon from November to April.

### **3.3. Hydrological conditions**

- At the central area, where focuses the lecture hall building, faculty buildings etc., there are some waste drainage ditches, two-sided stone embanked. In addition, there are a number of small lakes built to create ecological landscape for the university.

- The agriculture experimental gardens: the hydrological system mainly consists of a number of small irrigation ditches, which were built to cater for irrigation of rice farming experimental fields. These ditches are connected to the water pumping station located near the nearby village internal roads (near the construction location of the Center of Agricultural and Life Sciences Research) and usually have water only when experimental crops need water and the pumping station is in operation.

- The experimental areas for aquaculture (North of the university): There are several ponds dug and used by students for aquaculture experiments. The lakes are connected together by a system of sewers and drained into Cau Bay River.

Outside the university campus, running along the university campus in the west is Cau Bay River. This is a dug canal originating from the Kim Quan Lake (Viet Hung Ward, Long Bien District) and discharging into Bac Hung Hai river system at Xuan Thuy gate in Kieu Ky Commune, Gia Lam District. The river length is about 13km; water level ranges from 1.5-3m. The river is functioning as drainage for residential areas and agriculture in some wards and communes in Long Bien and Gia Lam districts.

### **3.4. Current status of the infrastructure and social conditions**

#### ***3.4.1. External traffic of the Academy***

Ngo Xuan Quang Street is the only route linking the Academy to the surrounding areas. It runs from Highway 5 along the academy in north - south direction and through the main gate. It is now the main road of the academy. This will also be the route used to transport the backfill materials and construction materials (1.4km long from Highway 5 to the main gate of the academy). Survey results show that the route section outside the Academy has been renovated and expanded with a cross-section of 22 meters, including a 12-meter roadway and two 5-meter pavements. Traffic on this route is quite crowded, especially during rush hours. Residents living along the route are also quite crowded, and most of them are residents of the Trau Quy town, and a number of households living adjacent to the academy, who are the academy staffs. The street-facing households mainly do business or have their houses rent.

Apart from this main route, at the intersection with NH5, there is the Hanoi - Haiphong railway crossing Ngo Xuan Quang road. With the current train schedule from Hanoi - Hai Phong and vice versa, each day has 8 times trains passing this intersection. In the course of subproject construction, material transport activities from outside to Ngo Xuan Quang road to enter the subproject area will have to cross this railway line. This should be well noted in the subproject construction process.

#### ***3.4.2. Internal infrastructure of the Academy***

- Ngo Xuan Quang road stretching from the entrance gate to the faculty of agronomic science with a length of about 1km, road width ranges from 9.5 ÷ 13.5m. This route has been paved with asphalt. Along this road from the entrance gate to 4 central lakes area, there are some households leasing land of the university to sell seedling crops and agricultural products and run small businesses (coffee shop, photocopying shop etc.). In addition, some lecture halls and office buildings of the university and some faculties are also located on the two sides of this road.
- Boundary road surrounded the university is from 3 ÷ 4.5m wide and 4.2km long. This route is recently upgraded using the university funding.
- Other routes: include internal roads between faculties or to the experimental areas, etc. These routes' cross-sections range from 2.0-10.5m, some sections are asphalt paved, some are cement concrete roads.

It can be seen that the current road system is able to meet the traveling needs of university's students and staffs. However, linkage with the surrounding area is limited, only through the Ngo Xuan Quang road as the main transport axis. There is no concentrated parking lot in the university. Currently vehicles of lecturers, students and guests are parked at the area surrounding the lecture halls. The inter-linkage between areas is discrete and inconvenient.

### **3.4. The existing components of natural environment**

Monitoring results on the current status of the natural environment in the subproject area was done in October 2016, including 20 air samples; 16 soil samples; 14 surface water samples, 10 groundwater samples, 06 dredged sludge sediment samples and 4 wastewater samples evenly distributed for subproject items. Details of the sampling location, structure, monitoring parameters and the detailed monitoring results are presented in the subproject EIA report. In summary, the monitoring results show that:

- Surface water environment: The measured parameters include: pH, DO, TSS, BOD<sub>5</sub>, COD, NH<sub>4</sub><sup>+</sup>, NO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, PO<sub>4</sub><sup>3-</sup>, etc. 7 over 14 analyzed samples are positive with TSS, and 2 over 14 samples with BOD<sub>5</sub> exceeding permitted standard according to QCVN 08-MT: 2015/BTNMT, but pollution levels may be considered as low (highest exceeding level is 1.44 times). For the remaining parameters, measurement results are below the permitted standards according to QCVN 08-MT: 2015/BTNMT
- Groundwater quality: Analyzed groundwater parameters include: pH, hardness, TSS, COD, NH<sub>4</sub><sup>+</sup>, As, Mn, Fe, Cu, Cl<sup>-</sup>, Ecoli and Coliform. Analysis results of 10 groundwater samples showed all analyzed indicators are still below the threshold allowed by QCVN 09-MT: 2015/BTNMT: National Technical Regulation on groundwater quality.
- Quality of waste water: 4 wastewater samples were taken for analysis at the wastewater collection sewers of the university's existing buildings. With 18 analyzed parameters include: pH, H<sub>2</sub>S, TSS, COD, BOD<sub>5</sub>, NO<sub>2</sub>, NO<sub>3</sub>, Cu, Pb, Fe, Cd, Mn, SO<sub>4</sub><sup>2-</sup>, Cr(VI), As, Hg, E.coli and Coliform, the analysis shows that 4/4 samples with levels of TSS, BOD<sub>5</sub> and Coliform exceeding the threshold allowed by QCVN 14:2008/BTNMT (column B), in which the highest TSS is 187 mg/l, 1.87 times higher (wastewater from the (Faculty of Veterinary Science); highest BOD<sub>5</sub> reaches 90.54mg/l, 1.8 times higher than standard Wastewater from the Faculty of Food Technology); and Coliform is 2.42 times higher than standard (wastewater from the Faculty of Veterinary Science).
- Regional air environment quality: 10 locations which were monitored are the planned locations for construction of the subproject, each position was observed at two different times, morning and afternoon, observation time is 1 hour on average. Monitoring results showed that the air quality at all monitoring locations were very good, all the parameters (dust, CO, NO<sub>2</sub> and SO<sub>2</sub>) are much lower than QCVN 05:2013/BTNMT.

The highest noise level is measured at 60.2dBA only much lower than QCVN 26:2010/BTNMT.

- Soil quality: 16 samples of land were taken for analyzing the parameters of heavy metals such as Cd, As, Zn, Hg, Cr(VI), Fe, Pb, Cu and plant protection chemicals (DDT and Adrin). Analysis results showed that contents of the elements such as Pb, Zn, As, Cd in all 16 analyzed samples were lower than permitted standards by QCVN 03:2008/BTNMT. Particularly content of Cu is high, with 9/16 samples with Cu content above permitted standard for agricultural land from 1.27 and 1.24 times. For residues of plant protection chemicals, compared with QCVN 04:2008/BTNMT - National Technical regulations on chemical residues in soil, 100% of the analyzed soil samples haven't shown sign of pollution in terms of plant protection chemicals.
- For sludge sediments taken from the basins in the area of subproject implementation: Analysis results showed that 6/6 sampled samples are with contents of Pb, Zn, As and Cd below the permitted threshold under 03:2008/BTNMT - National technical regulations on limits of heavy metals in agricultural land. This shows that using dredging sediment sludge for backfilling in experimental fields of the university is fully suitable.

### 3.5. Current status of the construction locations

#### 3.5.1. Component 1. (Sub-component 1.2. Construction of physical facilities serving training)

##### a. Construction site of the main lecture hall building:

The expected construction site of the main lecture hall building of this component is currently experimental fields of some fruit trees such as banana, lemon, guava etc. and the experimental area of agricultural crops such as rice etc. The terrain is relatively flat, surrounded by a number of works such as a newly-built 5-storey lecture hall (about 120 meters away); Institute for Plant Research and Development of Vietnam and Japan (about 100 meters away). The construction of this item does not require relocation of any architecture structures.



**Figure 3. The garden adjacent to the construction site of the main lecture hall building**

##### b. Building for faculty of agricultural mechanical engineering

A new 3-story building with construction area of 1,226.7 m<sup>2</sup> and floor area after construction of 3,405.3 m<sup>2</sup>, will be built to serve training and research activities of the faculty of agricultural mechanical engineering.



*The construction site is currently an experimental garden of fruit trees*



*Adjacent to the T lecture hall area*

**Figure 4 Construction site of building for faculty of agricultural mechanical engineering**

This new faculty building is to be located on the existing experimental garden of fruit trees and adjacent to the T lecture hall of 10 fourth-level classrooms (50m away), 70m away from the university main road and 100m away from the existing faculty of agricultural mechanical engineering office. In addition, within the construction area, there is also an experimental grid shell garden under the management of VNUA, which will be demolished upon construction.

*c. Building for faculty of food technology and post-harvest technology*

A new 3-storey building will be built on a construction area of 859.5m<sup>2</sup>. The planned location is currently a local nursery, one side adjacent to the university’s sewerage ditch at a distance of about 20 meters; the other side away from the central lecture hall of about 80 meters and Nguyen Dang lecture hall of about 130 meters. In addition, this area is also planned for construction of buildings for faculty of biotechnology and faculty of environment, which are 100 meters apart from each other. The construction of this work item does not require relocation of any architectural structures.



*The construction site is located right next to the experimental nursery and sewerage ditch of the university*

**Figure 5. Site of building for faculty of food technology and post-harvest technology**

*d. Building for faculty of environment*

A new building of 04 stories and 01 attic story will be built on a construction area of 810.2 m<sup>2</sup>. The construction location of this item is currently the university’s nursery area, adjacent to the sewerage ditch. Currently on the site there is a 5-story lecture hall that has been built (from 50 meters away) and the site is located right next to the existing main entrance road, to the right from the entrance, about 100 meters from the entrance. Currently, between the construction site and the outside traffic road, there is a series of level-four houses, which are service stores, such as language centers, IT shop, some seedlings and convenient stores etc.



*The construction location of this item is currently the university’s nursery area, adjacent to the sewerage ditch.*



*Entrance to the site as seen from the main road - Language center and international training center are in operation*



*Along the traffic road, near the entrance gate, there is currently a products showroom, which is adjacent to the construction area of Faculty of Environment, Faculty of Biotechnology and Faculty of Food Technology (about 80 meters away)*

**Figure 6. Construction site of building for faculty of environment**

*e. Building for faculty of Biotechnology*

A 3-story building will be built on a construction area of 859.5 m<sup>2</sup> as for faculty of biotechnology. It is planned to be located on the faculty of food technology and post-harvest technologies area; on the opposite side of the sewerage ditch is the construction area of environmental faculty; it is right next to the nursery area and separated with the outside traffic road by a series of service and convenient stores. This construction site is on the right of the entrance road from the main gate and located 80 - 100 meters away from the gate.



**Figure 7. Planned construction site of building for faculty of biotechnology**

*f. Building for faculty of veterinary medicine*

A 05-story building is planned to be built on a construction area of 4,955 m<sup>2</sup>. The planned construction site is currently fish pond land being used by the faculty of aquatic science - one side is adjacent to lane 65, Ngo Xuan Quang road - other side is adjacent to residential area (about 30 meters away) - which includes households who are former staffs of the university and under the administrative boundary of Trau Quy town. Faced with the construction area, across the Ngo Xuan Quang road is a veterinary hospital (from about 50 meters away) and turn right about 100m is the veterinary medicine research and testing production facility of the University. Located next to, on the same land and about 100 meters from the location is the planned construction site for building for faculty of foreign language.



*The planned construction site is currently fish pond land being used by the faculty of aquatic science - one side is adjacent to residential area - which includes households who are former staffs of the university and under the administrative boundary of Trau Quy town*



*Road in Lane 65, Ngo Xuan Quang Street - adjacent to the construction site of veterinary medicine faculty building - is being degraded - it is also one of the construction items to be funded under this subproject; and will be used as the waste transport route during construction process to the landfill.*



*Veterinary hospital*



*Residential area at lane 56, Ngo Xuan Quang road*

**Figure 8. Planned construction site of building for faculty of veterinary medicine**

Road in Lane 65, Ngo Xuan Quang Street is being degraded - it is also one of the construction items to be funded under this subproject; and will be used as the waste transport route during construction process to the landfill.

*g. Foreign language training building*

A 4-story building will be built on an area of 896.66 m<sup>2</sup>. The construction area is next to the building of faculty of veterinary medicine and fish pond land being used by the faculty of aquatic science, and also next to the lane 65, Ngo Xuan Quang road, adjacent to the Centre for assessment of agricultural machines and its dormitory; across Lane 65 is the experimental research and testing production of veterinary medicine facility.



*Construction site*



*Across the lane 65 is the experimental research and testing production of veterinary medicine facility*

**Figure 9. Planned area for foreign language training building**

*h. Construction of building for institutional and policy research*

A new 04-story building will be built on a construction area of 4,095 m<sup>2</sup>. The building is for 03 faculties, namely Accounting and Business Administration, Economics and Rural Development, Political Theory and Social Science. Each faculty is located in separate area for ease of management and administration.

The planned location is currently being used as experimental field of rice crops managed by university's students, next to a pumping station and irrigation approaching canal to the right; located along the market's access road and 200 meters away from the market. Opposite to the construction site, on the other side of the road, is the Crop Research and Development Institute and Vietnam-Japan Crop Varieties Research Center, within a distance of 150 meters.



*Location is currently being used as experimental field of rice crops*



*Vietnam-Japan Crop Varieties Research Center*

**Figure 10. Planned location for construction of building for institutional and policy research**

*i. Construction location of the physical education center*

A single-story physical education hall with a total floor area of 1,930 m<sup>2</sup>, for physical education and sport activities for students is planned to be constructed on a site, which is currently an experimental fish farming pond, located quite far away from the entrance gate; also with lane 85, Ngo Xuan Quang road as access road - passing the areas of faculties of veterinary medicine, foreign language training etc. This is said to be a quite low-lying area of the subproject, which is currently fish farming pond area, one side adjacent to the downtown area and dormitory of the Centre for assessment of agricultural machines (150 meters away); the other side next to road is adjacent to a newly-built experimental area. This area is next to a lake selected as organic waste disposal site of the subproject (150 meters away).



**Figure 11. Construction location of the physical education center**

**3.5.2. Component 2 - Sub-component 2.3. Construction of physical facilities serving scientific research**

*Center of Agricultural and Life Sciences Research*

Construction of physical facilities serving scientific research: expected to be a 06-story building with a total floor area of 7,445 m<sup>2</sup>. The designed building includes research labs, labs and experts' office, thus it is positioned at the western area of the university - the area is currently being used as experimental field of rice crops managed by university's students, to the left of the market's access road and about 500 meters away from the market. Within a radius of about 200 meters, to the left side is the Crop Research and Development Institute, to the right side is construction material storage area of local people and Cau Bay River; directly across the road is the construction site of the administrative office.



**Figure 12. The construction location is currently being used as experimental field**



**Figure 13. Construction location is currently experimental field area of agricultural crops**

### **3.5.3. Component 3- Sub-component 3.2. Construction of physical facilities to support university governance**

#### **a. Central building**

A new 5-story building is planned to be built on experimental field area of agricultural crops such as cabbage, cauliflower etc. with total floor area of 10 920m<sup>2</sup> for education, research administration, Board of Directors offices, University's Council, functional divisions, and foreign partners' offices, etc.

The construction site is located on the access road to a local market; within a radius of 200 meters there are construction area of the building for institutional and policy research, Crop Research and Development Institute, construction area of Center of Agricultural and Life Sciences Research, and planned inorganic waste disposal site of the subproject. (Figure 13)

#### **b. Transport items**

Within the scope of the subproject, there are investments in 06 sections of 3 main roads of 54 meters, 30 meters and 22 meters wide, of which Section 1 (L = 166.14m from Ngo Xuan Quang Road to the central roundabout), Section 2 (L = 502.08m, the central roundabout route;), Section 3 (L = 548.36m from the aquatic science faculty to the central roundabout) and Section 4 (L = 435.31m from the guest house to the central roundabout) are the 4 sections located around the central roundabout, and to connect faculties, zones of the University. This is an area with many activities including daily-life activities of local residents, teaching and other school activities. Construction activity will certainly affect the surrounding area include Cuu Viet Village, a local market, the Crop Research and Development Institute and Vietnam-Japan Crop Varieties Research Center and lecture hall area.

Section 5: L = 460.23m from the Faculty of Agronomy till the end of the collector road; Currently this area is purely experimental field, the beginning point is 50 meters away from the planned location of wastewater treatment plant.

Section 6: L = 1048.46m from Ngo Xuan Quang to the faculty of livestock. Currently it is the lane 65, Ngo Xuan Quang road, passing the Faculty of Veterinary, Center for Veterinary Medicine Production, dormitory of the Centre for Assessment of Agricultural Machines, Faculty of Aquatic Science and ending at the current Faculty of Livestock. The existing road is narrow, paved segment is being downgraded like section passing the center for veterinary medicine production; further to the section passing the Faculty of Aquatic Science and Faculty of Livestock is still earth road. Along this road section, within the scope of the

subproject, there will be some planned structures such as the Faculty of Veterinary Medicine, Centre for Foreign Languages and Physical Education Center as described in component 1. Detailed simulation about the location of the subproject works is shown in Figure 14.



**Figure 14: Overall investment and construction locations of the subproject**

### 3.6. Material transport routes

For leveling, the subproject will purchase sand from sandbank of Duong River in Loi village, Dang Xa commune, Gia Lam district, Ha Noi City. Materials from here will be transported through the recommended route from Vang dike (2 km), to Co Bi road (1.55 km), crossing National Highway No.05 to Ngo Xuan Quang road (0.5 km) to the university.

Identified sensitive subjects can be affected by material transportation include Cuu Viet population group, a substation, a local market adjacent to the university entrance gate; further to the National Highway 05, there are some households, small stalls, services shops, and rather big office buildings such as Gia Lam district military commander board, Hapro supermarket along the Ngo Xuan Quang road.

For Co Bi road section, backfilling material transportation is likely to affect residential areas along two roadsides, Trau Quy market, Cao Ba Quat High School, Co Bi Health Station, Co Bi Kindergarten, and Gia Lam District People's Committee.



**Figure 15. Description of subproject’s material transport routes**

### 3.7. Waste transport route

As described in Section 1, the subproject has planned 03 levered areas to discharge waste materials, including 2 organic materials disposal sites, which are planned to be experimental area of crops and 1 organic materials disposal site, which is planned into parking lot. According to locations of these 03 disposal sites, transport routes of waste material from construction sites to disposal sites are as follows:

- For construction of veterinary medicine faculty building and physical education center: follow the lane 56 (0.6km) to the disposal site near the faculty of livestock.
- For construction of building for institutional and policy research, central building, and the physical education center: follow the university internal roads (0.4km), to the Cau Bay River collector road (0.4km) to the disposal site near the Faculty of veterinary medicine.
- For the construction of main lecture hall building, buildings for faculty of environment, faculty of biotechnology: follow the university internal roads to the disposal site near the Faculty of veterinary medicine.



**Figure 16. Planned areas as waste disposal sites**

### 3.8. Sensitive locations affected by the subproject construction process

Survey results showed that the subproject construction process will not be likely to influence on learning and teaching activities of university staffs and students as well as daily life of the surrounding residential area. But along the material transport route, some other sensitive

subjects should also be noted. Details of those subjects are described in the Impact Assessment Section.

#### 4. ENVIRONMENTAL AND SOCIAL IMPACTS

##### 4.1. Environmental impacts

##### 4.1.1. Pre-construction phase

###### *Land acquisition, relocation, and resettlement*

The subproject does not require land acquisition, relocation and resettlement. All the land area occupied by the subproject is in the campus of VNUA.

###### *Air quality impact*

As calculated, the total volume of vegetation cleared is around 1,000 tons, mostly in the area of buildings for Faculty of Electro-mechanics, Faculty of Environment, Central Building, lecture halls, Faculty of Biotechnology, Center for Agricultural Research and Life Science.

In Component 1 several low-rise structures are needed for relocation and demolition with a total floor area of approximately 2800m<sup>2</sup>, some infield irrigation channels for the experimental area with a length of 500m. An estimated 3000 tons of waste is generated, mainly concrete, bricks, stones and waste soil.

###### *Dust and emissions generated at construction sites*

*Dust from devegetation:* The vegetation clearance, demolition and relocation of structures will generate dust. The volume of generated dust by clearing activity and ground leveling in an area of around 19.33 ha is estimated based on a coefficient of 2.69 tonnes/ha/month in construction period of 3 months, 30 days per month, 16 hours per day (US-EPA AP-42, 2006), and constant coefficient for urban areas is 50% (Thomson G. Pace, EPA, 2005). The total amount of dust generated by the devegetation is 78.04 tons with the emission level is 54.18 kg/h, equivalent to  $77,836 * 10^{-3} \text{ mg/m}^2/\text{s}$ . The impact can be assessed as moderate and can be minimized during pre-construction.

*Dust caused by the demolition of existing buildings:* The dust emission coefficient by demolition activities is estimated to be 0.34 kg/ton with the construction period of 3 months (US-EPA AP-42, 2006), and constant coefficient for urban areas is 50% (Thomson G. Pace, EPA), the total amount of dust removal by demolishing buildings is 0.51 tons, emissions 0.35kg/h, equivalent to  $35,136 * 10^{-3} \text{ mg/m}^2/\text{s}$ . The impact can be assessed as moderate.

###### *Dust from loading and unloading of waste stone and soil*

Based on the emission coefficient under the EPA guidelines of 0.02 kg/ton (AP-42, EPA 2006), the total amount of dust emissions from loading and unloading is around 0.04 tons of dust emissions is 0.028 kg/h, the emission factor by actual loading and unloading is calculated as  $0.040 * 10^{-3} \text{ mg/m}^2/\text{s}$ .

*Dust and emissions from operating the machines and equipment* Referring to the dust emissions and the emissions resulting from the operation of the equipment by WHO (Economopoulos, 1993-WHO) on 1 liter of oil consumed the concentration of dust and emissions is calculated in the below table.

**Table 5. Estimated concentration of dust and emissions in preparation phase**

No	H	Dust	CO	SO <sub>2</sub>	NO <sub>2</sub>	VOC
	m	( $\mu\text{g}/\text{m}^3$ )				
1	200	288.6	3356.0	21.3	41.9	0.28
2	300	206.6	3355.0	20.9	40.0	0.19
3	450	151.9	3354.3	20.7	38.6	0.12
4	600	124.5	3354.0	20.6	38.0	0.09
5	970	93.3	3353.6	20.4	37.2	0.06
6	1400	77.7	3353.4	20.4	36.8	0.04
QCVN 05:2013/BTNMT ( $\mu\text{g}/\text{m}^3\text{-1h}$ )		300	30000	350	200	-

The results in the table above show that the levels of dust and emissions at site are still within the threshold allowed by QCVN 05:2013/BTNMT National Technical Regulation on ambient air quality. Therefore this impact is assessed as negligible, localized mainly in the areas of construction and takes place during the clearance and demolition works. This effect can be fully controllable and mitigable during construction if the contractors are fully complied with the measures given in the subproject ECOPs. The subjects affected are mainly staffs and workers directly involved in the construction site.

*Dust and emissions generated from the transporting vehicles for waste disposal in preconstruction phase*

*Dust generated during waste transportation and disposal:* Of 4,000 m<sup>3</sup> of wastes generated by vegetation clearance and building demolition, organic materials will be disposed in 2 disposal sites for organic materials near Faculty of Husbandry and Faculty of Environment Buildings. Inorganic materials will be transported to the landfill near the construction material site rent by the local people. The transport routes are belt roads and approach roads in the university campus. The dust emission from the transportation of the subproject is approximately 18.64 kg, equivalent to emissions of about  $1,798 * 10^{-3}$  mg/m/s. The impact can be assessed as moderate and can be minimized.

*Dust and emissions by the operation of transport vehicles for waste disposal:*

With a total of 400 trips, during 3 months, results of dust and emissions concentration for the roads with the presence of transport vehicles are shown in Table 6.

**Table 6. Estimated emission concentration of transport vehicles ( $\mu\text{g}/\text{m}^3$ )**

Distance from road center road(m)	Dust	CO	SO <sub>2</sub>	NO <sub>2</sub>	VOC
3	43.02	3353.03	20.21	36.05	0.019
5	42.90	3353.02	20.21	36.04	0.015
10	42.73	3353.01	20.21	36.02	0.008
25	42.64	3353.01	20.20	36.01	0.005
50	42.60	3353.01	20.20	36.01	0.004
100	42.58	3353.00	20.20	36.01	0.003
<b>QCVN 05:2013/BTNMT</b>	<b>300</b>	<b>30000</b>	<b>350</b>	<b>200</b>	<b>-</b>

Thus, the concentration of dust and emissions due to transportation of waste to disposal sites in preconstruction phase meets QCVN 05:2013/BTNMT parameters of dust, regarding SO<sub>2</sub>, NO<sub>2</sub> and CO. Therefore impacts related to dust and emissions on routes to disposal sites are considered negligible, localized mainly in areas along the routes, during transport and fully controllable and mitigable with mitigation measures mentioned in ECOPs. The subjects affected mainly those travelling on the same routes and at the same time as means of transport.

### **Noise**

Noise level, as calculated by distance from the emission source and resonance of all active vehicles in the area 20 m away from the source, is within the allowed limits of QCVN 26:2010/BTNMT and standards of Health Ministry when all vehicles are active. This noise level is moderate and the construction areas are 20 m away from the residential areas. The shortest distance from the construction area to the sensitive receptors such as Nguyen Dang lecture hall, Faculty of Veterinary Medicine building, Faculty of Engineering office and residential areas along Ngo Xuan Quang Street. Therefore, it can be said that impacts of noise due to the construction machines and equipment in the pre-construction phase are insignificant and mitigable during about 3 months. People suffering from impacts are mostly the direct staffs and workers. The impact can be assessed as moderate.

### ***Solid waste***

*Construction solid waste:* Total volume of solid waste generated in the pre-construction phase is roughly 4,000 tons, of which vegetation biomass (branches, leaves, roots) is 1,000 tons making up of 25% of total. The disposal site is in the campus and away from the residential areas, therefore there will be no impacts on people's health. The impact can be assessed as minor and can be minimized during pre-construction

*Domestic solid waste:* Number of workers working in the leveling process in the construction site is 100 people. Total volume of domestic solid waste is around 60 kg/day including: leftovers, fruit peel, nylon bags, bottles, papers, glass, etc. Some of them are combustible and therefore if not appropriately collected and treated, they will create bad odor, damage the landscape and increase risks of disease spreading. The impact can be assessed as moderate and can be minimized during pre-construction

### *Hazardous waste:*

The total amount of the subproject pre-construction phase is about 11.29 kg/day. Though this volume is considered small, if not collected and handled properly, it would create potential risk of environmental pollution, especially for soil and water. The impact can be assessed as minor.

### ***Domestic wastewater:***

Total number of workers in the construction site who are in charge of leveling the ground is averagely 100 people. Total volume of domestic wastewater is around 8.0 m<sup>3</sup>/day. Given the discharge volume, domestic wastewater can be fully collected and treated, and the impact is marginal. The impact can be assessed as moderate and can be minimized.

### ***Ecosystem***

The terrestrial vegetation will disappear after clearance (mostly experimental trees or weeds, etc.), which causes impacts on habitats of terrestrial animals such as frogs, mice, etc. Total impacted area estimated is about 19.33 ha. However, most of animals are being studied and experimented by the University and can be supplemented in the operation phase, therefore impacts on ecosystem are inconsiderable.

For the aquatic ecosystem: the aquatic ecosystem is in the aquaculture ponds or irrigation ditches in the subproject areas and to be levelled. Species living in this ecosystem are mostly raised for experiment and some others grow naturally but have less value such as shrimps, craps, algae, etc. This level of impact is also marginal. The impact can be assessed as moderate and can be minimized.

## **4.1.2. Construction phase**

### **1. Generic impacts**

#### **Air quality impacts**

#### ***Dust and emissions generated in construction site of the subproject during construction phase***

Predicted concentration of air pollutants on construction site is given in Table 7.

**Table 7. Concentration of dust and emissions during the construction phase**

No.	H	Dust	CO	SO <sub>2</sub>	NO <sub>2</sub>	VOC
	m	( $\mu\text{g}/\text{m}^3$ )				
Co	-	42.5	3353	20.2	36	-
1	150	282.6	3356.0	21.3	41.9	0.28
2	200	269.3	3355.0	20.9	40.0	0.19
3	300	193.7	3354.3	20.7	38.6	0.12
4	600	155.9	3354.0	20.6	38.0	0.09
5	970	112.6	3353.6	20.4	37.2	0.06
6	1400	91.1	3353.4	20.4	36.8	0.04

No.	H	Dust	CO	SO <sub>2</sub>	NO <sub>2</sub>	VOC
	<i>m</i>	( $\mu\text{g}/\text{m}^3$ )				
QCVN 05:2013/BTNMT		300	30000	350	200	-

From the above table, the air quality on the construction site still meets the standards regulated in QCVN 05:2013/BTNMT for concentration of dust and emissions. As the construction activities will take place in different places, the impacts are accessed differently as minor to moderate depending on the distances to the buildings. For example, impacts are minor for building of Faculty of Veterinary Medicine, Center for Foreign languages, Centre for Agricultural Research and Life sciences while moderate impacts are for the construction of buildings of teaching halls, Electrical Engineering Faculty, Faculty of Environmental Sciences, Faculty of Food Technology and the connecting road from Ngo Xuan Quang Street to the central roundabout. Direct workers at site will be affected. These impacts are controllable and mitigable if contractors are fully compliant to measures mentioned in ECOPs.

#### ***Dust and emissions on the transport routes for waste materials***

*Dust emissions from the transportation of waste materials:* By design calculation, the total volume of material to be transported from the construction sites to the disposal site is 649,976 tonnes using 10 ton trucks. Hence there will be 64,998 truck trips. The transport routes are selected as those going around the university to the disposal site (fewer travelling students and staffs) and completely located within the university boundary. The average transport distance is 1 km. Using the formula similar to dust emissions in the preparation phase with actual dust emission factor is calculated as 23 296 g/km. Dust emissions from the transportation of the subproject is approximately 3,03 tons, equivalent to about  $24.34 \times 10^{-3}$  mg/m/s.

*Dust and emissions from the transportation vehicles of waste materials:* With the total number of trips of 64,998 and vehicles loading capacity of 10 tons, the concentration of dust and emissions in transport routes to disposal sites is estimated and presented in Table 8.

**Table 8. Concentration of dust and exhaust emission on the transport route to disposal sites**

TT	X	Dust	CO	SO <sub>2</sub>	NO <sub>2</sub>	VOC
	<i>m</i>	( $\mu\text{g}/\text{m}^3$ )				
<i>Co</i>	-	42.5	3353	20.2	36	-
1	5	52.6	3357.9	22.7	44.4	3.3
2	10	50.3	3356.8	22.1	42.4	2.5
3	25	46.9	3355.1	21.3	39.7	1.4
4	50	45.2	3354.3	20.9	38.3	0.9
5	75	44.5	3354.0	20.7	37.7	0.7
6	100	44.2	3353.8	20.6	37.4	0.5
QCVN 05:2013/BTNMT		300	30000	350	200	-

Therefore, dust and emissions volume on the transport roads in construction phase of the subproject is small. Its concentration and indexes of CO, SO<sub>2</sub>, NO<sub>2</sub> on the roads for transporting waste materials meet standards in QCVN 05:2013/BTNMT.

#### ***Dust and emissions on the transport routes for construction materials and ground leveling***

Concentration of dust and emissions on transport routes for backfilling and construction materials is calculated and presented in Table 9.

**Table 9. Estimated concentration of dust and exhaust emission on the roads for transporting**

TT	X	Dust	CO	SO <sub>2</sub>	NO <sub>2</sub>	VOC
	<i>M</i>	( $\mu\text{g}/\text{m}^3$ )				
<i>Co</i>	-	42.5	3353	20.2	36	-

1	3	56.0	3359.4	23.4	46.9	4.2
2	5	52.9	3357.9	22.7	44.3	3.2
3	10	48.4	3355.8	21.6	40.7	1.8
4	25	46.1	3354.7	21.1	38.9	1.1
5	50	45.2	3354.3	20.9	38.2	0.8
6	100	44.7	3354.0	20.7	37.8	0.7
<b>QCVN 05:2013/BTNMT</b>		<b>300</b>	<b>30000</b>	<b>350</b>	<b>200</b>	<b>-</b>

The results in the table show that the concentration of air pollutants generated by transport operations is not large. However, because the transport routes such as Ngo Xuan Quang Street, Co Bi Street... have high traffic volume, the increased amount of dust and emissions will create pressure on air quality along these routes. The extent of this impact is assessed as moderate but fully controllable and mitigable with measures outlined in ECOPs.

### Noise

Results of separate noise assessment for each construction and transport vehicles and as well as resonant noise are estimated and presented in Table 10.

**Table 10. Resonant noise generated from active vehicles and machines**

No.	Transport and equipment	Noise 1 m away from the source		Noise 20 m away from the source	Noise 50 m away from the source
		Range	Average		
1	Watering vehicles	82.0 - 94.0	88	62	54
2	Trucks	82.0 - 94.0	88	62	54
3	Dredging machines	72.0 - 84.0	78	52	44
4	Scrapers, levelers	80.0 - 93.0	86.5	60.5	52.5
5	Rollers	72.0 - 74.0	73	47	39
6	Bulldozer		93	67	59
7	Excavator	72.0 - 84.0	78	52	44
	Resonant noise		95.8	69.8	61.8
QCVN 26/2010/BTNMT: 6:00 to 21:00 is 70 dBA; from 21:00 to 6:00 is 55 dBA;					
Standard of Health Ministry: noise in the production area: contact time in 8 hours is 85 dBA					

Results show that the noise level is considered moderate and the construction sites are all 20 m far away from the residential areas. The shortest distance from the construction area to sensitive areas such as Nguyen Dang lecture hall, Faculty of Veterinary Medicine building, Faculty of Engineering office and residential areas along Ngo Xuan Quang Street is 30 ÷ 80 m. Therefore, it can be said that impacts of noise due to the construction machines and equipment in the pre-construction phase are marginal and insignificant. People subject to this impact are mostly the staffs and construction workers.

### Vibration impact from construction activities

The use of heavy trucks to transport materials as well as the operation of motorized vehicles in construction will cause substantial vibration in the construction sites, especially in carpeting roads and concrete piling. The forecast results are presented in Table 11.

**Table 11. Vibration attenuation with distance from construction machines**

No	Machines	Source vibration (r0=10m)		Vibration attenuation with distance							
				r=12m		r=14m		r=16m		r=18m	
		Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)
1	Excavator	80	1.72	70.5	0.58	61.1	0.20	51.9	0.07	42.6	0.02
2	Bulldozer	79	1.53	69.5	0.51	60.1	0.17	50.9	0.06	41.6	0.02

No	Machines	Source vibration (r0=10m)		Vibration attenuation with distance							
				r=12m		r=14m		r=16m		r=18m	
		Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)	Laeq (dB)	Lveq (mm/s)
3	Heavy truck	74	0.86	64.5	0.29	55.1	0.10	45.9	0.03	36.6	0.01
4	Compactor	82	2.17	72.5	0.73	63.1	0.25	53.9	0.08	44.6	0.03
5	Air pressor	81	1.93	71.5	0.65	62.1	0.22	52.9	0.08	43.6	0.03

QCVN 27:2010/BTNMT, allowing 75dB from 6am ÷ 21pm and 60dB from 21pm÷ 6am.

Source: Air pollution in urban and industrial areas, Technology Publisher, 1992

From the results in the table above within distance of 12m, the vibration levels from operating machines are higher than QCVN27:2010/BTNMT and from 14m or more the vibration falls within allowable limits. With this range the objects that will be affected include works located around the construction areas such as water supply and drainage works, electrical systems and communications. However the civil infrastructure and houses are located outside the distance of 18m from the outer boundary of the subproject and vibration impacts are assessed to be negligible.

### Impacts from risks and incident accidents

*Labor accident:* In general, labor accidents may happen at any stage during construction phase, the causes include:

- Environmental pollution may cause fatigue, dizziness or fainting for workers during their work.
- The installation, construction and transport of materials with a lack of focus can cause labor accidents, traffic accidents, etc.
- Accidents due to negligence in work, lack of PPE, or due to lack of awareness of labor safety rules.

*Fire, explosion and leakage of fuel:* Fire and explosion may occur in the case of transport and storage of fuel, or lack of safety of the temporary power supply system, causing the loss of life and damage to property during the construction process. The specific causes are identified as follows:

- The temporary fuel and material warehouse (gas, DO oil, FO oil, welding gas, etc.) are the source of fire and explosion. The occurrence of such incidents can cause serious damage to people, society, economy and the environment.
- Fire risk may happen when operating construction machineries, welding and vehicles using gasoline and diesel without compliance with fire regulations.
- The subproject owner will implement the fire prevention and strictly comply with measures to prevent leakage, fire or explosion. The fire prevention shall be done regularly to minimize the possibility of incidents and the levels of impact.

*Community Health and Safety Risk:* Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to local communities. Since there are households living along the transportation route in the proximity of construction site, traffic accident may happen. The incidence of road accidents involving subproject vehicles during construction should be minimized through a combination of education and awareness-raising. Increased incidence of communicable and vector-borne diseases attributable to construction activities represents a potentially serious health threat to the subproject personnel and residents of local communities. Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with activities are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections.

Communicable diseases of most concern during the construction phase due to labor mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. **This impact is considered moderate.**

### **Risks due to welding**

Welding creates an extremely bright and intense light that may seriously injure a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Workers work in this area face a serious risk of being injured or killed in a fire or other explosion. Besides, electric shock occurs when welders touch two metal objects that have a voltage between them, thereby inserting themselves into the electrical circuit. If a worker holds a bare wire in one hand and a second bare wire with another, electric current will pass through that wire and through the welding operator, causing an electric shock. The higher the voltage thus is the higher the risk for the electric shock to result in injury or death. These impacts are assessed as moderate and mitigable.

### **Solid waste**

*Construction solid waste:* According to calculations, the total volume of waste generated during construction is about 74,305 m<sup>3</sup>, of which organic soil layer is 53,880 m<sup>3</sup>, accounting for 72.5% of the total volume of solid waste. The solid waste will be transported to 3 disposal sites in the University. This impact is considered minor.

*Domestic solid waste:* There are 1225 people working at construction site of the subproject and the total volume of domestic solid waste is 735 kg/day. However, no worker camps will be arranged in the University and contractors will have to hire local workers who have accommodation in residential areas. In addition the city's garbage collectors go to the University to collect and transport waste, therefore this impact is considered insignificant.

*Hazardous waste:* The total amount of hazardous waste generated in this phase is calculated about 14.15kg/day. This type of waste will be collected, managed and processed in accordance with regulation for collection and management of hazardous wastes issued by Ministry of Natural Resources and Environment. This impact can be assessed as minor.

### **Water quality impacts**

#### *Stormwater run-off*

Based on the calculation results of water runoff flow in this period, the contents of pollutants that may be contained in the stormwater during the construction period under Component 1 of the Subproject are calculated and presented in Table 12.

**Table 12. Estimated pollutant concentration in the runoff**

No	Parameters	Unit	Contents
1	Total N	mg/L	0.4-1.6
2	TotalP	mg/L	0.003-0.05
3	COD	mg/L	10-27
4	TSS	mg/L	11-26

The above table shows the concentration of pollutants in stormwater is very low and this impact is assessed as negligible.

*Domestic wastewater:* According to the subproject design report, a total of 1,225 people will be mobilized for construction of works. As calculated, the average volume of wastewater discharged is 98 m<sup>3</sup>/day. As mentioned above, there is no workcamp in the University and local people will be hired as workers who live in surrounding neighborhood. Therefore a large part of this estimated amount of wastewater will be collected and treated by local system. This impact is considered minor.

*Construction wastewater:* This wastewater contains a large amount of sediment, suspended solids and high pH and may cause negative impacts on the receiving waterbody if it is

discharged directly into the environment. However, in fact, this wastewater is re-used for curing concrete and watering the haul road and construction site. Therefore, the impacts caused by this wastewater source will be insignificant.

### **Soil environmental impacts**

The subproject's adjacent area has the vegetation of agricultural cover in experimental zone and trees. During the construction period, potential impacts causing land pollution are mainly the changes on the construction site which causes soil disturbance, increases erosion and pollution due to domestic and construction wastewater. These impacts are insignificant and temporary during the construction period.

### **Ecosystem**

During the construction period, farming and aquacultural ecosystems in the construction sites are likely to be strongly affected and completely changed. During the pre-construction phase, terrestrial plants have been cut down and fish in ponds have been caught. However, during the construction period, the ground grading works shall make the ecosystem completely changed. The whole subproject site will be excavated and graded to prepare the site for construction, as a result, the farm and aquacultural ecosystems will become the construction site. However, since there is no rare species in the Red Books of Vietnam as well as in IUCN. Therefore, the impacts on ecosystem are insignificant.

## **2. Site-specific impacts**

### ***Impacts caused by dredging sediment sludge in aquacultural ponds***

Construction works such as Faculty of Veterinary Medicine, Center for Foreign Languages, physical education area will be constructed on current aquacultural ponds. The road connecting Faculty of Fishery to the central roundabout will cross over several experimental ponds nearby. Therefore, contractors will have to drain these ponds and dredge the organic sludge layers (8,397 m<sup>3</sup>) before backfilling materials for grading ground. These sediment sludge layers accumulated in ponds have quite high contents of organic substances. Such gases as CH<sub>4</sub>, H<sub>2</sub>S...and odors from sludge may be emitted during the dredging process. The amount of odors and gas emission depends on the accumulation of organic substances in the ponds. However, these are experimental aquaculture ponds, they are dredged annually. Since the volume of sludge dredged is not big (8,397 m<sup>3</sup>) and the time of sludge accumulation is not long, the amount of odors and gas emitted during dredging period is not significant. In addition, the results of the analysis of pond's mud quality show that concentrations of certain heavy metals analyzed are still within the allowable threshold in QCVN03:2015/BTNMT on heavy metal limits in agricultural soil. The construction area is very spacious, so this impact is considered negligible.

### ***Impacts on the on-field agriculture experiments***

Construction items such as Lecture hall building, Faculty of Engineering, Faculty of Environment, Faculty of Food Technology, Faculty of Biotechnology and building for institutional and policy research, Central Building, Center for Life Science, the route from Faculty of Agronomy to the approach path will be constructed on current lands for experimental growing of agricultural crops and fruit trees. Therefore, the construction activities shall have impacts on experimental activities in adjacent areas. Especially, some irrigation schemes in the experimental area may be interrupted by grading or material transportation activities.

However, these irrigation canals are mainly the small and earth canals. Therefore, when one irrigation canal is filled, it should be additionally constructed another canal in order to avoid affecting water supply activity for surrounding experiment zones. Thus, the impact is assessed as insignificant.

### ***Impacts on learning and researching activities of staffs and students of the University***

According to current status, lecture-room, office of Faculties and the University, laboratories, library and dormitory are almost located in the central of the University. Thus, construction of works may affect learning and researching environment of staffs and students of the University, especially in construction sites of the buildings of lecture-room, Faculty of Engineering, Faculty of Environment and Faculty of Biotechnology. The impacts include:

- ✓ Impacts caused by dust, exhaust and noise: as assessed in the Section of air status in the construction process, both dust and exhaust are low and within the acceptable limits in accordance with QCVN 05:2013/BTNMT. And noise in the distance of 20m or more is still within the acceptable limits in accordance with QCVN 26/2010/BTNMT. However, due to the characteristic of learning and researching environment, the contractors need to reasonably arrange construction activities to avoid use of machines causing noise in learning hours of students.
- ✓ Impacts on landscape in the learning and researching areas: for the learning and researching environment, to make students and staffs work effectively, it needs to have clean environment and
- ✓ In the areas which may affect learning and researching activities of students and staffs. However, the impact level is assessed as insignificant and only happens during the construction process.

#### ***Risks of accident at the construction site to the University's staffs and students***

Vietnam National University of Agriculture is a large training institute with a large number of students and research students. Therefore, construction of the buildings of lecture-room, Faculty of Engineering, Faculty of Environment, Faculty of Food Technology, Faculty of Biotechnology and building for institutional and policy research, Central Building, Center for Life Science, the road from Ngo Xuan Quang Street to the central roundabout, the route from Faculty of Agronomy to the approach path will cause risk of accident not only to workers who directly participate in construction activities, but also to staffs as well as students of the University. Thus, it is considered a potential impact which should be paid attention by the contractor to have suitable construction plan and mitigation measures prior to commencement. Details of mitigation measures is described in the Section of mitigation measures.

#### ***Fall Risks due to working at heights***

Worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. There are four types of high-rise accidents, which are by scaffolding, people fall from height, struck by falling object and plant and machinery. The workers are always exposed to the risk of collapse of the scaffolding. Major of the scaffold accidents occurred were due to the use of defective materials for scaffolding and coupled with the unskilled and careless workmanship in erection of scaffolds. Everybody in the construction site has the risk to expose to fall in anywhere and anytime especially at the higher level. In general, lack of the safety measure at the construction sites is one of the causes the occurrence of fall accidents. In addition, workers can be stricken by the equipment, private vehicles, falling materials, vertically hoisted materials and horizontally transported materials. The improper rigging method had caused the accident happen. Overloading is one of the factors that will cause the cranes collapse in the high-rise building construction. During the construction, the amount of allowable handling load by the crane is always not proper control by the supervisor. Accident is an event of unpredictable and it may occur due to the following causes, lack of training, improper equipment and working platform, wrong safety attitude, inadequate housekeeping, failure to use personal protective equipment, and problem procurement method and subcontracting method. The lack of training in safety and technology knowledge, workers are haven't ability and sufficient knowledge to predicts the potential risk and the way to avoid the accidents. The

use of unsafe working platforms also may put workers at risk when the equipment is not properly used, maintained or stored. Construction worker's safety attitude is influenced by their understanding and realizing of risk, management, safety rules and the working procedures. The unsafe actions include do not follow the standard safety procedures, constructing barbarously and deciding to proceed work in an unsafe conditions. The poor housekeeping in the workplace can be considered as a risk factor for occupational injuries. Working without wearing any personal protective equipment may highly increase the probability for occurrence of any undesired accident. The various reasons of workers refuse to wear PPE during working are such as feel uncomfortable with the gears while performing their job at site and consider it as a disturbing item to their work output. Sub-contractors usually have poor safety awareness at the construction site. Poor coordination, lack of proper instructions and misunderstanding between working trades all can lead to construction accidents. These impacts are assessed as magnitude if don't have any suitable mitigation measures.

#### ***Risk of traffic accidents within the University's campus***

Because most of the constructed works are located inside the University's campus, travelling of construction vehicles and activities of transporting waste materials as well as construction materials on some roads inside the University's campus are inevitable. The roads are mainly the border roads in the North of the University (alley 65 from Ngo Xuan Quang road to Faculty of Husbandry), some small roads connecting construction site to the border roads and to construction waste material site, and the main road of the University (Ngo Xuan Quang road) from the gate of the University to bypass to construction site of Biotechnology Faculty (about 400m). The travelling of vehicles and operation of construction machines will increase the risk of traffic accident for staffs as well as students of the University because number of students daily participating in traffic on the road is quite large and the road is also the bus route. Thus, this is considered as an impact which needs to be specially paid attention by the contractor to have a reasonable construction method.

#### ***Risk of traffic accidents outside the University's campus***

For backfilling materials, it is expected to be purchased from sand bank of Duong river in Loi village, Dang Xa commune, Gia Lam district and the transport road will include Duong dike embankment – Co Bi road – Ngo Xuan Quang road to the construction site. The survey result along the road shows that Ngo Xuan Quang and Co Bi streets have quite high traffic density, especially in rush hours. Thus, the risk of traffic accidents on both of the roads will be high, if the contractor does not have reasonable measures for managing and controlling vehicles.

In addition, for the road section from Ngo Xuan Quang road to Co Bi road, vehicles have to pass Ha Noi – Hai Phong railway and National highway 5. The Ha Noi – Hai Phong railway runs parallelly to the National highway 5 and train runs on the route eight times/day. The National highway 5 has high traffic density. According to the calculation result in EIA report of the subproject, transport activity will increase number of vehicles participating in traffic with an average of three to four times and most of the vehicles are trucks with loading of 10 tons which will cause high risk of traffic accident and the contractors should pay attention, have vehicle management plan and arrange reasonable transport time to minimize the risk of traffic accident in the area.

#### ***Risk of subsidence and damage to the existing structures***

During the construction process of the high buildings, it may easily cause the risk of damage to surrounding works. However, according to the design of the subproject, these buildings are designed with the height from one to five storeys and most of the buildings are constructed on vacant land and far from surrounding structures. The nearest structure is the electric building which is about 50m far from the lecture-room. Thus, risk of subsidence and damage to the surrounding works is assessed as insignificant.

In addition, drainage canal system of the University has been constructed and concreted in both sides of the canal system which is near the construction area of the buildings of Faculty of Environment, Faculty of Biotechnology, large lecture-room. If the material transport process serving construction of the works is not managed, it will cause the risk of damage to the works. Thus, after construction of the works, the contractor will have resolutions of repairing damaged positions caused by construction activities.

However, the transporting the equipment and material handling will take on rural roads and routes along Cau Bay River. Impact on the quality of the route is unavoidable, however these roads have been concreted, with pavement width between 6-7m. Upon completion of the subproject, the contractor will have to repair the damaged section and return to its initial state. This impact is considered minor.

***Impacts from construction disposal sites***

As described above, there are three construction disposal sites planned for the subproject (location of the disposal sites are described in item 3.5). These construction disposal sites are located in the University area. Therefore, gathering of construction waste will cause some impacts such as impact on landscape and ecosystem and impact on the use of land of the University. However, currently these sites are still lower than surround areas and often waterlogged when it rains. Two construction disposal sites gathering organic sludge and soil in accordance with the planning of the University will be arranged to plant experimental trees. And the construction waste site gathering inorganic materials will be planned for garage area for students and staffs' vehicles. Thus, impacts caused by gathering construction waste materials are assessed as insignificant and mainly cause impact on the landscape during the construction process.

***Increase the possibility of local flood around construction area***

According to the subproject description, VNUA area is lower than the surround areas so waterlogging status often occurs when it heavily rains, especially in the North of the University. According to the statistic of the University, currently there are nine hectares of water surface divided into ponds/lakes. These ponds/lakes not only serve aquaculture study purpose, but also serve draining of rainy water. Thus, construction of the buildings of Faculty of Veterinary Medicine, Faculty of Foreign Language and Faculty of Physical Education will cause filling of some ponds/lakes (3.5 ha) to prepare the site for construction and drainage possibility in the area will be reduced (39% of pond area) that will cause the risk of waterlogging in the areas. Also, in areas such as building construction for Faculty of Electrical Engineering, Environmental Sciences, lecture halls, building for educational institution, Center for agricultural research and Life Science, Central Building, the roads, the ground will be elevated. Thereby it increases the ability for local flooding for surrounding areas affecting farming experimental activities in fields and fruit trees. Consequently, suitable solutions need to be prepared to minimize the risk right from the time of planning the University and designing the subproject.

***Impacts on Sensitive Receptors***

The construction of the different items of subproject will likely impact some sensitive receptors located in close proximity to the construction sites, including the inconvenience of access of the people when they want to visit these places; smoke and dust may become a nuisance to the local residents and cultural and religious activities; risks of traffic safety and work related accidents.

**Table 13. List of sensitive receptors under the subproject**

<i>Sensitive Receptors</i>	<i>Potential impacts</i>
Construction of buildings	

<i>Sensitive Receptors</i>	<i>Potential impacts</i>
 <p>University drainage canals</p>	<ul style="list-style-type: none"> <li>- Building materials can be washed into canals</li> <li>- Erosion and damaged canals if machines and transporting vehicles encroach</li> <li>- Potential water pollution</li> <li>- Potential risk of local flooding</li> </ul>
 <p>Lecture hall of Electrical Mechanics Faculty</p>  <p>Newly built 5 story lecture hall</p>  <p>Nguyen Dang lecture hall</p>	<ul style="list-style-type: none"> <li>- Dust, noise and emissions</li> <li>- Potential labor accidents</li> <li>- Impact on learning activities of students</li> <li>- Traffic safety risk when students come to class</li> <li>- Potential risk of damage to the building when the construction equipment and transport vehicles operate</li> </ul>
 <p>Residential cluster in Alley 65 Ngo Xuan Quang Street</p>	<ul style="list-style-type: none"> <li>- Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to local communities.</li> </ul>
 <p>Veterinary Clinic</p>	<ul style="list-style-type: none"> <li>- Increased exhaust gases, dust, noise, vibration, construction wastes, wastewater, and the risks of traffic and construction accidents to customers to the veterinary clinic</li> </ul>
 <p>Experimental nursery for crops and fruits</p>	<ul style="list-style-type: none"> <li>- Impact on experimental activities in the field</li> <li>- Impact on drainage of local area</li> <li>- Increased risk of flooding</li> <li>- The effects of dust and emissions to the environment and the development of plant</li> <li>- Causing environmental degradation arable land areas and deterioration of biodiversity for ecosystem</li> </ul>
 <p>Village roads and the belt road for transporting waste material</p>	<ul style="list-style-type: none"> <li>- Degrading and damaging roads</li> <li>- Material scattered along the route would affect traffic activities</li> <li>- The risk of traffic safety</li> </ul>
<b>Construction of roads</b>	

<i>Sensitive Receptors</i>	<i>Potential impacts</i>
 <p>Residential cluster in Alley 65 Ngo Xuan Quang Street</p>	<ul style="list-style-type: none"> <li>- Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to local communities.</li> </ul>
 <p>Veterinary Clinic</p>  <p>Faculty of Fishery</p>  <p>Vietnam-Japan crop research</p>  <p>Center Crop development Institute</p>	<ul style="list-style-type: none"> <li>- Increased exhaust gases, dust, noise, vibration, construction wastes, wastewater, and the risks of traffic and construction accidents to lecturers, students, customers to the Units</li> </ul>
<b>On transport routes</b>	
 <p>Entrance gate to Faculty of Agronomy</p>  <p>Agro-product shops on the main road from the entrance gate to the Office Building</p>	<ul style="list-style-type: none"> <li>- Dust, noise and emissions</li> <li>- Impact on research activities and work of the academic staffs and students</li> <li>- Traffic Safety Risk</li> <li>- Potentially damaging and interrupted access to buildings and shops</li> </ul>
 <p>Hapromart on Ngo Xuan Quang Street</p>  <p>Trau Quy market on Ngo Xuan Quang Street</p>	<ul style="list-style-type: none"> <li>- Dust, noise and emissions</li> <li>- Impact on business activities</li> <li>- Traffic Safety Risk</li> <li>- Interrupted access to the supermarket and local markets</li> </ul>
 <p>Residents along Ngo Xuan Quang Street and Co Bi Street</p>	<ul style="list-style-type: none"> <li>- Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to local communities.</li> </ul>
	<ul style="list-style-type: none"> <li>- Potential risk of railway safety</li> <li>- Potential risk of congestion</li> </ul>

<i>Sensitive Receptors</i>	<i>Potential impacts</i>
Railway crossing Ngo Xuan Quang Street at intersection with NH5 and Ngo Xuan Quang Street	
 <p>Cao Ba Quat High School</p>  <p>Co Bi Kindergarten</p>  <p>Co Bi Health Clinic on Co Bi Street</p>	<ul style="list-style-type: none"> <li>- Increased dust, emissions and noise.</li> <li>- Potential risk of traffic accidents in the school gate and health clinic</li> <li>- Obstructing access to school for students and parents</li> <li>- Obstructing activities to visit and work in clinic</li> </ul>

### 4.1.3. Operation phase

#### 1. Generic impacts

##### *Domestic wastewater*

Structures are built to serve studying, researching and working and therefore domestic wastewater is mostly generated from the toilets of each building. The wastewater volume is specifically calculated in the EIA and total wastewater volume generated each day reaches 80 m<sup>3</sup>/day. This wastewater volume will be collected into a septic tank built underground of each building for treatment, then will be discharged to the treatment system of the University (with a capacity of 450m<sup>3</sup>/day and night) for the next treatment so that wastewater is classified type B, then finally will be discharged to Cau Bay river. Therefore, the impact is marginal.

##### *Storm water runoff*

When the structures are put into use, the ground will be cleared, and storm water is mostly from house roofs, surrounding concrete and asphalt grounds. There are separated storm water collection and drainage systems (separated from wastewater system). Therefore, this volume is not considered as a pollution source and can be discharged directly to Cau Bay river or combined water drainage system of the area outside the University. This impact is inconsiderable.

##### *Domestic solid waste*

Domestic solid waste from buildings in the operation phase is inorganic (including scrap paper, newspapers, nylons, etc.) and some other organic solid wastes (mostly food leftovers brought by staffs and students). As calculated, there are about 20,000 staffs, students and guests each day, therefore the average domestic solid waste generated is 12 tons/day. Total volume of solid waste will be collected by Hanoi Urban Environment Company (which is having a contract with the University) everyday. Therefore, this impact is also marginal.

#### 2. Site-specific impacts

##### *Toilet management*

When the buildings are put into use, many people will gather here for working and studying. Therefore, toilets may cause risks to the environment if they are not regularly cleaned and managed. Toilets without regular cleaning will generate hazardous gases (H<sub>2</sub>S, NH<sub>3</sub>,...) and cause stinks and also increase development of mosquitoes, flies and diseases, which has impacts on air environment, and health of teachers, students, and guests. However, for the

current structures, the University is hiring staffs who are in charge of cleaning inside the campus, lecture halls and also toilets. Therefore, the impacts are inconsiderable.

### ***Management of labs and practical rooms***

According to the subproject design, of 9 buildings in the component 1, except Lecture hall building, physical education area, Institutional and Policy office, Foreign Language Office, all other buildings have labs and practical rooms such as Agricultural Engineering Faculty building (9 rooms), Food technology and Post-Harvest Technology Faculty Building (5 rooms), Environment Faculty building (6 rooms), Biotechnology Faculty Building (5 rooms), Veterinary Medicine Faculty building (7 rooms) or Center for Agricultural Research and Life Science. At the labs, storage and usage of chemicals is on the regular basis. Therefore, it is likely to have potentials risks on management and chemical usage. Risks are assessed below:

#### ***- Risk of chemical leak***

Each Faculty has particular trainings and researches, therefore each lab/practical room is different and so are the chemicals. However, in the list of chemicals recorded, most of them are acids or bases or other mixtures. These chemicals are in solid, liquid and gas states (mostly solid and liquid) and stored in closed bottles. When chemicals are used, gas emitted from the chemical into the air is unavoidable. In addition, practicing/studying mixture of chemicals to create new ones or crushing samples by using chemicals also generates gases into the surrounding environment (acid steam, Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>,...). These gases with high concentration will directly make impacts on health of staffs as well as students in the lab. However, this impact can be totally mitigated and eliminated if labs develop management programs and apply detailed prevention measures. These impacts are long-term within the lab operation duration.

#### ***- Safety risks when using chemicals***

When using chemicals, safety is prioritized in all labs because if people get direct exposure to chemicals, they may get burnt, have skin corrosion, and negative impacts on respiratory system, mucosa, etc. Possible unsafety in using chemicals including:

- ✓ Not using protective equipment when using chemicals (gloves, face masks) leads to direct exposure of chemicals on skin and its steam affecting people's respiratory system.
- ✓ Chemicals have low quality, expire or do not have labels and specific instructions, which leads to misuse and have unpredictable chemical reactions.
- ✓ Careless storage and usage of chemicals leads to breakage and overflow, which causes impacts on environment and health of staffs/students, even can cause fire incidents.
- ✓ That management of chemicals when not in use does not meet standards and comply with instructions of each chemical kind also changes chemicals and is unsafe for users.

Generally, impacts listed above depend on conditions and management capacity of labs and are assessed as moderate and long-term. However, these impacts can completely be controlled and mitigated during the operation phase.

#### ***- Wastewater from the labs***

For buildings having labs/practical rooms such as Agricultural Engineering Faculty building, Food technology and Post-Harvest Technology Faculty Building, Environment Faculty building, Biotechnology Faculty Building, Veterinary Medicine Faculty building, apart from wastewater collection and treatment system as described, at these buildings, wastewater from labs/practical rooms needs to be collected and treated separately because it contains hazardous solvents and chemicals such as heavy metals. Composition, nature and concentration of wastewater in these labs are not sustainable and changeable depending on frequency, numbers, types and experimental purposes, etc. Wastewater is mostly generated due to cleaning devices and samples, and hands of students, etc.

According to the calculation, wastewater and its composition of each Faculty has following features:

- ✓ Agricultural Engineering Faculty: wastewater generated is averagely 1.6m<sup>3</sup>/day containing much suspended solids, grease, organic solvents and heavy metals.
- ✓ Food technology and Post-Harvest Technology Faculty: average wastewater generated is around 2.7m<sup>3</sup>/day containing BOD, COD, TSS, NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup>, organic solvents and high contents of microorganisms.
- ✓ Environment Faculty: average wastewater generated is around 2.5m<sup>3</sup>/day containing much BOD, COD, TSS, NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup>, organic solvents and heavy metals.
- ✓ Biotechnology Faculty: average wastewater generated is around 2.4m<sup>3</sup>/day containing BOD, COD, TSS, NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup>, organic solvents and high contents of microorganisms.
- ✓ Veterinary Medicine Faculty: average wastewater generated is around 2.9m<sup>3</sup>/day containing BOD, COD, TSS, NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup> and pathogenic microorganisms.

Although this volume of wastewater is not high, if it is not separately collected and treated, impacts on environment will be considerable. However, as designed, total volume of wastewater will be separately collected to the treatment system which is going to be built by the University, therefore the impacts will be controlled and mitigated and is assessed as minor.

#### *- Hazardous waste*

Waste from labs/practical rooms includes empty chemical/pesticide bottles, samples, sample packages, broken devices, grease, etc. These are hazardous wastes and its volume depends on frequency of usage in the labs. As calculated, the volume is around 31 kg/Day (of which Engineering Faculty: 7.4 kg/day; Food technology and Post-Harvest Technology Faculty: 5.5 kg; Environment Faculty: 6.2 kg; Biotechnology Faculty: 5.1 kg and Veterinary Medicine Faculty: 6.8 kg)

All these wastes must be collected and treated the same as hazardous wastes and only transported and treated under the permission of the competent agencies. Mismanagement of hazardous solid waste will cause negative impacts on environment and diseases, especially infectious diseases through water use as well as air and water pollution. It is assessed as moderate.

#### *- Safety in operating machines and equipment*

Most of the listed devices are generated by electricity and require strict and precise operation procedures. Therefore, if operation of these devices is not ensured, some potential risks may occur such as short circuit, or false of devices leading to false of findings. Therefore, to control this impact, before operation, the University should set up suitable management and usage plans to ensure safety. This impact is assessed as minor.

#### ***Electric explosion and short-circuit***

The University is in need of huge electricity demand for studying, especially operation of machines used in the labs or practical rooms. Thus, potential risks of electricity insecurity is likely to happen while materials used in the labs are combustible such as papers, tables, chairs, books, chemicals, etc. Fire prevention is always prioritized by the University leadership. This impact is assessed as minor and mitigable.

#### ***Impacts by usage, storage, management and handling of plant protection chemicals in agricultural research***

According to the subproject design, there will be three research centers in agriculture and high-tech planting greenhouse systems and insect breeding in Center of Agriculture Research and Life Sciences. Research works in these centers as well as the greenhouse system may have to use some sort of plant protection chemicals and insecticides to kill pests, weeds for crops and other agricultural products.

Pesticides are often highly toxic chemicals, and if not closely managed during the storage and use, they will be the poisoning agent for the health of researchers, students, staffs, public health and pose high risks to the environment.

The toxicity of plant protection chemicals is usually calculated by their decaying time (or residual level). The longer time they decay, the more toxic they are due to their accumulation in the environment and in agricultural products.

**Table 14. Residual time of pesticides in soil**

Plant protection chemical	Residual time
Chlorinated insecticides (e.g. chlordane, dieldrin)	2-5 years
Triazine herbicides (e.g. Amiben, simazine)	1-2 years
Benzoic herbicides (e.g. Amiben, Dicamba)	2-12 months
Urea herbicides (e.g. Monuron, diuron)	2-10 months
Phenoxy herbicides (2,4-D, 2,4,5-T)	1-5 months
Organophosphate insecticides (e.g. malathion, diazinon)	1-12 months
Carbamate insecticides	1-8 weeks
Carbamate herbicides (e.g. Barban, CIPC)	2-8 weeks

(Source: <http://www.greenpeace.org>)

**Table 15. The half-decay time of POP group pesticides**

No	Substance	Half-decay time	No	Substance	Half-decay time
1	Aldrin	5-10 years	5	Endin	> 12 years
2	Toxaphene	3 tháng -12 years	6	HCB	3-6 years
3	Chlordan	2-4 years	7	Heptachlor	> 2 years
4	Dieldrin	5 years	8	Mirex	> 10 years

(Source: <http://www.greenpeace.org>)

In addition to a long and persistent harm to the environment, particularly soil and water, some pesticides can be modified to produce a new compound which contains higher toxicity. This impact is assessed as magnitude.

*- The impact of pesticide residue to the soil environment*

When pesticides are sprayed or spread on a certain object, a small amount will be introduced into its body. Through the process of absorption, growth, development or through the food chain, pesticides will be accumulated in agricultural products and move and accumulate along the food chain by biological amplifier. Another part will accumulate in the soil and can be washed out by rain water, entering soil, water, air... polluting the environment.

When crops are sprayed with pesticides, about 50% of the chemical will fall to the ground. Part of it is absorbed by the trees and the rest is retained by soil colloids. The latter in the soil is gradually resolved through biological activity of the soil and through the effects of the physical and chemical elements. But the resolution is slow if drugs exist in environments with large amounts of soil, especially in soils with poor bioactivity.

*- Water pollution*

When accumulated in the soil, pesticides and insecticides can be washed by rainwater runoff to local water bodies (Cau Bay River or experimental aquaculture ponds) or intrude into aquifers and contaminate water sources.

Also, pesticides and insecticides may pollute water sources if the users dump excess chemicals, bottles containing chemicals, water washing into water bodies which will accumulate in sediment in rivers, ponds and create water pollution and affect the growth and development of aquatic wildlife.

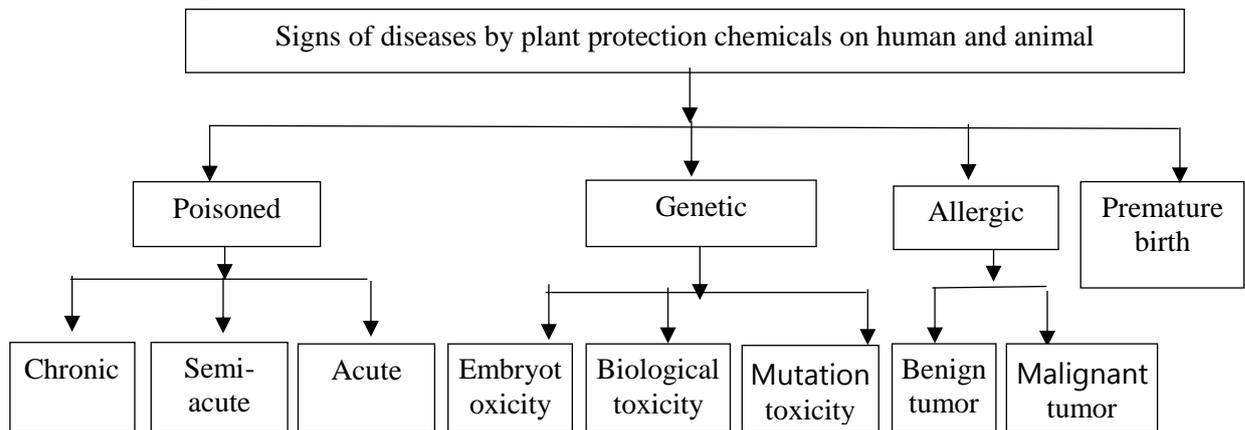
*-The effects of pesticides on humans and animals*

In addition to impacts on insects and grasses harmful to crops, pesticides also cause acute and chronic poisoning for those are exposed to and use them. Typically, plant protection chemicals penetrate the human and animal body via the following three paths:

- Absorption through the skin pores;
- Through esophagus via food or water intakes; and
- Through trachea via inhalation

The degree of impact on human health depends on the type of chemicals and the exposure time as well as how they enter the body.

Once entering into the body, pesticides are not only poisonous, but also cause many diseases to humans. The signs of diseases caused to humans and animals infected by pesticides are described in Figure 17.



**Figure 17. The harmful effects of pesticides on humans**

For VNUA, as a leading education institution in agricultural sector, most of its staffs and students are aware of this impact on the environment and human health. Therefore, the type of plant protection chemicals used will be those substances with high biological activity, short decay time and are not classified as drugs banned from use in Vietnam. Also, due to the scope of use mainly in the experimental areas this impact is considered negligible and the objects affected include mainly the direct users (students, researchers, staffs) of pesticides in the laboratory. Therefore, these impacts are assessed as moderate.

#### **4.2. Social impacts**

##### ***Impact on livelihood and income sources***

Potential impacts assessed based on consultation and in-depth interviews with key stakeholders, temporary impacts during construction phase have been recognized, including disorder in working and studying agenda of the University's staffs and students as well as influence on economic conditions of 10 households and 11 units that are borrowing/renting land for their trading activities within University campus (scope of impact can only be calculated in detail when technical designs are available as also depends on construction location and construction time).

There are both positive and negative impacts caused by the subproject (e.g: cause minor disorder in working agenda of lecturers and students and affect temporary income from seedling trading activities; diversion of discharge direction of existing drainage system might cause temporary water cut and inundation).

Associated construction activities also cause direct and indirect impacts on economic activities in the subproject area, in particular, (i) local stores along road sides as well as households/companies (10 households and 11 units) that are having trading activities within the University campus will have their trade volume reduced; (ii) cause obstruction to transport and commodity flows inside and outside the subproject area. This impact is considered as minor.

##### ***Social issues***

Social impacts may be caused mainly related to mobilization of workers from other localities to the subproject area. Community disturbance caused by increased level of dust and noise, traffic disruption and increased safety risks and disruption of existing public services may arise.

Construction of the buildings and internal transport routes will mobilize up to 1225 employees working for different contract packages. Each group will typically have 20-30 people, and up to 60 people coming from other localities will be mobilized to work at the construction sites. Mobilization of workers from other localities may lead to conflicts between the workers, students and local people living in the subproject area due to differences in behavior and customs, jobs and income, traditions, or if the workers get involved in gambling, drinking and prostitution.

The construction activities of work items will affect the working schedule of students and lecturers. Households who are borrowing land of the University for their trading of seedling and secondary income generating activities at the University entrance gate will also be affected. Particularly, business and incomes of roadside shops may be affected or even reduced. Conflicts between construction teams and local people may arise due to disturbance to urban landscapes, increased localized dust levels and safety risks, traffic obstruction, income reduction, etc. Survey data showed that about 10 businesses HHs and 11 business Units located along central routes of VNUA will be affected with access to their houses, noise, dust, odor, and increased traffic risks. So that, level of social impacts medium and can be mitigated.

#### ***Occupational Health and Safety of Workers***

Earthworks, loading and unloading materials, operation of construction plants such as excavators, cranes, trucks, welders, and concrete mixers all have potential accident risks or pollution affecting workers if there are no control measures.

The storage and usage of fuels such as power, gas, petrol contains accident risks related to electrical shock, fire, explosion, leakage etc., and pollution which will affect the health and safety of workers.

There are safety risks associated with working at construction sites with various types of materials and machines, equipment, and with many vehicles passing by. Other site risks include working at heights while construction of buildings, or working deep under the ground while excavating Laboratory pond aquaculture.

Camping conditions, availability of water supply, kitchen, sanitation facilities and drainage within and surrounding the camps will be important to the health of workers. If the camp or construction site is surrounded by vegetated ground, snakes and other harmful reptiles may enter the camps and attack the workers.

In addition, weather factors need to be taken into account during construction such as high temperature in the summer when the outdoor temperature may reach 38°C that can also cause health risks to the workers.

In conclusion, the risk level of these social impacts is assessed as medium and can be mitigated.

#### ***Connection potential evaluation of the subprojects with other project in VNUA***

Currently, agriculture has been constantly regarded as spear-head economic sector. Beside investment into agriculture infrastructure development, capacity building and improvement of training quality that attaches to scientific research to meet needs of national and regional markets are also being implemented for such objectives via subprojects such as: Project of constructing wastewater treatment plant for VNUA; Project of Student Dormitory construction - VNUA; Project of Improving the practice area of Faculty of Natural Resources and Environment; Project of Improving Quang Trung Farm area; Project of

Newly Constructing lecture hall; Project of Constructing Veterinary Hospital - Vietnam University of Agriculture. All such projects are financed by self-mobilized fund of the University, State budget and there is no investment connected to WB-funded project.

## **5. IMPACT MITIGATION MEASURES**

### **5.1. Environmental impact mitigation measures**

In order to minimize adverse environmental impacts, several measures have been proposed since the preparation stage of the subproject. Surveys and design activities have been conducted to consider alternatives to minimize the subproject's impacts during construction and operation stages. The following principles have been adopted in devising the mitigation measures:

- Disturbance to the life and transportation of the local people must be minimized.
- Proposed measures must be environmentally, socially and economically feasible.
- Technical standards and regulations must be abided by.
- Construction equipment and methods must be environment-friendly.
- Monitoring activities must be conducted on a regular basis.

This Section identifies mitigation measures for key impacts during the pre-construction and construction and operation phases of the subproject. Given that most of these impacts will occur from civil works and transportation of construction/waste materials, many of the potential negative physical, biological, social and environmental impacts could be mitigated through a set of general measures that are typically applied to most of construction subprojects to minimize such impacts as noise, dust, water, waste, etc.

#### ***5.1.1. Preconstruction phase and Construction Phase***

##### **A. Generic impacts**

As part of the Environmental and Social Management Plan (ESMP) for the subproject these general measures have been translated into a standard environmental specification to be incorporated into bidding and contract documents. These are referred to as Environmental Codes of Practice (ECOP), and will be applied to mitigate typical impacts of the subproject's civil works under Component 1, 2 and 3.

The ECOP describes typical requirements to be undertaken by contractors and supervised by the construction supervision consultant during construction. The ECOPs will be incorporated into the bidding and contract documents (BD/CD) annexes. The measures identify typical mitigation measures for the following aspects:

- ✓ Dust generation, emission, noise and vibration
- ✓ Wastewater management
- ✓ Solid waste management
- ✓ Hazardous waste management
- ✓ Water pollution
- ✓ Plants and aquatic species
- ✓ Urban landscape and aesthetic
- ✓ Sedimentation, erosion, flooding subsidence and landslide
- ✓ Traffic management
- ✓ Existing infrastructure and services
- ✓ Social impacts
- ✓ Cultural works
- ✓ Community's safety and health
- ✓ Workers' health safety
- ✓ Management of warehouses and borrow pits
- ✓ Communication to local community

**Table 16. Environmental Codes of Practice (ECOPs)**

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
1. Dust and exhaust emission	<ul style="list-style-type: none"> <li>- The Contractor is responsible for compliance with relevant Vietnamese legislation with respect to ambient air quality.</li> <li>- The Contractor shall ensure that the generation of dust is minimized and is not perceived as a nuisance by local residents and shall implement a dust control plan to maintain a safe working environment and minimize disturbances for surrounding residential areas/dwellings.</li> <li>- The Contractor shall implement dust suppression measures (e.g. use water spraying vehicles to water roads, covering of material stockpiles, etc.) as required.</li> <li>- Material loads shall be suitably covered and secured during transportation to prevent the scattering of soil, sand, materials, or dust.</li> <li>- 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.</li> <li>- Dust masks should be used where dust levels are excessive</li> <li>- All vehicles must comply with Vietnamese regulations controlling allowable emission limits of exhaust gases.</li> <li>- Vehicles in Vietnam must undergo a regular emissions check and get certified named: "Certificate of conformity from inspection of quality, technical safety and environmental protection" following Decision No. 35/2005/QD-BGTVT;</li> <li>- There should strictly be no burning of solid wastes or construction materials (e.g. wood, rubber, oil-based rag, emptied cement bags, paper, plastic, bitumen, etc.) on site.</li> </ul>	<ul style="list-style-type: none"> <li>- TCVN 6438-2005: Road vehicles - Maximum permitted emission limits of exhaust gas</li> <li>- Decision No. 35/2005/QD-BGTVT on inspection of quality, technical safety and environmental protection</li> <li>- QCVN 05: 2013/MONRE: National technical regulation on ambient air quality</li> </ul>	Contractor	PMU, CSC
2. Noise and vibration impacts	<ul style="list-style-type: none"> <li>- The contractor is responsible for compliance with the relevant Vietnamese legislation with respect to noise and vibration.</li> <li>- 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.</li> <li>- Measures to reduce noise to acceptable levels should be implemented, including: <ul style="list-style-type: none"> <li>+ Selecting equipment with lower sound power levels</li> <li>+ Installing silencers for fans</li> <li>+ Installing suitable mufflers on engine exhausts and compressor components</li> <li>+ Installing acoustic enclosures for equipment casing radiating noise</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- QCVN 26:2010/BTNMT: National technical regulation on noise</li> <li>- QCVN 27:2010/BTNMT: National technical regulation on vibration</li> </ul>	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<ul style="list-style-type: none"> <li>+ Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m<sup>2</sup> in order to minimize the transmission of sound through the barrier</li> <li>+ Barriers should be located as close to the source or to the receptor location to be effective</li> <li>+ Installing vibration isolation for mechanical equipment</li> <li>+ Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas</li> <li>+ Re-locating noise sources to less sensitive areas to take advantage of distance and shielding</li> <li>+ Siting permanent facilities away from community areas if possible</li> <li>+ Taking advantage of the natural topography as a noise buffer during facility design</li> <li>+ Reducing project traffic routing through community areas wherever possible</li> <li>+ Developing a mechanism to record and respond to complaints</li> </ul>			
3. Wastewater management	<ul style="list-style-type: none"> <li>- The Contractor must be responsible for compliance with the relevant Vietnamese regulations on wastewater discharges into surroundings.</li> <li>- Portable or constructed toilets must be provided on site for construction workers.</li> <li>- Consider hiring local workers to reduce wastewater generation on site.</li> <li>- Provide septic tanks for collecting and treating wastewater from toilets.</li> <li>- Wastewater from kitchens, showers, sinks shall be discharged into a local sewerage system.</li> <li>- Wastewater from washing vehicles and construction equipment shall be collected into a settling pond before discharged into local drainage system.</li> <li>- At completion of construction works, wastewater collection tanks and septic tanks shall be safely disposed of or effectively sealed off.</li> </ul>	<ul style="list-style-type: none"> <li>- QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater;</li> <li>- QCVN 40: 2011/BTNMT: National technical regulation on industrial wastewater</li> </ul>	Contractor	PMU, CSC
- Management of solid wastes	<ul style="list-style-type: none"> <li>- Before construction, a solid waste control procedure (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) must be prepared by Contractors and it must be carefully followed during construction activities.</li> <li>- Before construction, all necessary waste disposal permits or licenses must be obtained.</li> <li>- 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</li> </ul>	<ul style="list-style-type: none"> <li>- Decision No. 59/2007/NĐ-CP on solid waste management;</li> <li>- Decree No. 38/2015/NĐ-CP dated 24/04/2015 on waste</li> </ul>	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<p>refuse collection facilities.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof.</li> <li>- No burning, on-site burying or dumping of solid waste shall occur.</li> <li>- 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.</li> <li>- 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.</li> </ul>	and scrap management		
4. Management of chemical and hazardous wastes	<ul style="list-style-type: none"> <li>- 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.</li> <li>- The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers.</li> <li>- Used oil and grease shall be removed from site and sold to an approved used oil recycling company.</li> <li>- 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.</li> <li>- Used oil or oil-contaminated materials that could potentially contain PCBs shall be securely stored to avoid any leakage or affecting workers. The local DONRE must be contacted for further guidance.</li> <li>- Unused or rejected tar or bituminous products shall be returned to the supplier's production plant.</li> <li>- Relevant agencies shall be promptly informed of any accidental spill or incident.</li> <li>- Store chemicals appropriately and with appropriate labeling.</li> <li>- Appropriate communication and training programs should be put in place to prepare workers to recognize and respond to workplace chemical hazards.</li> <li>- 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 or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions.</li> </ul>	<ul style="list-style-type: none"> <li>- Decree No. 38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management</li> <li>- Circular No. 36/2015/TT-BTNMT on hazardous waste management</li> </ul>	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
5. Reduced water quality	<ul style="list-style-type: none"> <li>- The Contractors are responsible for controlling surface water quality when discharging it out of construction sites, in accordance with QCVN 08-MT:2015/BTNMT and QCVN 14:2008/BTNMT;</li> <li>- Store used and unused oil and petrol on impermeable grounds covered with roofs, with warning (flammable and danger) signs, and contained within surrounding fences for easy control and collection in case of leakage. Locate oil and petrol storage areas at least 25m from any ponds, lakes, rivers, and streams. Restrict accessibility to these temporary storages to only authorized persons;</li> <li>- Perform concrete mixing on impermeable ground only, at least 20m far from any water sources. Collect wastes and wastewater containing cement at sedimentation traps and drainage ditches regularly to limit number of solids entering receptors;</li> <li>- Maintain vehicles and replace oil at designated workshops only. Do not perform these activities at sites;</li> <li>- Collect and keep used/waste oil and materials polluted with oil/chemicals in containers, store in safe places (on impermeable grounds, roofed, fenced and with warning signs) for regular collection by licensed dealers;</li> <li>- Carry out concrete mixing on impermeable grounds only. Collect wastes and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit number of solids entering receptors;</li> <li>- Provide sedimentation pits and ditches at big construction sites;</li> <li>- Provide appropriate toilets for the workers;</li> <li>- Avoid carrying out excavation and backfilling in rainy weather;</li> <li>- Collect and transport materials and wastes generated during excavation and backfilling materials to designated sites for reuse or final disposal as soon as possible;</li> <li>- Collect and transport excavated soil out of construction sites within 24 hours. Dredged materials must be transported away from temporary disposal sites as soon as they are dry sufficiently;</li> <li>- Maintain vehicles and equipment, including oil replacement or lubrication, at designated areas only. Ensure that no chemicals, petrol, oil, or grease are leaked into the soil, drains or water sources. Use trays to hold rags and materials used in maintenance. Collect and dispose off wastes in accordance with hazardous waste management requirements.</li> </ul>	<ul style="list-style-type: none"> <li>- QCTĐHN 02:2014/BTNMT on Hanoi Technical Regulation on Industrial Wastewater</li> <li>- QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater;</li> <li>- QCVN 08-MT: 2015/BTNMT: National technical regulation on sufarewater</li> </ul>	Contractor	PMU, CSC
6. Flooding Risks	<ul style="list-style-type: none"> <li>- Check the existing drains within and surrounding the construction sites, improve them before levelling to ensure that rainwater can be drained properly;</li> <li>- Load construction materials and wastes at least 10 m far from any existing drainage ditches or water sources to minimize materials from entering the channels which may lead to sedimentation and blockage;</li> </ul>	-	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<ul style="list-style-type: none"> <li>- Clean up the existing drains regularly.</li> </ul>			
7. Erosion and Sedimentation	<ul style="list-style-type: none"> <li>- Strictly monitor excavation and backfilling operation, especially in the rainy season. Minimize disturbance to existing vegetation and trees. Reestablish vegetation covers in disturbed areas as soon as possible;</li> <li>- Transport wastes out of the sites within the shortest time possible but should not later than two days;</li> <li>- Install and maintain sedimentation traps within and/or surrounding centralized construction sites. Remove soil, stones and wastes periodically from traps to maintain their functions;</li> <li>- Gather materials and wastes neatly to limit the amount of materials being swept away by rainwater;</li> <li>- Carry out leveling and rolling after waste disposal at the disposal sites to minimize erosion;</li> <li>- Use Larsen sheet piles to protect walls/slopes when excavation is deeper than 2.5m. Reinforcing piles must be checked and maintained to ensure stability of excavated trenches and holes;</li> <li>- Level the disturbed areas to prevent erosion;</li> <li>- Strictly avoid disturbance or damages to the existing vegetation and trees.</li> </ul>	-	Contractor	PMU, CSC
8. Traffic safety management	<ul style="list-style-type: none"> <li>- Before construction, carry out consultations with local government and community and with traffic police.</li> <li>- 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.</li> <li>- Installation of lighting at night must be done if this is necessary to ensure safe traffic circulation.</li> <li>- Place signs around the construction areas to facilitate traffic movement, provide directions to various components of the works, and provide safety advice and warning.</li> <li>- Avoid material transportation for construction during rush hours.</li> <li>- Passageways for pedestrians and vehicles within and outside construction areas should be segregated and provide for easy, safe, and appropriate access. Signpost shall be installed appropriately in roads where necessary.</li> </ul>	<ul style="list-style-type: none"> <li>- Law on traffic and transport No. 23/2008/QH12;</li> <li>- Decree 46/2016/ND-CP on administrative penalty for traffic safety violation</li> <li>- Law on construction No. 50/2014/QH13;</li> <li>- Circular No. 22/2010/TT-BXD on regulation on labour safety in construction</li> </ul>	Contractor	PMU, CSC
9. Impacts on organism, aquatic system	<ul style="list-style-type: none"> <li>- Minimize disturbance caused by construction activities, especially at areas having green trees or vegetation. Do not use chemical substances to clear vegetation;</li> <li>- Do not pile up materials and wastes at vegetation covered areas.</li> <li>- Embank construction areas to limit impacts on water sources</li> <li>- Do not destroy vegetation and green trees outside construction areas</li> </ul>	Environment Protection Law 55/2014/QH13	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<ul style="list-style-type: none"> <li>- If possible, transplant green trees to other places before constructing pipelines on pavements</li> </ul>			
10. Impacts on landscapes	<ul style="list-style-type: none"> <li>- Place the signboard "Sorry to disturb" at the construction sites located in popular areas;</li> <li>- Keep the disturbed areas to be minimal; re-establish vegetation covers as soon as construction is completed;</li> <li>- All facilities are maintained in neat and tidy conditions and the sites shall be kept free of litter;</li> <li>- Fence the construction sites with solid materials if the construction sites are exposed to sensitive sites or exposed to tourist areas;</li> <li>- Do not load construction materials or wastes within 10 m from the gates of any public buildings or cultural structures such as government offices, temples, schools, etc.;</li> <li>- Collect and transport excavated materials and construction wastes to the disposal sites within 24 hours;</li> <li>- Clean up the construction sites daily if the sites are located in populated areas;</li> <li>- Wash vehicles periodically to prevent dust dispersion onto roads.</li> </ul>		Contractor	PMU, CSC
11. Interruption to the existing service infrastructures	<ul style="list-style-type: none"> <li>- Planned and unplanned interruptions to water, gas, power, internet services: the Contractor must undertake prior consultation and contingency planning with local authorities about the consequences of a particular service failure or disconnection.</li> <li>- Coordinate with relevant utility providers to establish appropriate construction schedules.</li> <li>- Provide information to affected households on working schedules as well as planned disruptions (at least 5 days in advance).</li> <li>- The contractor should ensure alternative water supply to affected residents in the event of disruptions lasting more than one day.</li> <li>- Any damages to existing utility systems of cable shall be reported to authorities and repaired as soon as possible.</li> </ul>	<ul style="list-style-type: none"> <li>- Decree No. 167/2013/ND-CP on administrative penalty for violations related to social security, order and safety issues</li> </ul>	Contractor	PMU, CSC
12. Social Impacts	<ul style="list-style-type: none"> <li>- The Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on construction safety.</li> <li>- Register workers with the local authorities for temporary residence.</li> <li>- Inform communities about construction plans at least two weeks before construction commencement.</li> <li>- In case that electricity and water supply is to be disrupted, the PMU must inform PAHs at least two days in advance.</li> <li>- Avoid construction at night time. Where this is inevitable, inform the nearby communities at least two days in advance.</li> </ul>	<ul style="list-style-type: none"> <li>- Decree No. 167/2013/ND-CP on administrative penalty for violations related to social security, order and safety issues</li> </ul>	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<ul style="list-style-type: none"> <li>- Construction should be performed within the shortest possible time, and carry out construction in various phases to minimize impacts on local communities.</li> <li>- Construction sites should be kept tidy and safe.</li> <li>- Wooden planks must be placed over open ditches to provide temporary access to roadside houses and shops.</li> <li>- Hire local workers to carry out simple tasks.</li> <li>- Instruct workers on environmental issues, safety and health before construction tasks are assigned.</li> <li>- Request workers to follow Code of conducts: <ul style="list-style-type: none"> <li>+ Use adequate safety gears provided</li> <li>+ Smoke designated places only. Do not litter the construction sites</li> <li>+ Do not store and use weapons and toxic substances;</li> <li>+ Do not cut the trees outside the construction sites, set fire, burning waste on-site (except invasive plants);</li> <li>+ Do not drink alcohols during working hours;</li> <li>+ Do not operate construction plants if not authorized</li> <li>+ Do not quarrelling, fighting, involving in gambling or social evils such as drug use, prostitution;</li> </ul> </li> <li>- Provide medical check-up for workers periodically. Do not employ people with highly infectious diseases shall.</li> </ul>			
13. Chance Find Procedures	<p>If the Contractor discovers archaeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:</p> <ul style="list-style-type: none"> <li>- Stop the construction activities in the area of the chance find;</li> <li>- Delineate the discovered site or area;</li> <li>- 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;</li> <li>- 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);</li> <li>- 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,</li> </ul>	<ul style="list-style-type: none"> <li>- Law on cultural heritage No. 28/2001/QH10;</li> <li>- Amended and supplemented Law on cultural heritage No. 32/2009/QH12;</li> <li>- Amended and supplemented Decree No. 98/2010/ND-CP</li> </ul>	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<p>social and economic values;</p> <ul style="list-style-type: none"> <li>- 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;</li> <li>- If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the subproject owner will need to make necessary design changes to accommodate the request and preserve the site;</li> <li>- Decisions concerning the management of the finding shall be communicated in writing by relevant authorities; and</li> <li>- Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage.</li> </ul>			
14. Health and Safety for workers and the public	<ul style="list-style-type: none"> <li>- Provide training in EHS to workers for raising their awareness of infectious diseases especially HIV/AIDS within 2 weeks prior to the commencement of packages for construction items lasting at least 6 months.</li> <li>- Provide training in first-aid skill and first-aid kit to workers and site engineer</li> <li>- Regularly exam worker's health to ensure occupational health</li> <li>- Provide workers with PPE such as masks, gloves, helmets, shoes/boots, goggles, safety belt, etc. and enforce wearing during working especially working at heights and in dangerous areas.</li> <li>- Limit or avoid working in extreme weather conditions, e.g. too hot, heavy rain, strong wind, and dense fog.</li> <li>- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required.</li> <li>- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hotwork on tanks or vessels that have contained flammable materials.</li> <li>- Safely install power lines at offices and in construction sites and do not lay connectors on the ground or water surface. Electric wires must be with plugs. Place outdoor electric panels in protection cabinets.</li> </ul>	<ul style="list-style-type: none"> <li>- Directive No. 02/2008/CT-BXD on labour safety and sanitation in construction agencies;</li> <li>- Circular No. 22/2010/TT-BXD on regulation on labour safety in construction</li> <li>- QCVN 18:2014/BXD: Technical regulation on safety in construction</li> </ul>	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<ul style="list-style-type: none"> <li>- Limit vehicle speed at 5km/hour at construction site and 20km/h on transportation routes across local resident areas.</li> <li>- Install fences, barriers for dangerous warning/prohibition sites around the construction area which show potential danger to the public.</li> <li>- 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.</li> <li>- Provide sufficient lighting when carrying out construction activities at night.</li> <li>- Locate noise-generating sources and concrete mixing plants far enough from and downwind of residential areas and camps.</li> <li>- Store fuels and chemicals in areas with impermeable ground, roofs, surrounding banks, and warning signs at least 50 m far from and downwind of residential areas and the camps.</li> <li>- Provide training in fire-fighting to workers and fire-extinguishers for the camps.</li> <li>- Prepare an emergency plan for chemical/fuel spill incident risk before construction begins.</li> <li>- Provide the camps with sufficient supplies of clean water, power, and sanitary facilities. There must be at least one toilet compartment for every 25 workers, with separate toilets for males and females. Workers' beds must be provided with mosquito nets so as to prevent dengue fever. Temporary tents will be unacceptable.</li> <li>- Clean camps, kitchens, baths, and toilets and sanitize regularly, and keep good sanitation. Provide dustbins and collect wastes daily from the camps. Clear drainage ditches around the camps periodically.</li> <li>- Stop all construction activities during rains and storms, or upon accidents or serious incidents.</li> </ul>			
15. Hazard Risk	<ul style="list-style-type: none"> <li>- Arrange electrical lines in a safe manner, do not place wires on the ground or without proper plugs. Protect electrical panel placed outside from weather and for safety;</li> <li>- Store oil, fuel and chemicals at least 10 m from workers' accommodation and Contractor's Site office. Store these hazardous materials on waterproof floor, bound and roofed. Place warning signs at such storage areas;</li> <li>- In case of accidental leakage or spillage of diesel/chemicals/chemical wastes, the Contractor(s) shall follow response procedures immediately:</li> <li>- The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Contractor(s), Supervision Engineer and PMU;</li> <li>- The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/leaked;</li> <li>- Should the accidents/incidents generate serious environmental pollution (e.g. spillage/leakage of toxic</li> </ul>	Law on labor safety and sanitation 84/2015/QH13	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<p>or chemicals, large scale spillage/leakage, or spillage/leakage into the nearby water bodies, the Contractor(s) shall immediately inform the PMU;</p> <ul style="list-style-type: none"> <li>- In such cases, the Contractor(s) shall take immediate actions to stop the spillage/leakage and divert the spilled/leaked liquid to nearby non-sensitive areas;</li> <li>- The Contractor(s) shall arrange maintenance staffs with appropriate protective clothing to clean up the chemicals/chemical wastes. This may be achieved through soaking with sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground);</li> <li>- Depending on the nature and extent of the chemical spill, site evacuation may be necessary;</li> <li>- Do not flush spilled chemicals to local drainage systems. Instead, sawdust or sandbags used for clean-up and removal of contaminated soil shall be disposed off by following the stipulated procedures for chemical waste handling and disposal;</li> <li>- The Contractor(s) shall prepare a report on the incident detailing the accident, actions taken, any pollution problems and recommended measures to prevent similar accidents in future. The incident report shall then be submitted to the Supervision Engineer and the PMU for review and record. The incident report shall also be submitted to DONRE, if required;</li> <li>- In case of accident, the Contractor should immediately cease the execution, provide first aids for involved victims and move them to the nearest health center, then report to the Supervisor and the Investor.</li> </ul>			
16. Management of stockpiles and borrow pits	<ul style="list-style-type: none"> <li>- Large-scale borrow pits or stockpiles will need site-specific measures that go beyond those in this ECOP.</li> <li>- All locations to be used must be previously identified in the approved construction specifications.</li> <li>- An open ditch shall be built around the stockpile site to intercept wastewater.</li> <li>- Stockpile topsoil when first opening a borrow pit and use it later to restore the area to near natural conditions.</li> <li>- If the need for new sites arises during construction, they must be pre-approved by the Construction Engineer.</li> <li>- If access roads are needed, they must have been considered in the environmental assessment.</li> </ul>		Contractor	PMU, CSC
17. Communication with local communities	<ul style="list-style-type: none"> <li>- 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).</li> </ul>	- Decree No. 167/2013/ND-CP on administrative penalty for violations related	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementation	Supervision
	<ul style="list-style-type: none"> <li>- Copies in Vietnamese of this ECOP and of other relevant environmental safeguard documents shall be made available to local communities and to workers at the site.</li> <li>- 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.</li> <li>- Disseminate subproject information to affected parties (for example local authority, enterprises and affected households, etc) through community meetings before construction commencement.</li> <li>- Provide a community relations contact from whom interested parties can receive information on site activities, subproject status and subproject implementation results.</li> <li>- Provide all information, especially technical findings, in a language that is understandable to the general public and in a form of useful to interested citizens and elected officials through the preparation of fact sheets and news release, when major findings become available during subproject implementation phase.</li> <li>- Monitor community concerns and information requirements as the subproject progresses.</li> <li>- Respond to telephone inquiries and written correspondence in a timely and accurate manner.</li> <li>- Inform local residents about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition, as appropriate.</li> <li>- Limit construction activities at night. When necessary ensure that night work is carefully scheduled and the community is properly informed so they can take necessary measures.</li> <li>- At least five days in advance of any service interruption (including water, electricity, telephone, bus routes) the community must be advised through postings at the subproject site, at bus stops, and in affected homes/businesses.</li> <li>- Provide technical documents and drawings to local authority and community, especially a sketch of the construction area and the ESMP of the construction site.</li> <li>- Notification boards shall be erected at all construction sites providing information about the subproject, as well as contact information about the site managers, environmental staffs, health and safety staffs, telephone numbers and other contact information so that any affected people can have the channel to voice their concerns and suggestions</li> </ul>	to social security, order and safety issues		
18. Chance find procedures	<p>If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:</p> <ul style="list-style-type: none"> <li>- Stop the construction activities in the area of the chance find;</li> </ul>	<ul style="list-style-type: none"> <li>- Law on Cultural Heritage (2002)</li> <li>- Law on Cultural</li> </ul>	Contractor	PMU, CSC

Environmental and social issues	Mitigation measures	Applicable the GoV's regulations	Responsibility	
			Implementa-tion	Supervi-sion
	<ul style="list-style-type: none"> <li>- Delineate the discovered site or area;</li> <li>- 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, Sport and Tourism takes over;</li> <li>- 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);</li> <li>- 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;</li> <li>- 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;</li> <li>- If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Subproject's Owner will need to make necessary design changes to accommodate the request and preserve the site;</li> <li>- Decisions concerning the management of the finding shall be communicated in writing by relevant authorities;</li> <li>- Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage.</li> </ul>	<p>Heritage (2009) for supplementary and reformation</p> <ul style="list-style-type: none"> <li>- Decree No. 98/2010/ND-CP for supplementary and reformation</li> </ul>		

## B. Site-Specific impacts in the construction phase

Table 17 presents site-specific impacts and mitigation measures that are not addressed through the general measures in the ECOPs, because the severity or site-specific nature of the impacts and mitigation measures required.

**Table 17. Site-specific mitigation measures in the construction phase**

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
Impacts by dredging sediment in aquaculture ponds	<p>As evaluated in Part 4, the dredged sludge are from the aquaculture ponds in the subproject areas of the Veterinary Faculty, Foreign Language Faculty, Physical Education Center buildings (in Component 1) and the connecting road from the central roundabout to Aquaculture Faculty building. As the sludge is accumulated in anaerobic environment, when dredged it will release such gases as CH<sub>4</sub>, H<sub>2</sub>S etc. to the environment. Although the assessment shows that this impact is minimal, the contractors should take following mitigation measures:</p> <ul style="list-style-type: none"> <li>- Before dredging, the contractor has to prepare a detailed construction plan which elaborates dredging method, transport plan and routes to the waste disposal site.</li> <li>- During dredging, if bad smell from the sludge is detected, the contractor should immediately spray the biological compounds to deodorize, while minimizing the exposure of workers and citizens to the dredging site.</li> <li>- During dredging, the contractor should reuse dredged material for backfilling as and where appropriate. Only unusable material (structurally unqualified) should be transported to the planned waste disposal site.</li> <li>- The dredged sludge is usually very wet if it is transported immediately, water would leak along the transport route, affecting the environment. Therefore, the contractor should pile up dredged material inside the dredging pond for drying before transporting to the disposal site.</li> <li>- The current test results meet the technical standard QCVN 43:2012/BTNMT on sediment quality, therefore, the dredged sludge can be disposed together with organic excavated soil at 2 sites planned for the subproject.</li> <li>- The construction activities should be conducted off rainy season to minimize drainage work and prevent local flooding</li> </ul>	Contractor	PMU, CSC
Impact on the on-field agriculture experiment	<ul style="list-style-type: none"> <li>- Buildings of the Lecture Hall, Faculty of Engineering, Faculty of Food Technology, Faculty of Environment, Faculty of Bio-technology, and Institutional and Policy Research are located in the areas which are being used as experiment sites for crops and fruit trees. Therefore, to minimize the impacts on field experiment of the surrounding areas outside the construction sites, the contractors should take the following mitigation measures:</li> <li>- Work only within the subproject area</li> <li>- Contractors are prohibited to gather waste materials, construction materials as well as the equipment and machinery outside the construction site, affecting the soil environment as well as other experiment activities.</li> </ul>	Contractor	PMU, CSC

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
	<ul style="list-style-type: none"> <li>- Before construction, the contractors have to survey thoroughly inside and outside the subproject area to detect drainage canal system. If any and it may be leveled and there may be impacts on the drainage capacity of the surrounding area, the contractor need to prepare a plan to build a replacement drainage system to avoid negative impacts on local drainage capacity</li> <li>- During construction, if the local drainage system is affected, the contractors should take appropriate measures for flow widening and diversion to ensure drainage capacity.</li> </ul> <p>The outdoor construction works such as excavating organic soil layer, transporting organic soil, transporting backfill soil during the construction phase should be conducted off the rainy season to minimize the drainage work and prevent local flooding.</p>		
Impacts on learning and researching activities of staffs and students of the University	<p>During construction of buildings of Engineering Faculty, Bio-tech Faculty, Environment Faculty, and the Lecture Hall or the road connecting the Agronomy Faculty to the collection road, the construction activities may affect the study and research environment of the faculties and students. Therefore, the contractors need to implement the following measures:</p> <ul style="list-style-type: none"> <li>- Inform all VNUA staffs and students of construction schedule and place so they can arrange their study and research schedules accordingly.</li> <li>- The contractors need to coordinate closely with the University to know the study and research schedules in order to arrange the operation schedule of the noisy machinery accordingly.</li> <li>- Minimize the operation of machinery during class and lab sessions, all machinery at rest for more than 2 minutes must be turned off.</li> <li>- The transport schedule of materials must avoid the starting and ending times of classes.</li> <li>- The construction and material transporting equipment can only operate according to the plan. The machineries are prohibited to roam around.</li> <li>- All equipment and machinery on site must be maintained regularly. Do not use outdated machinery without proper registration because the amount of emission and noise will exceed the limits;</li> <li>- Minimize the operation of numerous equipment at the same time to reduce the compounded impact from them</li> <li>- Do not set up concrete mixing station in the subproject area;</li> <li>- Do not store equipment and material outside the construction site, the storage area needs to be far from the students' and faculties' classroom and research areas</li> <li>- It's prohibited for the transports to be overloaded, dropping material on the road. When in transit, materials must be</li> </ul>	Contractor	PMU, CSC

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
	<p>covered, preventing dust and material from spreading to the environment</p> <ul style="list-style-type: none"> <li>- On the solid waste transport route, when passing any residential area or within the school boundaries, there must be a speed limit and a ban on air horn.</li> <li>- Around each construction site, the contractors must have solid fencing (possibly tin) with minimum height of 2m and a gate.</li> <li>- The contractors must manage their workers strictly, workers are prohibited from affecting the students' classroom and research activities.</li> <li>- The worker camps must be far from the students' routes, classrooms, and research areas.</li> <li>- All contractors must regularly clean up around the construction sites as well as the transport routes to not affect the landscape and the students' study environment.</li> <li>- The construction sites and material transport routes must be watered regularly, especially on dry-weather days.</li> </ul> <p>When the buildings reach certain heights, it's mandatory to use dust nets around the scaffold areas from the ground floor to the highest floor of the buildings;</p>		
<p>The risks of labor accidents in the construction site to the University's staffs and students</p>	<p>Because the construction sites are located within the University, where there are a lot of staffs and students working and learning, especially the Engineering Faculty building. Therefore, safety during construction must be constantly monitored. To minimize the risks, the subproject must implement the following mitigation measures at all sites:</p> <ul style="list-style-type: none"> <li>- Before construction, the contractors must plan to use methods that ensure the technical, design, and safety requirements.</li> <li>- Around each construction site, the contractors must have solid fencing (possibly tin) with minimum height of 2m and a gate to ensure construction safety;</li> <li>- When the buildings reach certain heights, it's mandatory to use safety nets for dust and falling objects. The nets must be installed around the scaffold areas from the ground floor to the highest floor of the buildings;</li> <li>- Do not store equipment and material outside the construction sites, the storage areas need to be far from the classrooms and research areas.</li> <li>- The construction sites must have numerous safety and warning signs.</li> <li>- The construction unit must have people on watch, especially when there are vehicles entering and exiting the construction sites.</li> <li>- It's strictly prohibited to scatter materials and wastes to the environment, affecting traffic safety in the area.</li> </ul>	<p>Contractor</p>	<p>PMU, CSC</p>

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
	<ul style="list-style-type: none"> <li>- At night, the construction sites must have adequate lighting and warning lights.</li> <li>- The contractors must ensure that all workers have had training on labor safety and sanitation</li> <li>- All workers must have full safety equipment and they must use all of the safety equipment during work.</li> <li>- The construction monitoring consultants must be present regularly and monitor the contractors complying with the construction techniques, labor safety and sanitation requirements</li> </ul>		
Fall Risks due to working at heights	<ul style="list-style-type: none"> <li>- Workers are responsible to wear or use at all the times of any protective equipment or clothing which provided by the constructors.</li> <li>- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area;</li> <li>- Proper use of ladders and scaffolds by trained employees;</li> <li>- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines;</li> <li>- Appropriate training in use, serviceability, and integrity of the necessary PPE; and</li> <li>- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall</li> <li>- Constructors should ensure that the training program is provided for all workers in construction work and make sure them particular attention towards to the safety issues</li> <li>- Providing instrument for new workers, implement daily toolbox checking, regular training to management level and supervision team regarding safety awareness at construction site, safety introduction awareness campaign site monthly meeting</li> <li>-</li> <li>- Regular safety inspection</li> <li>-</li> </ul>	Contractor	PMU, CSC
Traffic safety risks within the University	<p>For the traffic activities in the subproject area, the following mitigation measures:</p> <ul style="list-style-type: none"> <li>- The contractor must prepare a detailed plan and method to transport waste material, leveling and constructing materials within the university, routes to the disposal site, minimizing the impacts on the university traffic.</li> <li>- The transport routes need to avoid the busy areas, especially the central road and road connecting the departments, lecture halls/students' research and learning areas. In the cases where it's unavoidable, it's prohibited to transport</li> </ul>	Contractor	PMU, CSC

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
	<p>during the starting and ending time of classes. These routes must be cleaned to not affect the students' traffic activities.</p> <ul style="list-style-type: none"> <li>- The transport of equipment and material needs to avoid busy periods, especially the classes' starting and ending times.</li> <li>- All transport routes must have traffic safety and speed limit signs for all (including the university's staffs and students). For the construction machinery and material transport vehicles, the speed limit is 5km/h within the university.</li> <li>- All vehicles exiting the construction sites (including non-material-transport vehicles) must be wheel-cleaned before exiting the sites.</li> <li>- The transport routes inside the university must be lit at night, especially the routes with many students crossing.</li> <li>- The contractors must regularly send people to sweep and clean (at least 3 times a day: in the morning, afternoon, and at night) along the material transport routes inside the university and water the roads during dry-weather day.</li> </ul> <p>Send people to direct traffic at busy points when there are material transport vehicles or machineries passing, especially at the construction site gates.</p>		
Traffic safety risks outside the University	<p>Beside the traffic safety inside the university, traffic safety outside the university also needs to be monitored. With the transport routes for construction material being determined to include the routes from the University to Ngo Xuan Quang road, to the intersection with the Hanoi - Hai Phong railway, national highway 5 to Co Bi road then up to the Duong river dyke road to the material site in Loi village, Dang Xa commune. During the material transport, the following mitigation methods must be implemented:</p> <ul style="list-style-type: none"> <li>- The contractors must prepare a thoughtful transport plan before construction to minimize traffic congestion.</li> <li>- Notice the Trau Quy town government and citizens along Ngo Xuan Quang road on the material transport plan.</li> <li>- Organize the incoming and outgoing traffic, avoid narrow streets to minimize traffic congestion. Do not transport during rush hours, classes' starting and ending times.</li> <li>- Because the route passes through the Hanoi - Hai Phong railway, the contractors need to coordinate with the railway management unit to review the train schedules, avoid transport during these hours to minimize traffic congestion on Ngo Xuan Quang road and National Highway 5.</li> <li>- The drivers must have the necessary licenses. Regularly remind the drivers to comply with the traffic laws, not to speed or break traffic laws and have measures such as pay cut if they do. In particular, at railway crossings, it's strictly prohibited for the drivers to cross when there are warnings of incoming trains.</li> </ul>	Contractor	PMU, CSC

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
	<ul style="list-style-type: none"> <li>- The drivers must not use any stimulants, alcohol at work, and must not work overtime.</li> <li>- Send staffs to direct traffic when there's traffic congestion on Ngo Xuan Quang road if there's subproject transport activities, especially the intersection between Ngo Xuan Quang road and Alley 65 and the University gate.</li> <li>- For the transport equipment and vehicles, maintenance must be implemented regularly and the contractors must ensure that all vehicles meet the traffic safety requirements.</li> <li>- All vehicles are strictly prohibited to be overloaded, before every trip, the material in transport must be covered completely</li> <li>- Regularly send staffs to monitor traffic along the transport route, if any material scatters on the road, the contractor has to send staffs to clean up immediately.</li> </ul> <p>At the "sensitive" spots along the transport route, the mitigation measures will be proposed separately in the table below.</p>		
The risk of subsidence, damaging the existing works	<ul style="list-style-type: none"> <li>- Prior to the construction, the construction contractors, supervision consultants and PMU (VNUA) should coordinate with (relevant) local authorities and residents to examine the current status of the surrounding works, especially the houses at the beginning of Lane 65, Ngo Xuan Quang Street, the village road from Ngo Xuan Quang street to the construction area of Center of Life Sciences Research,... the existing transport routes that will be used for transport of construction materials, and other existing works surrounding the construction sites to form the basis of assessment and compensation (if there are any damages caused by the Subproject) and proper preparation of the construction plan.</li> <li>- All of contractors are required to prepare their construction plans, plans to utilize construction equipment and transport vehicles to avoid the present of multiple construction equipment at the same time to minimize the impact on surrounding buildings.</li> <li>- All contractors are strictly prohibited from gathering construction equipment and vehicles outside the subproject area and especially on the road from Ngo Xuan Quang street to Faculty of Animal Husbandry (Lane 65), the village road from Ngo Xuan Quang street temporary market to the construction site, and drainage canal road near the construction sites of lecture hall and Environment Faculty building...</li> <li>- During construction, contractors are required to manage construction materials properly to not leak them outside the construction sites and affect the area, especially the irrigation canals.</li> </ul> <p>Restricting the construction and material transport on rainy days to minimize the damages to surrounding buildings, especially the transport routes...</p>	Contractor	PMU, CSC

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
Increase the possibilities of local flooding around the construction area	<p>The filling of some lakes and ponds as well as improving the foundation levels of the construction works may increase the risk of flooding for the surrounding areas. To limit this risk, contractors are required to follow:</p> <ul style="list-style-type: none"> <li>- During construction, if the Subproject affects the current drainage system, contractors must take measures to widen or divert the flows to ensure the water drainage of the area.</li> <li>- Prior to construction, contractors must examine the current state of the area. If there are any drainage systems in the ground clearance areas, they must be replaced with alternative ones to ensure the surrounding drainage capacity.</li> <li>- All contractors are strictly prohibited from gathering solid wastes, waste materials and construction materials near the water drainage system of the area. In addition, contractors are required to dredge the drainage systems around the construction sites to clear the water flows.</li> <li>- During dredging and excavation for construction, contractors are required to utilize materials for ground levelling to minimize the transport of materials.</li> <li>- All contractors are strictly prohibited from discharging waste materials outside at the predetermined locations.</li> <li>- The current terrain of VNUA is considered lower than surrounding areas. Therefore, VNUA will collect and temporarily put these waste materials into the soil dump to be used for backfilling the low positions in VNUA campus to plant trees, instead of discharging them into construction waste dumps.</li> <li>- Minimize the construction, gathering materials and equipment on rainy days to reduce the risk of damage the drainage system, and to limit materials washouts and affecting local drainage.</li> </ul>	Contractor	PMU, CSC
Impacts of waste construction material dumps	<p>As mentioned in Part 4, the Subproject is expected to have 3 dumpsites inside VNUA, near the Cau Bay river; of which: 2 dumpsites for organic material are planned to be an Experimental Tree Plantation Area of VNUA, 1 dumpsite for inorganic materials is planned to be parking lots in the future. It can be observed that the placement of these dumps is entirely reasonable. However, these dumps are inside the VNUA campus with a lot of study and research activities; therefore, these mitigation measures are also needed to be applied:- Each dump must have fencing to limit the spread of dust and minimize the impact on overall appearance of the study and research area. In addition, this measure also prevents waste materials washouts into Cay Bay river whenever there's rain.</p> <ul style="list-style-type: none"> <li>- Regarding 2 dumpsites for organic materials: As evaluated, organic materials including dredged mud, sediment may cause odor dispersion; therefore, contractors should immediately use probiotics to deodorize if there is any odor dispersion.</li> <li>- Regarding the dumpsite for inorganic materials: Although this dumpsite is located inside VNUA, it is quite close to the An Lac residential area (the distance from the dumpsite and the nearest house is about 600m). Therefore, without</li> </ul>	Contractor	PMU, CSC

Site-specific impacts issues	Specific mitigation measures	Responsibility for implementation	Responsibility for Supervision
	<p>proper management, this area will likely become a garbage dump for residents. VNUA and contractors need to have suitable management measures.</p> <ul style="list-style-type: none"> <li>- Regarding all dumpsites, during discharging, all materials must be compacted and levelled as soon as they are discharged into the dumpsites to limit the spread of dust and affecting the surrounding environment.</li> </ul> <p>After disposal, if these dumpsites are not constructed yet, contractors must carry out soil renovation by compaction, removal of surrounding fences and planting trees.</p>		

**Mitigation measures for impact on the sensitive receptors**

The construction process of Component 1, 2 and 3 will be likely to affect part of these works' activities, including the people's safety and access to these places; smoke and dust as nuisance to residents and cultural and religious works that can be affected by the subproject operations are listed in Table 18.

**Table 18. Impact mitigation measures on sensitive receptors at the construction site**

Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	Supervised
 <p>Drainage ditch near the construction site of Faculty of Environment and Biological Technology (about 30m)</p>	<ul style="list-style-type: none"> <li>- Construction materials might be washed into ditches.</li> <li>- Ditches might be eroded and damaged if transporting materials or construction equipment approach ditches.</li> <li>- Potential risk of water pollution.</li> <li>- Potential risk of local flooding.</li> </ul>	<ul style="list-style-type: none"> <li>- Examine the initial status.</li> <li>- Construction materials, waste materials and construction equipment must be gathered at least 30m away from the ditches.</li> <li>- Periodically dredge mud and sediment at the bottom of ditches to facilitate water drainage.</li> <li>- Prior to completion of construction, contractors are required to dredge all ditches and repair any damaged embankment during construction of the Subproject.</li> <li>- Construction workers are strictly prohibited from throwing wastes into or near ditches.</li> </ul>	Contractor	PMU, CSC

Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	Supervised
 <p>Lecture rooms, 30m from the construction site of Faculty of Mechanical Engineering</p> <p>5-floor lecture building, 100m from construction sites of Faculty of Environment, Biological Technology</p>  <p>Nguyen Dang lecture building, 100m from the construction site of Faculty of B&amp;T</p>	<ul style="list-style-type: none"> <li>- Dust, noise and emission pollution.</li> <li>- Potential risk of labor accidents.</li> <li>- Impacts on studying activities of students.</li> <li>- Risk of impacts on traffic safety for students.</li> <li>- Potential risk of damaging buildings during operation of equipment, especially the pile driver.</li> </ul>	<ul style="list-style-type: none"> <li>- Construction equipment with loud noise will not work during class hours.</li> <li>- Gathering construction equipment and materials near lecture buildings is strictly prohibited.</li> <li>- Minimize simultaneous operation of multiple equipment on site to minimize the synergetic impacts of equipment.</li> <li>- Install 2m tall or more corrugated metal fences to separate the construction sites and the surrounding areas.</li> <li>- Material/Dustproof nets are required from the base to the highest point of the building.</li> <li>- Install safety warning signs around the construction site, especially in areas where students often pass through.</li> <li>- Regular humidify the construction site and surrounding areas.</li> <li>- Traffic regulators are necessary when means of transport enter and leave the construction sites.</li> </ul>	Contractor	PMU, CSC
 <p>The current status of the road connecting Ngo Xuan Quang road and Faculty of Husbandry</p> <p>Experimental fishery pond in the construction site of Faculty of Veterinary Science</p> 	<ul style="list-style-type: none"> <li>- Dust, noise and emission pollution.</li> <li>- Potential risk of labor accidents.</li> <li>- Impacts on studying activities of students, working activities of officers.</li> <li>- Risk of impacts on traffic safety.</li> <li>- Potential risk of damaging buildings during operation of equipment.</li> </ul>	<ul style="list-style-type: none"> <li>- Construction equipment with loud noise will not operate near residential areas at night.</li> <li>- Gathering construction equipment and materials outside the construction sites are strictly prohibited.</li> <li>- Minimize simultaneous operation of multiple equipment on site to minimize the synergetic impacts of equipment.</li> <li>- Install 2m tall or more corrugated metal fences to separate the construction sites and the surrounding areas.</li> <li>- Material/Dustproof nets are required from the base to the highest point of the building.</li> <li>- Install safety warning signs around the construction site, especially at the entrances of sites, at listed sensitive areas, and at the beginning and the end of the road.</li> <li>- Regular humidify the construction site and surrounding</li> </ul>	Contractor	PMU, CSC

Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	Supervised
<p>Veterinary Hospital, 40m from the road building</p>  <p>Faculty of Fishery, 40m from the road building</p>  <p>Dormitory of Center of Agricultural Machinery Expertise, 100m from the road building</p> <p>Vietnam-Japan Plan Variety Research Center, 50m from the road building</p>		<p>areas.</p> <ul style="list-style-type: none"> <li>- Traffic regulators are necessary when means of transport enter and leave the construction sites.</li> </ul>		
 <p>Experimental Agricultural Cultivation Area in the construction site of Center of Agricultural and Life Sciences Research</p>  <p>Experimental Agricultural Cultivation Area in the construction site of the main building</p>	<ul style="list-style-type: none"> <li>- Impact on experimental activities in cultivation fields.</li> <li>- Impact on drainage of the area.</li> <li>- Increase risk of flooding.</li> <li>- Dust and emissions affect the environment and growth of plants.</li> </ul>	<ul style="list-style-type: none"> <li>- Appropriate widen and diversion measures are required to ensure drainage of the area.</li> <li>- Contractors are prohibited strictly from gathering trash, waste materials and construction materials near drainage systems of the area.</li> <li>- Drainage systems around the construction site are regularly dredged to ensure that the water flows are clear.</li> <li>- Contractors are strictly prohibited from discharging waste materials not at the prescribed places.</li> <li>- Minimize construction, gathering materials and equipment on rainy days.</li> <li>- The construction sites must be fenced around to avoid spreading or washing soil, sand and materials outside.</li> </ul>	Contractor	PMU, CSC
 <p>The road along VNUA, near Cau Bay river, and</p>	<ul style="list-style-type: none"> <li>- The road might be degraded and damaged.</li> <li>- Construction materials might be dropped along the road and affect traffic activities there.</li> <li>- Risk of negative impacts on traffic safety.</li> </ul>	<ul style="list-style-type: none"> <li>- Overloaded vehicles are strictly prohibited on the road.</li> <li>- Materials must be covered and secured from dropping/spillage/leakage on the road.</li> <li>- Limit the speed of vehicles on the road.</li> <li>- Workers clean the road daily.</li> </ul>	Contractor	PMU, CSC

Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	Supervised
also the road for material transport				

**Table 19. Measures to mitigate impacts of material transport activities on sensitive receptors at construction**

Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	Supervised by
 <p>VNUA's gate on Ngo Xuan Quang street The central road (from the gate)</p>  <p>Business establishments along the central road</p>  <p>Hapromart supermarket on Ngo Xuan Quang street, near Highway No.5</p>	<ul style="list-style-type: none"> <li>- Health effects due to dust, noise and emission pollution.</li> <li>- Impacts on studying activities of students, working activities of officers.</li> <li>- Risk of impacts on traffic safety.</li> <li>- Potential risk of damaging buildings.</li> <li>- Temporary impact on business due to reduction in regular customers</li> </ul>	<ul style="list-style-type: none"> <li>- Contractors have to prepare appropriate material transport plans, avoiding rush hour.</li> <li>- Overloaded vehicles are strictly prohibited on the road.</li> <li>- Materials must be covered and secured from dropping/spillage/leakage on the road.</li> <li>- Drivers have to be trained properly with legitimate driving license.</li> <li>- Vehicle horns are strictly prohibited at some prescribed places.</li> <li>- Contractors have to appoint staffs to regulate traffic if they transport materials in rush hour or when there is any risk of traffic jams.</li> <li>- Regularly appoint staffs to supervise along the road.</li> <li>- Regularly humidify the road.</li> <li>- Staff has to clean up the road immediately if construction materials are dropped on the road.</li> <li>- Reckless driving is strictly prohibited to not affect traffic activities of residents.</li> <li>- Vehicles have to be maintained periodically to minimize noise and emissions.</li> <li>- Discussing with affected traders on support methods for loss of income if any</li> </ul>	Contractor	PMU, CSC
 <p>Cuu Viet residential</p>  <p>Cuu Viet residential</p>  <p>Residential area along</p>  <p>Trau Quy market</p>	<ul style="list-style-type: none"> <li>- Dust, emissions, noise from material transport activities.</li> <li>- Impact on residential activities.</li> <li>- Potential risks of traffic accidents.</li> <li>- Potential risks of traffic jams.</li> <li>- Degrade roads, streets.</li> </ul>	<ul style="list-style-type: none"> <li>- Contractors have to prepare appropriate material transport plans, avoiding rush hour.</li> <li>- Overloaded vehicles are strictly prohibited on the road.</li> <li>- Materials must be covered and secured from dropping/spillage/leakage on the road.</li> <li>- Drivers have to be trained properly with legitimate driving license</li> <li>- Vehicle horns are strictly prohibited at some prescribed places.</li> <li>- Contractors have to appoint staffs to regulate traffic if they transport materials in rush hour or when there is any risk of traffic jams.</li> <li>- Regularly appoint staffs to supervise along the road.</li> <li>- Regularly humidify the road.</li> <li>- Staff has to clean up the road immediately if construction materials are dropped</li> </ul>	Contractor	PMU, CSC

Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	Supervised by
<p>Ngo Xuan Quang street</p>  <p>Residential area along Co Bi road      Duong River dyke road mining area</p>		<p>on the road.</p> <ul style="list-style-type: none"> <li>- Speeding and reckless driving are strictly prohibited to not affect traffic activities of residents.</li> <li>- Vehicles have to be maintained periodically to minimize noise and emissions.</li> </ul>		
 <p>The railway crossing Ngo Xuan Quang street at the intersection with Highway No.5</p>	<ul style="list-style-type: none"> <li>- Potential risks of traffic accidents on railways.</li> <li>- Potential risks of traffic jams.</li> </ul>	<ul style="list-style-type: none"> <li>- Implement all measures for residential areas mentioned above.</li> <li>- Coordinate with the railway management unit to acknowledge the train schedule to prepare appropriate transport plans for the Subproject.</li> <li>- Minimize transport when trains pass through.</li> <li>- Staffs have to clean up the road immediately if construction materials are dropped on rails.</li> <li>- Enhance workers' awareness of obeying the traffic directions, especially railway signals.</li> <li>- Reckless driving is strictly prohibited, especially at railway crossings.</li> <li>- Contractors/PMU has to coordinate with functional authorities to solve rail accidents caused by material transport activities of the Subproject.</li> </ul>	Contractor	PMU, CSC

Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	Supervised by
 <p>Cao Ba Quat high school on Co Bi road    Co Bi kindergarten on Co Bi road</p>  <p>Co Bi health clinic on Co Bi road</p>	<ul style="list-style-type: none"> <li>- Increase dust, emissions, noise.</li> <li>- Potential risk of traffic accidents at school and clinic gates.</li> <li>- Interfere with school attendance of students as well as picking up children of parents.</li> <li>- Degrade roads.</li> </ul>	<ul style="list-style-type: none"> <li>- Inform schools of material transport plans prior to construction at least 1 month.</li> <li>- Contractors have to prepare appropriate material transport plans, avoiding starting and finishing times of schooldays.</li> <li>- Overloaded vehicles are strictly prohibited.</li> <li>- Materials must be covered and secured from dropping/spillage/leakage.</li> <li>- Vehicle horns are strictly prohibited at some prescribed places.</li> <li>- Parking of transport vehicles is strictly prohibited in front of school gates and within a radius of 200m.</li> <li>- Regularly humidify along the road.</li> <li>- Clean up immediately if construction materials are dropped on the road.</li> <li>- Inform Co Bi clinic of material transport plans at least 1 month prior to construction.</li> <li>- Minimize material transport activities on immunization days.</li> </ul>	Contractor	PMU, CSC

### 5.1.3. Operation phase

#### a. Wastewater collection and treatment

##### *Sewage system*

###### *- Domestic sewers*

Wastewater will be collected from sinks and floor (“grey” water) by separated sewers (u.PVC pipes) to the sewage system together with septic tank wastewater then to the treatment plant together with wastewater from labs and practice rooms.

Wastewater from toilets (“black” water) will be collected by separated sewers (u.PVC pipes) to underground septic tank. After preliminary treatment, it will go along with “grey” water to the treatment plant to be properly treated together with labs’ wastewater.

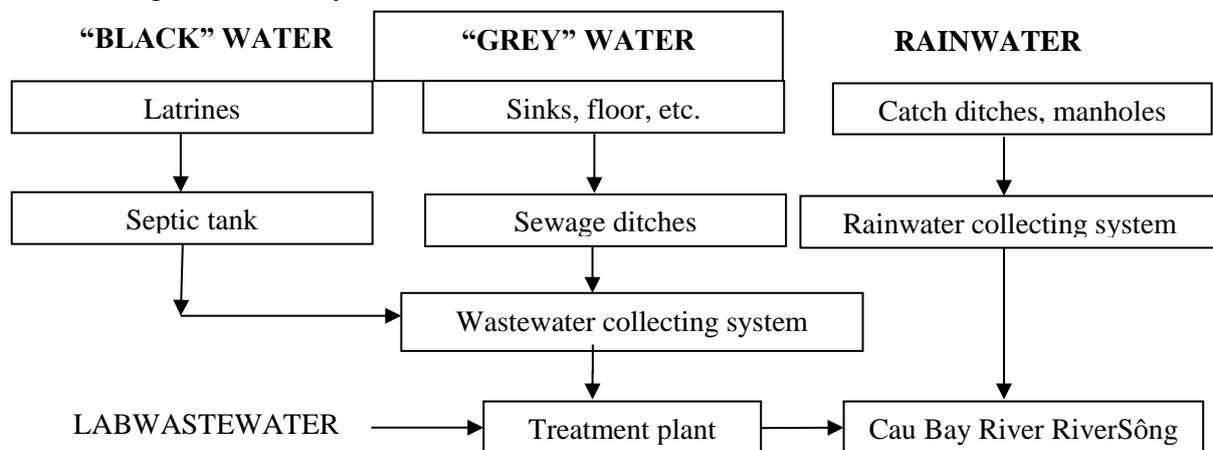
Wastewater from labs/practice rooms/plant room containing chemicals and hazardous substances will be collected by other separated sewers and conveyed to the treatment plant for multi-stage treatment before merging with grey water and septic tank wastewater.

###### *- External sewage system*

The system is designed to consist of following components:

- Rainwater drainage system: Designed to collect all local rainwater and discharge directly to Cau Bay River.
- “Grey” water and septic tank wastewater of each building will join in one sewer system to the treatment plant and merge with labs’ wastewater.
- Wastewater collected from labs/practice rooms/experiment rooms will flow along the separated pipeline to the treatment plant.

Treated wastewater is ensured to meet Category B of QCTĐHN 02:2014/BTNMT on Hanoi Technical Regulation on Industrial Wastewater before being conveyed to the sewage network and discharged to Cau Bay River.



**Figure 18. Diagram of sewage system**

##### *Wastewater collecting and treatment*

As planned by VNUA, a water-supply system and centralized sewage treatment system with capacity of 450 m<sup>3</sup>/day using AAO treatment technology will be built to reach the goals of construction, renovation and completion of VNUA’s wastewater treatment system in Trau Quy Town, Gia Lam District towards modern, synchronous, green, clean and beautiful environment. The centralized sewage treatment system is another VNUA project that has been approved by MARD’s Decision no. 4257/QĐ-BNN-KH dated 19/10/2016 approving **the investment project preparation of Construction and renovation of wastewater treatment system at VNUA**. With the total investment cost of 19 billion VND financed by GoV’s budget, the project is expected to launch by 2017 and brought into operation by Quarter 4 of 2018. When the buildings

to be constructed will operate, the treatment plant will have already been running to handle all domestic and laboratory/practice room wastewater. The projected position is inside VNUA's campus, adjacent to Hanoi- Hai Phong Highway and Cau Bay River.



**Figure 19. Location of the proposed wastewater treatment plant**

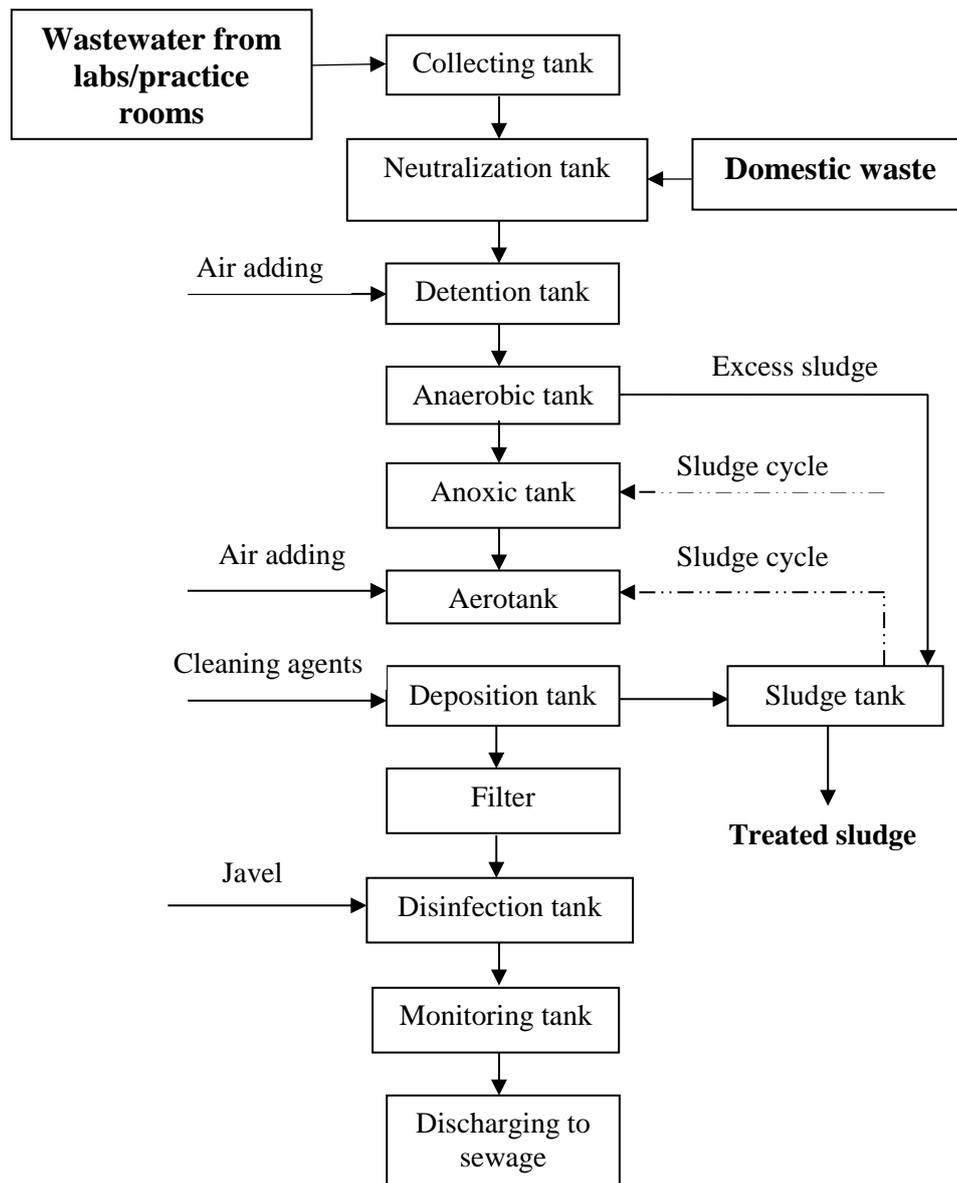
Treated wastewater is ensured to meet Category B of QCTĐHN 02:2014/BTNMT on Hanoi Technical Regulation on Industrial Wastewater before being conveyed to the sewage network and discharged to Cau Bay River.

#### ***Laboratory wastewater***

By design, most laboratories will be located at the buildings of Center of Agricultural Research and Life Sciences as well as Faculty of Agricultural Mechanical Engineering, Faculty of Biological technology, Faculty of Environmental technology, Faculty of Veterinary science, Food technology and Post-harvest technology. As evaluated in Part 4, laboratory wastewater carries potential risks to the environment, ecosystem and health if not properly collected and treated. In design of these buildings, wastewater will be segregated and collected separately before being conveyed to the treatment plant and merged with domestic wastewater using AAO treatment technology, ensuring Category B of QCTĐHN 02:2014/BTNMT on Hanoi Technical Regulation on Industrial Wastewater before discharging (Figure 20)

According to the design of the project "***Construction and renovation of VNUA wastewater treatment system***" the wastewater collection and treatment system is described as follows:

- ✓ Collection system: Domestic and laboratory wastewater will go through an anti-corrosion PCV pipeline with different diameters of D600, D500, D315, D200. Total pipeline length: 165m of D600, 438m of D500, 1.560m of D315, 1.110 m of D200 and 27m of D110;
- ✓ Newly built wastewater treatment plant: The plant is designed with capacity of 450 m<sup>3</sup>/day and operated with AAO technology, including: collecting tanks, neutralization tank, detention tank, AAO equipment component, sludge container, sludge drying ground, disinfection tank, operational office, chemical chamber, sludge pressing chamber. Installing sludge wiper, waste sorting and collecting equipment, wastewater pump, sludge pump, mixer, air distribution plate, air blower, sludge pressing machine, electrodynamics system, controller, measuring equipment and lighting system for operational office of chemical chambers.



**Figure 20. Proposal wastewater treatment process at VNUA**

### **b. Collection and treatment of domestic solid waste**

There will be 02 types of bins: green bins for organic waste and yellow bins for the rest or 3-compartment bins as trash containers for recycling. Trash bins will be installed in the buildings, lecture halls, labs, offices and within university's campus, etc. Different in size and appearance for different locations, bins with lid are used will prevent odor spreading out and rodents.

Garbage chutes will be integrated into high-rise buildings to collect all the garbage from upper floors instead of using elevators.

Sanitation workers will collect organic garbage and others in the one place. Garbage from smaller bins can be gathered by 140-240-liter wheelie cans to a specific place and transferred to Hanoi Urban Environment Company for further treatment.

### **c. Toilets:**

- ✓ Sanitation workers will be arranged to clean up regularly to prevent bad odor.
- ✓ Sewers and snorkels will be checked regularly to prevent congressional and odors.
- ✓ Ventilation fans and windows will be installed to prevent odor.

- ✓ The Hanoi Urban Environment Company will be hired to pump out sludge in septic tank regularly and provide effective transport and treatment solutions for the domestic wastewater.

#### **d. Practice room and laboratory management**

The following section provides general measures that can be applied to all laboratories. Details of principles and regulations at work in the laboratory can be found in Appendix 1: *Laboratory Safety Manual – Principles at Work in the Laboratory* and Appendix 2: *Environmental Health and Safety Management System in Laboratory*.

##### ***Measures to minimize leakages of chemical fumes***

- ✓ Small amount of laboratory fumes are leaked regularly. Therefore first priority is given to air ventilation for the labs. Besides, labs are equipped with ventilation fan and chemical fume hoods to ensure laboratory users' health.
- ✓ Laboratory fumes collection and treatment: Laboratory desks/areas will be arranged reasonably. Those experiments involving volatile chemicals will be conducted in separate area equipped with fume extractor ensuring all smoke and chemical fumes sucked entirely. In the labs where sample digestion and research are conducted a separate ventilated cabinet system will be installed for the sample digestion and the fumes will be sucked out with the fume extractor system.



**Figure 21. Chemical fume hood, ceiling-mounted fume hood and chemical fume extractor**

##### ***Risk prevention from usage of laboratory chemicals and instruments***

To reduce risks from usage of laboratory chemicals:

- ✓ Chemical storage room should be arranged separately, preservation depends on its chemical and management staffs are assigned clearly;
- ✓ Chemicals have verified origin, expiration date and quality assurance for analysis;
- ✓ Do not purchase large amount of chemicals to avoid prolonged inventory and unsafe for management;
- ✓ Teachers or guiders should monitor closely during chemical preparation or using by students;
- ✓ Staffs or students should be equipped fully or wear lab coat before entering especially related to chemicals;
- ✓ Make up a record for every laboratory noting entered chemicals, its expiration, precautions, etc.;
- ✓ For used-up chemicals, its bottle/package need to be collected thoroughly and taken into a system for collection and treatment of hazardous waste;
- ✓ Chemical oral suction is strictly prohibited;
- ✓ Regal training on laboratory safety for staffs.

##### ***Safe operation of equipment and machines***

- ✓ All staffs who operate equipment and machines must be trained, technical transfer before operation
- ✓ Absolutely no staffs/students/trainees who are not being trained participate to operate equipment
- ✓ On each equipment, must have a table to guide the used process
- ✓ Write a diary to follow all daily activities of equipment
- ✓ All equipment must be maintained regularly and periodically, checked the safety and accuracy of equipment
- ✓ The power supply for each equipment must be tested before installation and it must be install own automated system
- ✓ Depending on the equipment, but the majority of equipment must be placed in rooms with stable humidity. Therefore, these rooms are often installed air conditioning systems
- ✓ Absolutely chemicals must not be diluted and stored near the equipment. Only use chemicals in accordance with instructions of the equipment

#### **e. Hazardous waste**

Although the volume of hazardous waste from laboratories is not large, it may have severe environmental impacts. Therefore such waste should be collected, transported and handled by the competent authorities. Before the laboratories are operational, the VNUA should:

- ✓ Create registration dossier of generators of hazardous waste with Hanoi Department of Natural Resources and Environment in Hanoi while building the temporary storage of hazardous waste in accordance with Circular 36/2015/TT BTNMT dated 30/06/2016 of Ministry of Natural Resources and Environment.
- ✓ Contract with competent unit for collection and handling of hazardous waste.
- ✓ Provide hazardous waste containers for all the laboratories and practice rooms in faculties and centers.
- ✓ Develop rules for collection and management of all hazardous waste and other types of chemical packaging in every lab.
- ✓ Prohibit mixing hazardous waste with other solid waste
- ✓ Chemical waste from laboratories must be stored under strict safety regulations on chemical and biological substances. These regulations must be disseminated to those working in the laboratory;
- ✓ All types of hazardous waste must be labeled as prescribed;

#### **f. Measures to prevent electrical incidents and short-circuit**

- ✓ Design and install the electrical system with full electrical safety equipment such as fire-resistant materials, automatic circuit breaker to protect overload & short circuit, electrical leakage protection, etc.
- ✓ Design and arrange work items to comply with the safety rules for firefighting and prevention system, install fire protection, firefighting and prevention system inside and outside, is approved by the competent authority about the record of firefighting and prevention.
- ✓ Remind and propagate regularly about firefighting and prevention safety rules; Organize regular training and drills for firefighting and prevention.

#### **g. Mitigation measures for the impacts of plant protection chemicals (PPC)**

To prevent and minimize the environmental and health risks caused by plant protection chemicals, the usage, storage, management and handling of pesticides must comply with the Circular No. 03/2016/TT-BNNPTNT of Ministry of Agriculture and Rural Development dated

21<sup>st</sup> April 2016 on List of permissible and banned plant protection substances in Vietnam and HS codes thereof and the Circular No. 21/2015/TT-BNNPTNT of Ministry of Agriculture and Rural Development dated 8th June 2015 on pesticide management .

*Measures to minimize the impact in PPC management*

- As the amount of PPC used is small, it is unnecessary to keep stock of PPC because this may have many potential hazards to the environment and health of staffs and students.
- A dedicated storage for PPC should be built in VNUA which will be used to store the spraying tools, protective clothing, used and unused chemicals... The PPC storage is built in accordance with regulations issued by MARD. In addition, the storage site must be located at least 200m away from such areas as lecture halls, residential areas, academic and research areas of the staffs and students of the academy, the water source (aquaculture ponds, irrigation canals, Cau Bay River,).
- Clear origin, labeling and full manual are required for purchases of PPC.
- Chemicals outside PPC list issued by MARD are not allowed for use (according to Circular No. 03/2016/TT-BNNPTNT)

*Mitigation measures in use of PPC*

- The use of PPC must comply with four principles: right substance, right dose, right time and right way.
- Use of PPC with fast decay times, especially the types of chemicals are produced from bio products are prioritized.
- Those people using PPC must wear sufficient labor protective equipment (gloves, clothing, masks,) to minimize direct exposure to PPC.
- Those people using PPC must be equipped with the knowledge of its effects, how to manage and use, as well as the necessary response measures when their health are harmed by PPC.
- Before using, make sure to read the manual and expiry date. Do not use expired drugs and the preparation of drugs must comply with the instruction manual.
- It is strictly forbidden to wash tools and protective equipment after use of PPC in water sources such as ponds, lakes, Cau Bay River or irrigation ditches in the area.
- Unused and used PPC must be managed and stored in the designated storehouse.
- After use, PPC packages and containers must be cleaned thoroughly and collected for management and handling as hazardous waste. It is strictly forbidden to litter this kind of packaging as it will affect local environmental and ecological quality. Cleaning measures include the following:
  - Step 1: Pour the leftover PPC into spraying container (in about 30 seconds for liquid).
  - Step 2: Pour an amount of water equal to 1/4 - 1/3 of the PPC content into the package and close it well.
  - Step 3: Shake it carefully in about 30 seconds.
  - Step 4: Pour up the washed water from the package into the spray container, in about 30 seconds.

Repeat from Step 2 to Step 4 to make sure that the package is well cleaned. Note that:

- Also clean the lid and mouth of the used package.
- Wash any chemical stick to PPC package and pour into the spray container.
- The washing is finished when the washed water looks clean.

*\* Training on occupational safety in transport, storage and use of PPC*

VNAU must constantly coordinate with the Hanoi PPC Administration for organizing trainings for officials and employees regularly exposed to PPC (manager, storekeepers and employees) on occupational safety in transportation, storage and use of PPC according to the Circular 21/2015/TT-BNNPTNT on Pesticide product administration. The training content should include:

- a) Work safety in transportation and storage of plant protection products;
- b) Regulations on transport and storage of dangerous chemicals;
- c) Specification of plant protection products; instructions for management and use;
- d) How to read labels of plant protection products, graphical warning, signs of hazardous goods.
- e) Harmful effects of plant protection products for users and prevention measures;
- f) Measures to ensure safety during the transportation of plant protection drugs including emergency responses, road safety, basic knowledge about the use of protective gear and preventive measures troubleshooting for with each plant protection product;
- g) Practice in safe storage and transportation of PPC.

*\* Construction of PPC storehouse*

Although the storage of large amount of PPC is not encouraged in the Subproject, VNAU should build a storehouse for PPC, tools, equipment, unused and used PPC. This storehouse must meet the following criteria:

- The storage of plant protection products must meet the requirements of TCVN 5507: 2002 on hazardous chemicals – code of practice for safety in production, commerce, use, handling, and transportation.
- Sufficient capacity to contain the entire amount of plant protection products at any time;
- The storage site must be located at least 200m away from such areas as lecture halls, residential areas, academic and research areas of the staffs and students of the academy, the water source (aquaculture ponds, irrigation canals, Cau Bay River,).
- The storehouse must be properly designed and arranged to avoid risks of fire and explosion from possible chemical reaction between products.
- Plant protection products must be stored on high racks at least 10cm and 20 cm from the wall with wide aisle for easy checking, inspection and firefighting
- Must have a ventilation system, tools for solid waste collection and transport.
- Must have Chemical Safety Warning with understandable graphics and specifications, hazard level of each chemical.
- Must have work safety code, protective gears (glove, mask, goggles, protective clothes) in exposure to PPC, medical box and first aid kits.
- Must have a separate room for changing and washing for storehouse staffs.
- The storehouse must comply with all fire prevention requirements specified in Fire Prevention Law.
- Signs of ‘No fire’, ‘No smoking’ in bid, red letters outside of the storehouse. Fire prevention regulation and instruction must be posted in most noticeable place.
- The storehouse must be operated in a way to avoid any hazards and risks such as fire, leakage and spillage.
- The storekeeper must follow MSDS of all stored plant protection products, safety instruction, cleaning manual and emergency responses.

- The storekeeper must be trained on work safety in PPC storing, chemical storing as stated in Section 3 of this Part and obtain firefighting and work safety and sanitation certificates.

Particularly, the following guidelines on good practice for ground application of pesticides will apply to the subproject.

*(i) Pesticide purchase*

The subproject is not allowed to procure pesticides that fall into (i) Appendix III of Rotterdam Convention, and (ii) WHO classes IA and IB, or formulations of products in Class II.

*(ii) Operator training*

Operators of spray equipment must receive suitable training before handling and applying pesticides. Training should be provided by a recognized provider and courses are frequently offered by local training groups, agricultural colleges, government extension departments, spray equipment manufacturers and the chemical industry. The satisfactory completion of a course may result in a recognized certificate of competence to cover:

- safe product handling,
- delivery of the product to the target
- instruction on using the relevant spray equipment.

It is important that as technology moves forward, field spray operators are kept up to date with new methodology to help ensuring that pesticides are safely used. In some countries where spray operators are licensed, they can only renew their operator's license if they attended regular refresher courses. Operator training is best organized and provided through sustainable permanent national structures.

*(iii) Spray equipment selection*

The selection of appropriate and suitable spray equipment is essential safe and effective pesticide use. International and national equipment testing schemes have been established in many countries where after thorough testing under laboratory and field situations, sprayers are given certificates of approval. Where testing is not in place equipment manufacturers can be required to confirm that a sprayer complies with the requirements in countries where testing is mandatory or the equipment meets the appropriate FAO guidelines.

Equally important when selecting spraying equipment is access to spare parts, service and support facilities.

Ideally, equipment selection should not be based primarily on cost. Safety, design, comfort and ease of use must be major considerations, and ease of maintenance must be a high priority. Knapsack sprayer maintenance should require only simple tools.

The combination of operator training to a recognized standard, combined with the selection of appropriate spray equipment will contribute to improving the accuracy of pesticide delivery as well as protecting the environment.

*(iv) Using pesticides correctly*

Pesticides should only be used if there is an economically important need and all pesticides must be used strictly in accordance with their label recommendation. Product selection must assess the potential exposure hazard of the selected formulation and determine what control measures and dose rates the label recommendations advocate.

*(v) Managing operator exposure*

The use of Personnel Protective Equipment (PPE) is essential for protecting operator health and advice on its use will be found on the product label. Effective health monitoring records will be able to provide early warnings and identify changes in operator health, which may be attributed to working with pesticides.

As well as the workers handling and spraying pesticides the public must be safeguarded, both during, and after spraying, for example where they might have access to a treated area. Maybe livestock also ought to be prevented from re-entering treated areas immediately after spraying.

*(vi) Do not use unapproved and non-labeled product*

The product label carries statutory instructions for the user, which must cover the crops for which it is registered, the recommended dose rate, the number of permitted treatments during the growing season and how many days before harvest the last treatment may be applied. Additionally, the label will inform the user of the correct Personal Protective Equipment to be used when handling and applying the product and advise on environmental protection measures to be carried out.

Labels may refer to “non-spray” barriers for when products are to be used near waterways or sensitive environmental areas. The widths of unsprayed barriers are dictated by the pesticide, the sprayer type and setting, and its drift potential. Equally important to prevent environmentally sensitive areas are the weather conditions at the time of application.

Label information on suitable application technology, nozzle selection, volume of spray solution and correct spray timing will also help to improve product safety.

The label also provides other relevant and useful safety information, which will include the product common name, chemical name, the manufacturer's name and a contact in the event of an accident. The label must also be available for medical staff treating anyone who has been accidentally poisoned or contaminated by the pesticide. A good copy of the label must be retained as reference for the emergency services in the event of an accident.

Information on the decontamination and disposal of empty containers is also usually included on the label.

*(vii) Product transport and storage*

Care must be taken when using farm vehicles to transport pesticides as the chemicals must be secured and isolated and spills must be covered with a non-combustible absorbent material, which must be correctly disposed of.

Pesticide containers must be kept closed when not in use and must be secured against unauthorized interference, particularly when spray operators are working away from mixing areas and cannot always see the chemical containers.

The storage of pesticides on the farm should be covered by local legislation and farm stocks of pesticides must be kept to a workable minimum to cover peak demand. Correct storage is essential to maintain a safe working environment, to maximize product shelf life and to minimize the risk of fires and spillage. Varying climatic conditions and specific product demands (flammability-toxicity) make it difficult to offer other than general recommendations in these guidelines. The Guidelines for the Packaging and Storage of Pesticides (FAO 1985) offer a more comprehensive reference.

Pesticides must be kept in a dedicated store, which is accessible in case of emergency and can be locked when not in use. When considering erecting a pesticide store guidelines relating to construction materials, design, siting, emergency procedures etc can be obtained from FAO, or from national regulatory authorities.

Under no circumstances must pesticides be stored near foodstuffs!

*(viii) Personal protection*

There are three principal routes that chemicals enter the body:

- a) Accidental or deliberate ingestion
- b) Dermal, through handling, measuring and pouring the concentrate.
- c) Inhalation of small particles or dust during handling and spraying.

Dermal exposure represents the most common hazard. Avoiding exposure by using PPE and by paying attention to personal hygiene by washing exposed parts of the body after work and before eating, smoking and toileting will minimize risk. Personnel Protective equipment must be selected in accordance with the label recommendation. It must be comfortable to wear/use and be made of material, which will prevent penetration of the pesticide.

PPE will only remain effective if it is correctly selected and maintained. Where the equipment is damaged, repairs must restore it to its original condition otherwise the item must be replaced. Items such as the respirator must be checked on a regular basis and filter elements changed in accordance with the manufacturer's instructions.

Remember, products containing the same active ingredient but sold under different brand names may pose different risks due to the product formulation. Care must be taken to always refer to the individual label for the product being used.

*(ix) Chemical handling*

Water is probably the most sensitive environmental issue involved with pesticide use and the site of the sprayer filling and pesticide mixing area is critical. Water and environmental agencies should be consulted when selecting filling sites.

Permanent filling sites, for example for tractor sprayer use, must provide a washing apron where rinse water and spillage's can be retained and an area that can be kept secure. Siting must take into consideration the proximity of waterways and the soil type in relation to the speed of liquid percolation. The use of filling and mixing sites adjacent waterway is common and temporary mixing sites should be regularly rotated between locations.

Absorbent material to contain spills must be available at the filling site, as should suitable first aid equipment and secure facilities for PPE. Where present, a dedicated chemical store must be kept locked when not in use and should have a secure section for storing empty chemical containers before their disposal.

*(x) Chemical container handling*

To help keep tractor sprayer-operator exposure to a minimum, wherever possible preference must be given to using pesticide packs handled via closed transfer systems.

All operators must be correctly trained to handle chemical containers, remove seals, measure, pour and then after use. Where mechanical rinsing is not available, triple manual rinsing will decontaminate empty liquid containers; three rinses with clean water (Use 20% container volume) will remove chemical residues and leave the container ready for disposal. Containers must be rinsed immediately after use and the emptied into the spray tank. If the operator is using the induction hopper to load the concentrate into the tank, the liquid level in the bowl must be high enough to prevent the pump drawing in air when introducing the chemical.

Where knapsack sprayers are being refilled from "nurse-tanks" containing pre-mixed spray solution it is important that the tank pumping system provides adequate re-circulation while the spray mix is standing. Where knapsack sprayers are being refilled from "nurse-tanks" containing pre-mixed spray solution it is important that the tank pumping system provides adequate re-circulation while the spray mix is standing.

Handling the undiluted pesticide presents the operator with the highest exposure risk so correct safety equipment and clothing must be available and operators trained to use and maintain it properly. Operator protection may be different for the actual application when the product is diluted with water.

Engineering controls, closed transfer systems, returnable pesticide containers, water dispersible sachets etc, should be used wherever possible. **EMPTY CHEMICAL CONTAINERS MUST NOT BE RE-USED.**

Partially used chemical containers must be re-sealed and then taken back to store.

#### *(xi) Disposal of surplus spray*

Pesticide waste is present in the form of surplus diluted spray solution and surplus undiluted product. Contaminated safety equipment and clothing, tractor cab filter elements and material used to absorb spills, also have to be disposed of.

Pre-planning should ensure that surplus spray solution is kept to a minimum and only enough product for the area to be treated is purchased.

Unused dilute spray and tank washings can cause serious problems, particularly on horticultural holdings where many different chemical treatments may be used each day. Installing a dedicated effluent plant to deal with washings should be seriously considered.

Applying surplus spray and tank washings to the crop is a first priority, even if it means that the dose rate for the penultimate tank load is reduced so that the overall label dose rate is not exceeded.

Good product stock control will keep surplus concentrate materials to a minimum. In some countries unused chemicals can be returned to the retailer, otherwise a registered disposal contractor will have to be used. Where this service is used, the waste chemicals must be securely packed and clearly labeled in accordance with local legislation so as not to constitute a hazard when transported.

#### *(xii) Disposal of empty chemical containers*

Before final disposal, empty chemical containers must be thoroughly cleaned either by using an approved rinsing nozzle or by the manual triple rinse technique. Such rinsing must be done when the containers are first emptied so that the washings can be added to the spray tank in the field. If this is not possible, the container must be collected, clearly labeled and stored for future use as a spray diluent. Empty containers must be securely stored before disposal in accordance with local legislation.

Different countries have different approved ways of container disposal, which may include burial, incineration or removal by registered contractor. Empty chemical containers must be thoroughly cleaned and rendered unusable (punctured/crushed) before burial. The burial site must not be near surface or ground water. Soil type and natural drainage must be taken into consideration when selecting the site. Burial depth should be greater than 1m. Moreover, pits must avoid land drains. Site location and content must be recorded.

Not all containers can be burnt; reference to the product label will indicate if the container held a flammable product or was an aerosol. Containers must be thoroughly cleaned before burning. Additionally, burning containers may present a further hazard if smoke drifts over roadways or becomes an inconvenience.

#### *(xiii) Pesticide storage*

Unused pesticide must be returned to store. Pesticides in or damaged containers should be emptied into clean replacement containers, which are fully labeled. Stock control must ensure that old stock is used before recently purchased similar new products.

Good stock control and accurate planning will mean that waste concentrate and diluted spray is kept to a minimum. However, where old or obsolete chemical products have to be disposed of an approved contractor must be used. Chemicals for disposal must be secure in their original containers, fully labeled in accordance with local regulations.

#### *(xiv) Personal Protective Equipment (PPE)*

PPE is only as good as its maintenance and should be provided to individuals. To make sure safety equipment gives maximum protection full operator training is important.

Wearing protective clothing on its own does not guarantee total protection if equipment becomes defective through wear or damage so regular visual checking must be carried out. Specialist equipment, such as respirator must be checked in accordance with the manufacturer's

recommendation. The periods between checks will be more frequent when working conditions are more severe. Faults must be recorded and corrected before further use.

## 5.2. Social impact mitigation measures

### 5.2.1 Impacts on livelihood and income sources

In the university's campus, there are 10 families and 11 entities that are borrowing the university's land to sell seedlings for additional income. Upon consultation, the proposed intervention for livelihood restoration focuses on skill training program which is designed to meet their needs, priorities and education level.

**Table 20. Framework of social action plan for the subproject**

Contents	Objectives/Outputs	Proposed action	Implementing agencies	Indicators	Remarks
Livelihood of seedling selling as a source of extra income	Affected households will be involved in community consultation and socio-economic survey as a basis for determining compensation and corrective measures and costs to ensure that their livelihoods will not be deteriorated because of the construction subproject	Develop skill training program	PMU Local authorities Consultants	Skills training program/plan is developed	Activities and costs must be calculated and determined by the consultants
Access to public works	Secure the health of staffs, lecturers and students as well as local residents; Create landscape, workspace; Reduce pollution from wastewater	Detailed design, Technical drawings	PMU Local authorities Consultants	Increased number of students by improving/expanding the learning environment. Facilitated economic development for the subproject area	Cost estimation and detailed design are conducted by the consultants
Sexually Transmissible Infections (STI) risk	Reduce exposure to STIs due to increasing inflows during construction	Incorporate intervention measures for raising awareness of HIV/AIDS contractor's bid documents	PMU Contractors Local authorities Consultants	Measures for interventions and raising awareness of STIs included in contractor's bid documents	Implementation and monitoring activities will be carried out by detailed design consultants and implementation consultants

Contents	Objectives/Outputs	Proposed action	Implementing agencies	Indicators	Remarks
Labor	The contract for contractors should include provisions to ensure the health and occupational safety; no wage discrimination between women and men, prevention of child labor; and compliance with labor laws and relevant obligations of international treaties Maximize the employment of women and the poor in the process of construction	The contract of contractors is reviewed to ensure that the provisions relating to occupational health and safety (OH & S) and gender equality Priority for women and the poor in unskilled work.	PMU Social and political organizations (Youth Union, Women's Union,...) Centre for employment information Local authorities Contractors Consultants	Provisions relating to: i) OH & S; ii) promoting gender equality and preventing gender discrimination; and iii) prevention of use of child labor are included in the contractor's contract. The number of local workers according to the gender Men and women will receive equal remuneration for equal work;	Monitoring activities will be carried out by the DDIS consultant Excluding costs as part of its monitoring DDIS activities

### 5.2.2. Impacts by construction activities

Details of mitigation measures for social impacts by construction activities are described in Item 12, Table 16.

### 5.2.3. Impacts on cultural heritages

When construction activities would be carried out near any cultural, historical sites such as pagoda, church, temple,, the contractor shall have appropriate construction schedule to avoid festivals or special events held at these cultural sites such as the 15<sup>th</sup> day of lunar month, public holidays. When carrying out the works in such areas, the contractor shall implement good site management practice including regularly cleaning up the site, loading materials in a tidy manner, and promptly transporting waste out of the sites;

If artifacts, archeological sites, historical sites, remains and objects, including graveyards and/or individual graves are unearthed during construction phase, the Contractor shall follow Chance Find Procedure as described below:

- 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;

If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Subproject’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.

**5.2.4. Impacts on community safety and health**

- The contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on labor safety in construction operations;
- In case of epidemic outbursts, the Subproject shall cooperate closely with the local government to carry out the required mitigation and control measures;
- Fence centralized construction sites with solid materials of at least 2m high;
- Place warning signs and fence open pits and ditches to prevent accidents;
- Sufficient lighting will be provided when construction is carried out at night;
- Apply speed limit of 20km/h within 200m from the construction;
- Where possible, place machines generating high level of noise as far as possible from residential houses and public areas so as noise level and be kept below 70dBA;
- Use static compacting when the road base is constructed near areas with many households and weak temporary works to restrict vibration;
- The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers.

**5.2.5. Impacts on worker safety and health**

Details of mitigation measures for social impacts by construction activities are described in Item 14, Table 16.

**5.2.6. Other social impacts**

A number of adverse social impacts during construction and operation phases of subproject have been identified, namely, reduced sources of income due to loss of agricultural land, land use for animal breeding, and temporary loss of income (estimated to be minor) from doing business along transportation routes and roads to be resurfaced and limited access to several social and religious structures, impacts on irrigation canals and agricultural activities, increased risks of exposure to HIV/AIDS, dust and noise etc.

Related to the impacts of travel disruption for households/individuals/students, etc., the subproject will inform about the construction progress of the subproject to residents/students can be active about their time in accordance with the construction schedule of the subproject. The activities were launched, including:

- Increase the awareness of the community about traffic safety and the prevention of social evils in the construction period;
- The contract with the contractors includes measures to transport materials or sludge which must comply with the regulations on weight of vehicles and waste. When local infrastructure is damaged by transport operations, the contractor must restore the infrastructure affected, return status quo prior to subproject implementation.

**Table 21.Measures to minimize other impacts**

Negative impacts	Mitigation measures	Implementing agencies
Temporary impacts to seedlings sales	Inform local people/companies before construction	The PMU should require contractors to work closely with local authorities in information dissemination in accordance with the progress in areas

Impact on traffic and increase social evils	Raising public awareness about traffic safety and prevention of social evils for local people	The PMU should work closely with the authorities at all levels in the implementation of communication strategies. Based on the existing communication system which aims to disseminate information, contents of the subproject to households/students
Infrastructure is affected	Contractors comply with the rules on recovery of infrastructure	The PMU should require contractors to comply with regulations on weight and measures to ensure environmental hygiene during transport of materials as well as regulations in the case of making impacts to traffic roads

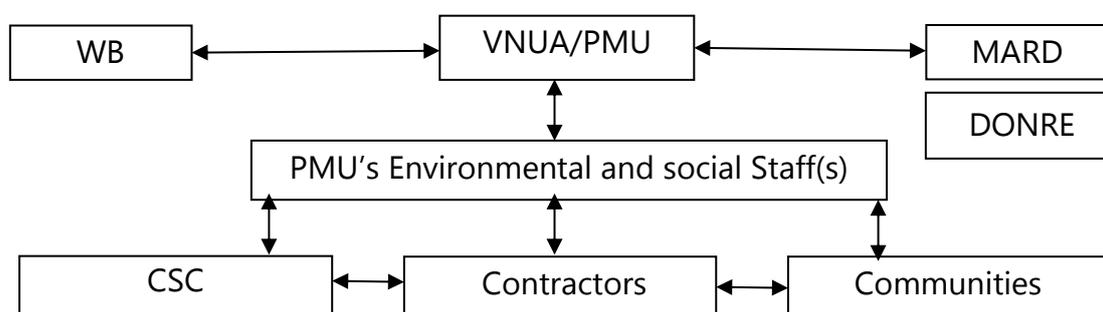
## 6. ESMP IMPLEMENTATION ARRANGEMENT

ESMP during construction requires the involvement of several stakeholders and agencies, each with different roles and responsibilities including VNUA, PMU, DONRE (Hanoi Department of Natural Resources and Environment), the Contractors, the Construction Supervision Consultant (CSC), and local communities.

To ensure effective implementation of the ESMP, the following actions will be carried out during the implementation of the subproject:

*During the detailed design and tender documentation making*

- During the detailed design of technical specifications and preparation of bidding contract documents for each contract, the technical design consultant will incorporate into these bidding and contractual documents the parts of the EMP specific to that contract, as well as the specific measures identified in the EMP.
- In preparing the bidding and contract documents, make an effort to ensure that the contractors are aware of the safeguard obligation and commit to comply.



**Figure 22. Organization chart for ESMP Implementation**

*During the course of preconstruction and construction*

VNUA/PMU will assign the Construction Supervising Consultant (CSC) and/or field engineer to be responsible for supervision of safeguard performance of contractor on a daily basis with the following tasks:

- Review and approve ESMP to be prepared by contractor before the commencement of the construction.
- Closely supervise the implementation of the ESMP throughout the construction period.
- Confirm the compliance with the agreed environmental plan and inspect any damages incurred by the contractor. If necessary, prepare an order to compensate/restore the construction sites as specified in the contracts. Contractor safeguard performance will be included in the subproject progress report.

## 7. RESPONSIBILITIES FOR THE IMPLEMENTATION

The roles and responsibilities of the key parties and their relationships regarding the implementation of the ESMP are described in Table 22.

- ✓ Contractors will be responsible for implementing mitigation measures. These measures will be included in bidding documents and their costs are to be included in construction bid packages;
- ✓ CSC will be responsible for monitoring the day-to-day implementation of mitigation measures. Related costs are included in the CSC service contract;

**Table 22. Roles and responsibilities of key parties**

Community/ Agencies	Responsibilities
PMU	<ul style="list-style-type: none"> <li>- PMU will be responsible for monitoring the overall subproject implementation, including environmental compliance of the subproject. PMU will have the final responsibility for ESMP implementation and environmental performance of the subproject during the construction and operational phases. Specifically, the PMU will: (i) closely coordinate with local authorities in the participation of the community during subproject preparation and implementation; (ii) monitor and supervise ESMP implementation including incorporation of ESMP into the detailed technical designs and bidding and contractual documents; (iii) ensure that an environmental management system is set up and functions properly; (iv) be in charge of reporting on ESMP implementation to the DONRE and the World Bank.</li> <li>- In order to be effective in the implementation process, PMU will assign Environmental Staff(s) (ES) to help with the environmental aspects of the subproject.</li> </ul>
PMU Environmental and Social Staff(s) (ES)	<ul style="list-style-type: none"> <li>- The ES is responsible for monitoring the implementation of the World Bank’s environmental and social safeguard policies in all phases and process of the subproject. Specifically, ES will be responsible for: (i) helping PMU incorporate ESMP into the detailed technical designs and civil works bidding and contractual documents; (ii) helping PMU incorporate responsibilities for ESMP and supervision into the TORs, bidding and contractual documents for the Construction Supervision Consultant (CSC) and other safeguard consultant (IEMC) as needed; (iii) providing relevant inputs to the consultant selection process; (iv) reviewing reports submitted by the CSC and safeguard consultants; (v) conducting periodic site checks; (vi) helping the PMU on solutions to handle social issues of the subproject; and (vii) preparing environmental and social performance section on the progress and review reports to be submitted to the MARD, DONRE and the World Bank.</li> </ul>
Construction Supervision Consultant (CSC)	<ul style="list-style-type: none"> <li>- The CSC will assign Environmental and Social Staff(s) and will be responsible for routine supervising and monitoring all construction activities and for ensuring that Contractors comply with the requirements of the contracts and the ECOP. The CSC will engage sufficient number of qualified staffs (e.g. Environmental Engineers) with adequate knowledge on environmental protection and construction subproject management to perform the required duties and to supervise the Contractor’s performance.</li> <li>- The CSC will also assist the PMU in reporting and maintaining close coordination with the local community.</li> </ul>
Contractor	<ul style="list-style-type: none"> <li>- The contractor will assign Environmental and Social Staff(s) to carry out Environmental and Social mitigation measures proposed in ESMP.</li> <li>- 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 PMU 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.</li> <li>- The Contractor is required to appoint a competent individual as the contractor’s on-site <i>Safety and Environment Officer (SEO)</i> who will be responsible for monitoring the</li> </ul>

Community/ Agencies	Responsibilities
	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 staffs and workers understand the procedure and their tasks in the environmental management program. - Report to the PMU and CSC on any difficulties and their solutions. - Report to local authority and PMU and CSC if environmental accidents occur and coordinate with agencies and keys stakeholders to resolve these issues.
Local community and students of VNUA	- Community and students of VNUA: 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 PMU. If unexpected problems occur, they will report to the CSC and PMU.
MARD, Hanoi People's Committees, DONRE	- Oversee implementation of subproject under recommendations of MARD/DONRE and PMU to ensure compliance of Government policy and regulations. MARD/DONRE is responsible for monitoring the compliance with the Government environmental requirements.

## 8. ENVIRONMENTAL COMPLIANCE FRAMEWORK

### 8.1. Environmental Duties of the Contractor

The contractor firstly shall adhere to minimize the impact that may be result of the subproject 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 phases.

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 Staffs of the CSC;
- Carry out any corrective actions instructed by the Environmental Staffs of the PMU and CSC;
- In case of non-compliances/discrepancies, carry out investigation and submit proposals on mitigation measures, and implement remedial measures to reduce environmental impact;
- Stop construction activities, which generate adverse impacts upon receiving instructions from the Environmental Staffs of PMU and CSC. Propose and carry out corrective actions and implement alternative construction method, if required, in order to minimize the environmental impacts; Non-compliance by the Contractor will be cause for suspension of works and other penalties until the non-compliance has been resolved to the satisfaction of the ES of PMU and CSC.

## **8.2. Contractor's Safety, Social and Environmental Officer (SEO)**

The contractor shall be required to appoint competent staff(s) as the Contractor's on-site safety, Social and environmental 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 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 ES of PMU and CSC
- Inform the contractor and ES (of PMU and CSC) of environmental issues, submit contractor's ESMP Implementation Plan to the ES of PMU and CSC, and relevant authorities, if required;
- Keep detailed records of all site activities that may relate to the environment.

## **8.3. Environmental and Social Supervision during Construction (CSC)**

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

- Review and assess on behalf of the PMU 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 PMU and prepare the environmental supervision statement during the construction phase; and

## **8.4. Compliance with legal and contractual requirements**

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

All the works method statements submitted by the Contractor to the CSC and PMU for approval

to see whether sufficient environmental protection and pollution control measures have been included.

The CSC and PMU 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 of CSC and PMU. 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 PMU 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 PMU accordingly.

### **8.5. Environmental Claims and Penalty System**

In the compliance framework, if non-compliance with environmental regulations are discovered by CSC/ES/PMU 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/PMU) to repair the violation. If the Contractor performs the repairs within the grace period (confirmed by CSC/PMU), 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 CSC/PMU not detected of non-compliance with environmental regulations of the contractor, they will be responsibility payment to repair the violation.

### **8.6. Reporting Arrangements**

ESMP monitoring and reporting requirements are summarized in Table 23.

**Table 23. Regular Reporting Requirements**

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

PMBs' report on environmental performance/compliance of the subproject should be included in the progress report submitted to the NPT before each subproject implementation support mission and must include sufficient information on: i) preparation and disclosures of environmental safeguards instruments for subprojects; ii) incorporation of new subproject EMPs in the bidding and contractual documents; iii) monitoring and supervision of EMP implementation by the contractor, the construction supervision engineer, and the PCs; iv) any challenges in safeguard implementation, solutions, and lessons learned.

## 9. ENVIRONMENTAL MONITORING PROGRAM

### 9.1. Monitoring Location, Parameters and Frequency

Environmental monitoring program is carried out in 3 stages of the subproject: before construction phase; construction phase; operational phase (Tables 24, 25 and 26):

Table 24. Scope of environmental monitoring during construction

No.	Monitoring items	Pre-construction	Construction phase	Applied standard
<b>I</b>	<b>Ambient noise/vibration monitoring</b>			
1	Parameter	Temperature, Humidity, Wind, $L_{eq}$ , $L_{max}$	Temperature, Humidity, Wind, $L_{eq}$ , $L_{max}$	QCVN 26/2010/BTNMT
2	Frequency	01 time before construction	Every 3 month; 01 location/day, 03 time/h	
3	Monitoring position	As defined in the dredge material management plan		
<b>II</b>	<b>Ambient air monitoring</b>			
1	Parameter	TSP, CO, NO <sub>2</sub> , SO <sub>2</sub>	TSP, CO, NO <sub>2</sub> , SO <sub>2</sub>	QCVN 05:2013/BTNMT, QCVN 06:2009/BTNMT
2	Frequency	01 time before construction	Once per 3 months	
3	Monitoring position	As defined in the dredge material management plan		
<b>III</b>	<b>Surface water/wastewater quality monitoring</b>			
1	Parameter	pH, DO, TSS, BOD <sub>5</sub> , COD, NH <sub>4</sub> <sup>+</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , oil, Coliform	pH, DO, TSS, BOD <sub>5</sub> , COD, NH <sub>4</sub> <sup>+</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , oil, Coliform	QCVN 08:2008/BTNMT
2	Frequency	01 time before construction	Once per 03 months	
3	Monitoring position	As defined in the dredge material management plan		
<b>IV</b>	<b>Waste water</b>			
1	Parameter	pH, DO, BOD <sub>5</sub> , COD, NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , TSS, As, Hg, Pb, Cd, Cu, oil, Coliform, E.Coli	pH, DO, BOD <sub>5</sub> , COD, NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , TSS, As, Hg, Pb, Cd, Cu, oil, Coliform, E.Coli	QCVN 14:2008/BTNMT
2	Frequency	01 time before construction	Once per 3 months	
3	Monitoring position	Baseline environmental locations should be established in line with the construction sites at the time of monitoring.		
<b>V</b>	<b>Soil</b>			
1	Parameter	pH, Cu, Pb, Zn, Cd, As, Hg	pH, Cu, Pb, Zn, Cd, As, Hg	QCVN 03:2008/BTNMT
2	Frequency	01 time before construction	Once per 3 months	
3	Monitoring position	As defined in the dredge material management plan		
<b>IV</b>	<b>Dredged sludge: If required as indicated in the dredge material management plan</b>			
1	Parameter		pH, Cu, Pb, Zn, Cd, As, Hg	QCVN 03:2008/BTNMT
2	Frequency		01 time before dredged	
3	Monitoring position	As defined in the dredge material management plan		
<b>V</b>	Traffic: during construction, the contractor monitor and report the traffic route and driving performance			

Table 25. Estimated numbers for soil, water, and air sampling

No.	Construction	Construction time	Total samples				
			Air	Land	Surface water	Dredging sludge	Wastewater
1	Large lecture hall building	24	8	4	4	-	0
2	Faculty of agricultural	12	4	2		-	1

	mechanical engineering -						
3	Faculty of food technology and post-harvest technology	12	4	2	2	-	1
4	Faculty of environment:	12	4	2	2	-	1
5	Faculty of Biotechnology	12	4	2	2	-	1
6	Faculty of veterinary science	15	5	2	2	2	1
7	Foreign language training	12	4	4	4	2	1
8	Building for institutional and policy research	15	5	2	2	-	0
9	Physical education center:	18	6	5	5	2	0
10	Center of Agricultural and Life Sciences Research	24	8	4	4	-	1
11	Central Building	27	9	4	4	-	1
11	Building Roads (1 sample for 1 Road)	27	27	13	9	-	1
12	Wastewater treatment plant.	-	-			-	1
13	Cau Bay River	-	-		2	-	
	<b>Total samples</b>		<b>91</b>	<b>46</b>	<b>42</b>	<b>6</b>	<b>10</b>

## 9.2. Estimated cost for environmental sample collection and analysis

**Table 26. Estimated cost for sampling and analysis**

(Exchange rate: 1 USD = 22,600 VND)

No.	Cost items	Unit price	Number of samples	Amount	
				VND	USD
<b>I</b>	<b>Ambient Air</b>				
1	Temperature	42,787	91	3,893,617	172
2	Humidity	42,787	91	3,893,617	172
3	Wind speed	42,659	91	3,881,969	172
4	Noise	168,288	91	15,314,208	678
5	SO <sub>2</sub>	494,884	91	45,034,444	1,993
6	CO	790,484	91	71,934,044	3,183
7	NO <sub>2</sub>	492,750	91	44,840,250	1,984
8	TSP	572,186	91	52,068,926	2,304
	<b>Total</b>	<b>2,646,825</b>	<b>91</b>	<b>240,861,075</b>	<b>10,658</b>
<b>II</b>	<b>Soil</b>				-
<b>1</b>	pH	169,373	46	7,791,158	345
<b>2</b>	As	789,268	46	36,306,328	1,606
<b>3</b>	Cd	744,101	46	34,228,646	1,515
<b>4</b>	Cu	667,971	46	30,726,666	1,360
<b>5</b>	Pb	744,101	46	34,228,646	1,515
<b>6</b>	Zn	667,971	46	30,726,666	1,360
<b>7</b>	Hg	789,268	46	36,306,328	1,606
	<b>Total</b>	<b>4,572,053</b>	<b>46</b>	<b>210,314,438</b>	<b>9,306</b>
<b>II</b>	<b>Surface water</b>				
<b>1</b>	pH	105,340	42	4,424,280	196

No.	Cost items	Unit price	Number of samples	Amount	
				VND	USD
2	Dissolved oxygen	105,545	42	4,432,890	196
3	TSP	235,081	42	9,873,402	437
4	BOD <sub>5</sub>	532,005	42	22,344,210	989
5	COD	348,715	42	14,646,030	648
6	N-NH <sub>4</sub> <sup>+</sup>	397,175	42	16,681,350	738
7	Nitrate	456,017	42	19,152,714	847
8	Nitrite	369,386	42	15,514,212	686
9	Phosphate	424,277	42	17,819,634	788
10	Total oil and grease	912,198	42	38,312,316	1,695
11	Coliform	980,998	42	41,201,916	1,823
12	E.Coli	499,963	42	20,998,446	929
	<b>Total</b>	<b>5,366,700</b>	42	<b>225,401,400</b>	<b>9,974</b>
<b>III</b>	<b>Waste water</b>				
1	pH	105,340	10	1,053,400	47
2	DO	105,340	10	1,053,400	47
3	BOD <sub>5</sub>	532,005	10	5,320,050	235
4	COD	348,715	10	3,487,150	154
5	Nitrate	369,386	10	3,693,860	163
6	SO <sub>4</sub> <sup>2-</sup>	357,535	10	3,575,350	158
7	TSS	235,081	10	2,350,810	104
8	As	888,450	10	8,884,500	393
9	Hg	909,748	10	9,097,480	403
10	Pb	815,885	10	8,158,850	361
11	Cd	815,885	10	8,158,850	361
12	Cu	596,045	10	5,960,450	264
13	Total mineral oil and grease	912,198	10	9,121,980	404
14	Coliform	980,998	10	9,809,980	434
15	E-Coli	499,963	10	4,999,630	221
	<b>Total</b>	<b>8,472,574</b>	10	<b>84,725,740</b>	<b>3,749</b>
<b>IV</b>	<b>Dredging sludge sediment samples</b>				
<b>1</b>	pH	169,373	6	1,016,238	45
2	As	789,268	6	4,735,608	210
<b>3</b>	Cd	744,101	6	4,464,606	198
4	Cu	667,971	6	4,007,826	177
<b>5</b>	Pd	744,101	6	4,464,606	198
6	ZN	667,971	6	4,007,826	177
<b>7</b>	HG	789,268	6	4,735,608	210
<b>9</b>	Aldrin (organic chloral)	2,780,830	6	16,684,980	738
10	DDT (organic chloral)	2,780,830	6	16,684,980	738
	<b>Total</b>	<b>10,133,713</b>	8	<b>81,069,704</b>	<b>3,587</b>
	<b>Total cost of monitoring</b>			<b>832,238,644</b>	<b>37,273</b>

To ensure that waste generation due to developing of subproject create facilities to acceptable negative impacts as anticipated in the ESMP, annual monitoring program has been developed and

it will be carried out by the VNUA which are responsible for operations and using their own operating cost. The monitoring results will be submitted to the Vietnam Government. ESU assisted by IEMC will prepare a detailed monitoring plan with the concerned agencies at least Six months before construction has completed. The program should also include a waste water quality monitoring which will be prepared and implemented in close consultation with the responsible agencies. Key monitoring parameters should include, but not limited to: pH, DO, BOD<sub>5</sub>, COD, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, TSS, As, Hg, Pb, Cd, Cu, oil, Coliform, E.Coli. Monitoring of water quality at the water supply intake and measure to protect proper land use of the watershed should also be considered.

## **10. CAPACITY BUILDING PROGRAM**

### **10.1 Technical Assistance support for the implementation of safeguards**

An assessment of safeguards implementation capacity of existing PMU staffs indicate that PMU staffs have limited knowledge on WB safeguard requirements as well as limited knowledge of environment and social issues. Such lack of capacity represents a risk to subproject 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 PMU during the implementation of the safeguards requirements. The technical assistance will provide the necessary technical support the PMU 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 cover both the knowledge on safeguards requirements and procedures for the subproject as well as training that covers both specific knowledge on safeguard procedures and requirement for the subproject staffs, consultants, and national contractor would be important. This would include, for example, assistance in the preparation of documents and implementation of training program on environmental management and environmental monitoring for contractors, CSC and relevant staffs of PMU (environmental staffs and coordinators of packages) to do their tasks. It would also include assisting the PMU's environmental staffs 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 PMU to enhance overall subproject 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 subproject implementation. The WB safeguard specialists will participate in the capacity building in particular in the training activities as appropriate.

### **10.2 Training programs proposed**

Table 27 below provides examples of the basic trainings 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 with the support of the Technical Assistance team for the implementation of safeguards will provide the training to contractors, CSC and other groups.

Other more specific and tailored training will be developed and agreed upon between PMU and the Technical Assistance team for the implementation of safeguards during subproject implementation based upon an reassessment of needs and the status of safeguards implementation.

- ✓ *Target groups for the training:* include PMU staffs, ESU staffs, field engineers, CSC, construction contractors, local authorities, and community representatives in the subproject area. Training of workers and drivers is the responsibility of the contractor.

- ✓ *Training schedule:* At least 1 month before the construction 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 Table 27 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. It is foreseen that the training program for PMU staffs will continue until year three of implementation. Three days of training for CSC and contractors are also planned to take place twice a year on an annual basis for at least two years.

**Table 27. Training Programs for Capacity Building on Environmental Supervision and Management**

<b>I. Objects</b>	<b>SUBPROJECT MANAGEMENT UNIT (PMU)</b>
Training course	Environmental supervision, monitoring and reporting
Participators	Environmental staffs and technical staffs
Training Frequency	Soon after subproject effectiveness but at least 1 month before the construction 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 until year three of implementation
Content	<ul style="list-style-type: none"> <li>- General environmental management relating to subproject including requirements of WB, MARD, DONRE, cooperating with relevant enterprises</li> <li>- Requirements on environmental supervision;</li> <li>- Supervision and implementation of mitigation measures;</li> <li>- Community participation in environmental supervision</li> <li>- Guide and supervise contractor, CSC, and community representatives in implementation of environmental supervision.</li> <li>- Forms used in environmental supervision;</li> <li>- Risk response and control;</li> <li>- Other areas to be determined;</li> <li>- Receiving approach and submit forms.</li> </ul>
Responsibilities	PMU with support of the Technical Assistance team for the implementation of safeguards
<b>II. Objects</b>	<b>CSC, CONTRACTOR, COMMUNE/WARDS AUTHORITIES, COMMUNITY REPRESENTATIVES</b>
Training course	Implementation of mitigation measures
Participators	CSC; on-site construction management staffs; environmental staffs of contractor; commune/ward/group authorities
Training frequency	After bidding, update based on requirements
Time	Three days of training for CSC and contractors and two days of training for other also to be repeated twice a year on an annual basis depending on needs
Content	<ul style="list-style-type: none"> <li>- Overview of environmental monitoring;</li> <li>- Requirements of environmental monitoring;</li> <li>- Role and responsibilities of contractors and CSC</li> <li>- Content and methods of environmental monitoring;</li> <li>- Response and risk control;</li> <li>- Propagate monitoring forms and guide how to fill in the forms and risk report;</li> <li>- Other areas to be determined;</li> <li>- Preparation and submission of report</li> </ul>
Responsibilities	PMU with support of the Technical Assistance team for the implementation of safeguards
<b>III. Objects</b>	<b>COMMUNITIES AND WORKERS</b>
Training course	Environmental sanitation and safety
Participators	Representatives of community and/or worker leaders (as appropriate)
Training frequency	As appropriate

<b>I. Objects</b>	<b>SUBPROJECT MANAGEMENT UNIT (PMU)</b>
Time	One-day presentation and one-day on-the job training twice a year to be repeated on a per needs basis
Content	<ul style="list-style-type: none"> <li>- Preliminary presentation on environmental protection and environmental overview</li> <li>- Key issues that require community and workers attention to minimize safety risks (roads, equipment, machines, etc.) as well as reduce pollution (dust, fume gases, oil/grease spill, waste management, etc.)</li> <li>- Management of environmental safety and sanitation in work sites and worker camps;</li> <li>- Mitigation measures at construction site and work camps;</li> <li>- Safety measures on electricity, mechanical, transportation, air pollution;</li> <li>- Other areas to be determined;</li> <li>- Procedures to deal with emergency situation</li> </ul>
Responsibilities	Contractor, PMU

## 11. ESMP COST ESTIMATION

Table 28 provides an estimated cost for ESMP implementation. The ESMP cost<sup>1</sup> will comprise (i) cost for implementation of the mitigation measures by contractor, (ii) cost for supervision by the CSC, (iii) cost for environmental monitoring consultant (IEMC) (iv) monitoring of environmental quality (v) PMU safeguard management costs, including technical assistance support for the implementation of safeguards and training. Costs for the implementation of the mitigation measures during construction will be part of the contract cost while cost for monitoring of ESMP by the CSC is provided for in the construction supervision contracts. Costs for PMU operations related to ESMP are provided for in the subproject management budget of the PMU, including basic safeguards training and allowances for people who participate in the monitoring program. After subproject completion, the cost for environmental monitoring of the constructed facilities will be funded by the VNUA.

It is noted that the attendance of community representatives in ESMP implementation is voluntary, and without salary. Hence, to encourage the participation of community members, the cost for materials, equipment used for monitoring and rewards for people who are voted to implement monitoring are taken into account. Following decision No. 80/2005/QĐ-TTg dated 18/4/2005 of Prime Minister on regulations of community investment monitoring and joint circular for guidelines of decision implementation No. 80/2005/QĐ-TTg “cost for supporting the investment monitoring of community in commune/ward are calculated in cost estimation of commune/ward fatherland front and are guaranteed by commune/ward people’s committee budget; cost for propagation, training courses, guiding, closing of community investment monitoring at district and provincial level are calculated in cost estimation of commune/ward Fatherland Front and are guaranteed by commune/ward people’s committee budget”.

Table 28 provides an estimated environmental quality monitoring cost in line with the national practices for reference. However the final cost will be updated during the detailed design.

**Table 28. Cost estimation for ESMP implementation (million USD)**

	<b>Cost (millions of \$US)</b>	<b>Source of funds</b>
(a) Mitigation during construction	Part of contracts	WB
(b) Supervision of safeguards during construction	Part of CSC costs in Comp. 4	WB
(c) Environmental Safeguards unit (ESU) of PMU	Part of PMU costs in Comp. 4	WB
(d) Environmental quality monitoring	0.03	WB
(e) Safeguards capacity building program	0.25	WB

## 12. GRIEVANCE REDRESS MECHANISM (GRM)

Complaints relating to any subproject's problems will be solved through negotiations to achieve the consensus. A complaint will go through three Stages before it can be transferred to the court. The

enforcement unit will pay all administrative and legal fees relating to the acceptance of complaints. This cost is included in the subproject budget.

Complaint procedures and resolution will be performed as follows:

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

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

**The second level *the CPC*.** Upon receiving a complaint from a household, the CPC will have 15 days after receiving the complaint to resolve the case. The CPC is responsible for filing and storing documents on all complaints that it handles.

When the CPC has issued a decision, the household can make an appeal within 30 days. In case a second decision has been issued and the household is still not satisfied with such a decision, they can appeal to the Hanoi People's Committee.

**The third level *The Hanoi People's Committee (HPC)*.** Upon receiving a complaint from the household, the HPC will have 30 days after receiving the complaint to resolve the case. The HPC is responsible for filing and storing documents for all complaints to be submitted.

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

**The Forth Level Provincial Court.** In case a complainant brings his/her case to a provincial court and the court rules in favor of the complainant, the provincial authorities will have to increase the compensation up to such a rate as may be ruled by the court. In case the court's ruling is in favor of the HPC, the complainant will be refunded the amount of money that has been paid to the court.

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

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

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

During construction, the GRM will also be managed by the contractors under supervision of the CSC. The contractors will inform the affected communities and communes about the GRM availability to handle complaints and concerns about the subproject. This will be done via the

community consultation and information disclosure process under which the contractors will communicate with the affected communities and interested authorities on a regular basis. Meetings will be held at least quarterly, monthly information brochures will be published, announcements will be placed in local media, and notices of upcoming planned activities will be posted, etc.

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

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

Upon receipt of a complaint, the CSC, the contractors' safeguard staffs or representatives will register the complaint in a complaint file and maintain a log of events pertaining to it thereafter, until it is resolved. Immediately after receipt, four copies of the complaint will be prepared. The original will be kept in the file, one copy will be used by the contractor's safeguard staffs, one copy will be forwarded to the CSC, and the fourth copy to the PMU within 24 hours since receipt of the complaint.

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

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

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

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

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

Service (GRS), please visit [www.worldbank.org/grs](http://www.worldbank.org/grs). For information on how to submit complaints to the World Bank Inspection Panel, please visit [www.inspectionpanel.org](http://www.inspectionpanel.org).

### **13. PUBLIC CONSULTATION AND INFORMATION DISLCOSURE**

#### **13.1. Objectives**

Public consultation and involvement are among the basic conditions to ensure the support of the subproject as well as the views expressed by the local government and the community for the subproject. Through public consultation, a number of adverse impacts and mitigation measures yet determined will be identified and incorporated into the report.

The basic principle of public consultation: (i) in compliance with the provisions of Clause 4, Article 12, Decree No.18/ND-CP dated February 14, 2015 of the Government on information disclosure and consultation of the community affected by the subproject; (ii) For group B subprojects, consultation of the affected and non-governmental organizations on local environmental issues of the subproject is required and their opinions are considered in the process of impact assessment and design of mitigation measures. Consultation should be further implemented in the subproject implementation phase to identify and resolve issues that may arise.

#### **13.2 Public Consultation Results**

The public consultation was held at the meeting hall of Trau Quy Town People's Committee with 87 participants (44% female). The consultation content includes: a) general information on the subproject; b) results of the environmental and social assessment and potential negative environmental and social impacts that can occur during subproject implementation; identify the scope of influence, proposed mitigation measures. Participants discussed with the Subproject Owner to incorporate their appropriate views and comments into the EIA and ESMP report; and c) presenting additional research needed. The meeting participants include:

- Representatives from the town: the departments of Trau Quy Town;
- Representatives of VNUA (leadership, lecturers);
- Representatives of VNUA students;
- Representatives of the companies/households doing business in VNUA campus.
- Representatives of households currently living in VNUA campus;

In addition to organizing the meeting, VNUA has sent a letter with a summary of the main investment categories, environmental issues, the environmental protection measures of the subproject to the Town People's Committee and Fatherland front Committee to consult on the subproject impact assessment report. Opinions of the participants of the meeting will be made in written by the Town People's Committee. At the same time the Subproject Owner has received the comments from the community, local authorities and other mass organizations in the consultation process. These comments are summarized in Table 29.

- About the consent to the subproject implementation: 100% participants agreed to implement the subproject, saying that the subproject will enhance infrastructure and improve the quality of research and training;
- Regarding the negative environmental and social impacts of the subproject: Households, VNAU staffs, students and representatives from the Town People's Committee agreed with the assessment of the negative environmental impacts such as dust and noise generated by vehicles transporting construction materials. Other impacts include issues of social security and order, environmental sanitation at the construction site, possible damage to the roads as transporting routes for raw materials;
- Regarding environmental mitigation measures: Vehicles transporting materials only operate at night to avoid nuisance to the life of people living along the routes and students. The supervision of the construction contractors must be taken seriously. Waste

from the laboratories must be checked against applicable standards before discharged into the local system.

- After receiving comments VNUA responded as follows:
- Commit to compensate for any damage to infrastructure by construction activities in accordance with the policies of the World Bank and the Government of Vietnam;
- Commit to perform mitigation measures as presented in the ESMP report;
- Commit to regularly coordinate with local government and contractors to manage staffs and workers during the subproject process to avoid conflicts with local people, traffic accidents, work accidents, and other harmful incidents;
- Commit to ensure normal traffic on the roads during the construction period;
- Hold accountable before the law if violate the standards and regulations of Vietnam on environmental protection.

**Table 29. Summary of public consultation results**

<i>Participants</i>	<i>Opinions</i>	<i>Responses by PMU/Consultant</i>
<ul style="list-style-type: none"> <li>- Trau Quy Town PC: 15 participants (Party cell, Fatherland front, Women’s Union, PC Office, Construction Dept., Youth Union, Land Admin. Dept., War Veteran Union, Elderly Union, Farmer Union,...)</li> <li>- VNUA: 07 (leadership, lecturers);</li> <li>- Representatives of VNUA students: 10 from different faculties;</li> <li>- Representatives of the companies/households doing business in VNUA campus: 5 households and 02 companies.</li> <li>- Representatives of households currently living in VNUA campus: 48</li> </ul>	<ul style="list-style-type: none"> <li>- The implementation of the subproject is really needed. VNUA has long been a training institution in agriculture with limited resources and arising obstacles which can be addressed by the subproject implementation.</li> <li>- The mitigation measures have been discussed adequately.</li> <li>- The impacts of the construction activities of the subproject are temporary and insignificant.</li> </ul>	All comments are well noted by PMU and consultant
	<ul style="list-style-type: none"> <li>- The layout of each investment item should be clarified in the general plan of VNUA.</li> </ul>	<ul style="list-style-type: none"> <li>- The overall map of the subproject was printed and posted at the hall by PMU for reference. After the consultation it will be kept at PC and sent to related neighborhood for reference if requested.</li> </ul>
	<ul style="list-style-type: none"> <li>- The restructuring of agricultural sector should be highlighted.</li> </ul>	<ul style="list-style-type: none"> <li>- Upon completion, a Subproject Performance Review will be conducted. This report will better highlight the restructuring of agricultural sector via subproject implementation.</li> </ul>
	<ul style="list-style-type: none"> <li>- All labs should be situated in a single building for better management of chemical waste.</li> </ul>	<ul style="list-style-type: none"> <li>- In design scheme, measures to collect and treat wastewater from labs in accordance with applicable regulations have been proposed.</li> </ul>
	<ul style="list-style-type: none"> <li>- Due attention should be paid to supervision.</li> </ul>	<ul style="list-style-type: none"> <li>- The subproject supervision is conducted by a competent consultant team to ensure the approved design be followed and compliance to all existing applicable regulations and standards.</li> <li>- In addition, the subproject is funded by the World Bank and will be closely supervised by an independent monitoring system for the Bank as well the community supervision board.</li> </ul>
	<ul style="list-style-type: none"> <li>- Dredging Cau Bay River should part of the subproject</li> </ul>	<ul style="list-style-type: none"> <li>- Subproject objectives include strengthening science and technology capacity and human</li> </ul>

<i>Participants</i>	<i>Opinions</i>	<i>Responses by PMU/Consultant</i>
	component in order to solve local environmental problem.	resources for agricultural restructuring and new rural development. However this opinion will be sent to the Subproject Owner for consideration.
	- How the waste soil from the subproject is addressed?	- The Subproject Owner has planned a site for waste material.
	- Do subproject design and implementation have impacts on local drainage system?	- Prior to construction, the contractor will survey the local drainage system and propose appropriate measures for temporary drainage during construction period. After construction, the site will be returned to original state by contractor.
	- Better clarify and quantify such issues as: post subproject staffs, training facilities, resources for agricultural restructuring, post subproject socio-economic status etc.	- Upon completion, a Subproject Performance Review will be conducted. This report will quantify these indicators to verify the subproject effectiveness and contribution to socio-economic development.
	- Proposed mitigation measures should be strictly followed.	- All environmental protection measures as presented in the approved EIA/ESMP will be integrated in the construction bidding documents, in addition, depending on the nature of each construction items the contractor will propose appropriate construction methods to minimize adverse impacts.

### **13.3 Responses and Commitments of Subproject Owner**

The Subproject Owner agrees on and acknowledges opinions/comments from the People's Committees of Trau Quy Ward and their local residents. The Subproject Owner and the Consultant have reviewed and incorporated those opinions/comments in the report and finalized the EIA and ESMP reports on the basis of fully acquiring opinions/comments of the People's Committees of Trau Quy Ward and local communities in the subproject area.

The Subproject Owner will continue to pay attention to the implementation and supervise the Contractor's performance of mitigation measures for environmental impacts adequately and in accordance with the contents in the EIA and ESMP report.

The Subproject Owner commits to reasonably handle all issues related to compensation and assistance for local people, according to regulations prescribed by the Vietnamese Government.

### **13.4. Information Disclosure**

The first draft ESMP in Vietnamese had been published at the offices of Trau Quy People's Town and the VNUA on November 28, 2016 for public consultation. Basing themselves on the contents of the EIA and ESMP, the local people could get the Subproject information and contribute their opinions/comments on environmental issues of the Subproject. The final draft ESMP in Vietnamese language will be published at the offices of Trau Quy People's Town, Ministry of Agriculture and Rural Development and VNUA on January 7<sup>th</sup> 2017.

The final draft ESMP in English will be disclosed through the World Bank's Operations Portal on January 10<sup>th</sup> 2017.

## **14. CONCLUSIONS, RECOMMENDATIONS AND COMMITMENT**

### **14.1 Conclusions**

The “Strengthening the Scientific and Technological Capacity and Human Resources Training for Agriculture Restructuring and New Rural Development” Project at Vietnam National University of Agriculture is to increase quality in training and scientific research, satisfying local and regional demand as well as supporting agricultural industrialization and modernization and the GoV’s integrated agricultural restructuring plan for new rural development. The proposed project is a step forwards to realize the Development Strategy for VNUA, which was approved by Ministry of Agriculture and Rural Development in 2015, with targets to develop VNUA as a multi-disciplinary, internationally recognized research university in agriculture and rural development.

The contents of ESMP report comply with environmental impact assessment requirements by Vietnam GoV as well as environmental safety policies of WB. The report will be an important document to be submitted to state management agencies on environment for use in the process of specifying location and scale of the construction works as well as for the approval process in obtaining the investment license for the subproject. Furthermore, this is an important document supporting the process of subproject appraisal and negotiation, signing a loan agreement between Vietnam GoV and WB’s sponsor.

The ESMP report identified and evaluated most of the environmental impacts in all the subproject phases, from designing phase to construction and operation phase. In the ESMP process, the impacts are evaluated based on theory, experiments, statistics, and experiences from similar projects. However, there is no absolute exact assessment, but only relative quantification for the impacts. During the subproject implementation, there must be proper adjustment based on the opinions of environmental monitoring consultants to reduce negative environmental impacts.

The positive impacts of implementing the subproject can be enumerated as increased capacity in scientific research and policy advocacy in agricultural sector, making significant breakthrough in agricultural scientific technologies and technology transfer for the restructuring and fostering Vietnam’s agricultural production to participate in global value chains; developed high-quality human resource for integration of Vietnam’s agriculture and regional labor market provision; enhanced social responsibility to better benefit agricultural communities from development and international integration; and upgraded facilities for researches and training at VNUA.

Most of impacts in the pre-construction and construction phases are temporary and small scale and taken place in construction sites and transport road route. There is no land acquisition, relocation or resettlement required for the subproject. In addition, the environmental impacts caused by transportation of materials and construction solid waste such as emissions of dust, exhaust gases, noise, vibration are unavoidable. Apart from generic environmental impacts, the subproject implementation can cause some negative impacts on learning and research activities by VNUA students and lecturers in a pedagogic environment.

Impacts in the operation phase are generally positive and long-term. Low negative impacts are expected as they mainly involve increased traffic density on newly construction roads within the VNAU campus and ambient air quality. Nevertheless, the subproject owner will fully perform prevention measures up to Vietnam environmental standards. The prevention and mitigation measures proposed and recommended in the report for environmental pollution (arising in the construction phase and operation phase) are feasible and meet Vietnam environmental regulations.

Environmental monitoring will be carried out as soon as the subproject is approved and licensed for subproject construction and operation by the State. Monitoring data will be recorded and serve as a legal basis for compliance with Vietnam environmental protection laws and environmental safety policies of WB. These data will also be used for evaluating efficiency and environmental sustainability of the subproject.

Subproject details have been disclosed to local people and authorities in the subproject areas. The subproject is supported and valuable opinions from local people and authorities were received.

The subproject has been disseminated to the people and the local government where the subproject is implemented. The subproject has received the support and good opinions of and local authorities.

#### **14.2 Recommendations**

In subproject implementation, PMU recommends Hanoi City People's Committee to direct relevant departments to closely collaborate with the Subproject Owner regarding environmental protection for the entire subproject life from preparation, construction to operation phase of constructed components.

For environmental protection, PMU needs coordination, support, and opinions from Department of Natural Resources and Environment of Hanoi City for effective subproject implementation.

For traffic access, PMU needs coordination as well as supports from Hanoi City Department of Transport, traffic police, local authorities to divert traffic flow, prevent traffic jam, railway accidents.

For dust prevention and construction site sanitation, PMU needs coordination from Hanoi City Urban Environmental Company to perform this task.

## **APPENDIX**

### **APPENDIX 1: LABORATORY SAFETY MANUAL- PRINCIPLES AT WORK IN THE LABORATORY**

To ensure safety and avoid unfortunate situations when working in the laboratory, each faculty staffs, lecturer, student, trainee and PhD student must master the required procedures and rules. The equipment and the use of personal protection are extremely necessary.

Before starting operations one must master 15 general regulations for working in the laboratory.

#### **I. LABORATORY REGULATIONS**

- 1) Conduct experiment only with the presence of lecturers and laboratory technicians.
- 2) Read the directions carefully and think before conducting experiments.
- 3) Know where the safety equipment is stored.
- 4) Wear laboratory coat.
- 5) Wear goggles.
- 6) Hair is neatly tied.
- 7) Clean experiment table before starting an experiment.
- 8) Never taste laboratory chemicals.
- 9) Do not eat or drink in the laboratory.
- 10) Do not look into the test tube.
- 11) In case of chemical spillage or accidents, immediately notify lecturers and/or laboratory technicians.
- 12) Wash the skin when exposed to chemicals.
- 13) If the eye contacts with chemical, wash the eye immediately.
- 14) Dispose of laboratory waste in the designated places as directed.
- 15) If there is any inquiry, please ask the laboratory head.

#### **II. LABORATORY RULES:**

1. Everyone who works in the lab (laboratory) should be trained and examined of labor safety rules, processes, rules and technical measures to ensure workplace safety.
2. Respect working discipline, workplace sanitation and guidance from the responsible staffs. No stranger or overtime working is allowed, except for pre-agreed permission from the lab head and VNUA security department.
3. Read carefully the document, understand all the details of the experiment before performing and anticipate problems that may occur for proactive prevention.
4. During conducting experiments carefully observe and record the data for the experiment report. After completion, clean and neatly arrange equipment and laboratory instruments.
5. In addition to the general provisions mentioned above, the specific provisions are applied to each laboratory depending on the nature of the experiments to ensure absolute safety for persons and property in the lab.

#### **III. LABORATORY SAFETY RULES**

All experiments using volatile substances, having unpleasant smells, toxic gases or concentrated acids must be conducted in a fume hood or well-ventilated place. Characteristics the chemicals used in the laboratory such as toxicity, risks of fire and explosion should be well comprehended to avoid mistakes when conducting experiments, leading to unfortunate consequences.

### 3.1. Working with toxic agents:

- In chemistry lab there are common but highly toxic chemicals, such as HCN, NaCN/KCN, Me<sub>2</sub>SO<sub>4</sub>, Hg, HgCl<sub>2</sub>, CO, Cl<sub>2</sub>, Br<sub>2</sub>, NO, NO<sub>2</sub>, H<sub>2</sub>S, NO<sub>2</sub>,... or substances used in organic synthesis such as CH<sub>3</sub>OH, C<sub>5</sub>H<sub>5</sub>N pyridine, THF, benzene, toluene, acrylonitrile, aniline, HCHO, CH<sub>2</sub>Cl<sub>2</sub>...
- Do not smell chemicals directly; smell them in a distance using hand waving.
- After work wash your face, hands and utensils (use soap).
- Store chemicals carefully.

### 3.2. Working with flammable substances:

- Flammable, volatile substances such as Et<sub>2</sub>O, Me<sub>2</sub>CO, ROH, kerosene, gasoline, CS<sub>2</sub>, benzene, etc. can be heated or distilled in a water or air bath on the sealed electric stove.
- Do not place near heat sources, circuit breakers,...
- When conducting crystallization from flammable solvents separate instruments must be used with the reflux condenser.

### 3.3. Working with explosive substances:

- When working with substances such as H<sub>2</sub>, alkali (metal & liquid), NaNH<sub>2</sub>/KNH<sub>2</sub>, concentrated acid, explosive organic matters (especially polynitro)... as well as when working under low or high pressure, protective glasses (made of organic glass) must be worn to protect the eyes and the important parts on the face.
- Do not bow to the boiled liquids or heated solids to prevent chemical splash (not well noticed issue). When heating the solution in a test tube use holder and always turn the tube mouth away from body, especially when heating concentrated acid or alkaline. Apprehend storing place and proficient use of firefighting tools and first aid medicine box in case of accidents for prompt and effective control.

## IV. WORKING WITH CHEMICALS

### 4.1. Experiments with toxic substances

- In the laboratory there are many toxins such as mercury (Hg), white phosphorus (P), carbon oxide (CO), hydrogen sulfide (H<sub>2</sub>S), phenol (C<sub>6</sub>H<sub>5</sub>OH), formic acid (HCOOH), benzene (C<sub>6</sub>H<sub>6</sub>), chlorine (Cl<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), etc...
- The experiments with hazardous substances should be conducted with small amounts of chemicals, work in a well ventilated area and good posture.

**Note:** do not taste chemical and master common chemical smelling practices.

### 4.2. Experiment with caustic and burning substances:

- Carefully perform experiments with concentrated alkaline, acid, alkali metals, phenols etc. to avoid contact to hands, clothing, especially the eye (use goggles).
- When diluting H<sub>2</sub>SO<sub>4</sub> acid carefully pour the acid into the water slowly and stir it well but not vice versa.
- When heating a solution of these substances comply with the rules of chemical heated in vitro

### 4.3. Experiment with flammable substances

- There are flammable substances such as alcohol, gasoline, Benzene, acetone ether... in the laboratory.
- Use small amount in experiment keep solutions away from the flames.... do not heat them directly over fire, use water bath instead.
- Do not use large pot to store these substances and keep them away from fire sources (eg Bunsen burner, electric stove...)

- Use alcohol burner in compliance with the defined rules.

#### 4.4. Experiments with explosives:

The explosives often found in laboratories are nitrate salts, chlorate salts etc.... These substances should be kept away from fire sources and carefully blended in accordance with the proper ratio of the volume. Wear protective gauges in experiment; high risk experiments are not allowed. When such gases as  $H_2$ ,  $C_2H_2$ ,  $CH_4$ , etc are burnt... their purity must be tested to avoid mixing with oxygen creating dangerous explosive mixture. Do not put large amount of sodium into the water as this will cause a fire and explosion accident.

##### How to test:

Collect  $H_2$  gas through  $H_2O$  into the small test tubes. Use finger to cover the tube containing  $H_2$  and put the tube mouth near an alcohol burner. When opening the tube, the mixture of  $H_2$  gas and  $O_2$  (in the air) will fire with pretty loud sound. Continue this process until no loud sound is heard to gain the pure  $H_2$ .

Use of glassware:

- Carefully put glass tube through the button to avoid cracking.
- Do not put hot water, boiling water into the cold or room temperature glass container.
- If finger is cut by broken glass bleed off the toxic substance for few seconds before washing with 90° alcohol and applying bandage.
- Broken glass instruments should be collected separately from other waste.

### V. NOTES FOR TOXIC PREVENTION IN CHEMICAL LABORATORY

#### 5.1. Toxic precaution

- Each chemical laboratory should be equipped with protective facilities such as gowns, rubber gloves, goggles, ventilators etc.
- Carefully read labels and understand toxicity signs when using chemicals. Keep in mind how to take and smell chemicals. In the process of experimenting with toxic escaping fumes such experiment should be conducted in a well ventilated area or in fume hood.

#### 5.2. Explosion and fire precautions

- Each laboratory should prepare sufficient means of fire prevention and fighting: fire extinguishers, sand, water containers, sacks, buckets etc. Laboratory staffs should understand the principles of firefighting and especially master the principles of storing and using explosive chemicals, flammable and explosive fire symbols on the label on the chemical containers. When a fire or explosion occur quickly determine the causes to propose suitable remedial measures.
- In cases when accidents happen all employees must apply first aid rules for the victims before transferring to the medical facility.

#### 5.3. First aid for chemical accidents

##### *In case of burns:*

- For burns by flammable solvents such as benzene, acetone ( $C_6H_6$ ,  $CH_3COCH_3$  etc....) use wet cloths over the burnt part, then apply sand or wet burlap to extinguish the fire. Do not use water to wash the burns; instead use potassium permanganate soaked gauze ( $KMnO_4$  1%) or carefully apply picric acid  $H_3BO_3$  2% on burn wounds.
- For concentrated alkali burns, caustic soda, caustic potat ( $NaOH$ ,  $KOH$ ): Use clean water to wash the wound several times, then wash with 5% acetic acid solution. If the eye contacts with alkaline it must be washed with clean water several times then boric acid solution ( $H_3BO_3$  2%).

- For concentrated acid burns like sulfuric acid, nitric ( $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$ ...): First wash with clean water several times, then use 5% of ammonia or 10% solution of  $\text{NaHCO}_3$ , to remove the acid (do not use soap to wash the wound). If the eye contacts with acid it must be quickly washed thoroughly several times with clean water and distilled water then sodium hydrogen carbonate ( $\text{NaHCO}_3$ ) 3%.
- For burns by phosphorus (P): First wash the burn with copper sulfate solution ( $\text{CuSO}_4$ ) 2%. Do not use ointments or vaseline. Then apply gauze soaked with copper sulfate 2% solution or aqueous potassium permanganate ( $\text{KMnO}_4$ ) 3% on the wound. This type of burns takes longer time to recover, be aware of infection.

### ***In case of poisoning:***

- Drinking acid by mistake: First let the victim drink ice water, crushed egg shells (1/2 spoon in the cup of water) and drink slowly magnesium oxide powder ( $\text{MgO}$ ) mixed with water (29 grams in 300 ml of water). Do not use purge.
- *Poisoned by absorbing alkali (ammonia, caustic soda...)*: first have the victim drink diluted vinegar (2% acetic acid) or lemon juice. Do not drink purge.
- *Poisoned by digesting mercury compounds*, first have the victim vomit and drink milk with egg whites. Then have the victim drink activated charcoal.
- *Poisoned by white phosphorus*: first have the victim vomit, then drink copper sulfate solution ( $\text{CuSO}_4$ ) 0.5 grams in a liter of water and iced water. Do not drink milk, egg whites, oil because these substances solute phosphorus.
- *Poisoned by lead mixture*: have the victim drink sodium sulfate ( $\text{Na}_2\text{SO}_4$ ) 10% or magnesium sulfate ( $\text{MgSO}_4$ ) 10% in warm water because these substances will form a precipitate with lead. Then drink milk with the egg whites and activated charcoal.
- *Poisoned due to inhalation of toxic gases such as chlorine, bromine..* ( $\text{Cl}_2$ ,  $\text{Br}_2$ ): carry the victim to open space, loosen waistband, breath in a small amount of ammonia or 90° alcohol mixed with ammonia.
- *Poisoned from breathing hydrogen sulfide, carbon oxides...* ( $\text{H}_2\text{S}$ ,  $\text{CO}$ ): lay the victim in open space and breath in pure oxygen for breathing and apply artificial respiration if necessary.
- + *Poisoned by overinhaling ammonia*: let the victim inhale hot water steam, then drink lemon juice or diluted vinegar.

### ***Fire fighting in the laboratory***

#### ***a. Water:***

- Water is effective in wetting, cooling, extinguishing and preventing fire from spreading when sprayed onto the material near the fire. It is best to use a small jet of water with droplet size of 0.3-0.8mm.
- Water is effective in extinguishing fire of the conventional solids: wood, paper, coal, rubber, cloth and some water-soluble liquid (organic acid, acetone, low ranking alcohol)

#### **Do not use water when:**

- Extinguishing fire in powered equipment as this will destroy other equipment.
- There are substances reactive with water in the fire area.
- Extinguish the fire and liquid hydrocarbons dissolved in water which is lighter than water density. These substances will float on the water and the fire will spread.
- Fire by oil, high temperature liquids or melting solids. It is dangerous to use water which will cause boiling, exploding or foaming.

***b. CO<sub>2</sub> tank:*** Pressurized  $\text{CO}_2$  (often 60atm) will evaporate and cover the fire by dry snow forms when released.

Advantages:

- Easy to use, especially in the small fire, CO<sub>2</sub> is not harmful for machinery and equipment, including electrical equipment.
- The amount of CO<sub>2</sub> is determined by weighing the tank.

Do not use CO<sub>2</sub> tank in the following cases:

- burning clothes (because cold CO<sub>2</sub> will harm exposed skin)
- fire by alkali metal, magnesium, substances capable of separating oxygen (peroxide, chlorate, potassium nitrate, permanganate,...), the organometallic liquids such as aluminum alkyl (however CO<sub>2</sub> can be used for the alkali metal and organometallic substances in organic solvents)
- CO<sub>2</sub> is less effective when extinguishing fire of decaying materials.

*c. Portable chemical foam tank:*

Powder extinguisher (eg, sodium carbonate and additives, ammonium phosphate and additives, or some other substance) + compressed inert gas in a small bottle mounted on the extinguisher.

Usage:

- Overturn the tank, NaHCO<sub>3</sub> reacts with sulfuric acid generating CO<sub>2</sub> foam that insulates air from fire and cools fired objects.
- when there are no other means of extinguishing fires, or other means are ineffective.
- Most effective for extinguishing fires of alkali metals, alkaline earth, organometallic, metal hydride...
- Less toxic, little or no damage to equipment, no risk of electrocution.

Disadvantages:

- Powder cover should be thick enough for the fire not to be resumed.
- Foam with acid and salt → good electrical conductivity → only use when power is disconnected.
- Do not use in places where substances can react with water to cause explosions, fires and gas separation, corrosive gas, heat... (eg peroxide chemicals, hydra, carbide, andrit, organometallic...)
- Do not use in places where chemicals can corrode or damage due to fire-fighting foam.
- Best for extinguishing large fires when other means are less effective.
- The usage range can vary depending on powder type loaded in the tank: For example, sodium bicarbonate is not used for alkali metal fires because when heated it decomposes into CO<sub>2</sub> and H<sub>2</sub>O, the remaining material interacts with hot alkali metal and makes the fire stronger.

*d. Asbestos fabric:*

- Only used for extinguishing small fires (<1m<sup>2</sup>). Incombustible asbestos cloth, separating the oxygen with fire → extinguishing fire. Only cover asbestos cloth over the fire when the temperature is lowered to avoid fire resuming from flammable materials.
- To cool down quickly, spray CO<sub>2</sub> foam on asbestos cloth to extinguish burning cloth on body.
- Use wet cloth, thick woolen cloth or wet blanket to put out the fire of clothes on body.

However, usage of asbestos material is restricted as it can be toxic to humans.

*e. Dried sand:* Dry sand can be used to extinguish the fire containing small amounts of liquids, solids when water can not be used.

**VI. FIRST AID FOR INJURY AND POISONING IN LABORATORY:**

- The general instruction is given as different specific solutions are applied by cases.
- Easy access must be secured to laboratory medicine cabinet. Medicine cabinets usually contain bandages, alcohol iodine, ointments, solutions of  $\text{KMnO}_4$  3%,  $\text{CuSO}_4$ ,  $\text{NaHCO}_3$  2%,  $\text{CH}_3\text{COOH}$  1%, tannin solution in alcohol...

### **First-aid kits in chemistry lab**

First-aid kits in chemical laboratories should be in the most appropriate place and managed by lab staffs. The kit cabinet includes:

- Tools: medical cotton, gauze, bandages, tweezers, scissors, syringes.
- Drugs.
  - hemostatic drugs: alcohol iodine 5% solution
  - antiseptic drugs: potassium permanganate solution ( $\text{KMnO}_4$  5%), alcohol 400
  - burn treating drugs: sodium bicarbonate ( $\text{NaHCO}_3$ ) 5% ammonia solution ( $\text{NH}_4\text{OH}$ ) 2%, copper sulfate solution ( $\text{CuSO}_4$ ) 2%, solution of acetic acid ( $\text{CH}_3\text{COOH}$ ) 2%.
  - assisting drugs: vitamin B1, C, K, glucose or saccharose sugar...
    - + When contacting with concentrated acid ( $\text{H}_2\text{SO}_4$ ,  $\text{HNO}_3$ ,  $\text{HCl}$ ,  $\text{HOAc}$ ,...) or bromine, phenol, wash with strong running water for a few minutes, then use cotton dipped with  $\text{NaHCO}_3$  2% or tannin in alcohol covering up the burn.
    - + When the eye contacts with chemicals it must be washed with water several times before the victim being hospitalized immediately.
    - + If poisoned by breathing too much gases such as  $\text{Cl}_2$ ,  $\text{Br}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{CO}$ ,... the victim must be carried to the open space immediately. When poisoned with metals such as As, Hg,... or cyanide the victim must be transferred immediately to the hospital for emergency treatment.

The laboratory always stores a certain amount of chemicals that may be spread into the air and exposed to staffs. Also while performing experiment, chemicals interact and react with each other; reckless operations will lead to unfortunate consequences.

## **APPENDIX 2: ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT SYSTEM IN LABORATORY**

### **I. CHEMICAL MANAGEMENT PROGRAM**

One of the most important components of a laboratory safety program is chemical management. Prudent chemical management includes the following processes.

#### **1.1. Chemical Procurement**

Before a substance is received, information on proper handling, storage, and disposal should be known to those who will be involved. The standard further Vietnam Government that “No container should be accepted without an adequate identifying label. Preferably, all substances should be received in a central location.” These procedures are strongly recommended. Personnel should be trained to identify signs of breakage (e.g., rattling) and leakage (e.g., wet spot or stain) on shipments and such shipments should be refused or opened in a hood by laboratory staffs.

Some organizations have specific purchasing policies to prohibit unauthorized purchases of chemicals and other hazardous materials. The purchaser must assume responsibility for ownership of the chemical.

Because of the possibility of a chemical leak or release and subsequent exposure, chemical shipments should only be received by trained personnel in a laboratory or central receiving area

with proper ventilation. Neither administrative offices nor the mail room is appropriate for receipt or opening of chemical shipments.

When preparing to order a chemical for an experiment, several questions should be asked:

- What is the minimum amount of this chemical that is needed to perform the experiment? Is it available elsewhere in the facility? Remember, when ordering chemicals, less is always best. Prudent purchasing methods will save storage space, money, and disposal costs. Larger containers require more storage space and will incur additional disposal costs if the chemical is not used.
- Has the purchase been reviewed by the chemical hygiene officer (CHO) to ensure that any special requirements can be met?
- Is the proper personal protective equipment (PPE) available in the laboratory to handle this chemical?
- What are the special handling precautions?
- Where will the chemical be stored in the laboratory?
- Does the laboratory chemical hood provide proper ventilation?
- Are there special containment considerations in the event of a spill, fire, or flood?
- Will there be additional costs or considerations related to the disposal of this chemical?

### ***1.2 Chemical Storage***

To lessen risk of exposure to hazardous chemicals, trained laboratory personnel should separate and store all chemicals according to hazard category and compatibility. In the event of an accident involving a broken container or a chemical spill, incompatible chemicals that are stored in close proximity can mix to produce fires, hazardous fumes, and explosions. Laboratory personnel should read the Material Safety Data Sheet (MSDS) and heed the precautions regarding the storage requirements of the chemicals in the laboratory.

To avoid accidents, all chemical containers must be properly labeled with the full chemical name, not abbreviations, and using a permanent marker. All transfer vessels should have the following label information:

- Chemical name,
- Hazard warnings,
- Name of manufacturer
- Name of researcher in charge, and
- Date of transfer to the vessel.

Incoming chemical shipments should be dated promptly upon receipt, and chemical stock should be rotated to ensure use of older chemicals. It is good practice to date peroxide formers upon receipt and date again when the container is opened so that the user can dispose of the material according to the recommendations on the MSDS. Peroxide formers should be stored away from heat and light in sealed airtight containers with tight-fitting, nonmetal lids. Test regularly for peroxides and discard the material prior to the expiration date.

When storing chemicals on open shelves, always use sturdy shelves that are secured to the wall. Use secondary containment devices (i.e., chemical-resistant trays) where appropriate. Do not store chemicals in the laboratory chemical hood, on the floor, in the aisles, in hallways, in areas of egress, or on the benchtop. Chemicals should be stored away from heat and direct sunlight

Only laboratory-grade explosion-proof refrigerators and freezers should be used to store properly sealed and labeled chemicals that require cool storage in the laboratory. Periodically clean and defrost the refrigerator and freezer to ensure maximum efficiency. Domestic refrigerators and freezers should not be used to store chemicals; they possess ignition sources and can cause

dangerous and costly laboratory fires and explosions. Do not store food or beverages in the laboratory refrigerator.

Highly hazardous chemicals must be stored in a well-ventilated secure area that is designated for this purpose. Cyanides must be stored in a tightly closed container that is securely locked in a cool dry cabinet to which access is restricted. Protect cyanide containers against physical damage and separate them from incompatibles. When handling cyanides, follow good hygiene practices and regularly inspect your PPE. Use proper disposal techniques..

Flammable liquids should be stored in approved flammable-liquid containers and storage cabinets. Observe National Fire Protection Association, International Building Code, International Fire Code, and other local code requirements that limit the quantity of flammables per cabinet, laboratory space, and building. Consult the local fire marshal for assistance, if needed. Store odiferous materials in ventilated cabinets. Chemical storage cabinets may be used for long-term storage of limited amounts of chemicals.

Rooms that are used specifically for chemical storage and handling (i.e., preparation rooms, storerooms, waste collection rooms, and laboratories) should be controlled-access areas that are identified with appropriate signage. Chemical storage rooms should be designed to provide proper ventilation, two means of access/egress, vents and intakes at both ceiling and floor levels, a diked floor, and a fire suppression system. If flammable chemicals are stored in the room, the chemical storage area must be a spark-free environment and only spark-free tools should be used within the room. Special grounding and bonding must be installed to prevent static charge while dispensing solvents

### ***1.3 Chemical Handling***

Important information about handling chemicals can be found in the MSDS. A comprehensive file of MSDSs must be kept in the laboratory or be readily accessible online to all employees during all work shifts. Trained laboratory personnel should always read and heed the label and the MSDS before using a chemical for the first time. Laboratory personnel should be familiar with the types of PPE that must be worn when handling the chemical. Ensure that the ventilation will be adequate to handle the chemicals in the laboratory. One should be familiar with the institutional Chemical Hygiene Plan (CHP) and Emergency Action Plan (EAP) so that appropriate actions are taken in the event of a chemical spill, fire, or explosion.

### ***1.4 Chemical Inventory***

The Occupational Safety and Health Administration (OSHA). Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity. Thus, a system for maintaining an accurate inventory of the laboratory chemicals on campus or within an organization is essential for compliance with local and state regulations and any building codes that apply. There are many benefits of performing annual physical chemical inventory updates:

Ensures that chemicals are stored according to compatibility tables,

- eliminates unneeded or outdated chemicals,
- increases ability to locate and share chemicals in emergency situations,
- updates the hazard warning signage on the laboratory door,
- promotes more efficient use of laboratory space,
- checks expiration dates of peroxide formers,
- ensures integrity of shelving and storage cabinets,
- encourages laboratory supervisors to make “executive decisions” about discarding dusty bottles of chemicals,
- repairs/replaces torn or missing labels and broken caps on bottles,

- ensures compliance with all federal, state, and local record-keeping regulations,
- promotes good relations and a sense of trust with the community and the emergency responders,
- reduces the risk of exposure to hazardous materials and ensures a clean and healthful laboratory environment, and
- may reduce costs by making staffs aware of chemicals available within the organization.

Every laboratory should maintain an up-to-date chemical inventory. A physical chemical inventory should be performed at least annually, or as requested by the CHO. Although the software that is used to maintain the inventory and the method of performing the chemical inventory will vary from one institution to another, ultimately, the chemical inventory should include the following information:

- Chemical name,
- Chemical Abstract Service number,
- Manufacturer,
- Owner,
- Room number, and
- Location of chemical within the room.

Note that the chemical name should be listed with its synonyms. This will allow for cross-indexing for tracking of chemicals and help reduce unnecessary inventory.

Important safety issues to consider when performing a chemical inventory are:

- Wear appropriate PPE and have extra gloves available.
- Use a chemical cart with side rails and secondary containment.
- Use a laboratory step stool to reach chemicals on high shelves.
- Read the EAP and be familiar with the institution's safety equipment.
- If necessary cease all other work in the laboratory while performing the inventory.

Once the inventory is complete, use suitable security precautions regarding the accessibility of the information in the chemical inventory. For example, precautions should be taken when the database shows the location of Department of Homeland Security (DHS) Chemicals of Interest in excess of DHS threshold quantities.

### ***1.5 Transporting, Transferring, and Shipping Chemicals***

It is prudent practice to use a secondary containment device (i.e., rubber pail) when transporting chemicals from the storeroom to the laboratory or even short distances within the laboratory. When transporting several containers, use carts with attached side rails and trays of single piece construction at least 2 in. deep to contain a spill that may occur. Bottles of liquids should be separated to avoid breakage and spills. Avoid high-traffic areas when moving chemicals within the building. When possible, use freight elevators when transporting chemicals and do not allow other passengers. If you must use a general traffic elevator, ask other passengers to wait until you have delivered the chemicals.

Always ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup. Use a properly operating chemical fume hood, local exhaust, or adequate ventilation, as verified by monitoring, when transferring PHSs.

All outgoing domestic and international chemical shipments must be authorized and handled by the institutional shipper. The shipper must be trained in U.S. Department of Transportation (DOT) regulations for ground shipments and must receive mandatory International Air Transport Association training for air shipments. DOT oversees the shipment of hazardous materials and has the authority to impose citations and fines in the event of noncompliance.

## ***1.6 Chemical Waste***

All chemical waste must be stored and disposed of in compliance with applicable of VietNam Government, and institutional regulatory requirements. Waste containers should be properly labeled and should be the minimum size that is required. There should be at least 2 in. of headspace in the liquid waste container to avoid a buildup of gas that could cause an explosion or a container rupture.

## **II. EMERGENCY PROCEDURES**

### ***2.1 Fire Alarm Policy***

When a fire alarm sounds in the facility, evacuate the laboratory immediately via the nearest exit. Extinguish all Bunsen burner and equipment flames. If the fire originates in your laboratory, follow all institutional policies regarding firefighting and suppression. Check restrooms and other areas with possible limited audio or visual notification of an alarm before exiting the facility. Where necessary, provide assistance to persons with disabilities to ensure they are able to exit the facility.

### ***2.2 Emergency Safety Equipment***

The following is a guide to safety equipment found in a laboratory

1. A written EAP has been developed and communicated to all personnel in the unit. The plan includes procedures for evacuation, ventilation failure, first aid, and incident reporting.
2. Fire extinguishers are available in the laboratory and tested on a regular basis. If a fire extinguisher is activated for any reason, make an immediate report of the activity to the CHO, fire marshal, or appropriate individual responsible for fire safety equipment so that the fire extinguisher is replaced in a timely manner.
3. . Eyewash units are available, inspected, and tested on a regular basis
4. . Safety showers are available and tested routinely
5. Fire blankets are available in the laboratory, as required. Fire blankets can be used to wrap a burn victim to douse flames as well as to cover a shock victim and to provide a privacy shield when treating a victim under a safety shower in the event of a chemical spill.
6. NOTE: Laboratory personnel should be taught that fire blankets can be dangerous if used incorrectly. Wrapping a fire blanket around a person on fire can result in a chimney-like effect that intensifies, rather than extinguishes, the fire. Fire blankets should never be used on a person when they are standing.
7. First-aid equipment is accessible, whether through a kit available in the laboratory or by request through the organization
8. Fire alarms and telephones are available and accessible for emergency use
9. Pathways to fire extinguishers, eyewash units, fire blankets, first-aid kits, and safety showers are clear.

### ***2.3 Chemical Spill Policy***

Laboratory personnel should be familiar with the chemical, physical, and toxicological properties of each hazardous substance in the laboratory. Consult the label and the MSDS prior to the initial use of each hazardous substance. Always use the minimal amount of the chemical and use caution when transporting the chemical. In the event of an accidental chemical release or spill, personnel should refer to the following general guidelines

Most laboratory workers should be able to clean up incidental spills of the materials they use. Large spills, for example, 4lit or more, may require materials, protective equipment, and special

handling that make it unsafe for cleanup by laboratory workers themselves. Lab workers should be instructed to contact EHS personnel to evaluate how to proceed with spill cleanup

In the event that the spill material has been released to the environment, notify EHS personnel immediately. A release to the environment includes spills directly into a drain or waterway or onto land, such as grass or dirt

*Low-flammability and low-toxicity materials that are not volatile (e.g., inorganic acids and caustic bases)*

1. Decontaminate any victim at the nearest safety shower or eyewash unit. Take other appropriate action as described in the MSDS.
2. Notify appropriate personnel immediately.
3. Limit or restrict access to the area as necessary
4. Wear PPE that is appropriate to the degree of hazard of the spilled substance
5. Use chemical spill kits that contain an inert absorbent to clean up the affected area if this action can be accomplished without risk of additional injury or contamination to personnel. If the spill is located on the laboratory floor, be aware that some absorbents can create a slipping hazard.
6. Dispose of contaminated materials according to institutional policy.
7. Complete an incident report and submit it to the appropriate office or individual
8. Label all phones with emergency phone numbers.

*Flammable solvents of low toxicity (e.g., diethyl ether and tetrahydrofuran)*

1. Decontaminate any victims at the nearest safety shower or eyewash unit. Take other appropriate action as described in the MSDS.
2. Alert all other personnel in the laboratory and the general vicinity of the spill.
3. Extinguish all flames and turn off any sparkproducing equipment. If necessary, turn off power to the laboratory at the circuit breaker. The ventilation system must remain operational.
4. Immediately notify appropriate personnel.
5. Limit or restrict access to the area as necessary.
6. Wear PPE that is appropriate to the degree of hazard of the spilled substance.
7. Use spill pillows or spill absorbent and nonsparking tools to soak up the solvent as quickly as possible. Be sure to soak up chemicals that have seeped under equipment and other objects in the laboratory. If the spill is located on the laboratory floor, be aware that some absorbents can create a slipping hazard.
8. Dispose of contaminated materials according to institutional policy.
9. Complete an incident report and submit it to the appropriate office or individual.

*Highly toxic materials (e.g., dimethylmercury)*

1. Alert all trained laboratory personnel in the laboratory and the general vicinity of the spill and immediately evacuate the area.
2. Decontaminate any victims at a safety shower or eyewash unit in a safe location. Take other appropriate decontamination action as described in the MSDS.
3. Immediately notify appropriate personnel.
4. Limit or restrict access to the area as necessary.
5. Do not attempt to clean up the spill. EHS personnel will evaluate the hazards that are involved with the spill and will take the appropriate actions.
6. Only EHS personnel and appropriate outside industrial hygienists are authorized to

decontaminate the area and dispose of the contaminated waste.

7. Complete an incident report and submit it to the appropriate office or individual.

#### **2.4 Accident Procedures**

In the event of an accident, follow all institutional policies for emergency response and notify the internal point of contact for laboratory safety and local emergency responders. All accidents involving personal injury, however slight, must be immediately reported according to your institution's procedure. Provide a copy of the appropriate MSDS to the attending physician, as needed. Complete an accident report and submit it to the appropriate office or individual within 24 hours of the incident.

### **III. EMPLOYEE SAFETY TRAINING PROGRAM**

Newly hired employees or students working in a laboratory should be required to attend basic safety training prior to their first day. Additional training should be provided to laboratory personnel as they advance in their laboratory duties or when they are required to handle a chemical or use equipment for the first time

Safety training should be viewed as a vital component of the laboratory safety program within the organization. The organization should provide ongoing safety activities that serve to promote a culture of safety in the workplace that will begin when the person begins work and will continue for the length of their tenure. Personnel should be encouraged to suggest or request training if they feel it would be beneficial. The training should be recorded and related documents maintained in accordance with organizational requirements.

Training sessions may be provided in-house by professional trainers or may be provided via online training courses. Hands-on, scenario-based training should be incorporated whenever possible. Safety training topics that may prove to be helpful to laboratory personnel include

- use of CHPs and MSDSs,
- chemical segregation,
- PPE,
- safety showers and eyewash units,
- first aid and cardiopulmonary resuscitation,
- chemical management,
- gas cylinder use,
- fire extinguisher training,
- laser safety, and
- emergency procedures.

## **APPENDIX 3. SUSTAINABLE DESIGN GUIDE**

### **Optimize Site Potential**

Sustainable site planning should consist of a whole system approach that seeks to:

- Minimize development of open space through the selection of disturbed land, re-use of brown-field sites, and retrofitting existing, buildings;
- Provide wildlife corridors if possible on a base, campus or facility-wide scale. Link natural areas to the greatest extent possible so that contiguous areas allow for undisturbed wildlife movement;
- Consider energy implications and carbon emissions in site selection and building orientation;

- Control erosion through improved grading and landscaping practices;
- Use native plants and remove existing invasive plants;
- Reduce heat islands through building design methods, minimizing impervious surfaces, and using landscaping;
- Minimize habitat disturbance;
- Reduce, control, and treat surface runoff;
- Restore the health of degraded sites by improving habitat for indigenous species through appropriate native plants, climate-adapted plants, and closed-loop water systems;
- Locate the building in walkable distance to a range of stores and services, particularly grocery stores;
- Incorporate transportation solutions along with site plans that acknowledge the need for bicycle parking, carpool staging, and proximity to mass transit. Encourage alternatives to traditional commuting;
- Consider site security concurrently with sustainable site issues. Location of access roads, parking, vehicle barriers, and perimeter lighting, among others are key issues that must be addressed; and
- Work closely with lighting designer to reduce security lighting and its associated light pollution. With overly bright security lighting, often the "bad guys" can safely stage operations just out of range, invisible to the security personnel whose eyes are adjusted to the overly bright immediate environment.

### **Optimize Energy Use**

During the facility design and development process, building project must have a comprehensive, integrated perspective that seeks to:

- Reduce heating, cooling, and lighting loads through climate-responsive design and conservation practices;
- Employ renewable energy sources such as day-lighting, passive solar heating, photovoltaic, geothermal, and groundwater cooling;
- Specify efficient heating, ventilating, and air-conditioning (HVAC) and lighting systems that consider part-load conditions and utility interface requirements;
- Optimize building performance by employing energy modeling programs and optimize system control strategies by using occupancy sensors CO<sub>2</sub> sensors and other air quality alarms;
- Monitor project performance through a policy of commissioning, metering, annual reporting, and periodic re-commissioning; and
- Integrate water saving technologies to reduce the energy burden of providing potable water.

### **Protect and Conserve Water**

The protection and conservation of water must be considered throughout the life of the building. Facility owners and developers must seek to:

- Use water efficiently through high efficiency fixtures, elimination of leaks, water conserving cooling towers, and other actions;
- Balance the energy and water conservation strategies in cooling tower through water and air side economizers and the use of off-peak cooling as appropriate;
- Improve water quality. For example, storm water settling ponds, kitchen grease-traps, eliminate garbage disposals, and lead-bearing products in potable water;

- Recover non-sewage and gray-water for on-site use (such as toilet flushing and landscape irrigation, and more generally, consider the water quality requirements of each water use);
- Establish waste treatment and recycling centers;
- Apply the Best Management Practices for Water Conservation;
- Follow Environmental Protection Agency (EPA) Technical Guidance on Implementing the Storm water Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act hydrology requirements to maintain or restore predevelopment hydrology of the property with regard to the temperature, rate, volume and duration of flow.

### **Optimize Building Space and Material Use**

As early as during conceptual design and design-development stages, the project must have a comprehensive, integrated perspective that seeks to:

- Salvage and utilize existing facilities, products, and equipment whenever possible, such as historic structures, previous brown-field or grey-field sites, and reconditioned fixtures and furnishings;
- Design facilities adaptable for different uses during their life cycle incorporating building components that can be disassembled, and reused or recycled;
- Reduce overall material use through optimizing building size and module;
- Evaluate the environmental preferability of products using lifecycle thinking and lifecycle assessment (LCA)
- When new materials are used, maximize their recycled content, especially from a post-consumer perspective;
- Specify materials harvested on a sustained yield basis such as lumber from third-party certified forests;
- Limit the generation of construction and demolition (C&D) materials, encourage the separation of waste streams, and ensure that reuse and recycling is done in an environmentally acceptable manner during the construction, renovation, and demolition processes;
- Eliminate the use of materials that pollute or are toxic during their manufacture, use, or reuse;
- Give preference to locally produced products and other products with low embodied energy content; and
- Encourage success of operational-waste recycling through planning in the design-development phase.

### **Enhance Indoor Environmental Quality (IEQ)**

During the facility/renovation design and development process, the project must have a comprehensive, integrated perspective that seeks to:

- Facilitate quality IEQ through good design, construction, commissioning, and operating and maintenance practices;
- Value aesthetic decisions, such as the importance of views and the integration of natural and man-made elements;
- Provide thermal comfort with a maximum degree of personal control over temperature and airflow;
- Supply adequate levels and quality of ventilation and outside air for acceptable indoor air quality;

- Prevent airborne bacteria, mold, and other fungi, as well as radon, through building envelope design that properly manages moisture sources from outside and inside the building, and with heating, ventilating, air-conditioning (HVAC) system designs that are effective at controlling indoor humidity;
- Use materials that do not emit pollutants or are low-emitting;
- Assure acoustic privacy and comfort through the use of sound absorbing material and equipment isolation;
- Control disturbing odors through contaminant isolation and removal, and by careful selection of cleaning products. Pursue energy efficient strategies to remove harmful odors while recovering the energy used in conditioning the interior environment;
- Create a high-performance luminous environment through the careful integration of natural and artificial light sources; and
- Provide quality water.

### **Optimize Operations and Maintenance Practices**

Throughout the building's life cycle, operations and maintenance should seek to:

- Train building occupants, facilities managers, and maintenance staff in sustainable design principles and methods that will minimize system failures;
- Purchase cleaning products and supplies that are resource-efficient, bio-degradable and safer for both janitorial staff and building occupants, and thereby improving indoor air quality;
- Test sensor control points on a regular basis to ensure energy efficiency is not compromised;
- Use automated monitors and controls for energy, water, waste, temperature, moisture, and ventilation;
- Reduce waste through source reduction and recycling to eliminate off-site disposal;
- Minimize travel by supporting telecommuting programs and enabling a mobile work environment;
- Perform scheduled energy audits and re-commissioning of systems; and
- When updating a facility or its systems, choose higher efficiency equipment, durable materials that will withstand storms and other natural events, and improve the tightness of the building envelope if feasible.