

LAO CAI PROVINCIAL PEOPLE'S COMMITTEE
ODA PROJECTS MANAGEMENT UNIT



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Final Report

MEDIUM CITIES DEVELOPMENT PROJECT (MCDP) -
ADDITIONAL FINANCE
LAO CAI CITY SUBPROJECT



LAO CAI, December 2016

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ADDITIONAL FINANCE
LAO CAI CITY SUBPROJECT**

**INVESTOR'S REPRESENTATIVE
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LIST OF ABBREVIATIONS

AP	Affected person
AS	Allowing standards
BOD	Biochemical oxygen demand
BC	Basic Construction
Con	Construction
CMC	Construction monitoring consultant
COD	Chemical oxygen demand
CC	Consultant
DPI	Lao Cai department for planning and investment
DONRE	Lao Cai Department of Natural Resources and Environment
DD	Detail Design
EP	Environmental protection
ESIA	Environmental and social impact assessment
ESMP	Environmental and social management plan
ES	Environmental sanitation
EPA	USA environmental protection agency
EM	Environmental monitoring
FS	Feasibility study
FTA	Authority of the US road traffic management
FF	Fire fighting
GDP	Gross domestic products
HW	Highway
IP	Investment preparation
I&E	Import and Export
IDA	International development association
LC	Land clearance
Ltd	Limited
M&O	Maintenance and operation
MEDP	Ethnic minority development plan
NTR	National Technical regulations
ODA	Official development assistance
OCI	Orient JSV Infrastructure Construction and Investment
PM	Project management
RP	Resettlement plan
RS	Resettlement
RC	Reinforcement concrete
PS	Primary school
PPC	People Committee
SEMP	Site Environmental management plan
TCVN	Viet Nam national standards
T-N	Total of Nitrogen
TOR	Term of reference

T-P	Total of Phosphorous
TSP	Total Suspended Particles
TSS/ SS	Total of suspended solids
TP	Treatment plant
USD	USD
VNĐ	Việt Nam Currency
WB	World Bank
WHO	World Health organization
WSC/ LCWSC	Lao Cai water supply company limited
WWTP	Wastewater treatment plant
WT	Wastewater treatment
WP	Water plant
WS	Working safety

CHAPTER 1: INTRODUCTION AND PROJECT DESCRIPTION

This Environmental Impact Assessment (EIA) report has been prepared by the City of Lao Cai to ensure that the proposed Lao Cai City Subproject of the Medium Cities Development Project (MCDP) - Additional funds is compliant with both World Bank and Government of Vietnam (GoV) requirements.

1.1. Background and objectives of the project

Original Project

The Medium Cities Development Project (MCDP) was approved by Prime Minister in Document No. 602 / TTg-QHQT dated April 16, 2010. The Credit Agreement No. 5031-VN was signed between the Vietnam Government and the World Bank (WB) on 12th of Jan, 2012. The Project is funded by the World Bank's IDA fund and counterpart fund from the provincial budget / supporting capital from the Central.

Objective of the Original MCDP: is to increase accessibility to services in better urban infrastructure, in order to improve people's living conditions, especially in communities located in 40% of the population with lowest income.

The MCDP has been being implemented in three cities under the provincial management: Phu Ly (Ha Nam Province), Lao Cai (Lao Cai Province) and Vinh (Nghe An Province); and consists of 4 components: (1) Basic infrastructure upgrade and services improvement; (2) Water supply and sanitation; (3) Urban road and bridge; (4) Project's management and technical support.

Started to be implemented from 2012, the project is on right track to gradually achieve the project's development goals. The components, which have been invested as per the original design are bringing huge economic efficiency, improving people's living conditions, creating motivation for infrastructure development, improving the urban layout, gradually bringing civilization, clean, beauty and sustainable development.

The appreciation of US\$ against SDR resulted in a decrease in IDA funds for the project, from the original US\$210 million to US\$184 million, a reduction of 12%. In the case of Vinh City, biggest sub-project, the impact was mitigated by reducing the scope of road investments and the use of contingencies. In the cities of Lao Cai and Phu Ly, however, major investments have been affected by the reduced availability of funds. The cancellation of these investments would adversely affect the achievement of the PDO, unless corrective action through the AF is taken. The requested Additional Financing of US\$53 million would: (i) close a financing gap resulting from exchange rate losses; and (ii) scale-up investments in critical areas which were omitted in the original design, in order to enhance project benefits. The proposed scaled-up activities are aligned with the MCDP's existing components. Due to the necessity of capital supplement for the project, the World Bank has already agreed to provide Additional Financing (AF) to Ha Nam and Lao Cai Province to complete the project design investments and finance scale-up activities to enhance achievement of project objective (Shown in the Management Letters dated November 13, 2015 and February 15, 2016 of Ms. Victoria Kwakwa - Country Director in Vietnam of the World Bank, which were sent to the Chairmans of Ha Nam, Lao Cai and Nghe An PPCs).

The Deputy Prime Minister's (DPM's) decision, as in letter no. 2003/Ttg-QHQT dated November 8, 2016, sanctioned the following:

- a. Agreement to proceed with the additional IDA amount of US\$13 mil due to exchange

rate loss (US\$6.5 million each province);

- b. Approval of the proposals from Lao Cai and Phu Ly requested for additional IBRD amount of US\$40 mil (Lao Cai: US\$20.5 million; Phu Ly: US\$19.5 million) for scale up activities following request from MPI and applicable financing mechanism;

Additional Financing

The proposed AF would be utilized to support two subprojects of Lao Cai City and Phu Ly City to finance:

- a. investments that were excluded from the scope of MCDP project because of the financing gap arising from the appreciation of the US Dollar vis-à-vis the SDR (~US\$13 million); and
- b. additional investments in critical areas to strengthen the achievement of the PDO (~US\$40 million). Total AF proposal is US\$68.04 million, of which US\$53 million blended fund from the WB and US\$15.04 million counterpart fund (CF)¹.

Objectives of AF MCDP Project: The objective of the AF Project is to increase access to improved urban infrastructure service in selected medium-sized cities in support of Vietnam’s urban development program

Total AF cost for Lao Cai is US\$35.13 mil, of which IDA is US\$6.5 mil, IBRD is US\$20.5 mil and Counterpart Fund (CF) is US\$8.13 mil. The proposed investments under AF for Lao Cai city are outlined below.

- a. **Component 1: Urban Basic Infrastructure Upgrading and Service Improvement** (~US\$14.27 million², IDA: US\$5.1 mil, IBRD: US\$3.5 mil, and CF: US\$5.6 mil) includes upgrading secondary and tertiary infrastructure for the Van Hoa community, which is in poor condition as a result of its physical location separate from other city communities. Local residents do not have water supply connections, drainage, and sewage systems. The proposed investments will provide basic urban infrastructure services (water supply, electricity, drainage and sewer collection, rehabilitation of local roads and lighting) to improve the living condition for local people and enhance environmental sanitation. Currently, sewer was discharged freely from households to Red River without treatment, the project will collect sewer and deliver to the exiting WWTP that built by the city in Pho Moi area. Hydraulic calculation and technical due diligent confirmed that the capacity of the existing WWTP is adequate to accommodate the sewer volume from Van Hoa commune and treatment technology is appropriate. Treated effluent from WWTP meets Category A (of VN standard) and dilute to a local stream prior discharge to the Red River. IDA will partly finance the investments under this components.
- b. **Component 2: Urban Water Supply and Sanitation** (~US\$9.93 mil, IBRD: US\$9.93 mil) consists of: (i) dredging, embankment and rehabilitation of the central regulation lake to separate sewage and storm water (sewage will be collected by interceptors and transferred to the WWTP that is under construction); and (ii) rehabilitation of drainage and sewer pipes along streets to prevent flooding and improve sanitary conditions, and the resurfacing of these streets.
- c. **Component 3: Urban Roads and Bridges** (~US\$0.5 million of IBRD) to construct

¹ Figures refer to costs including contingencies and taxes.

² Component costs mentioned in this section refer to based costs, VAT and contingencies are additionally added

of Ngoi Dum Bridge. It will reduce traffic jams and increase connectivity between critical parts of the city.

- d. **Component 4: Project Management Support and Technical Assistance** (~US\$2.85 million, IBRD: US\$1.47 mil and CF: US\$1.38 mil) will support (i) project management and supervision of additional investments, and (ii) independent social and environmental monitoring and financial auditing service.

1.2. Legal and Technical Basis for ESIA Preparation

1.2.1. National Legislations and Technical Basis

a. Administrative framework on Environmental Assessment

Law on Environmental Protection (No.55/2014/QH13) dated June 23, 2014 and Decree on Environmental Protection Planning, Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Plans (No. 18/2015/ND-CP) dated February 14, 2015 are key legal frameworks for environmental management in Vietnam. Law on Environmental Protection (LEP) provides statutory provisions on environmental protection activities; measures and resources used for the purpose of environmental protection; rights, powers, duties and obligations of regulatory bodies, agencies, organizations, households and individuals who are tasked with the environmental protection task. LEP is applicable to regulatory bodies, public agencies, organizations, family households and individuals within the territory of the Socialist Republic of Vietnam, including mainland, islands, territorial waters and airspace. LEP is on regulating strategic environmental assessment, environmental impact assessment and environmental protection commitment.

Furthermore, the law also indicated to consultation on, inspection and approval of the planning for environmental protection (Article 11, chapter II) as well as the list of entities subject to strategic environmental assessment in appendix I and II of the Decree No. 18/2015/ND-CP dated February 14, 2015 of the Government.

The Article 13 of the Decree (No. 18/2015/ND-CP) explains the requirement of the pertaining ESIA agencies. Clause 1: the project owner or the advisory organization conducting ESIA must meet all requirements – (a) there are staff members in charge of ESIA meeting requirements prescribed in Clause 2 of this Article; (b) there is specialist staff members related to the project obtaining at least Bachelor’s degrees; and (c) there are laboratories, inspection and calibration devices eligible for performing measurement, sampling, processing and analysis of environmental samples serving the ESIA of the project; if there is not any laboratory with decent equipment for inspection and calibration, it is required to have a contract with a unit capable of carrying out inspection and calibration. Clause 2: the staff members in charge of ESIA must obtain at least Bachelor’s degrees and Certificate in ESIA consultancy and Clause 3: the Ministry of Natural Resources and Environment shall manage the training and issuance of Certificates in consultancy of ESIA.

The project does not involve wetlands and natural protected areas, neither does it relate to emission of persistent organic pollutants or international trade in endangered species of wild fauna and flora. Therefore, no relevant international environmental agreements to which Vietnam is a party would apply.

- Environmental Protection Law No. 55/2014/QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on June 23, 2014.
- Land Law No. 45/2013/QH13 dated 29 November 2013.
- Investment Law No. 67/2014/QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on November 26, 2014.

- Construction Law No. 50/2014/ QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on June 18, 2014.
- Law on Water Resources No. 17/2012/QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on June 21, 2012.
- Law on Standards and Technical Regulations No. 68/2006/QH11 ratified by the National Assembly of the Socialist Republic of Vietnam on June 29, 2006.
- Decree No. 18/2015/ND-CP dated April 1, 2015 of the Government promulgating environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan.
- Decree No. 19/2015/ND-CP dated 14 May 02, 2015 of the Government detailing the implementation of some articles of the Law on Environmental Protection.
- 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.
- 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.
- Decree No. 80/2014/ND-CP dated August 6, 2014 of the Government stipulating drainage and waste water treatment.
- Decree No. 03/2015/ND-CP dated 06 May 2015 of the Government on the environmental damage assessment.
- Decree No. 59/2015/ND-CP dated June 18, 2015 of the Government on construction project management.
- Decree No. 38/2015/ND-CP dated April 24, 2015 of the Government on the management of waste and scrap.
- Decree No. 179/2013/ND-CP dated December 30, 2013 of the Government on sanctioning of administrative violations in the field of environmental protection.
- Decree No. 43/2014/ND-CP dated May 15, 2014 of the Government detailing the implementation of some articles of the Law on Land.
- Decree No. 44/2014/ND-CP dated May 15, 2014 of the Government regulating land prices.
- Decree No. 45/2014/ND-CP dated 05/15/2014 of the Government providing the collection of land use levy.
- Decree No. 46/2014/ND-CP dated 05/15/2014 of the Government providing the collection of land and water surface lease.
- Decree No. 47/2014/ND-CP dated 05/15/2014 of the Government regulating compensation, support and resettlement upon land acquisition by the State.
- Decree No. 84/2013/ND-CP of the Government on management of housing development and resettlement.
- 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;
- Circular No. 27/2015/TT-BTNMT dated May 29, 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan.
- Circular No. 36/2015/TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment on hazardous waste management.

- Circular No. 36/2014/TT-BTNMT dated 06/30/2014 of MONRE on land pricing method; compilation of and adjustment to land price lists; determination of specific land prices and consultancy on land pricing.
- Circular No. 37/2014/TT-BTNMT 06/30/2014 MONRE detailing regulations on compensation, support, and resettlement upon land expropriation by the State.
- Decision No. 63/2015/QĐ-TTg of the Prime Minister dated 10/12/2015 on policy on assistance in vocational training and job search for workers whose land is acquired.
- Decision No. 1956/2009/QĐ-TTg of the Prime Minister dated 17/11/2009 approving the project on "Vocational training for rural workers by 2020".

Applicable standards and regulations:

- QCVN 03:2008/BTNMT - National technical regulations on permissible limits of heavy metals in the soil.
- QCVN 05:2013/BTNMT: National Technical Regulation on Ambient Air Quality.
- QCVN 06:2009/BTNMT: National technical regulation on hazardous substances ambient air;
- QCVN 08-MT:2015/BTNMT - National technical regulation on surface water quality.
- QCVN 09-MT:2015/BTNMT - National technical regulation on ground water quality.
- QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater
- QCVN 26:2010/BTNMT: National technical regulation on noise.
- QCVN 27:2010/BTNMT: National technical regulation on vibration.
- QCVN 50:2013/BTNMT: National Technical Regulation on Hazardous Thresholds for Sludge from Water Treatment Process.
- Viet Nam Building Code QCVN 01: 2008/BXD compiled by Vietnam Institute for Urban and Rural Planning, approved by Science and Technology Department, issued under Decision No. 04/2008/QĐ-BXD dated 3 April 2008 by the Ministry of Construction.
- Distribution System and Facilities - Design Standard;

b. Legal documents, decisions and written opinions of competent agencies on the project

- Circular providing guidance on a number of articles of decree no. 59/2007/ND-CP dated 09th April 2007 by the government on solid waste management of the ministry of construction No.: 13/2007/TT-BXD dated December 31st 2007.
- Decision promulgation of national technical regulation on environment of ministry of natural resources and environment No. 04/2008/QĐ-BTNMT dated July 18, 2008.
- Circular No. 06/2007 / TT-BKH dated 27th August 2007 of the Minister of Planning and Investment on guiding the implementation of Decree No. 140/2006 / ND-CP of November 22th, 2006 of the Government provides for the protection of the environment in the processes of formulation, appraisal, approval and implementation of strategies, planning, plans, programs and development projects.
- Circular 27/2015/TT-BTNMT dated 29 May 2015 of the Ministry of Natural Resources and Environment guiding implementation of strategic environmental evaluation, environmental impact evaluation and commitments to environmental protection;
- Circular 02/2009 / TT-BTNMT dated 10th March 2009 of Ministry of Natural

Resources and Environment regulating the evaluation of the wastewater receiving possibility of water resources.

- Circular on the issuance of “national technical regulation on drinking water quality” of Ministry of health No. 04/2009/TT-BYT dated 17th June 2009.
- Circular on the issuance of “national technical regulation on domestic water quality” of Ministry of health No: 05/2009/TT-BYT dated June 17, 2009.

c. Documents and data created by the project owner during the EIA process

- Decision No 244/2001 / QD-UB of the People's Committee of Lao Cai province: overall planning of urban cluster of Lao Cai - Cam Duong to 2020.
- Decision No. 46/2008 / QD-TTg dated 31/March/2008: The overall planning of social economic development - Lao Cai up to 2020.
- Decision No. 342 / QD-Committee dated November 17th, 2009 of the Lao Cai provincial People's Committee on approving the adjustment of investment projects construction: Water supply systems in urban area Lao Cai - Cam Duong.

2.2.2. World Bank’s Social and Environmental Safeguard Policies

The objective of safeguard policies is to prevent and mitigate direct and indirect impacts on the residents and the environment in the development process.

The relevant safeguard policies of the WB triggered for the subproject are described:

*Environmental assessment (OP/BP 4.01)*³,

The proposed subproject would mainly involve the following physical investments under Components 1, 2, 3: i) Construction, upgrading, and rehabilitation of short urban roads; ii) Installation of combined wastewater and drainage systems; iii) Installation of water supply distribution network; iv) Construction of river and lake embankment; and v) Construction of school and kindergarten block.

The subproject’s overall potential socio-environmental impacts would be positive as it is expected to bring about: i) improved environmental sanitation and urban landscape; ii) increased wastewater collection and urban drainage capacity; iii) minimized discharge of untreated wastewater into the environment; iv) reduction of public health risks associated with water-borne diseases and related healthcare cost; v) reduction of safety risks and asset loss caused by inundation; vi) increased the accessibility of local people to nearby areas.

There are also potential negative socioenvironmental impacts associated with the proposed physical investments. These include commonly known construction impacts and risks, such as: i) loss of vegetation cover and trees, disturbance to the habitats of aquatic species ii) increased level of dust, noise, vibration; iii) pollution risks related to generation of waste and wastewater, particularly large amount of excavated/dredging materials; iv) traffic disturbance, and increased traffic safety risks; v) erosion and land slide risk on slopes and deeply excavated areas as well potential negative impacts on existing weak facilities; vi) interruption of existing infrastructure and services such as water and power supply; vii) disturbance to daily socio-economic activities in project area and social disturbance; viii) health and safety issues related to the public and the workers at construction sites; and ix) social impacts associated with land acquisition, construction disrupting businesses by construction related activities and mobilization of workers to the site. These impacts are site-specific; temporary; few if any of them are

³Full treatment of OP/BP 4.01 can be found at the Bank website:
<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543912~menuPK:1286357~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html>

irreversible; and in most cases mitigatory measures can be designed more readily. Therefore, the subproject has been proposed to be classified as a Category A subproject.

*Natural habitats (OP/BP 4.04)*⁴;

The subproject will not impact any protected area nor will it affect important/endangered flora or fauna species or biodiversity areas of high value. During the environmental assessment process, it is confirmed that natural habitat are present in the project areas, including the Red River, Nhac Son lake, and Ngoi Dum stream. Construction and operation of the wastewater collection, bridge construction and lake dredged work would have some potential adverse impacts on natural habitats of the river and lake, including loss of benthic habitats and disturbance of benthic organisms. Impacts and mitigation measures have been included in the subproject ESIA and ESMP to address these impacts.

*Physical cultural resources (OP/BP 4.11)*⁵

The subproject does not necessitate relocation of physical cultural resources (PCRs) such as monuments, temples, churches, religious/spiritual and cultural sites. This policy is triggered as the subproject civil works will involve relocation of 05 graves, which are also considered PCR. Since the project includes dredging and excavation activities, which may result in chance finds, a chance finds procedure has been included in the subproject ESMP.

*Resettlement (OP/BP 4.12)*⁶

*OP/BP 7.50 - International Waterways*⁷

Under the AF, the Lao Cai city subproject investment will collect of raw wastewater in Van Hoa Commune, which is currently flow freely in a populated area, and convey it to the existing Dong Pho Moi WWTP for treatment. This WWTP empties treated wastewater into an unnamed river which eventually flows into the Red River, an international waterway. Therefore, the policy is triggered in accordance to para 7(b) of the OP 7.50.

However, it is assessed that the subproject fall within the exception to notification provisions, namely para 7(a) of the policy. This exception is applied as the project involves making additions of treated wastewater discharge from an existing WWTP to the tributary of the Red River, an international waterway. It is assessed that this additional discharge will not change the quality or quantity of water flow to riparian states, in this instance to China.

*World Bank Group Environmental, Health, and Safety Guidelines*⁸

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

⁴Full description of OP/BP 4.04 is available at

<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543920~menuPK:1286576~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html>

⁵ OP/BP 4.11 is accessible at

<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543961~menuPK:1286639~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html>

⁶ Detail of OP/BP 4.12 is available at

<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543978~menuPK:1286647~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html>

⁷ Detail of OP/BP 7.50 is available at

<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20544007~menuPK:1286706~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html>

⁸ Detail of OP/BP 4.12 is available at

<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543978~menuPK:1286647~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html>

⁹The EHS Guidelines can be consulted at www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

Good International Industry Practice.

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

1.3. Project description

1.3.1. Project Location

The Medium Cities Development Project - Lao Cai Subproject - additional financing will be conducted in Lao Cai City, Lao Cai Province.

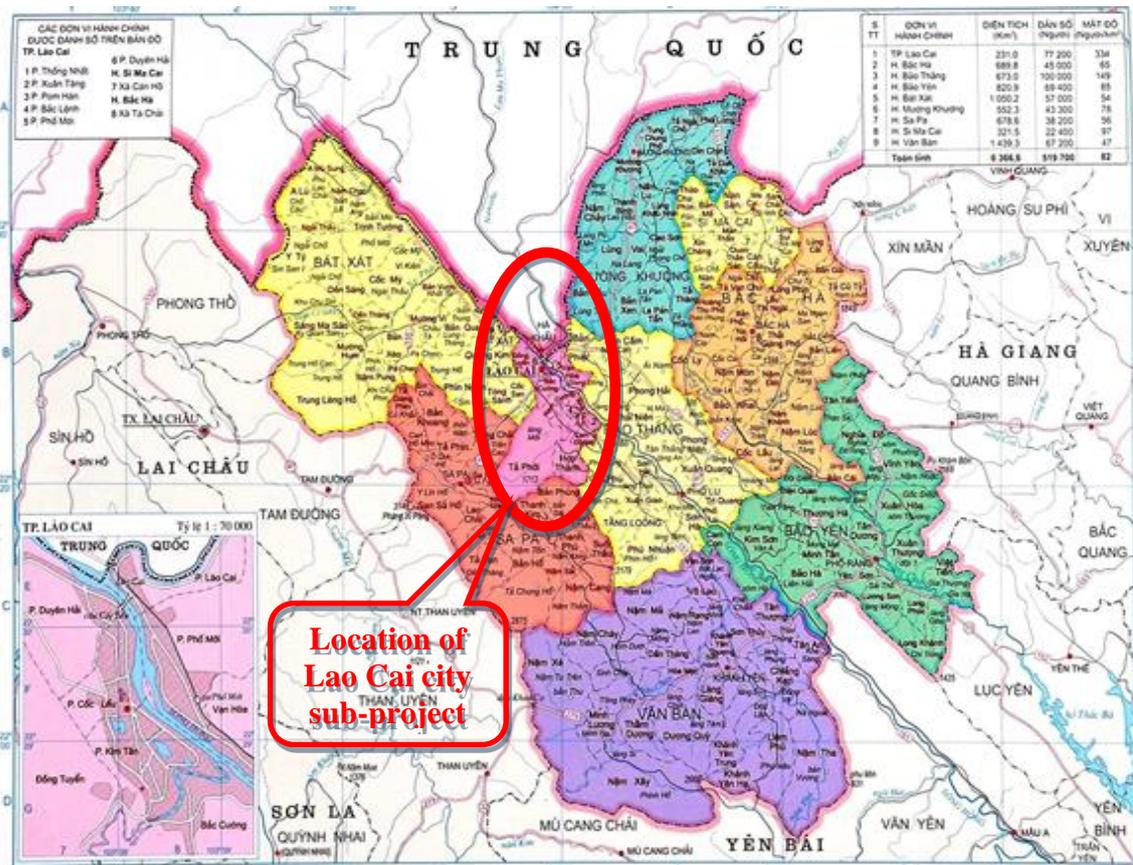


Figure 1.1. Map of Lao Cai location

1.3.2 Project Components

The AF project consists of 4 components: (i) Component 1: Basic infrastructure upgrading and service improvement; (ii) Component 2: Environmental sanitation improvement.; (iii) Component 3: Urban roads and bridges, (iv) Component 4: Project Management and Technical Support.

Table 1.1 The main investment items of the project

No.	Investments	Detailed description
1	Component 1	Basic infrastructure upgrading and service improvement (US\$14.27 mil)
1.1	Upgrading infrastructure of Van Hoa Commune	Investments include: <ul style="list-style-type: none"> • Construction/rehabilitation of 09 internal roads with the total length of 6.1 km, and width from 16.5 to 24.0 m. • Construction of the separate drainage system along the main road. <ol style="list-style-type: none"> 1. The storm water drainage with the total length of 11.0 km including: 7.9 km box culvert with the dimension of BxH=500x600 - 600x800; and 3.1 km pipe with D= 750-1000. 2. The wastewater collecting pipe is 4.0 km long, D= 225 - 315, the pressure wastewater pipelines connecting 3.7 km, D=110; 02 pumping station capacity Q = 10-20 m³/h to convey the waste water to the Dong Pho Moi Waste Water Treatment Plant (WWTP) • Construct a distribution water supply system with the total length of 3.7 km; D = 50-110; • Provision of power supply, lighting and trees planting for the constructed road
2	Component 2:	Environmental sanitation improvement (US\$9.93 mil)
2.1	Rehabilitation of the central lake of Lao Cai city.	The central lake of Lao Cai city is located inside Nhac Son Park with total area of about 5.4ha. The investments include: <ul style="list-style-type: none"> • Dredging the lake bed with the total area of 5.4 ha, existing depth of 3.7-5.2 m to the depth of 5.2 m • Repairing the damaged sections of the lake embankment, with the estimated total length of 100 m • Constructing drainage system for the lake including: interceptor with the length of 539 m, D=560; 01 overflow chamber; box culvert of 149 m long and BxH=2.0x2.0 m; 01 pumping station with capacity 324 m³/h; and wastewater pressure sewer pipe of 1.5 km long and D= 315 conveying wastewater to Ngoi Dum WWTP, which is being constructed under the MCDP parent project.
2.2	Rehabilitation of drainage system and resurfacing the remaining streets roads	Investments include: <ul style="list-style-type: none"> • Rehabilitate the existing drainage of about 71 km; • Construction of 5.2 km drainage with D=600-1000 at flooding locations, associated with resurfacing the remaining streets roads with the total length of 48.0 km at 10 wards as Duyen Hai, Kim Tan, Bac Cuong, Nam Cuong, Coc Leu, Pho Moi, Binh Minh, Bac Lenh, Pom Han Wards
3	Component 3	Urban road and bridge (US\$0.5 mil)
3.1	Construction of a bridge across Ngoi Dum stream.	The bridge is 48 m long, and the approaching roads at the two ends of 62 m. The main bridge is designed with expected working load HL93, pre-stress reinforced concrete structure, spans diagram L = 3x15(m), bridge size K=7+2x0,5m (no pavements for pedestrians).
4	Component 4	Project Management and Technical Support (US\$2.85 mil)
4.1	Construction supervision and contract management	Investments include: Supporting all activities of the PMU in construction supervision and contracts management.
4.2	Independent environmental and social safeguard monitoring	The scope includes the independent services for: <ol style="list-style-type: none"> i) Environmental safeguards monitoring; ii) Social safeguards monitoring;
4.3	Independent financial audit	Executing independent audit following the agreed schedule during the project time.
4.4	Project Assessment	Conduct post project implementation evaluation at closing date;

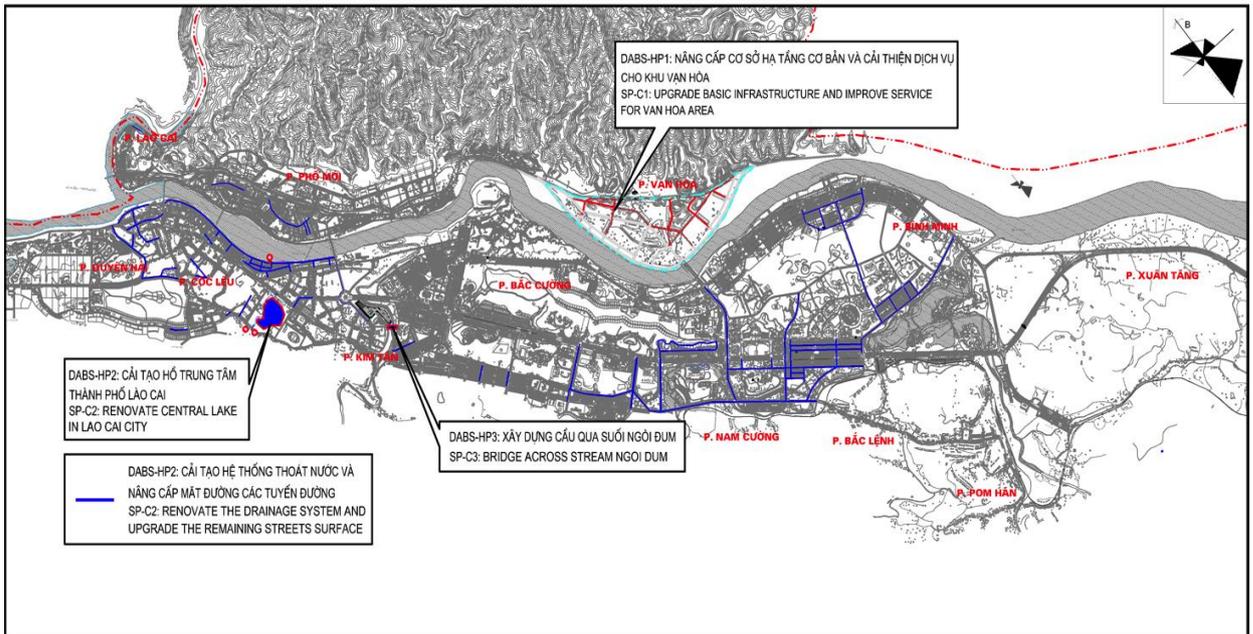


Figure 1.21 Map of Project's location

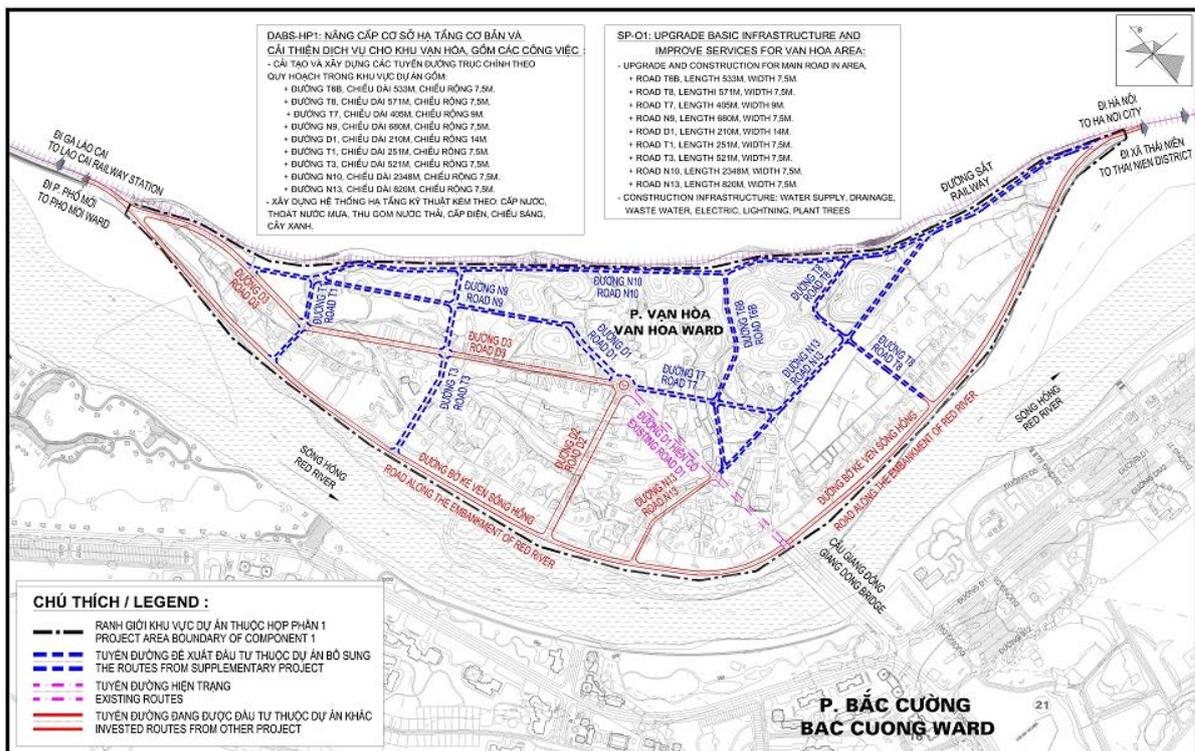


Figure 1.32 Map of Component 1 investments

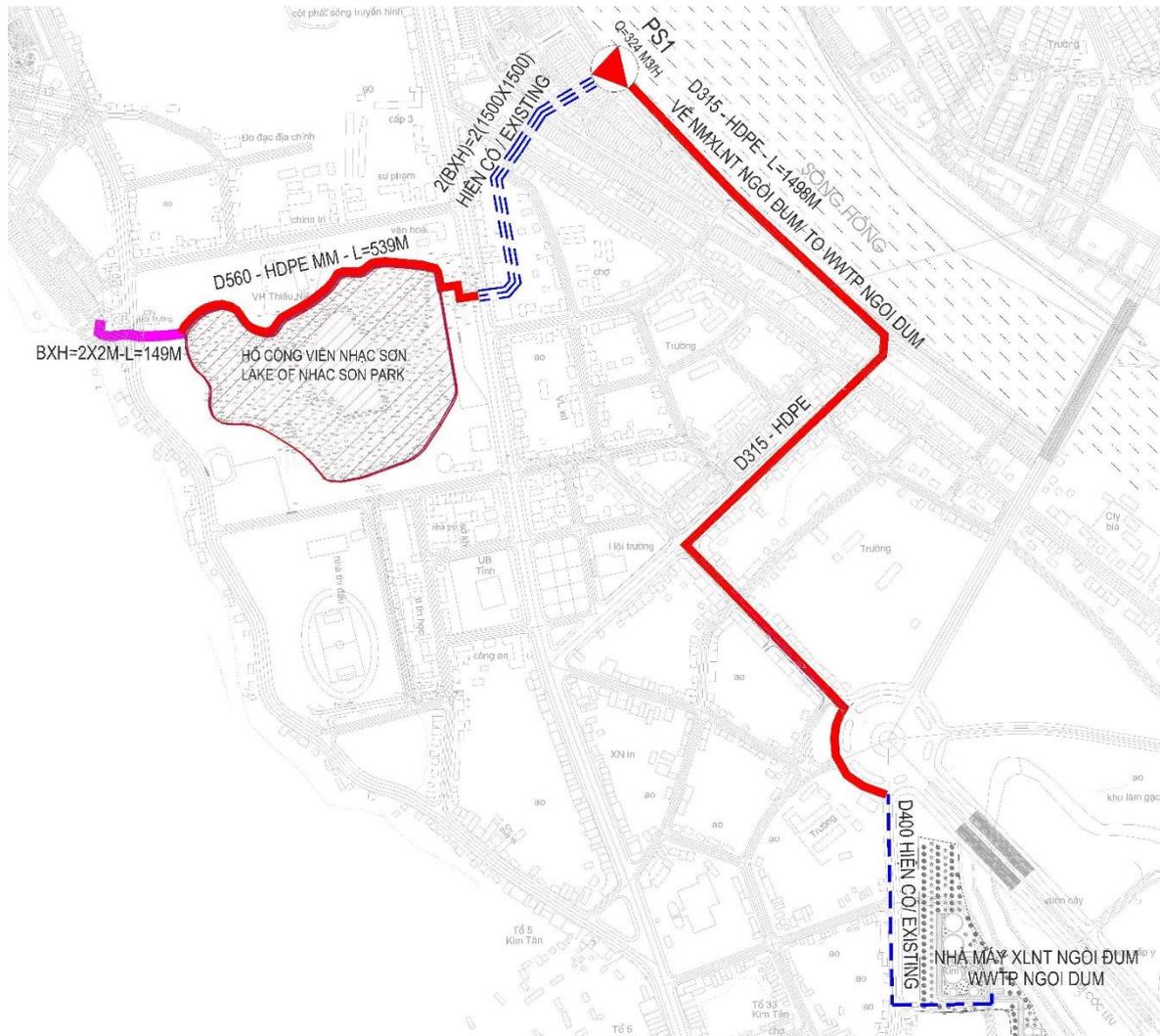


Figure 1.43 Location of investments under Component 2

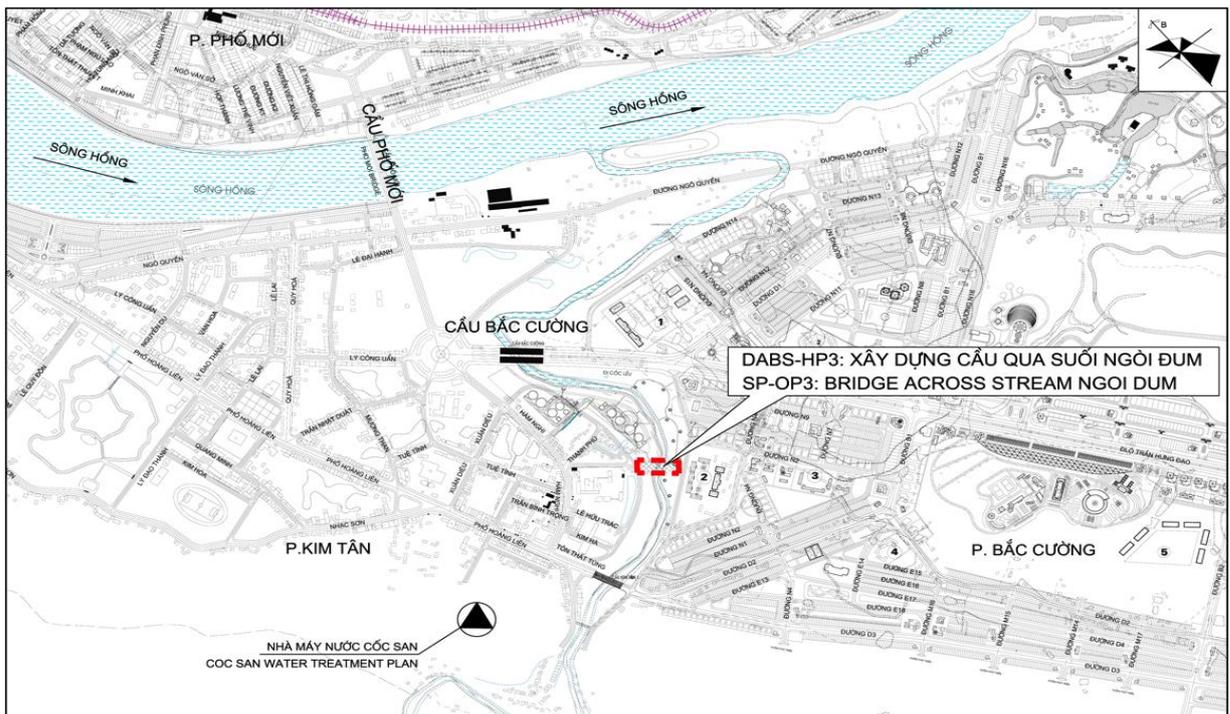
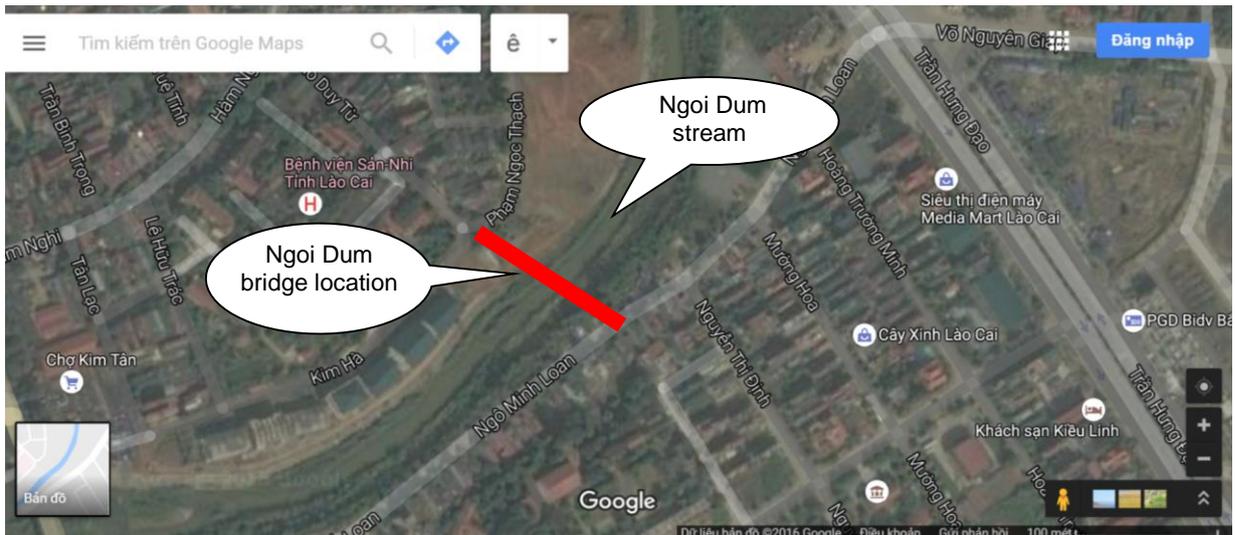


Figure 1.5.4 Location of investment under Component 3

1.2.3 Subproject area of influence

In the process of assessing the environmental and social impacts of a subproject, it is very important to take into account scoping of the subproject influence area. The investment of the MCDP Project - Lao Cai city subproject - AF” aims to improve environmental sanitation and transportation control for the entire city and prevent the rapid degradation of surface water quality, especially for Red rivers and Ngoi Dum stream. The investment will be implemented through : (i) construction, upgrading and rehabilitation of roads and bridges in the Van Hoa Commune and urban area of Lao Cai City; (ii) collection and treatment of freely runoff

wastewater in Van Hoa commune before discharging to the natural stream; and (iii) dredging, embankment and rehabilitation of Nhac Son lake.

The subproject area of influence does not limit to the subproject boundary, but extend to the whole area of the city, covers both old and new expansion parts of the city. Environmental impacts of the subproject investments will also relate to some a section of Red River potentially affected by the effluent from the wastewater that will be discharged via the newly constructed sewer's system in Van Hoa commune.

The subproject area of influence would also include the ancillary aspects including quarries, disposal site, routes for transportation of construction and disposal materials. Details on these facilities are presented below.

1.2.4. The Ancillary Facilities

a. Construction Materials and Disposal Sites

The volume of materials estimated for the subsubproject components is shown in the Table 1.2 below.

Table 1.2 Estimated amount of materials for the Lao Cai city subproject

No	Materials	Unit	Component 1	Component 2	Component 3
1	Different types of rocks, stones	m ³	32,000	12,000	17,000
2	Different types of sand	m ³	7,000	6,000	7,000
3	Steel wire	kg	23,400	11,000	11,000
4	Nail	kg	9,000	7,000	5,000
5	Wood plank	m ³	700	850	600
6	Welding rod	kg	14,000	7,000	4,000
7	Different types of steel	kg	227,000		
8	Cement PC30 PC300	kg	2,500,000	1,500,000	1,500,000
9	Bitum asphalt	m ³	34,500	921,000	50,000

b. Supply of construction materials

Steel and cement are provided by material suppliers in Lao Cai City and all district centers in the subproject area. Bricks are available as locally manufactured products in the province of Lao Cai by factories in Ban Vuoc, Ban Qua communes.

Sand and gravel are exploited from permitted companies in Lao Cai province in an average distance of 20km from construction sites. A list of sand and gravel suppliers are permitted by Lao Cai provincial authorities and presented in the table 1.3 below.

All of the materials shall be tested in terms of physical properties in accordance with the current regulations. If the materials compositions do not meet the standard, the contractor shall change the materials sources. Demands for material and technical supplies are associated with the construction progress.

The material supply will take into account the depreciation due to transport and unloading.

Table 1.3. List of quarry stone, sand and gravel in the province of Lao Cai

N0	Location	Materials	Places	Distance to the subproject location
1	Ban Cam	Gravel, cobble	Bao Thang	15km along Highway 4D.
2	Ben Den, Gia Phu	Sand	City Lao Cai	14 km along Highway QL 4E.

Regarding backfilling soil, according to the design, soil of class 2 excavated from the components of the subproject can be reused for backfilling demands in all components. If the demand for soil arises during actual construction, it will be met from the borrow pits in the districts of Bat Xat, Van Ban, Si Ma Ca, Bao Thang, Bac Ha of Lao Cai province. The average distance from the building site to the soil mine is about 20 km.

These quarries are operational since 2008 with permission by Lao Cai PPC. Their supplies are not only for Lao Cai subproject but also neighboring provinces. The MCDP AF Lao Cai subproject does not involve large scale extraction of sand and gravel, therefore, does not require opening of any new quarry. None of those quarries is an exclusive source for the subproject.

In the future, choosing specific quarries to supply materials for the subproject will be proposed by the construction contractors, based on specific technical requirements of technical design. The bidding documents and contractual documents have been ensured that the proposed material mines have to meet the technical requirements, and have the certification of environmental protection and operation license.

Power and fuel supply

The national power grid is easily accessible in the whole subproject area. Mobile diesel generators are also prepared for use where needed. The low-voltage power system has been distributed to the subproject area for construction and operation of facilities.

Oil and gas for the operation of machinery in the construction sites are supplied by local petroleum companies. Since the distribution network is available, the fuel supply for the subproject is quite convenient.

d. Water supply for construction and domestic uses

Water sources for work execution will mainly come from rivers/streams available nearby. For construction areas that are afar from the water sources or the water quality is unqualified, water tank trucks shall be used for transferring water to construction sites.

For domestic purpose, depending on conditions of given sites, water can be supplied from centralized water supply schemes where available and dug and drilled wells at the construction sites. Where water schemes are not available for domestic use, water from wells will be purified through an on-site simple filter system and/or clean water in tanks is supplied.

e. Domestic solid waste treatment

The total amount of domestic waste is about 548 kg/d at maximal. The solid waste generated at the subproject sites in Lao Cai city will be collected by Lao Cai URENCO and disposed at Tong Mon landfill (6 km distance from the city).

The domestic waste generated at construction site and working camps will be collected and transported, treated at legitimate local landfill managed by local environmental sanitation groups or coops.

Hazardous waste will be collected and stored temporarily in storehouses at sites, then transported by specialized units through a contractual service. At present Lao Cai URENCO is capable of handling all of the waste generated in the whole city area.

f. Disposal of excavated materials

The amount of excavated materials from subproject activities is summarized in the Table 1.4 below:

Table 1.4. Excavated soil and sludge volume of each component

No	Works	Excavation (m ³)	Back filling (m ³)	Dredged Sediment (m ³)	Volume to be transported out of construction sites
	Component 1				
1	Road construction	447,973	306,763		141,210
2	Drainage system	4,950	3,250		1,700
	Component 2				
3	Dredge the central lake of Lao Cai city			67,500	67,500
4	Drainage system	5,700	3,500		2,200
	Component 3				
5	Dredge Ngoi Dum stream			2,500	2,500
6	Bridge piling	3,000	2,000		1,000
	Total	461,623	315,513	70,000	216,110

About 460,000 cubic meters of excavated materials will be generated from the subproject activities, mainly from the construction of roads in Van Hoa community. Among those, 320,000 m³ will be used for back filling at the construction site and the excess volume of 140,000 m³, could be used for land filling at Tong Mon landfill.

There are about 70,000 m³ dredged sludge from central lake within the Nhap Son Park of Lao Cai city and Ngoi Dum bridge. The testing showed that the dredged sludge is not hazardous, however, they have high content of organic substances and thus will be disposed at Tong Mon land fill. This landfill in Dong Tuyen commune -Bat Xat district, about 6 km from the city. Tong Mon landfill is the only area collecting and treating all solid wastes for the whole Lao Cai city and Bat Xat district with the capacity of 70 tons/day. The landfill locates in a valley surrounded by forest production mountains, on an total area of 46 ha. It was constructed and put into operation since 1999. The solid waste in the serviced areas is collected 2 times per day and compacted within the day with the depth of 0.8-1.0 m for every layer. After being sprayed with enzyme products (about 10-12l of EM/m³ of waste), the waste is covered with a soil layer of usually 7-10cm thick.

Trees are planted in order to create environmental landscape around the landfill. There is a leachate collecting system for Tong Mon landfill that includes three sand-filtration compartments: sediment containing compartment with the volume of 104 m³, horizontal filtration compartment 10.4 m³ and lime treatment compartment of 45 m³.

a. Organizational methods

- Managing Agency: Lao Cai Provincial People’s Committee.
- Inspection Agency: Department of Planning and Investment of Lao Cai Province.
- Investors: Department of Planning and Investment of Lao Cai province..

- Implementation Agency: ODA subproject management unit, Lao Cai province
- The Donor: The World Bank.

b. Organization and management model

The organisation and management model is illustrated in the Figure 1.6 below.

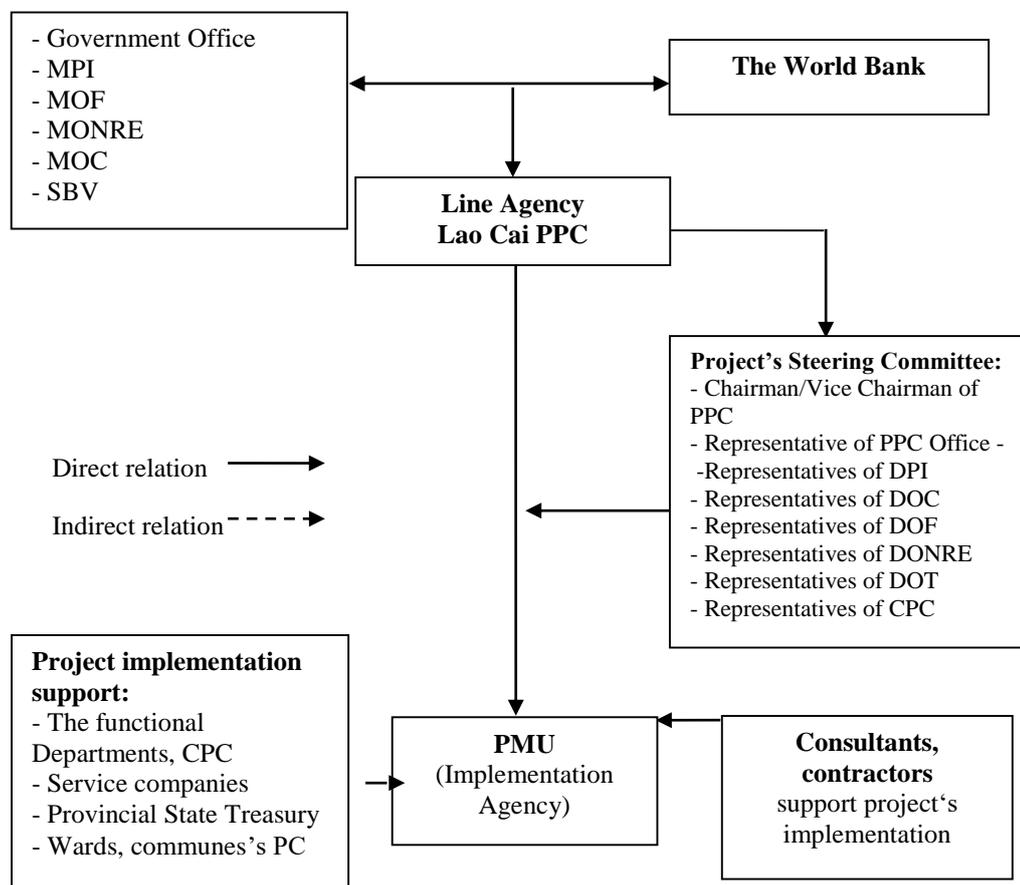


Figure 1.6 Organization and management model

c. Working mechanism between Ministries and related agencies

** The relevant ministries and related agencies*

The Ministry of Planning and Investment: To Guide the managing agency to propose the subproject investment lists, summarized lists of ODA subprojects, preside over the preparation of content, organize, mobilize and coordinate the appropriate ODA sources ; chair and coordinate with the Ministry of Finance to review the detailed allocation of investment capital allocation; support to other ministries, agencies and localities to prepare the content and follow-up the process of negotiation of specific international agreements on ODA loans with the Donors; follow, monitor and evaluate periodical investment, the MPI is focal unit to handle according to their competence or to propose the Prime Minister in handling of the relevant issues.

The Ministry of Finance: To chair, coordinate with the Ministry of Planning and Investment, the managing agency and the relevant authorities to submits to the Prime Minister for approval of the domestic financial mechanism applied to the sub-subprojects prior signing of the financing agreement. Perform checking of letter for withdrawal and disbursement of IDA / IBRD capitals for subsubprojects under the current regulations. At the same time, to implements

financial management for the use of capitals of sub-subprojects and state budget audit for this capital.

Ministry of Natural Resources and Environment: To guide, inspect and coordinate the ministries to consider environmental issues, waste management of the subproject.

Ministry of Construction: To implement the provisions of the law on guiding and supervision of the establishment of construction investment subprojects, conduct evaluation of prescribed designs or examine the evaluation of technical design, construction drawings and cost estimations of the components, the cost of subproject's management; guide, inspect the quality management of construction works, the testing activities, evaluation and certification of quality conformity of construction works; coordinate with the Ministry of Finance on guiding principles, valuation methods for sewer service prices and inspect and supervise the the implementation process.

The State Bank of Vietnam: Preside and coordinate with the Ministry of Finance, Ministry of Planning and Investment and relevant agencies to prepare content, negotiate and conclude international agreements with the donors and the official representative of the borrower stipulated in international treaties as assigned or authorized by the President or by the Government.

** Lao Cai PPC*

Lao Cai provincial People's Committee (PPC) plays a role of the line agency of Lao Cai MCDP, assigned for the DPI to be the subproject's Owner. Lao Cai PPC is responsible for preparation of subproject Investment Policy (IP), submit and clarify to the relevant ministries and donor; coordinate with the State Bank of Vietnam in submission to the Prime Minister for the signing of specific international agreements with the World Bank; collaborate with the Ministry of Planning and Investment on ODA capitals, negotiate the on-lending agreement with the Ministry of Finance; direct Subproject's owner to follow the signed agreements, perform the functions of state management on ODA capital and preferential loans of the subproject, approve subproject's documents authorized by the Prime Minister; implement land acquisition, compensation and site clearance for the subproject under the approved resettlement policy framework; allocate capital, which to be repaid to the central budget to repay foreign loans for on-lending loans.

** Subproject Steering Committee (PSC)*

The subproject steering committee includes the members who are representatives of PPC, the relevant departments and the CPC. The PSC will coordinate and support invested managing owner, subproject's investor solving issues arising in the preparation, implementation of the subproject, especially in the works related to site clearance, resettlement, allocation of local funds and disbursements for the subproject.

** The Subproject management unit (PMU)*

PMU directly manages investment subproject according to regulations, per the signed FA and signed agreements and the tasks assigned by the subproject line agency; implement overall planning and detailed annual plan for implementation of programs and subprojects; implement procurement activities and contract's management; disbursement, financial and subproject's assetsmanagement; monitor and evaluate the implementation of the subproject; conduct commissioning and handover of the outputs of the subproject upon completion; complete audit work, hand over the assets of the subproject; develop ending report and balancing subproject's report.

* *The Donor*

The World Bank will provide implementation support during subproject implementation, give recommendations to remedy the existences to better implement the subproject. The World Bank will also conduct site visits, review the reports, submission, procurement activities of the subproject.

d. Implementation plan:

The AF subproject is planned to be approved by April 2017 and will be implemented from July 2017 to December 2019.

e. Construction methods, list of machinery and equipment estimated to be used

Construction work will be carried out according to the conventional method and the subproject will not require any special techniques, and does not require Contractors to have the experience for the jobs, which are not be done in Vietnam

On the basis of costs, technical characteristics, local materials availability and convenience in construction matters, maintenance, could suggest the construction methods in the subproject are as follows:

Reinforced concrete construction

Concrete circular and box culvert are precast at the casting area planned in accordance with the overall construction site plan. When excavating the foundation to the design elevation, using cranes combined with specialized equipment to move the culverts to the design elevation.

The principles and requirements for construction and handover must comply with the Construction Standard VN286:2003.

Concrete placement method

The height of the form is less than 4m. The construction solution is to use mobile concrete mixer with the capacity of 250 liters to 500 liters to mix concrete mortar. Using curbs and gutters to pour concrete into the forms and then using vibratory plate compactor or needle vibrator to compact the concrete.

Brick construction

Using mortar mixer machine with capacity of 80 liters. Gather and build the bricks; ensure technical conditions and standards.

Backfilling

Motorized transportation of soil from the borrow pits. Manual and motorized combination method is used for leveling and compacting soil. Using jumping jack compactor MRT60S for compaction. For the compaction at the sluice gate, the work must be closely supervised and checked to ensure its quality.

Equipment installation

The installation of mechanical equipment is carried out by machinery and by hand.

Hydro-mechanical equipment such as pump, valve gate, sewer grate, pump pipeline, etc. are installed as follows:

1. Check the machines/equipment before installation
2. Comprehensively check the components to be installed
3. Check the operation of the pump such as: ensure that hand crank, bearings, and plain bearings are working normally (are not jammed, rusty dirt) and fully lubricated.

4. Solve the problems caused by the transportation and storage process. If there is doubt or need to handle the important parts such as silver copper, bearings, impellers, etc., it is necessary to notify the manufacturer for solutions.
5. Install the machine/equipment
6. The machine/equipment is installed in the following sequence: pump motors -piping.
7. When installing, the following requirements must be met:
 - The pump is working smoothly, there is no unusual noise.
 - The cover is balanced, easy to open and close

Installation of valve gate and sewer grate: Sluice gate valve, sewer grate and other accessories are installed by 3T-5T chain hoist; and then manually adjust to suit the design position.

Installation of precast structure

Precast concrete structure is casted at the material area. After meeting standards, the structures will be installed. They are transported and installed manually.

Excavation and spoil transportation:

The construction of roads does not generate considerable earthwork volume. In order to accelerate the construction progress and reduce the cost, the construction method is primarily based - machine and manual works are minimized. Specifically:

Excavation: Using 1.3 m³ excavators and transporting excavated soil to the disposal site by the 10T-12T dump trucks; leveling the site with contractors 110CV. During the excavation process, the contractors should arrange soil storage area to ensure the quality of backfill soil. Lower quality soil will be used to cover the ground or transported to the disposal site.

Backfilling soil: Due to the relatively large volume of excavated soil, a part of good quality soil can be salvaged for embankment in order to reduce the cost, accelerate the construction progress, reduce the disposal site area as well as the amount of soil exploited from the borrow pits. Excavating backfill soil by the 1.3 m³ excavators; transporting to the filling area by 10T-12T dump trucks; leveling the site with contractors 110CV and 9T compactor. For such the area where large compactors cannot and must not be used, manual compaction with portable compactors is carried out.

Dredging the central lake inside Nhat Son Park

The central lake of Lao Cai city is located inside Nhat Son Park with total area of about 5.4 ha and the existing depth varies from 3.7 - 5.2 m. Under the proposed project, the lake will be dredged to the depth of 5.2 m.

To minimize the impacts on the lake ecosystem, the dredging will be carried out on a successive basis by dividing the area of the lake into 4 dredging cells which are dredged one after one. Prior to the dredging lake bank is reinforced with sheet pile and water is pumped out. Mud is dredged the design elevation (+80.80) and temporarily stored at one point for a week for drying, and then transported by specialized trucks to disposal sites. The process repeats for the second cell after finishing the first one. With this approach, the ecosystem of the lake will be maintained and not altered dramatically (by maintaining the water level in the lake at a depth of 2.5 - 3.0 m) and the impact on the landscape and environment around will be minimized.

Concrete and reinforced concrete work:

The subproject has quite certain volume of concrete work. Concrete construction work must be done in the condition of dry pit to ensure the quality of the work. In addition, the works have

relatively complex structures and construction activities will be carried out in narrow foundation pits, which require appropriate construction solutions from the construction unit to accelerate the construction progress because the concrete work plays a decisive role in the progress of the construction works. The concrete construction solution is proposed as follows: mixing by 500-liter-mobile mixers; mixed concrete is then poured manually or through curb and gutter into the forms. As for the pump station, 10T-15T cranes can be used to pour concrete and compaction by needle vibrator or vibratory plate compactor depending on the structure of the work. Maintenance is carried out by watering the concrete directly.

f. List of construction machinery

The equipment includes pumps and other related devices provided by the manufacturers, and pumps and other equipment such as cranes, chain hoists, valves, etc... are provided by the manufacturers by the order. List of equipment and machinery is expected to construction activities are presented in Table 1.5 below:

Table 1.5 List of machines and equipment in subproject’s construction

N ^o	Equipment	Components		
		1	2	3
1	Bulldozer 110 CV	3	2	2
2	Excavator 0.45 m ³	2	1	1
3	Truck for waste soil 8 ton	5	2	3
4	Compaction roller 9 ton	2	2	5
5	Jumping compactor	3	1	4
6	Pulled crane (0.7^1.1)m ²	2	2	2
7	Steel bending machine 5 KW	2	1	4
8	Steel cutter machine	2	1	4
9	Chained crane 5 ton	1	2	3
10	Welding machine 50 KW	2	1	3
11	Transformer welding machine 50 KW	2	1	2
12	Concrete mixer 750L	4	1	2
13	Fixed concrete plant 30 m ³ /h	2	1	3
14	Cement warehouses	2	1	2
15	Cement convey trucks	2	1	4
16	Material conveyor belt	2	1	2
18	Transport trucks and concrete mixers	2	1	1
19	Concrete pumps	2	1	2
20	Vertical vibrator 1.5kW	15	3	3
21	Horizontal vibrator 1.5kW	10	2	2
22	Concrete hammer	10	2	2
23	Concrete drill f 32 mm	2	1	2
24	Concrete durability testing machine	2	1	1
25	Automotive pumps	2	1	2
26	Generator 320 KVA	2	1	1

1.3 Methods to be applied during the esia process

During the study, investigation and preparation of ESIA report, the consulting firm used a combination of following study methods:

Rapid assessment method

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

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

Impact matrix method

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

Environmental modeling method

This method is applied to calculate and simulate by Mathematical Equations for the process of spreading exhaust gas, wastewater generated from the subproject to ambient environment.

Comparison method

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

Identification method

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

Listing method

It is used quite common (since the establishment of the National Environmental Protection Agencies in some countries - NEPA) and bring positive results thank to many advantages as clear approach, systematic provision during system analysis and evaluation. It includes 2 main categories:

- The description listing table: This method lists the environment components in need of research in addition to the information on the measurement, prediction and evaluation.
- Simple checklist: This method will list environmental components to be studied and likely to be affected.

System analyzing method

This method is popular in environment. An advantage of this method is comprehensive assessment of impacts and effectiveness in identification of impacts and sources of waste.

This method is applied on the basis of considerations of waste sources, sources of impacts, affected objects and environment components as elements with intimate relationship in the system, thereby determining, analyzing and assessing impacts.

Method of Public Consultation

This method is applied during the interview with local authorities' leaders and people at the subproject area to collect essential information for EISA/EIA of the subproject. Particularly, the public consultation will introduce about subproject benefits and possible negative impacts on environment and their life. Whereby, summarize feedbacks and expectations of local people to the subproject.

On the other hand, discussions and direct interviews with local officials and local people on the local socio-economic development.

Method of information and data inheritance, summary and analysis

This method is to identify and assess natural conditions and socio-economic conditions of the subproject area through data and information collected from various sources such as the statistic yearbook, regional socio-economic profile report, regional baseline environment and relevant studies.

At the same time, the inheritance of the available studies and reports is really essential to use up available findings and further develop limitations.

Field survey method

Field survey is compulsory for ESIA/EIA to identify the status of the subproject area, relevant surrounding objects to select sampling position, survey of status of water supply, drainage and power supply.

The consultancy firm carried out the geographical and topographical surveys, collecting of meteorology-hydrology materials for designing in accordance with Vietnam's applicable standards. These survey results will be used for assessment of natural conditions of the subproject area.

Consensus method

Based on knowledge and experiences in environmental science of EIA specialists of the consultancy unit and other scientific research units.

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

After the field survey, the sampling and analyzing program will be developed with some main contents, including: position of sampling, measurement parameters, analysis, human source, required equipment and tools, time, sample preservation plan, analysis plan and so on.

For this subproject, the consultant coordinates with Ha Noi city Center for Analysis and Environment to conducting the monitoring, sampling and analyzing of air, water, soil, sediment and aquatic organism in the subproject area in accordance with Vietnam's applicable standards.

For ambient air

Height of sampling point from ground is 1.5m. Air sample is collected on impermeable pipe by pump Sampler (America) Model: 224.PCXR8. Dust sample is collected by air collector pump KIMOTO (Japan).

- Dust: Sampling and analyzing according to TCVN 5067:1995, sampling equipment: KIMMOTO, weighing on analytical scale: Sartorius BP 211D, sensitivity 1x 10-5gr (German).

- SO₂: Collecting sample from Kimmoto Handy Sample HS-7- Japan, according to TCVN 5971:1995. Sample analyzer by colorimeter on UV spectrum -1691 PC...
- CO: Sampling and analyzing according to standard HD.5.7-13.

For analyzing samples of water, soil and sediment

Vietnam's standard TCVN 6663-6:2008: Guidance on sampling of rivers and streams. TCVN 5999:1995: Guidance on sampling of wastewater. TCVN 6663-11:2011: Guidance on sampling of ground water. TCVN 7176:2002 - Methods of biological sampling. TCVN 6663-3:2000: Guidance on sampling of sewage sludge and sediment. TCVN 6663-3:2008: Guidance on preservation and handling of samples.

Parameter analyzing methods according to Vietnam's standards and ISO, including:

- pH: Directly measured by digital meter - Wagtech, according to TCVN 6492:2011.
- DO: Directly measured by digital meter - Wagtech, TCVN 7325:2004.
- Total suspended solid (TSS): Weight method, TCVN 6625:2000.
- BOD₅: BOD Track analyzer, according to TCVN 6001-1:2008.
- COD: COD analyzer brand HACH, includes colorimeter DR/890, sample destroying stove according to SMEWW 5220 D:2012.
- Hardness: Analyze on two-channel ion chromatography LC-0ADVP, Detector CDD according to TCVN 6224-1996.
- NH₄⁺-N: UV-VIS Spectrophotometer Model Shimazu UV - 1691 PC theo SMEWW 4500-NH₃ F:2012.
- NO₃⁻-N: Analyze on UV-VIS Spectrophotometer Model Shimazu UV - 1691 PC according to EPA 352.1.
- PO₄³⁻: Analyze on two-channel ion chromatography LC-0ADVP, Detector CDD or UV-VIS Spectrophotometer Model Shimazu UV - 1691 PC according to TCVN 6202:2008.
- SO₄²⁻: Analyze on two-channel ion chromatography LC-0ADVP, Detector CDD or UV-VIS Spectrophotometer Model Shimazu UV - 1691 PC according to SMEWW 4500 SO-42-E:2012
- Cd, Zn, Fe, Pb, Cu, Cd...: Analyze according to SMEWW 3113B:2012, As according to TCVN 6626:2000, Hg according to TCVN 7877:2008, on atomic absorption spectrum Model AAS-800.
- Mineral oil: Weight method, TCVN 5070:1995.
- Coliform: Pipe method, TCVN 6187-2:1996.
- Chloride: Two-channel ion chromatography analysis equipment LC-0ADVP, Detector CDD according to Vietnam's standard TCVN 6494-1:2011.

CHAPTER 2. NATURAL, ENVIRONMENTAL AND SOCIO-ECONOMIC CONDITIONS OF THE SUBPROJECT AREA

2.1. Physical and biological conditions

2.1.1. Geographical and Topographical Conditions

Lao Cai city spreads from 22°25' to 22°30' North Latitude, and from 103°37' to 104°22' East Longitude and consists of 17 administrative wards with natural area of 229,25 km² accounting for 3.6% of the whole provincial area. Boundary of the city is as follows:

- North: close to Hekou town, Yunnan Province, China.
- South: close to Bao Thang district, Sa Pa district, Lao Cai province.
- East: close to Bao Thang district.
- West: close to Bat Xat, Sa Pa districts.

Lao Cai City is located in the Red River valley region which is created by Con Voi and Hoang Lien Son mountains. The terrain tends to gradually slope from the northwest - southeast and is divided by rivers, streams, water slots, hills, etc. Lao Cai City is situated on both sides of the Red River, surrounded by hills and mountains.

Mountainous terrain which represents 60% of the city area concentrates in Ta Phoi and Hop Thanh and part of Van Hoa and Dong Tuyen communes. The mountainous area has an average altitude of 80-100 meters above sea level, and an average mid slope of 12-180. The highest mountain peak with an elevation of 1260 meters is located in the southwest of the city.

The lowland is located in the Red River and between the hills, distributed mainly in the area of urban wards and sub-urban communes such as Cam Duong and part of Van Hoa and Dong Tuyen with an average slope of 6-90, and an average height of 75-80 m above sea.

In the sub-project area, the civil works of Component 1 and 3 will be undertaken in Kim Tan ward. This is the center of the city of Lao Cai which is relatively flat terrain with the elevation difference from 1- 2 m. In the west part of Nhac Son Park there are some low hills (elevation difference between the tophill and foothill ranges from 5-10 m).

For road investments in Component 1 &2, the civil works are located on Van Hoa Commune, a peri-urban area southeast of the city of Lao Cai. The topography of this area tends to be lower gradually from east to west. The south and southwestern parts are relatively flat and adjacent to the Red River, which are suitable for the development of short-term crops, fruit trees, aquaculture, livestock, poultry and vegetable intensive eco-production. The northeast terrain is formed with hills and mountains and there is a large difference in elevation (average 10 to 30 meters from foothill to tophill), suitable for forest plantation and fruit trees. Among the 09 roads to be built under the subproject 08 roads will go along the foothills and 1 will pass over hillsides (Figure 2.1)



Figure 2.1. Map on location of investments at Van Hoa Commune of Component 1

2.1.2. Hydrogeological and meteorological features

The project consists of 3 components, of which Component 3 and part of Component 2 investments are located at the center of Lao Cai City, while Component 1 and part of Component 2 is located in the peri-urban area of the city. Therefore the meteorological conditions and hydrology project area is characterized with those of Lao Cai city.

Lao Cai city has the subtropical climate with monsoon, with a cold and dry winter due to the influence of the northeast monsoon from the high pressure Siberian. Lao Cai climate is divided into two seasons, the rainy season lasts from April to September, and the dry season lasts from October to March next year. The average temperature is 22.8 °C and rainfall is 1,792 mm. The distribution of temperature, rainfall and humidity in the city was not high. The average temperature in the coldest month is only 16°C, thermal amplitude is 11°C/year, with an average of 1 day hoar frost.

These quite stable climatic conditions are favorable factors for the development of agriculture with diversified crops and livestock, such as the tropical and sub-tropical fruit trees (longan, litchi, mango, banana, pineapple, peach, plums, apples, pears, etc.); industrial crops (tea, sugar cane, etc.) and various types of livestock, poultry and aquaculture.

Although there are no extreme weather phenomena like snow, frost, hail, Lao Cai climate may be affected by local winds (dry and hot O Quy Ho wind) or heavy rain accompanied by strong currents of the major rivers in the flood season, this increased activity aggressive erosion, affecting the agricultural production, tourism and daily life of the people.

a. Air temperature

Air temperature affects the propagation and transformation of pollutants in the air. The average air temperature measured in Lao Cai City is presented in Table 2.1. The annual average temperature is about 23.9 °C, the highest annual average temperature is about 29.0 °C, the lowest average temperature is about 16.0 °C.

Table 2.1 Temperature characteristics (°C) in Lao Cai

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
2010	15,1	22,4	21,7	24,8	26,6	28,7	28,8	29,1	28,1	26	20,2	18,6	24,2
2011	18,6	20,6	22,2	24,5	28,3	28,8	29,5	28,1	28	24,3	21,5	18,2	24,4
2012	12,8	18	17,6	23,4	26,4	28,9	29,3	28,2	27	24,3	21,9	16,4	22,9
2013	15,6	17	21,1	26,7	28,9	29,2	28,5	28,7	26,4	25,3	22	18,4	24,0
2014	15,8	18,1	21,7	26,1	29,4	29,3	28,7	28,7	28,1	25,5	21,7	16,5	24,1
2015	17,1	19,6	23,3	25,1	30,0	30,7	29,3	28,9	28,3	25,7	23,6	17,9	24,9
Average	16	19,2	20,9	25,1	27,9	29,0	29,0	28,6	27,5	25,1	21,5	17,6	23,0

Source: Lao Cai meteorological station in the period 2010 ÷ 2015

In winter months (December ÷ March), the temperature falls below 17 °C, and the weather is cold. The lowest air temperature measured in meteorological station in Lao Cai is 1.4 °C. The coldest month is January, with average temperature at about 16.0°C. The hottest months are June and July, with average temperature of about 29.0°C. Diurnal fluctuation range of temperature is at about 8÷10 °C.

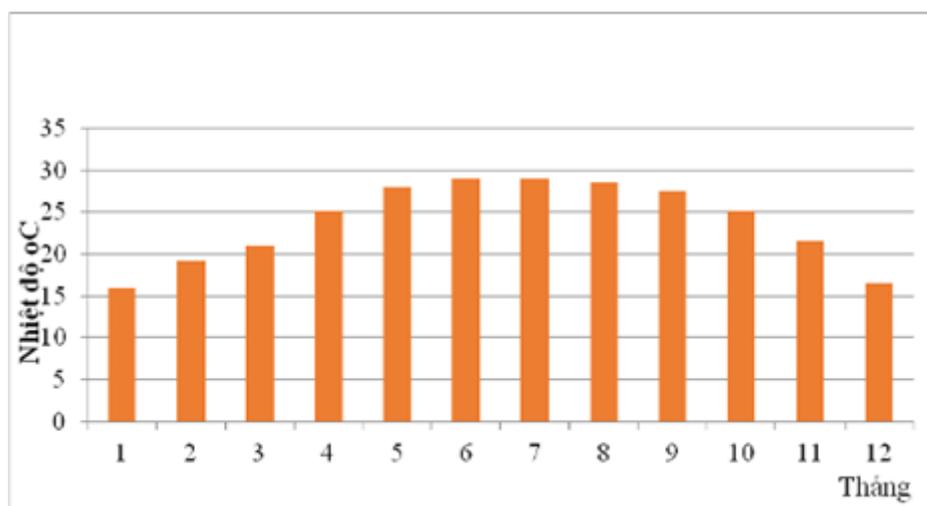


Figure 2.2 Diagram of temperature in Lao Cai meteorological station

Source: Lao Cai meteorological station in the period 2010 ÷ 2015.

b. Humidity

The average humidity of the year is 81.3%. The average humidity between the months of the year ranges from 78.8 to 83.4 %. The highest humidity month is December (83.4 %), the lowest humidity month is May (78.8 %).

Table 2.2 Humidity characteristics (°C) of Lao Cai

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
2010	82	80	78	80	83	79	83	80	80	82	79	80	80.5
2011	81	73	76	79	80	82	80	83	82	83	81	86	80.5
2012	84	80	82	83	81	81	75	82	84	84	84	84	82
2013	85	83	78	76	77	82	84	81	85	84	86	84	82.1
2014	83	79	81	82	73	81	83	82	83	80	85	83	81.3
2015	83	80	79	76	75	74	76	81	83	81	82	86	79.6
Average	83	79	79	80	78.8	81	81	81.6	82.8	82.6	83	83.4	81.3

Source: Lao Cai meteorological station in the period 2010 ÷ 2015

c. Rainfall

The average measured rainfall in Lao Cai city is showed in the Table 2.3. The total annual average rainfall in the area is quite large, about 1,652 mm. Average rainfall is higher than 200 mm and is continuous in June, July, August, and September. The month with maximum rainfall is August, on average 306 mm. Less rainy season starts in October and ends in March. February is the month that has the lowest average rainfall (14.8mm).

Table 2.3 Rainfall characteristics (°C) in Lao Cai meteorological station

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
2010	11	9	51	184	356	195	228	284	212	16	21	4	1,571
2011	9	15	27	154	337	142	199	316	176	89	34	76	1,574
2012	22	13	105	68	216	140	237	250	344	124	126	15	1,660
2013	34	3	35	70	199	170	365	185	324	103	51	32	1,571
2014	17	34	46	102	29	374	435	496	183	11	139	20	1,886
2015	73.8	21.0	25.8	98.4	126.6	61.4	283.7	275.6	230.9	176.1	61.4	80.3	1,515
Average	18.6	14.8	52.8	116	227	204	293	306	247.8	68.6	74.2	29.4	1,652

Source: Lao Cai meteorological station in the period 2010 ÷ 2015.

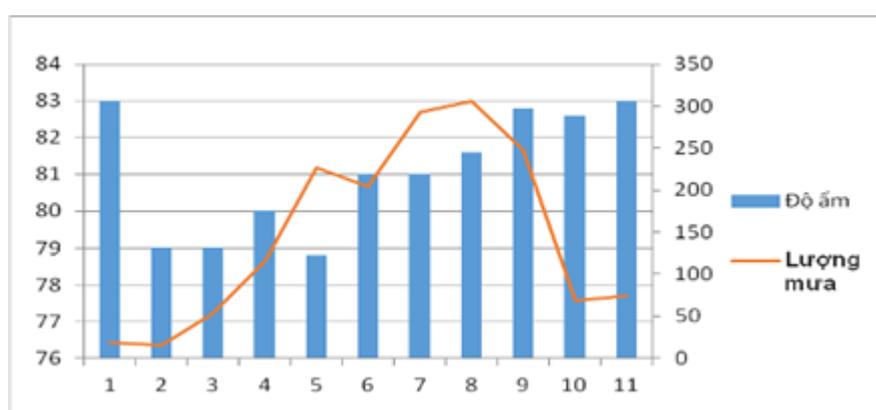


Figure 2.3 Average annual rainfall and humidity

Source: Lao Cai meteorological station in the period 2010 ÷ 2015

d. Sun:

The average number of sunny hours in the year in the subproject area is 1,539 h. Months with high sunny hours are from April to October, ranging from 133h - 180 h. May is month that has

the highest number of sunshine hours, average 180 h. Months in winter have low sunny hours (from November to March next year).

Fog: Fog often occurs across the province, especially there is thick fog in some places. In the freezing phase, in the high mountains and sheltered valleys there are also hoar frost, each session lasts 2-3 days.

e. Wind speed and wind direction

The direction and average wind speed in Lao Cai City is presented in the Table 2.4. The main wind directions in winter are the north and northeast, those in the summer are the south and southeast. The average annual wind speed in the subproject area is 1.3 m/s, the average wind speed between the months of the year ranges from 1.0 to 1.8 m/s.

From May to July, there are hot dry wind events, which last about 5 or 6 days. The impacts of the storm in Lao Cai is insignificant, but large tornadoes often appear on February, March, April.

Table 2.4 The average wind speed in the city of Lao Cai

Month	1	2	3	4	5	6	7	8	9	10	11	12
wind direction	NE	NE	NE	SE	SE	SE	SE	SE	SE	NE	NE	NE
Average wind speed (m ³ /s)	1,4	1,6	1,6	1,8	1,5	1,1	1,3	1,1	1,1	1,0	1,1	1,1

Source: Lao Cai meteorological station in the period 2010 ÷ 2015

2.1.3. Hydrological condition

There are 2 rivers running through Lao Cai City, the Red River and Nam Thi River. The Red River runs across Lao Cai City and plays an important role in agricultural production, supplying irrigation water, and build up a fertile plain. Nam Thi River running around the north of Lao Cai province is the natural border with China. Nam Thi River is the source of water for the city's water supply plant. Nam Thi River confluences with the Red River at the border between Lao Cai City and China.

Red River originates from Nguy Son range, Yunnan Province of China at an altitude of 1,776 m; flows through the town of Hekou and Vietnam at Lao Cai city. Red River is recognized as an international waterway with total length of 1,149 km originating from China, running through Vietnam before entering East Sea. In the subproject area, Red River starts from the confluence with Nam Thi River, which is about 100 m upstream distant from Coc Leu Bridge. Segment through the city of Lao Cai has a length of 15 km with pretty meandering flow, with high velocity, high slope, the average width of 150 m-180 m. At the Coc Leu bridge it has the width of 190 m wide and the depth of 9.5 m. Red River annual average water flow is huge, around 338 m³/s was measured in 2015 with a total water volume flowing is 14 billion m³/s, but did not unevenly distributed. During the dry season, flow is only about 121 m³/s in March 2015, the shallow water affect waterway transportation, making difficult for the production and life of local people. And at the pick of the rainy season, the flow can reach 3,620 m³/s in October 2015. The monitoring data of Red River water level at Lao Cai station as follows:

- Average water Ngoi Dum Stream in location construction is:
- Average river water level in 2015 is: 76.51 m.
- Highest water level is 81.41 m measured in October 2015.
- The lowest water level in 2015 as in March Hmin = 75,72 m.

- Flow rate $V_{max} = 3.5 \text{ m/s}$; $V_{min} = 0.5 \text{ m/s}$;

Nam Thi River originated in the Ming Thuu town, east district of Mongtu, Honghe Autonomous prefectures of Yunnan Province, China. Nam Thi River forms the border China-Vietnam and flows into the Red River in Lao Cai wards in the city of Lao Cai and Ha Khau town.

Nam Thi River is place of the water supply for the Lao Cai water plant with a capacity of 12,000 m³/day, serving almost 100 thousand people and institutions in the Lao Cai city. However intersection between Nam Thi River and Red River is now polluted, the segment flowing through the city has length of 2 km, with the average width of 100-120 m, is being exploited as a main source of potable water supply for city. Hydrological data of the Nam Thi River as follows:

- Minimum flow $Q_{min} = 10 \text{ m}^3/\text{s}$
- Maximum flow $Q_{max} = 1000 \text{ m}^3/\text{s}$
- Highest water level corresponding with $P=1\%$ is $H_{max} = 87.0 \text{ m}$
- Minimum water level $H_{min} = 75.32 \text{ m}$.
- Flow velocity $V_{max} = 2.5 \text{ m/s}$; $V_{min} = 0.5 \text{ m/s}$.

In addition to two major rivers, there are some small streams and ponds for aquaculture within the project area.

Ngoi Dum stream is a primary tributary located on the right bank of the Red River, originating from 2233 m high mountain of Hoang Lien Son, and flows southwest to Lao Cai City and runs into the Red River in Bac Cuong Ward. The basin area of the stream is about 156.0 km²; basin's length is 25km, the length of mainstream is about 27km. Ngoi Dum's flow is divided into two seasons, the flood season and the dry season. The flood season usually begins in June and ends in September. The flow of the flood season accounts for about 70-75 % of the annual flow, large floods usually occur in July and August. Dry season begins in October and ends in May next year, the flow of this season accounts for 20-25 % of the annual flow. Monitoring data at Kim Tan pump scheme shows hydrological regime of Ngoi Dum scheme as follows:

- The minimum water flow $Q_{min} = 1.85 \text{ m}^3/\text{s}$
- The maximum water flow $Q_{max} = 160 \text{ m}^3/\text{s}$
- The highest water level $H_{max} = 86.45 \text{ m}$
- The lowest water level $H_{min} = 77.20 \text{ m}$.

The central lake has an total area of 5.4 ha and is located in Nhac Son Park in Kim Tan Ward, in the center of Lao Cai City. The lake is functioning to create an ecological landscape for Nhac Son Park. Water of the lake is mainly supplied by surface rainwater runoff and domestic sewage from the residential areas at the north of the lake. The field survey results showed that the lake water is now heavily polluted, causing many fish dead in the dry season. The sediments are deposited in the bottom with (the average thickness of the layer of mud ranging from 1.0 - 1.3 m) deteriorating water quality of the lake and the park landscape. At the time of survey in July 2016, the average lake water level reaches 3.5m (the highest 4.0m).

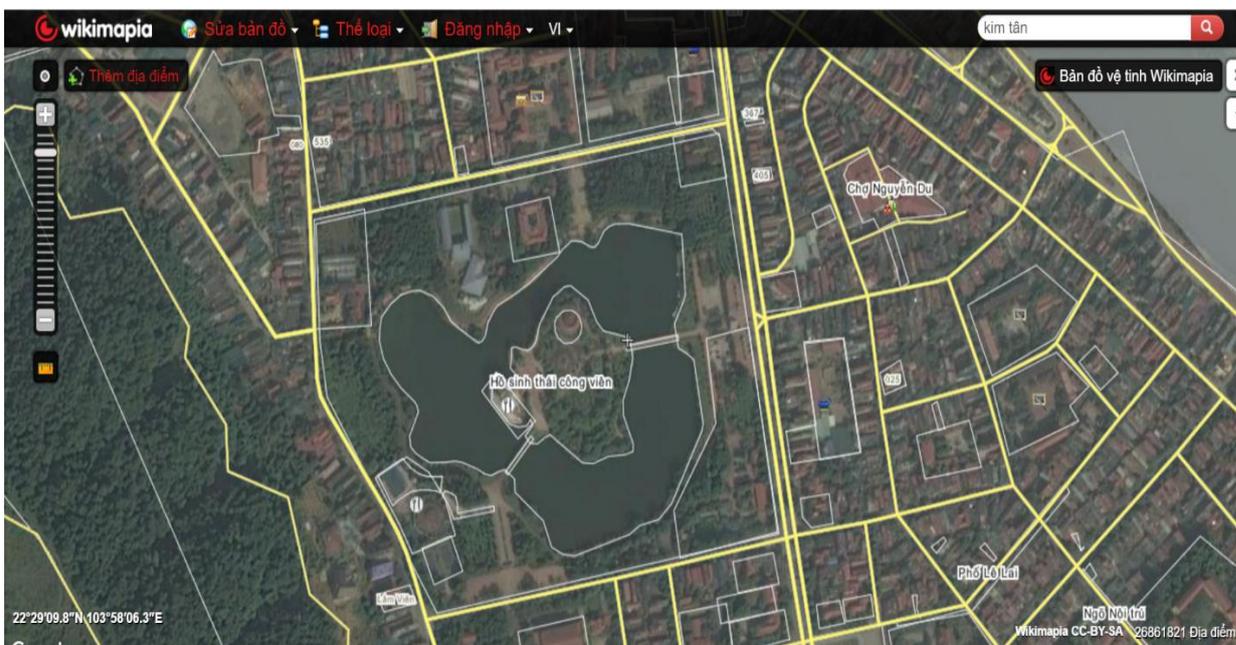


Figure 2.4. Map of central lake in Nhạc Sơn Park

2.1.4. Biological and ecological conditions

2.1.4.1. Biological and ecological conditions on Lao Cai province

In order to assess the current status of biological resources in the subproject area, apart from field investigations, surveys, and assessments conducted in the area, the report is also prepared with reference to several documents and secondary data on biological resources survey and assessment in Lao Cai Province, with focus on aquatic and terrestrial ecosystems along the subproject related rivers and lakes such as Red River, Ngoi Dum Stream and central lake.

According to the Report of Lao Cai Department of Natural Resources and Environment (DONRE), Lao Cai province has several rare species that need preserving. However, the sources of biodiversity conservation in Lao Cai are only limited within Hoang Lien Son National Park, Van Ban Natural Reserve and Bat Xat Natural Reserve (about 18-30 km distance to the City). In Hoang Lien Son National Park only, there are 1,847 species of vascular plants, belonging to 229 families under 6 phyla. Of which, the number of rare plant species listed in the Vietnam Red Book are 133 species. These rare and valuable plants include Fokienia, spruce, tsuga, cryptomeria japonica, Amentotaxus yunnanensis, red pine, Syringa, Madhuca alpina, Cinnamomum balansae, Parashorea chinensis, Chukrasia tabularis, Coptis, Schefflera arboricola, Panax pseudoginseng, Stephania glabra, Stephania dielsiana, Campanumoea javanica Blume.

The fauna has also been investigated by many scientists of domestic and international research institutions. By far Lao Cai has 555 species of terrestrial vertebrates, including 96 species of mammals; 346 species of birds; 63 species of reptiles and 50 species of amphibians. Some of the specific orders, families and species that were discovered are presented in the Table 2.5 below:

Table 2.5: List of vertebrate in Lao Cai

No.	Taxon	No.of order	No.of family	No. of species
1	Mammal	9	27	96
2	Bird	16	52	346
3	Reptile	2	9	63
4	Amphibian	1	7	50
	Total	28	95	555

Of the 555 vertebrate species that have been recorded in the Hoang Lien, 60 species are rare and precious listed in the Vietnam Red Book (1992), 33 species in the IUCN Red List/2004, five endemic bird species for Vietnam and 55 other bird species endemic to the high mountains of Hoang Lien Son.

Insects: Leaf-eating beetles of 89 species, 40 varieties and 9 subfamilies of Coleoptera, Lucanidae of 18 species in 7 varieties, of which 4 species are found only in the Hoang Lien Son Mountains.

In summary, the diversity of species in Lao Cai is very high, but most species found in Lao Cai are in the Hoang Lien Son mountain range managed by the Hoang Lien Son National Park.

According to the reports of the Lao Cai DONRE and the Lao Cai Department of Agriculture and Rural Development (DARD), as well as the survey of the subproject, the rare species listed in the Red Book of Vietnam and the protected species under the IUCN are only found in the Hoang Lien Son mountain range and Van Ban NR and Bat Xat NR. These rare and protected species are absolutely not discovered in the project area.

Within the scope of the subproject there are absolutely no sensitive ecological areas, natural conservation areas or national forests. Hoang Lien Son National Park and Nature, Van Ban and Bat Xat Reserves are located far away from the subproject site (about 18-30 km distance). Hence the impact of the project on the species of rare plants or parks and national park reserves is not found.

The project investments are scattered in Lao Cai city urban area and Van Hoa Commune, peri-urban area. The relevant aquatic and terrestrial ecological conditions in the project area are described below:

2.1.4.2. Biological and ecological conditions on subproject areas

a. Aquatic biodiversity

**** Red River***

According to the report of Lao Cai DONRE, (period 2010-2015), the potential of natural fish in the Red River is great. Particularly in fish fauna of the Red River within the province, there are 54 species belonging to 7 families, with 5 species. The most diversified aquatic fauna within the Red River is catfish (*Siluriformes*) with 6 families, followed by *Perciformes* ordo with 05 families; common carp (*Cyprinus carpio*) ordo with 3 families.

In December, 2007, it was identified by a survey of Phan Mach (Institute of Ecology and Biological Resources) on creatures and zooplankton on Red River that floating plankton is distributed almost every water body. Plankton is the direct or indirect feeding of the species of shrimp, fish and other valueable aquatic species. Among key phytoplankton species there are 10 typical freshwater algae. Zooplankton species on 20 different groups were also found.

According to the information provided from Lao Cai DONRE and DARD, there is no endangered and rare fish species in the Red River section at the subproject area. No migratory

fish nor catadromous/anadromous species is detected and recorded in the subproject area of influence.

* Ngoi Dum River

The survey on biodiversity of Ngoi Dum River basin found 11 fish species including sharpbelly (*H. leucisculus*), ray-finned fish (*O. gerlachi*), pipefish (*S. argentatus*), (*H. medius*), (*O. bidens*), goldfish (*C. auratus*), Chinese barb (*P. semifasciolatus*), and yellowhead catfish (*P. fulvidraco*). In addition, there are fish kept in the farming ponds in the area and then sold at Thien Ke market, which are Rohu (*L. rohita*), Mrigal carp (*C. mrigala*), Silver carp (*H. molitrix*), Grass carp (*C. idella*), and Mozambique tilapia *O. mossambicus*).

Regarding aquatic plant, there are 198 aquatic plants found long Ngoi Dum River basin under 6 divisions: *Cyanobacteriophyta*, *Bacillariophyta*, *Dinophyta*, *Chrysophyta*, *Euglenophyta*, *Chlorophyta*.

Regarding zooplankton, there are 23 species under phylum of Arthropoda and 14 species of *Nemathelminthes phylum*.

In short, the biodiversity in Ngoi Dum River is assessed as poor with dominant freshwater species. According to the information provided from Lao Cai DONRE and DARD, there is no endangered and rare fish species in the Ngoi Dum River section at the subproject area. No migratory fish or catadromous/anadromous species is detected and recorded in the subproject area.

* Central Lake in Nhap Son Park

Regarding biodiversity, the survey found that the fish farmed by local households include barb, tilapia, grass carp and common carp. Other aquatic species are shrimp, crab, goby fish etc.

According to the Lao Cai DARD, plankton found in central Lake include Cyanobacteria under 5 orders, 11 families, 33 genera of 5 phyla: *Cyanobacteriophyta*, *Chlorophyta*, *Euglenophyta* and *Bacillariophyta*.

Chlorophyta has the highest number of species of 64, in which Scenedesmus genus has the highest species and subspecies, followed by Pediastrum genus with 11 species and subspecies. These two genera are commonly found in all sampling sites. Bacillariophyta has 6 species.

* Other aquatic environment:

Mainly species of freshwater aquatic plants and recorded include live aquatic communities submerged and floating on a number of irrigation canals, ponds, small streams, pros that include: water hyacinth (*Eichhornia crassipes*), common water hyacinth (*Pistia stratiotes*), kariba weed (*Salvinia cuculata*), *Salvinia natans*, Lotus (*Nelumbo nucifera*), water lily (*Nymphaea pubescens*), spinach (*Ludwigia hyssopifolia*), vegetables and coconut water (*Ludwigia adnascens*), golden bladderwort (*Utricularia aurea*), waterthyme (*Hydrilla verticillata*), etc

b. Terrestrial biodiversity on subproject location

Within the subproject scope, terrestrial species found in 2 specific sub-zones.

* Urban ecosystem

The construction activities in Component 2 and 3 will be carried out in urban landscape. This area is characterized with low biodiversity of animals and plants grown by human. The survey results demonstrated that:

- Terrestrial plants include mainly timber plants, shading plants and ornamental plants for parks, and along streets such as willow, Lagerstroemia, flamboyant tree, *Dracontomelon*

duperreanum, *Magnolia conifera*,... and garden trees such as jackfruit, guava, *Dracontomelon duperreanum*, apple,... and other grasses. Animals in the subproject area are mainly households cattle, poultry such as pigs, chickens, dog,...

* *Residential and agricultural ecosystems*

The project survey results show that, except for the dredging and rehabilitation of the central Lake in Nhac Son Park in Component 2, other categories of sub-projects, especially roads to be constructed at Van Hoa commune and renovated or the construction of Ngoi Dum bridge all pass through residential areas and agricultural areas.

The residential and agricultural ecosystem in the area are mainly composed of:

- ✓ The animals found are some cattle, pigs, chickens etc. that are raised by local people.
- ✓ The amphibians consist mostly Amphibia and Anura with 5 families, 35 species (accounting for 97.1% of the species). Orders of newts and salamanders (*caudata*) and caecilian (*Gymnophiona*) consists of 01 family and one species (2.9% of the species)
- ✓ Reptiles: There terrestrial species: kukri snake (*Oligodon*); skinks (*Eutropis*). Aquatic reptile found is water snake (*Colubridae*).
- ✓ For terrestrial plants: plant communities surrounding residential areas mainly include: chinaberry tree (*Melia azedarach*), Orange (*Citrus sinensis*), Lemon (*Citrus aurantium*), longan (*Dimocarpus longan*), Papaya (*Carica papaya*), bananas (*Musa paradisiaca*),... *Cratoxylon prunifolium*, *randia spinosa*, *Chromolaena odorata*...
- ✓ For agricultural areas: The main crops include grain crops like corn (*Zeamays*), Sweet potato (*bataas Ipomoea*), potato (*Solanum tuberosum*), cassava *Manihot esculenta*, short time crops and wet rice (*Oryza sativa*).
- ✓ For forest production hilly areas: primarily developed in the northeast of the commune. Key plants found include timber trees such as *Acacia*, *Magnolia conifera*, *Cinnamomum verum*.....and several scrubs such as *Cratoxylon prunifolium*, *randia spinosa*, *Chromolaena odorata*...

In summary, the overall biological diversity of residential and agricultural zones are rated as poor, there is no species included in the list of species under critical threat listed in the Red Book of Vietnam.

2.1.5. Existing social and environmental conditions at the sub-project area.

a. Component 1. Construction of 9 roads in Van Hoa Area

Van Hoa is a suburban commune in Lao Cai City locating on the left bank of the Red River and is separated from the city by the Red River. According to Van Hoa Commune People's Committee, by the end of 2015 the commune has a total area of natural land of 2,032 ha, of which 151.38 ha is agricultural and residential land, 1,487 ha is plantation forest land. The commune has 1,265 households with 3,605 people, including 11 hamlets with 9 ethnic groups (Kinh: 1,106 households; Dao: 78 households; Day: 40 households; Nung: 11 households; Thai: 1 household; Tay: 24 households; Muong: 2 households; H'Mong: 1 household; Hoa: 1 household; Xa Pho: 1 household). The population density is low.

The communal economy is mainly based on the activities of agricultural and forestry production and trade and small-sized handicraft. Agricultural crops mainly include rice, upland rice, corn, potatoes, plantation forest trees consist of acacia mostly.

According to the survey results, Van Hoa commune people still face many difficulties (per capita income in 2015 is 24 million VND). In recent years, in order to facilitate the development of Van Hoa, Lao Cai province has invested in Giang Dong Bac Bridge across the Red River

with 1 communal road Giang Dong Bridge (completed in 2015).

According to survey results, apart from the main communal road that is newly built, the other infrastructure such as roads in the villages, water supply and drainage system is under developed compared with other urban areas of the city. Internal roads in the area are mostly macadam roads or dirt roads without drainage system. The people's living conditions are very difficult. In the south of the Commune there is Hanoi - Lao Cai railway crossing along the Red River dike.

For 9 roads to be built including T1, T3, N10, N13, D1, T6B, T7, T8 and N9, they pass over low hilly terrain with an average altitude of 80-100 m over sea level, with a few high hill area of 20 - 30m compared to regional average. Among those, Road N9 has a total length of 650m connects to D1 at the foothill and has one section going along the foothill in 200m, following the path through the hillside and hilltop of 250m (the hill is 30m high hill and planted with Acacia and managed by Quyet Thang Cooperative), then through agricultural land in 200m to the intersection with N10 and T1.

Of 9 roads, 8 roads will cross mostly over residential area, farming area and gardens along several hills.

The project will acquire permanently 94,781 m² of land, including agricultural land of 72,894 m² agricultural land (including 16,138 m² garden plantation forest land); 7,992 residential land; 13,211 m² of public land managed by the CPC. The number of affected households and the number of people affected are listed in the Table 2.6:

Table 2.6: Statistics of households affected by component 1

Permanently acquired land	AHs	APs
- Affected with residential and agricultural land acquisition	117	454
- Affected as ethnic minority households and vulnerable households whose 10% of residential and agricultural land is acquired	33	122
- Affected with crops and plants	117	454
- Affected households who need relocation	25	97
- Affected with houses/property	61	240
- Affected with business	09	20

Table 2.7. Detailed survey of land use of project site for 09 proposed roads in Van Hoa

No	Road	Road width (m)	Road length (m)	Description
1	T1	16.50	232	Starting from Red River, connecting with Red River embankment road, passing through rural residential area in 120m long in Canh Chin Hamlet, and then the Acacia plantation land of Quyet Thang Cooperative Decision in 112m long.
2	T3	20.50	501	Starting from Van Hoa Agricultural Cooperative going through gardens, farm lands in 320m long. Then passing hilly crop lands (Acacia, Cinamon plantations) in 181m long.
3	N10	16.50	2220	This road goes parallel to the railway, the starting point behind the residential area opposite to Van Hoa Secondary School, the first 170m going through rice fields, the next 1550m away foothills through the residential, garden and shrub land, and the last 500m going between households and fields. Endpoint connecting to the Red River embankment.
4	N13	16.50	820	Starting point from the existing D1 going through a number of houses in 300m long; passing along the foothills through the garden then rice fields to the N10 route in a length of 520m.
5	D1	24.00	210	Starting from the roundabout of the existing D1, going through residential land to foothill through agricultural and garden land and then connecting N9 road in 210m long.
6	T6B	17.50	533	Start point at the intersection between N13 and D1, passing foothill, 533 m long. Ending point connects to Road N10.
7	T7	19.00	405	Start point from the roundabout of the existing D1 heading southwest over residential land to N13 in 405m long.
8	T8	16.50	540	Start point from intersection with the Red River embankment road, 260m through rice fields; then going between the foothills comprising of residential and garden land, through some households and garden land in 280 m, endpoint connecting to the N10 route.
9	N9	16.50	680	Start point connecting to D1, going along the at the foothill through residential, garden and agricultural land going about 200m then passing hillside and hilltop 250m in, then through the land of Quyet Thang Cooperative (Acacia and Cinamon plantation land) and agricultural land in 230 meter long to the intersection with N10 and T1.

b. Component 2 – Dredging the central lake

The central lake of Lao Cai city located inside Nhat Son Park with total area of about 5.4 ha will be dredged and rehabilitated. The main work include dredging the lake bed (existing depth varies 3.7-5.2) with the total area of 5.4 ha to the depth of 5.2 m; repairing the damaged sections of the lake embankment, with the estimated total length of 100 m; constructing drainage system for the lake including: interceptor with the length of 539 m, D=560; 01 overflow chamber; box culvert BxH=2.2x2.2 m; 01 pumping station with capacity 324 m³/h; and wastewater pressure sewer pipe of 1.5 km long conveying wastewater to Ngoi Dum WWTP, which is being constructed under the MCDP original project. By design, there are no land acquisition and resettlement activities in this Component; other local socio-economic impacts are unavoidable.

Nhat Son Park serves as a entertainment site for local people and is managed by Lao Cai Urban Environment Company (URENCO). It is surrounded by streets of Le Quy Don, Hoang Lien, Trung Do and Nhat Son. In the park, the surveyors found three restaurants, Lao Cai Provincial Children's Palace (next to Le Quy Don Street), children playground (corner to Hoang Lien Street and Trung Do street),



Figure 2.5. Current state of Central Lake in Nhat Son Park

The lake is paved with marble and planted with shading trees such as coconut, willow, crape myrtle, flamboyant tree, magnolia etc. According to Nhat Son management unit, there are about 300 visits to the park every day and the number increases during weekends, holidays, varying during the day between morning and afternoon when people go to the park for leisure and sport activities.

Water of the lake is mainly supplied by surface rainwater runoff and domestic sewage from the residential areas at the north of the lake. The field survey results showed that the lake water is now heavily polluted, causing many fish dead in the dry season. The sediments are deposited in the bottom with (the average thickness of the layer of mud ranging from 1.0 - 1.3 m) deteriorating water quality of the lake and the park landscape. At the time of survey in July 2016, the average lake water level reaches 3.5m (the highest 4.0m).

The four surrounding streets are described as follows:

- Nhat Son Street: main entrance to the park, most residents along the street have business activities.
- Le Quy Don Street: most residents are city official staff, 1-2 households have business activities. Two educational institutions, School for Official Staff Training and Kim Tan Secondary School, locate in this street.
- Hoang Lien Street: locating behind the park, hosting 18-20 households of whom 6-7 doing business. There are a cultural center and Lao Cai city job promotion center in this street.
- Trung Do Street: There are a city cultural center and office of Department of Internal

Affairs. 10-12 households reside on this street.

The households who live in these streets are mostly civil servants and classified as those of medium income level.

The lake is fenced with trees and the closest distance to the residential neighborhood of 100-300m on Hoang Lien Street and Trung Do and Le Quy Don Street at the forest end.



Figure 2.6. Layout of the Central Lake in Nhạc Sơn Park

c. Component 3 – Construction of Ngoi Dum Bridge

Ngoi Dum Bridge in subproject Component 3 is designed to cross over Ngoi Dum Stream of total length of 48 m with 2 approach paths of 62 m long. The main bridge has the expected working load HL93, pre-stress reinforced concrete structure, spans diagram L = 3x15(m), bridge size K=7+2x0,5m (no pavements for pedestrians). It will connect Dao Duy Tu Street in Kim Tan Ward with Ngo Minh Loan Street in Bac Cuong Ward.

The bridge construction does not require any land acquisition or resettlement for local residents.

Ngoi Dum Stream originates from Hoang Lien Son range, Sapa region, flowing southwest to Lao Cai City and entering into Red River in Kim Tan Ward (500m from Cau Moi Bridge). The flow length is about 27 km.

The results showed that both side of the bridge have relatively flat terrain; the transport infrastructure as well as embankment of Ngoi Dum have been completed and is being used. Some households live near the bridgehead towards Dao Duy Tu Street; the Children's Hospital of Lao Cai also locates there (about 100 meters from the construction site of the bridge). The population density is quite high at the bridgehead toward Ngo Minh Loan Street where people live mainly on business and trade. No cultural and historical sites are found within a radius from 500 m up from the construction site.

Preliminary evaluation of the local environmental quality shows that Ngoi Dum is strongly influenced by water regime of the river upstream as well as wastewater discharge in upstream area of the city of Lao Cai. Along Ngoi Dum there are many storm drains and sewage from the nearby areas.



Figure 2.7. Layout of the Ngoi Dum Bridge

2.2. Existing environmental quality in the subproject area

2.2.1. Current State of Air Quality

The analytical results for air quality in the subproject areas, sampling in August 2016, are shown in Table 2.8. According to the analytical results, concentrations of air pollutants in all taken samples meet the allowable limits of national technical regulations on ambient air quality (QCVN 05:2013/BTNMT). Dominant wind direction is northeast and the wind speed is not high.

Table 2.8. The analysed results of environmental air quality in the subproject area

(sampling survey in August and October 2016)

N ^o	Analysed parameter	Results												Testing method	QCVN 05:2013/ BTNMT TB 1h
		KK1		KK2		KK3		KK4		KK5		KK6			
Sampling coordination		X:22°25'03" Y: 104°01'26"		X:22°30'26" Y: 104°10'42"		X:22°27'08" Y: 104°08'27"		X:22°23'06" Y: 104°05'57"		X:22°26'30" Y: 104°11'21"		X: 22°29'06 Y: 103°58'06			
Monitoring time		24Aug 8h35	25 Aug 13h30	26 Aug 10h30	26 Aug 15h30	27Aug 9h30	27 Aug 17h25	D28 Aug 11h15	28 Aug 14h40	29 Aug 16h25	30 Aug 8h10	30 Otc 16h00	30 Oc 8h50		
1	T (oC)	321.5	34.0	32.5	31.5	33.5	31.5	30.5	32.0	31.5	28.5	30.5	34.2	QCVN 46:2012/ BTNMT	-
2	Humidity (%)	72	67	69	69	72	74	67	69	67	69	69	67.4		-
3	Wind direction	South west	South west	South west	South west	South west	South west	South west	South west	South west	South west	South west	South west		-
4	Wind speed (m/s)	0.25	0.45	0.43	0.34	0.36	0.48	0.46	0.57	0.37	1.13	0.47	0.49		-
5	Noise (dBA)	64	62	63	61	67	54	62	57	54	58	58	67	TCVN 5964:1995	<75**
6	Total dust (µg/m ³)	110	115	135	125	65	60	110	95	92	83	98.7	112	TCVN 5067:1995	300
7	NO ₂ (ug/m ³)	121.0	63.4	42.4	41.3	43.3	29.2	51.5	64.8	38.7	75.6	39.2	64.6	TCVN 6137-2005	200
8	SO ₂ (ug/m ³)	72.1	67.4	56.3	51.5	61.2	64.5	46.7	47.1	75.2	64.4	77.2	69.3	TCVN 5971:1995	350
9	CO (ug/m ³)	1,151	1,248	1,241	1,223	1,138	1,326	1,421	1,106	1,150	1,148	1,230	1,258	52 TCN 352-89- BYT-1993	30000
10	HC (ug/m ³)	1,149.7 7	899.55	878.38	766.38	783.5	715.28	742.95	757.91	691.89	728.79	661.3	879.8	NIOSH Method 1400	5000

Note: KK1: In front of cultural house of Giang Dong village, Van Hoa commune);

KK3: Under Bridge Chui, highway 70, Lao Cai ward. (Component 2);

KK5: Phan Dinh Giot street, near Pho Moi people committee;

QCVN 05:2013/ BTNMT - National technical regulations for ambient air. - *

- **QCVN 06:2009/ BTNMT - National technical regulations for hazardous substances in the ambient air environment.

KK2: At construction site of bridge across Ngoi Dum stream, Kim Tan ward

KK4: Nam Cuong people committee

KK6: Central lake of Lao Cai city (Component 2)

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

Through field surveys in the subproject area and the results of air quality analysis, it can be assessed as follows:

- Vehicle traffic density of the current area is not high, so air quality is still good. All the factors are within the permitted limits of national technical regulations on air and noise quality.
- Based on the air analysis, it can be seen that the load capacity of environment is still relatively large, can absorb impacts during construction and operation of the Subproject. However, mitigation measures is required to minimize the impacts on air.
- Results of the current measurement will be the benchmark for the process of environmental monitoring during implementation and evaluation impacts of the subproject on regional environment.

2.2.2. Current State of Water Quality

a. Surface Water Quality To assess the status of the Red River water quality and surface water quality in the subproject's area, the Consultant has conducted sampling of surface water on the river, and springs. The samples are taken in the dry season in August, 2016. Results of surface quality analysis are shown in Table 2.9, below.

The monitoring indicators include: pH, DO, TSS, BOD₅, COD, Fe, NH₄⁺ (according to N), NO₂⁻ (according to N), NO₃⁻ (according to N), PO₄³⁻ (according to P), Chloride (Cl⁻), oil, Coliform.

Table 2.9. The analysis results of surface water quality in the subproject area

(surveyed in August 2016)

N ^o	Parameters	Units	NM1	NM2	NM3	NM4	NM5	QCVN 08:2015/ BTNMT, column B1
1	pH		7.45	6.58	7.63	6.46	7.8	5.5-9
2	T	°C	27.5	28.7	26.8	27.9	23.8	
3	DO	mgO ₂ /	4.74	3.96	3.98	4.89	2.28	≥4
4	TSS	mg/l	65.6	82.3	116.4	108.7	143	50
5	NH ₄ ⁺	mg/l	0.55	0.67	0.77	0.44	1.77	0.9
6	BOD ₅	mgO ₂ /l	4.4	3.7	2.9	3.8	5.9	15
7	COD	mgO ₂ /	7.8	5.9	8.1	7.9	11.1	30
8	Total N	mg/l	3.1	2.9	2.8	1.9	6.8	10
9	Total P	mg/l	0.33	0.25	0.15	1.16	0.45	0.3
10	Grease	mg/l	0.45	0.44	<0.15	<0.15	<0.35	1
11	Total coliform	MPN/100ml	1,900	2,050	1,650	2,475	2,650	7,500

Note: NM1- Red River surface water, 0.8 km downstream distant from Coc Leu bridge; NM2- Surface water in Ngòi Đum stream, 150 m downstream from the location of the proposed bridge ; NM3- Surface water in Ngòi Đum stream at Kim Tân bridg, 100 m upstream of the proposed bridge; NM4- Surface water in one lake in Canh Chinh village, Vạn Hòa commune, NM5- Surface water in central lake in Nhac Son park

The analyses samples area compared with the national technical regulations for surface water using for irrigation purpose (QCVN08:2015/BTNMT, column B1).

The results showed that indicators on pH, BOD₅, COD, Total N, grease, and total Coliform of all analysed samples are within the allowable limits of the compared technical regulation.

Nevertheless, the TSS concentrations are higher than the permissible limits about 1.3-2.9 times, which could be explained by the fact that due to the silt from the upstream.

The total P levels of surface water samples in from central lake in Nhac Son park (NM4) and pond in Van Hoa commune are respectively 2.0 and 1.5 times higher than the allowable limits.

Furthermore, it is note that the DO and NH₄⁺ concentrations in Nhac Son surface water sample (NM4) are do not meet the national standards.

Overall, it is assessed that the water quality at Red River and Ngoi Dum stream at the monitoring period are still good. Nevertheless, the quality of surface water from the lake of Van Hoa Commnue and the central lake in Nhac Son park show sign of organic pollutions, which could be explained by the fact that these watercourses are receiving the domestic wastewater from surrounding local residents.

b. Groundwater Quality

Groundwater samples in the subproject area are taken from the drilled wells, at a depth of 10-15m in Binh Minh, Pom Han wards and Van Hoa commune. Local people in this area are using ground water for daily living purposes. Overall, in the area, there are not many factors affecting the groundwater quality. In this area, there are no industrial establishments; and the local people make a living mainly by farming, afforestation, and agriculture. The analytical results on groundwater quality are presented in following Table 2.10.

From the analytical results, it can be seen that the quality of groundwater in the area is still good, with the analyzed parameters meeting the standards on groundwater quality according to QCVN 09:2015/BTNMT (national technical regulation on underground water quality).

Table 2.10. The results of groundwater quality in the subproject area

(surveyed in August 2016)

N ^o	Analysed parameters	units	Analysed results				QCVN 09:2015/ BTNMT
			<i>NG1</i>	<i>NG2</i>	<i>NG3</i>	<i>NG4</i>	
1	pH		6.53	6.56	6.49	6.45	5.5-8.5
2	T	°C	27.9	26.9	24.8	25.8	
3	TSS	mg/l	146	114	147	136	1,500
4	Total hardness	mgCaCO ₃ /l	36	27	25	15	500
5	NO ₃ ⁻	mg/l	0.85	1.23	3.7	2.9	15
6	Mn	mg/l	0.013	0.004	0.055	0.047	0.5
7	PO ₄ ³⁻	mg/l	0.085	0.48	0.81	1.12	
8	Cl ⁻	mg/l	9.6	11.2	30.9	20.2	250
9	NO ₂ ⁻	mg/l	0.13	0.04	0.01	0.12	1
10	Oxidation level KMnO ₄	mgO ₂ /l	0.86	0.85	1.55	1.36	4
11	As	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	0.05
12	Fe	mg/l	0.26	0.36	0.36	0.46	5

Note: NG1- Ground well in 9 unit, Kim Tan ward; NG2- Ground well in Giang Dong village, Van Hoa commune.; NG3- round well in 4 unit, Binh Minh ward.; NG4- Ground well in 7 unit, Pom Han ward.

2.2.3. Wastewater and its effects on water quality

Wastewater in the city are domestic sewage. Due to the sampling during the rainy season (early August 2016), drains and wastewater sampling area can be diluted by rainwater runoff into the common sewer system. The results of the analysis of wastewater samples thus only partially reflect the characteristics and actual pollution levels of waste water in the area. In the early stages of implementation construction of the subproject, the independent environmental monitoring consultant will be selected to perform monitoring of the construction phase of EMP. Environmental monitoring Consulting unit will continue to conduct research and adjust the timing and location of sampling in the case needed to assess accurately the characteristics of the background environmental status before construction in subproject areas.

The analytical results are presented in Table 2.11 and are compared to the national technical regulation on waste water discharged into the receiving surface water not used for the purpose of water supply (QCVN24:2009/BTNMT)".

The results on wastewater water quality in the project area region showed that:

- At most locations the residue levels are exceeded the permitted standards 1 to 1.6 times at the point of wastewater discharged at the Coc Leu bridge, in sewage ditches in Kim Tan ward, discharged wastewater at the outlet to the Red river near Kim Tan bridge.
- Wastewater at samplings positions have higher levels of NH_4^+ than allowing standard from 1.3 to 1.6 times,
- BOD_5 concentrations at all sampling locations exceeded the permissible standards from 1 to 8 times. Levels are expected to rise higher if the the day before the day of sampling have no rain. COD exceeded permissible standards from 1.1 to 6.2 times at all sampling locations.

All samples of wastewater were coliform contaminated, coliform in wastewater exceeded standards from 5 to 60 times.

Table 2.11. The results on wastewater quality in the subproject area

(surveyed in August 2016)

N ^o	parameters	units	Results				QCVN 24:2009/BTNMT
			NT1	NT2	NT3	NT4	
1	pH		7.20	6.87	6.25	7.42	5.5-9
2	T	°C	29.0	27.8	28.2	28.2	40
3	Dissolved Oxygen	mgO ₂ /l	1.67	1.48	1.12	2.16	-
4	Sediment content	mg/l	86	184	98	79	100
5	NH_4^+	mg/l	7.0	16.6	12.4	12.0	10
6	BOD_5	mgO ₂ /l	74.6	79.8	64.1	54.2	50
7	COD	mgO ₂ /l	144.2	164.5	136.9	116.1	100
8	Total N	mg/l	22.3	21.9	33.5	13.4	30
9	Total P	mg/l	3.61	7.08	3.42	3.31	6
10	Total grease	mg/l	0.5	1.7	0.8	0.3	20
11	Total Coliform	MPN/100ml	9.2*10 ⁴	2.8*10 ⁵	6.4*10 ⁴	7.3*10 ⁴	5000

Note: NT1- Wastewater to Red river near Coc Leu bridge; NT2- Wastewater to Red river near Kim Tan bridge; NT3- Wastewater to Ngoi Dum river near construction site of WWTP Ngoi Dum; NT4- Wastewater to Red river in Giang Dong village, near cultural house of Giang Dong village, Van Hoa commune;

2.2.4 Sludge quality

The sludges samples at the central lake in Nhac Son park were taken for analysis by October 2016. The samples were taken at 03 different locations of the lake at the different layers. The sampling locations and results were presented in Fig 2.3, Table 2.12 and Table 2.13.

The analysis shows that all the heavy meatal concentrations in sludge samples are within the permissible limit of the national technical regulation on sediment quality, for the purpose of aquatic life protection (QCVN43:2012/BTNMT).

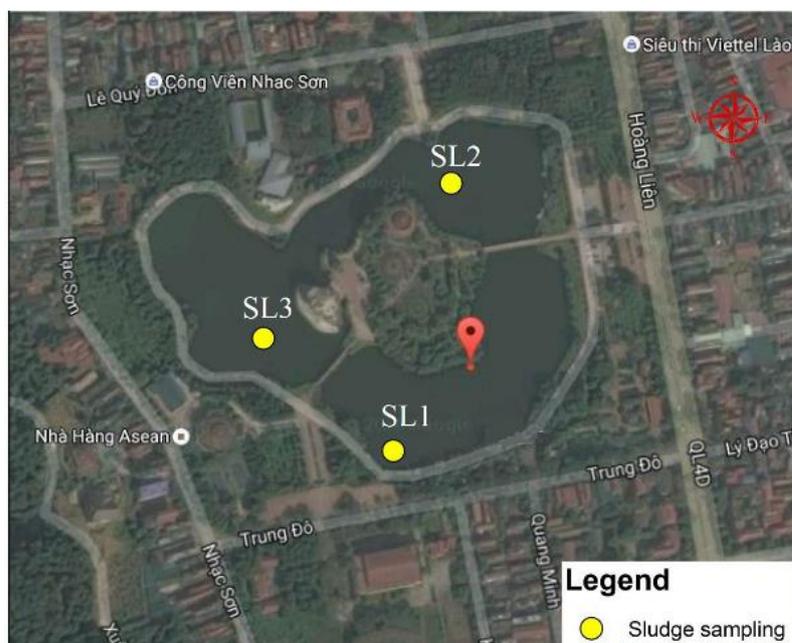


Figure 2.8. Map of sludge sampling locations

Table 2.12. Location of sludge samples

Sample	Coordination	Locations
SL1.1	22°29'5,766" N; 103°58'5,765" E	At the South of the lake, 5 cm depth from surface
SL1.2	22°29'5,766" N; 103°58'5,765" E	At the South of the lake, 60 cm depth from surface
SL1.3	22°29'5,766" N; 103°58'5,765" E	At the South of the lake, 125 cm depth from surface
SL2.1	22°29'11,584" E; 103°58'5,070" E	At the North of the lake, 5 cm depth from surface
SL2.2	22°29'11,584" N; 103°58'5,070" E	At the North of the lake, 60 cm depth from surface
SL2.3	22°29'11,584" N; 103°58'5,070" E	At the North of the lake, 22 cm depth from surface
SL3.1	22°29'7,534" N; 103°57'59,159" E	At the West of the lake, 5cm depth from surface
SL3.2	22°29'7,534" N; 103°57'59,159E" E	At the West of the lake, 60 cm depth from surface
SL3.2	22°29'7,534" N; 103°57'59,159" E	At the West of the lake, 112 cm depth from surface

Table 2.13. Result on analysed sludge samples at the central lake in Nhạc Sơn part

Samples	Parameters (mg/kg)				
	As	Cd	Pb	Zn	Cu
SL 1.1	3.21	0.23	18.67	214.61	38.23
SL 1.2	3.82	0.31	19.64	223.63	21.92
SL 1.3	4.08	0.35	28.45	267.14	16,02
SL 2.1	3.89	0.18	19.43	205.92	19.73
SL 2.2	4.23	0.31	25.93	267.21	38.47
SL 2.3	3.89	0.27	27.34	279.63	32.93
SL 3.1	6.75	0.19	32.01	233.16	52.17
SL 3.2	4.09	0.27	33.45	239.47	25.91
SL 3.3	5.37	0,25	39.56	292.54	53.72
QCVN 43:2012/ BTNMT	17	3.5	91.3	315	197

QCVN43:2012/BTNMT: National Technical Regulation for sludge for the purpose of aquatic life protection

2.2.5. Soil quality

Results of soil quality analyses in the subproject area are shown in Table 2.14. The results are compared to the soil standard using for residential purposes (QCVN03:2015/MONRE).

Among those, only the soil sample Van Hoa commune (S3) met the standard on all analysed indicators. The soil samples at other locations (S1, S2, S4) have the higher concentration of Cu than the allowable limits from 1.2 to 1.8 times. In addition, the Pb concentration of soil sample near the location of proposed bridge at Ngoi Dum stream (S2) is about 2.5 times higher than the allowable limit.

Table 2.54. Result analysis soil quality in the subproject area

(surveyed in August 2016)

Sample	S1	S2	S3	S4	Testing methods	QCVN 03:2015/ BTNMT, Residential soil
	X:22°26'47" Y: 104°09'58"	X:22°22'15" Y: 103°49'13"	X:22°24'43" Y: 103°48'49"	X:22°28'38" Y: 103°44'58"		
Cu (mg/kg)	141.03	181.65	53.27	124.62	TCVN 6496:1999 / EPA 1311	100
Pb (mg/kg)	57.65	175.28	31.65	44.66		70
Zn (mg/kg)	85.65	217.50	43.56	68.6	TCVN 6496:1999 / TCVN 6193:1996	200
Cd (mg/kg)	0.835	1.475	0.454	0.750	TCVN 6496:1999 / EPA 1311	2
As (mg/kg)	1.35	2.685	0.885	1.683	TCVN 6496:1999 / TCVN6626:2000	15

Note:

- S1- Soil in in Cau Go street, Pom Hán ward;
- S2- Soil in, 20-30 m distant from location of proposed bridge at Ngoi Dum stream
- S3- Soil at near culture house in Giang Đông village, Van Hoa commune;
- S4- Soil at along An Dương Vương street, Coc Leu ward, behind Hong Ha culture house;

2.3. Socio-economic condition

2.3.1. Economic Development Situation

For economic growth, in the period of 2004 - 2013, Lao Cai GDP increased in average of 12.5%/year; the city' GDP reached 10.67% in 2013, the total value added of this year reached 42,500 billion Viet Nam Dong (VND), about 2.5 times higher compared to 2004. The value of industry in 2013 reached nearly 37,000 billion, up 3.5 times compared to 2004; total retail sales of merchandise and service revenues this year is to reach 42,000 billion. Highlight of Lao Cai is revenues in 2013 which reached nearly 7,000 billion VND, exceeded the plan 21.5%. (Source: Report of the first nine months, 2014, Lao Cai DPI).

Regarding GDP per capita: Along with the rapid growth of the economy, GDP per capita in the province is also increasing rapidly. The average growth rate is 16% per year and expected by 2020 to reach VND 18.5 million/person, equivalent to US\$ 850-1,100, higher than the national average rate (reached \$ 1,220/person by 2010). AGDP growth ranked into the sixth position in the Northern key economic zone, followed by Ha Noi, Hai Phong (1.800-1.900 US\$/person) and Quang Ninh (1,757 US\$/person).

Industry and Construction: Industrial production in the Lao Cai city undergoes a steady development, enterprises have been actively expanding markets; some new enterprises are contributing to the increase in production value of the whole industry. The index of industrial

production (IIP) in the province increased by 10.60% over 200/2015. In the first eight months of 2015, the industrial production index increased by 4.56%. In particular, the mining sector increased by 22.45%; processing and manufacturing sectors increased by 4.54%; production and distribution sectors of electricity, gas, hot water, steam and air conditioners increased by 14.51%; water supply sector, waste management and treatment sector decreased by 2.29% compared to the first eight months of 2014. Agriculture, Forestry and Aquaculture. The structure of this sector also changed and a reduction from 14.9% in 2010 to 9.4% in 2015 is registered.

2.3.2. Social Situation

In 2014 the city had 154,200 people, of which 78.1% live in urban areas and 21.9 % of the population live in rural areas.

Table 2.15. Information about the administrative units of the city of Lao Cai

N ^o	Wards	Population density (people/km ²)	Population (people)	Ethnic minorities
1	Ward Bac Lenh	1,156	7,784	
2	Ward Bac Cuong	1,105	9,656	Mông xanh, Hoa, Tu Dí, Mường
3	Ward Binh Minh	1,956	8,894	Mông xanh, Pa dí, Mường
4	Ward Coc Leu	2,835	11,625	Mông xanh, Phù lá, Pa dí, Hoa, Mường
5	Ward Duyen Hai	2,574	9,876	Xa phó, Hoa, Pa dí, Mường
6	Ward Kim Tan	4,065	14,894	Xa phó, Hà nhì, Pa dí, Hoa, Mường
7	Ward Nam Cuong	935	9,975	Pa dí, Thái, Mường
8	Ward Lao Cai	813	8,726	Hoa, Mường, Mông xanh
9	Ward Pho Moi	2,637	10,872	Pa dí, Hoa, Thái, Mường
10	Ward Pom Han	2,815	13,804	Mông, Hoa
11	Commune Van Hoa	721	4,825	Thái, Hoa, Mường, Mông xanh, Phù lá, Pa dí.
	Lao Cai City	565	110,931	

Source: The socio-economic report of wards, communes

The Lao Cai province has more than 16 ethnic groups, the survey show that Kinh account for 94.07 %, Thai is 3.1 %, and Tay people is 2.1%; and other ethnic minorities are accounted for the low rate.

Table 2.16. Ethnic groups in the city Lao Cai

N ^o	Nationality	Quantity (người)	Rate (%)
1	Kinh	104,353	94.07
2	Dao	122	0.11
3	H'Mong	255	0.23
4	Dáy	2,884	2.60
5	Tày	2,318	2.09
6	Thái	288	0.06
7	Mường	322	0.06
8	Other	388	0.45
	Total	110,931	100

Source: The socio-economic report of wards, communes

According to survey data of General Department of Statistic on living standards, the growth rate of per capita income in Lao Cai City is high compared with the rest of the province. In the period 2010-2014, per capita income grew averagely by 11.8 % per year compared while that of the country is 6.05 %. Poverty rate in the province has decreased from 11.3 % (according to the new national standards) in 2005 to 6 % in 2010.

Table 2.17. Labour force in Lao Cai City

Achievement	2012		2014	
	(Person)	(%)	(Person)	(%)
The total number of people in working age	58.810	100	78.080	100
- Working	53.400	80.7	76.760	80.5
- Study	5.570	10.3	6.084	10.5
- Household	2.480	4.6	2.512	4.3
- In the working age but do not work	1.010	1.9	1.368	2.4
- In the working age but are unemployed	1.350	2.5	1.356	2.3

In the subproject area, the number of agriculture households accounted for the highest proportion (40.3%); followed by those in the trade / services / processing of agricultural products (28.9%), public servants, accounting for 19.7% and those in other industries accounted for a small percentage. Incomes of households have delimited different areas, as follows:

In the Binh Minh Ward, Bac Cuong, Nam Cuong, Bac Lenh, households is largely government officials. Meanwhile, in the remaining wards this ratio is low.

Trading in services concentrated in Kim Tan Ward, Lao Cai, Pho Moi, Duyen Hai accounting for 45-52% households.

Seasonal labour concentrated in Lao Cai and Coc Leu ward. Lao Cai ward, Coc Leu, Duyen Hai due to specific and near the gate border with China so the number of seasonal workers is often more in the other wards. In other Van Hoa commune is still more difficult, people here mostly live on farming combined with more seasonal work in other areas to increase their income.

Occupation of the head of household in the subproject area also reflects the professional painting of the entire region. According to survey data, economic and social, occupational structure in the wards of the city as follows:

Table 2.18 Career Structure

	Government staffs	Business	Agriculture	households	Retirement	Hiring workers/ free lancers	Seasonal workers	Unemployed	Others
P. Bac Lenh	1.7	0.2	0	0.1	1.8	0	1.9	0	0.1
P. Coc Leu	3.6	0.3	0.1	0	2.5	2.5	0	0	0
P. Kim Tan	4.9	0.7	0.2	0	2.4	10	0	0	0
P. Lao Cai	0.9	0.3	0	0.1	1	0.2	5.1	0.1	0
P. Pho Moi	2.5	0.2	0	0	1.1	6.2	0.3	0	0.1
P. Bac Cuong	0.8	0.2	0.6	0.3	0.3	0	5.6	0	0.1
P. Nam Cuong	2.3	0	0.9	0	1.3	0	5.4	0	0
P. Binh Minh	0.7	0.1	3.6	0	0.4	0	6.4	0	0
P. Pom Han	0.2	0	3.8	0	0.1	1.2	0.1	0	0
P. Duyen Hai	6.6	0.1	0	0	2.2	2.6	0	0	0
Van Hoa	0.5	0.1	1.9	0	0.7	0	0.8	0	0
	24.6	2	11	0.4	13.6	22.6	25.6	0.1	0.2

Source: The socio-economic report of wards, communes

Survey results show that in the region of Binh Minh Ward, Van Hoa commune, the proportion of households is highest in agriculture accounted for 2.9% to 4.8%. The proportion of bussiness, public employees and officials focused more on Duyen Hai ward, Coc Leu, Kim Tan, Pho Moi, from 3.6 to 6.6% of Lao Cai, the trade ratio, employment and labor freedom is most concentrated in Lao Cai ward, Coc Leu, Kim Tan, Pho Moi; heads have no stable jobs concentrated in the Bac Cuong Ward, Nam Cuong and Binh Minh. Survey results also indicate that up to 20.7% of households with production and business, most concentrated in the Binh Minh Ward (24.8% of those investigated)

and Bac Cuong (accounting for 39% of those polled). Mostly of them are small traders in the household.

Medical and health

In the affected area of the subproject, the illness of the common household are common conditions, with the percentage of diseases such as influenza (90.2%), other diseases: malaria, hepatitis, diabetes... up about 9.8%.

In general, people's health conditions are guaranteed, no in the appearance of pandemic disease. Over the years, the city also took the initiative in the fight against the epidemic could break out as the H1N1 flu, blue ear disease... should have limited the impact of this epidemic to the health of people.

Education

In the city, all the wards (17/17) are have primary school and secondary school. So far, the city has 17 schools meeting national standards. In which 3 preschool level, primary school 9, 5 junior high school level.

Tourism

Lao Cai City is the intersection point of the domestic and international tours in the Northwest region of Vietnam. Lao Cai City has a favorable waterway and road system, therefore three tourist routes can be developed including Hanoi - Lao Cai - Sa Pa; Hanoi - Lao Cai - Bac Ha and Hanoi - Lao Cai - Kunming (China).

Gender

The survey results showed that 56.5% of respondents stated that women is responsible to manage money in the HH and 79.7% of respondents stated that women are responsible for daily household tasks.

Some family issues are decided by both male and female. 70.2% of households stated that both wife and husband jointly decide on buying vehicles or houses. 72.4% of spouse decide on borrowing bank's loan or investment, business. 73% of spouses decide on studying and occupation of their children.

Most of the Land Use Right Certificate (LURC) (58.2% of households) are under the name of both wife and husband. 22.1% under husband name only and 19.7% under wife name only. The survey results also that 60.2% of respondents stated that both wife and husband own family assets. However, the proportion of male owning assets is 24.1%, which is higher than the proportion of female, 15.7%.

The participation in community activities and local organizations show that there is gender difference. Male often participates in both activities more than female. 54% of respondents stated that males play main role in community activities while the proportion of females is 21.6%. Similarly, the proportion of males participating in local organizations is 54.7% and the proportion of females is 23.4%.

The survey results by questionnaire with households and community also showed that there is no significant gap between male and female in education, income and health.

2.4. Infrastructure conditions

2.4.1. Transport system

The urban transport infrastructure consists of 134 routes, with a length of 250 km; including concrete roads and asphalted roads of 56 km; aggregate roads of 7 km. Currently 12 km of roads has deteriorated due to the roadbed subsidence and bad drainage.

The inner city road density is about 2.9 km/km², in which the main road density is 1.8 km/km² (10 roads of 15 km long) at the traffic land density on urban land is 9.8 %.

Currently 70% of the length of urban roads is covered with trees, drainage and lighting system; over 50% of the pavement has been built completely (approximately 219,000 m²) and urban road density reaches 12.1 km/km².

Rural roads have a total length of 155 km, of which communal and inter-communal roads account for 55 km, 2 km asphalted; inter-village roads of 100 km long, with 40 km are gravel covered.

There are 7 bridges in the City crossing over Nam Thi River, Red River and Ngoi Dum Stream.



Figure 2.9. Cau Kieu 2 from China to Viet Nam over Nam Thi River

Coc Leu Bridge on Highway 4D across the Red River at km 140 + 560, including two bridge abutments, 3 piers, 400 m long, 16 m wide with four lanes for motor vehicles and walkway for pedestrians.

Giang Dong Bridge over the Red River linking Lao Cai Urban Area - Cam Duong with Van Hoa planned zone.

Pho Moi Bridge is a modern bridge crossing over Red River to connect Cam Duong and Lao Cai City.

Kim Tan Bridge and Bac Cuong Bridge go across Ngoi Dum Stream to connect wards of Kim Tam and Bac Cuong.



Figure 2.10. Coc Leu, Giang Dong and Pho Moi Bridges

2.4.2. Water supply system

Water supply system for the city of Lao Cai include three water supply plants with the total capacity of about 22,500 m³/day. The water treatment plant consists of:

- Lao Cai water plant: provide water for old Lao Cai town from Nam Thi River. Design capacity is 12,000 m³/day, production of 2.5 million m³/year, 60% of design capacity. In 2004, by city credit sources, the plant has increased the capacity to 14,000 m³/day. The total length of main supply pipeline is 38 km type F100- F250. Loss coefficient of 23% (the national average is 30%)

- Water Plant Coc San: built in 2006 by province credit sources, capacity of 600 m³/day, take water from rivers Duong.
- Cam Duong Water Treatment Plant provides water for the town of old Cam Duong area, get water from wells, reaching 87.4% of design capacity. The total length of the pipeline supply is 8 km type F100- F250, poor quality pipes so the higher loss ratio (30-35% loss).
- Rural areas: people use wells to households, household groups, the gravity water line, treatment ponds, rainwater stored in tank. For 10 years the city has started from 12 gravity water project, 80 wells and 300 water jars for rural population.

Table 2.19. The use of water in the subproject area

Wards	Percentage of population using tap water (%)	Percentage of population using wells (%)
Ward Bac Lenh	97.8	2.2
Ward Coc Leu	97.5	2.5
Ward Kim Tan	96.2	0.0
Ward Lao Cai	92.4	3.4
Ward Pho Moi	94.0	3.3
Ward Bac Cuong	87.6	4.2
Ward Nam Cuong	94.7	3.4
Ward Binh Minh	95.4	4.1
Ward Duyen Hai	91.2	1.2
Ward Pom Han	94.4	3.3
Commune Van Hoa	8.5	90.4

Source: The socio-economic report of wards, communes

2.4.3. Collection and treatment of solid waste

Garbage collection, solid waste in production and living activities in city areas are under responsibility of urban environmental company in forms of public enterprises. Due to budget funding activities, cleaning fee revenues accounted for a small proportion of total environmental costs and should be approximately guaranteed for 65% amount of solid waste is processed.

The amount of waste collected 30-33 tons / day by the manual method, then be transported to the landfill Tong Mon, Dong Tuyen commune -Bat Xat district, about 6 km from the city. Wastes were not classified but mixedly buried. Garbage is levelled, compacted within a day (morning and afternoon) with bulldozer and excavator. Debris was leveled and compacted into tight litter thickness 0.8 to 1.0 m, EM is sprayed directly into the landfill, which had been leveled before, and covered intermediately by coating of soil, then use lime and chemicals that can kill flies and mosquitoes around the landfill (within the impact range).

Tong Mon Landfill, Dong Tuyen commune

At the present, Tong Mon landfill in Dong Tuyen commune is the only area collecting and treating all solid wastes for the whole Lao Cai city and Bat Xat district with the capacity of 70 tons/day. The landfill locates in a valley surrounded by forested mountains. It was constructed and put into operation since 1999 under Lao Cao Urban Environment Limited Company (URENCO) management. With the planned area of 46 ha, Tong Mon landfill has capacity to handle of waste materials for 25 years (until 2024). The solid waste in the serviced areas is collected 2 times per day and compacted within the day with the depth of 0.8-1.0 m for every layer. After being sprayed with enzyme products (about 10-12l of EM/m³ of waste), the waste is covered with a soil layer of usually 7-10cm thick.

Trees are planted in order to create environmental landscape around the landfill. There is a leachate collecting system for Tong Mon landfill that includes three sand-filtration compartments: sediment

containing compartment with the volume of 104 m³, horizontal filtration compartment 10.4 m³ and lime treatment compartment of 45 m³.

Lao Cai URENCO has constructed a biological pond for leachate treatment. After treated in the pond, water is discharged to a drain to flow through the valley then to rice field in Dong Tuyen area.

In 2015, a solid waste treatment plant was put into operation. This plant was constructed in Tong Mon landfill area to treat municipal solid waste for Lao Cai city and some adjacent districts. This plant is constructed under the subproject “Construction of Lao Cai city solid waste treatment plant” supported by Agency of France Development (AFD) with total investment cost of 52.9 billion VND. The plant was constructed in an area of 8 ha in Tong Mon landfill area; with a treatment capacity of 100 tonnes/day; waste treatment efficiency is about 90% using biocomposting technology. About 10% of remained waste will be disposed in the landfill. Wastewater from the plant will be collected and treated in accordance with national standards before discharged to the environment.

2.4.4. Power system

Grid system in the city is relatively complete and basically meet the needs of industrial, commercial, and residential customers in the province with 1,552 km of transmission lines and 347 substations of all kinds.

- Power supply: Since 2003, the consent of the Government, Lao Cai have to balance the power in the country and the implementation of plans to buy commercial electricity from China on the basis of economic efficiency and consistent with the guidelines bilateral economic relations between the two countries.
- Grid: system configuration and power supply lines in the city area for production and daily life from the 110 KV national power grid with a total of 140 substations of all kinds; 135 km of 35 kV lines and 35km of 10 kV line; nearly 100 km of 0.4 kV line and 20km of 6 kV line. The rate of power consumption during the current transfer is 6-7%.

2.4.5. Sewer and Wastewater Treatment System

The city has 121 km sewers with diameter ranging from D400 - D2.000 and 700 manholes to ensure drainage of stormwater and wastewater for the city. Demand for concrete of drainage system in the near future is about 100 km. Sewer density was about 4.05 km sewer/km², including more than 100 road crossing sewers diameter D1000-D1500mm to drainage stormwater and some underground sewers diameter D1000-D2000mm on the road Hoang Sao, Hoang Lien, Hung Hoa, Tran Hung Dao, etc..., along with the number of covered canals size B x H = 500x600mm, 600x800mm, 750 x 750mm and 1000 x 1150mm using for combined wastewater and stormwater drainage, concentrated mainly in the area of the old town of Lao Cai and 700 manholes to collect stormwater and wastewater for the city. Wastewater and stormwater is discharged naturally by the terrain slope to Red River at 5 outlets in left bank and 9 outlets in right bank with diameter from D1000 - D2000 mm.

2.4.6. Physical Cultural Resources and Sensitive Receptors

a. Cultural Physical Resources in Lao Cai Province

According to the results of the survey, Lao Cai City has 10 important cultural sites, of which 3 sites are classified as national level sites:

- Thuong Temple: an ancient architectural work built in the 19th century, associates with beautiful natural scenery. The temple is the famous religious and cultural work in Lao Cai City, holy Tran Hung Dao and his generals. This Temple is about 5 m distant from Phan Boi Chau road, which will be rehabilitated in the Lao Cai subproject (component 2.2)

- Cam Temple: an ancient cultural monument of Vietnamese located behind the Lao Cai international station. Cam Temple has beautiful scenery and lays against mountains. In front of the temple, there are old trees adjacent to the lake (more than 1000 m distant from the subproject's construction site).
- Cam Duong revolutionary base: located in the valley of the Da I village, Cam Duong commune. This is a historical relic of the 9-year revolution against the French colonialists. (more than 2000 m distant from the subproject's construction sites)

In recent years, the 3 ranked PCRs of the city (Thuong Temple, Cam Temple, Cam Duong revolutionary base) and some other relics of the province have been invested tens of billion VND to repair and renovate. This has actually brought a huge economic efficiency of tourism, served the spiritual life of the people, contributed to the promotion and preservation of cultural heritage.

In the city of Lao Cai, many cultural artifacts has also discovered, such as:

- Lao Cai: artifacts including an ancient bronze drum of the type IV Hego being stored at the Museum of the Department of Culture - Information Hanoi (more than 1000 m distant from the subproject's construction sites)
- Vi Kim : discovered in 1984, artifacts including 18 tools and 7 pieces of stripping tool, divided into these groups: axes with vertical blades: 9 axes, axes with horizontal blades: 5 axes, tools with spearheads: 2 tools, grinding bases: two pieces, with traces of flaking, these tools belong to Son Vi cultural archeology site (more than 500 distant from subproject's construction sites)
- Pac Ta : located in Phu Thinh village, Nam Cuong commune, Lao Cao City. An ancient bronze drum was found in 1963 and stored in the Department of Culture and Information of Lao Cai province (more than 1000 m distant from subproject's construction sites).
- Nam Cuong : discovered in 1983, in Nam Cuong commune. Artifacts includes a long copper awl with semicircular blade and a copper spear. These artifacts belong to the archaeological culture of Dong Son. (more than 450 m distant from subproject's construction sites)

b. PCR and sensitives points in the project area

During the project implementation, there are about 05 graves needed to be relocated in Van Hoa Commune. According to the site survey, it is anticipated that some PCRs and sensitive points could be temporarily affected during the construction period.. The list of of sensitive PCRs and receptors are in the project area is described below.

Table 2.20. Description of PCRs and sensitive receptors in subproject area

No.	Receptor	Work location	Distance to the project site (m)	Description
Component 1				
1	<p>Van Hoa Temple</p> 	N10 Road	150	It was built in 1940. Located in Canh Chin village, Van Hoa commune, 5 km from city center. Sparsely populated area.
2	<p>Canh Chin Village Graveyard</p> 	N9 Road	5	Located in Canh Chin village, Van Hoa commune. There is few graves there, most of the graves have been relocated to Lao Cai City Graveyard.
Component 2				
3	<p>Thuong Temple</p> 	Resurfacing Phan Boi Chau Street, Lao Cai Ward	5	It is located at Cluster 7, Phan Boi Chau Street, Lao Cai Ward. The temple was built in the 18th century, as famous cultural work in Lao Cai city worshipping Tran Hung Dao and his generals.
4	<p>Tan Bao Pagoda</p> 	Resurfacing Phan Boi Chau Street, Lao Cai Ward	5	Located adjacent to Thuong temple, Tan Bao Pagoda also located on the roadside. The temple covers an area of 1500 m ² .
5	<p>Mau Temple</p> 	Resurfacing Nguyen Hue Street, Lao Cai Ward	15	Mau Temple is located at Cluster 4, Lao Cai Ward. Worshipping Lieu Hanh princess. densely populated area. 30 m from Lao Cai International Border gate and 15m from Nguyen Hue Street
6	<p>Coc Leu Church</p>	Resurfacing Soi Tien	50	Coc Leu Church located on Son Tung Street, Coc Leu Ward. The

No.	Receptor	Work location	Distance to the project site (m)	Description
		Street, Coc Leu Ward		Church is surrounded by trading households.
7	Residential area at the main entrance of the Central Lake 	Dredging Central Lake	60	Located in Nhac Son Street, Kim Tan Ward with many trading households
8	Viet Plaza Restaurant 	Dredging Central Lake	0	Located on the isle of Central Lake
9	ASEAN Restaurant 	Dredging Central Lake	50	At the corner of the park and bound by Nhac Son Street and Trung Do Street
10	Royal Restaurant 	Dredging Central Lake	30	Located lakeside in Nhac Son Park, bound by Hoang Lien Street and Le Quy Don Street
11	Children's Cultural Palace	Dredging Central Lake	30	Located lakeside in Nhac Son Park

No.	Receptor	Work location	Distance to the project site (m)	Description
				
12	Kim Tân High School 	Dredging Central Lake	150	Located on Hoang Lien Street in Kim Tan Ward.
13	Civil servant School 	Dredging Central Lake	100	Located on Le Quy Don Street in Kim Tan Ward.
14	Cultural Center 	Dredging Central Lake	50	Located on Hoang Lien Street in Kim Tan Ward.
Component 3				
15	Lao Cai Children's Hospital 	Constructing Ngoi Dum Bridge	100	Located on Ham Nghi Street in Kim Tan Ward.
16	Lao Cai Endocrine Hospital 	Constructing Ngoi Dum Bridge	250	Located on Ham Nghi Street in Kim Tan Ward, next to Lao Cai Children's Hospital

CHAPTER 3. ANALYSIS OF ALTERNATIVES

The development of Lao Cai MCDP-AF subsubproject is fully consistent with several important strategies including *Urban Construction Masterplan for Lao Cai up to 2030 with vision to 2050* and *Urban drainage planning of Lao Cai up to 2030 with vision to 2050*; *Detailed masterplan 1/500 scale for Van Hoa Urban Area in Lao Cai City and Detailed Masterplan 1/500 scale for Ngoi Dum Stream*.

During the impact assessment of the subproject, the analysis of alternatives is an important stage in the assessment. The main objective of the analysis of alternatives is to identify location/design/technology applicable for a particular subproject component in order to minimize adverse impacts and maximize positive impacts. The analysis of alternatives is conducted for each component of the subproject, specially the component 2 in dredging, upgrading Central lake of Lao Cai city for sanitation improvement and component 3 in researching to select locations, measures and technology for the new bridge. The results of analyses are presented below.

3.1. “Without Subproject” Alternatives

In the case of not doing this subproject, it is obvious that drawbacks still arise in the current condition:

- Firstly, in the former urban area, there are regular floods and water logging in Kim Tan, Coc Leu, wards etc as most of drainage system in the former Lao Cai urban area is operated ineffectively because of degradation. Concretely, many broken channels with collapsed covers, cracked pavements along traffic routes affecting drainage, inappropriately constructed rainwater and exploratory manholes; mud, sand, garbage deposits cause blockage-interrupting flows. The current drainage capacity is in dire situation completely failing to meet requirements. Wastewater is mostly treated in septic tanks of households and then discharged to common sewers, flowing through discharge outlets to streams and rivers. Septic tanks were built inappropriately resulting in poor quality post-treatment wastewater and thus, water pollution. Consequently, regional pollution in terms of smell, urban aesthetic deterioration, sources of infectious diseases exerts great impacts on the quality of life in the community. In view of growing population and life necessities, amounts of wastewater and levels of pollution will be increased.

- Secondly, in Nam Cuong, Binh Minh, Bac Lenh, Pom Han, etc wards, existing infrastructures are of poor quality. There are no power generation system, drainage and water supply systems. Most of residents here use water obtained from well or drilled wells; this amount of water is filtered carelessly for daily activities. Domestic wastewater is released directly to the natural environment thus, deteriorating hygiene and sanitation conditions in the surrounding residential areas.

Inconvenient traffic system is one of the big interference with respect to economic development and life quality enhancement. In this area, Tran Hung Dao Road serving as the main traffic axis extending from Bac Cuong Bridge to Binh Minh Intersection. Most of future administrative authorities therefore will be located along this road; resulting in more traffic problems. This in turn, affects economic exchanges and new urban development orientation. This phenomenon will result in burdens placed on the former urban area in terms of population concentration, socio-economic and cultural development. With the current growth rate of the city, southward city expansion is essential for the sustainable development because it will help alleviate overloads on the former urban city.

When the Lao Cai MCDP-AF subproject is implemented, it will help to improve the efficiency of the original subproject through investments on supplementary items. It is expected to increase the number of direct and indirect beneficiaries of 45,000 and 95,000 people respectively. Through the project interventions, the environmental and social benefits from the original subproject will be augmented when the people in the subsubproject area have better access to clean water, better

wastewater collection treatment, better transport infrastructure and improved landscape and environment. Table 3.1 describes in more details the comparison between the “with” and “without” subsubproject options.

Table 3.1. Analysis “with” or “without” the subproject

Investment items	With the subproject	Without the subproject
Basic infrastructure	<ul style="list-style-type: none"> - The environment and infrastructure in Van Hoa Area are improved with enhanced sewage system, urban lighting, wastewater collection and treatment and resurfaced roads 	<ul style="list-style-type: none"> - The urban infrastructure in Van Hoa Area will be left behind with basic services are inadequately provided
Environmental sanitation and landscape	<ul style="list-style-type: none"> - improved environmental sanitation and urban landscape in the project area is improved - increased wastewater collection and urban drainage capacity - Persistent flooding in some areas will be eliminated with newly constructed drainage canals - Reduction of safety risks and asset loss caused by inundation; - Reduction of public health risks associated with water-born diseases and related healthcare cost; 	<ul style="list-style-type: none"> - Existing poor conditions on environment sanitation, local flooding, accessibility to nearby area, degraded drainage system, - Poor water and sanitation facilities affecting children’s learning, polluting the environment, and hindering their health and development.
Traffic works	<ul style="list-style-type: none"> - Investment in these work items will facilitate local people’s travel, and speed up the development of residential areas. - Urban traffic connection is improved with newly constructed and upgraded urban bridge/road and traffic jams are reduced 	<ul style="list-style-type: none"> - The efficiency of the improved roads in the original subproject is not brought to full. - Pressure on road traffic persists and increases.
Resettlement	<ul style="list-style-type: none"> - There 117 affected households in housing and buildings, entirely 25 housed holds in housing and structures need to be relocated, resettled. 	<ul style="list-style-type: none"> - No land acquisition
Social disturbance	<ul style="list-style-type: none"> - There will be disturban to living and business activities of local residents during implementation period 	<ul style="list-style-type: none"> - No social disturban is caused
Project effectiveness	<ul style="list-style-type: none"> - Benefits of existing work of Lao Cai MCDP subproject is not maximized. 	<ul style="list-style-type: none"> - Maximise the benefit of the overall MCDP Lao Cai subproject

3.2. “With Subproject” Alternative

During the feasibility study, alternative analyses were made for the subsubproject’s major investments for all three Components.. The analysis has been conducted in regard of design options, location selection and technological aspects to verify correspondent social and environmental impacts of each alternatives. The results of these analyses and the best option to choose from are presented in from table 3.2 to table 3.6.

3.2.1 Component 1: Basic infrastructure upgrading and service improvement

Upgrading Van Hoa Commune with total area of 100 ha, 4500 person. The main work includesL

Main work include:

- Construct 09 main internal asphalt roads with the total length of 6.1 km, and width from 16.5 to 24.0 m.
- Construction of the separate drainage system along the main road.

The storm water drainage has the total length of 11.0 km including: 7.9 km box culvert with the dimension of BxH=500x600 - 600x800; and 3.1 km pipe with D= 750-1000.

The wastewater collecting pipe is 4.0 km long, D= 225 - 315, the pressure wastewater pipelines connecting 3.7 km, D=110; 02 pumping station capacity Q = 10-20 m³/h to convey the waste water to the Dong Pho Moi Waste Water Treatment Plant (WWTP)

- Construct a distribution and service water supply system with the total length of 3.7 km; D = 50-110
- Provision of power supply, lighting and trees planting for the constructed road

Table 3.2 Alternatives for the designed elevations of proposed roads in Van Hoa

	Option 1 (selected)	Option2
Description	Elevation of road follow the master plan. Roads are designed to suit to local masterplan regarding elevation, alignment and connectivity to the existing infrastructure.	Elevation of roads are designed to suit to current terrain and avoid large excavation work.
Technical	- ensuring the synchronisation and connectivity with other roads as regulated in the masterplan	- synchronisation and connectivity with other roads in the master plan is not ensured
Environment	The amount of earthwork would be higher, thus environmental impacts on dust, noise, air pollution during the construction period will be higher	- The elevation is adaptive to the terrain, and the earth work will be smaller causing lower environmental impacts on dust, noise,air
Land acquisition/social disturbance	Similar as the alignments are the same in two options	Similar as the alignments are the same in two options
Cost	Lower (3.7 mil.USD)	Higher (3.9mil. USD)
Conclusion	Compared to option 1, the option 2 will cause less environmental impacts during the construction period. However, it require higher investment cost. Most importantly, it is not consistent with the urban planning and thus the connectivity with other proposed roads in the future will not be ensured. In consideration of all aspects, the option 1 is selected.	

Table 3.3. Alternatives on provision of clean water for Van Hoa Commune

Description	Option 1 (selected)	Option2
	Construct a new clean water supply scheme with capacity of xx m3/d to provide water for Van Hoa commune	Using the city existing sytem. The water supply pipeline of the Van Hoa commnue will be connected with the city water supply pipe D250 on Road 1-5 via Giang Dong bridge
Technical	More difficult as the design shall include both distribution pipeline and water supply scheme, and water resources analysis at project area.	Less difficult as technical design only consider the distribution pipeline
Environmental	The environmental impacts during construction period is higher as it include more civil works.	The environmental impacts during construction period is lower as it includes less civil work
Land acquisition/social disturbance	Requireme more land acquisition for the construction of the water supply scheme	No land acquisition is required for construction of the water supply scheme
Cost	Construction cost is higher (250,000 USD) due to higher amount of civil work In addition, O&M cost for the small water supply schem has to be mobilized	Construction cost is lower (105,000 USD due to lesser amount of civil work Not necessary to mobilize O&M cost for the small water supply schem
Conclusion	Overall, option 1 is better than option 2 in all analysed aspects including technical, environment, social and cost. Therefore, it is selected.	

Table 3.4. Alternatives for waste water treatment and collection in Van Hoa Commune

	Option 1	Option 2	Option 3 (selected)
Description	Collected wastewater will be pumped to Ngoi Dum waste water treatment plant (WWTP), 6.2 km distant from the commune. The WWTP has a capacity of 5,700 m ³ /d; is being constructed under the original MCDP Project.	Construction of a new WWTP in Van Hoa Area under the regional plan that has been approved.	Collected wastewater will be pumped to Ngoi Dum waste water treatment plant (WWTP), 3.7 km distant from the commune. The WWTP waste water treatment plant which is currently under operation with a capacity of 500 m ³ /day.
Technical	Least feasible as it involves the construction of long pressurized pipe of 6.2 km across Red River to convey the wastewater to the WWTP The current capacity of the WWTP is unable to handle additional volume from Van Hoa Area.	Feasible as it is located inside the planned area and will be able to best handle the wastewater with modern technology.	Feasible as it requires shorter pressurized pipe of 3.7 km along River River bank to convey the wastewater to the WWTP The Dong Pho Moi WWTP is running under its capacity and able to receive wastewater from Van Hoa Area.
Environment	- Low environmental impacts on dust, noise, emission and waste during construction period as it require moderate civil work. - Impact during operation period is low	Highest construction related environmental impacts as the amount of civil work is highest (including also the WWTP) - Highest impacts during operation period, which includes odor and sludge management from the operation of the WWTP	Lowest construction related environmental impacts as the amount of civil work is lowest - Impact during operation period is low
Social impact	No land acquisition for the WWTP	Require land acquisition for the WWTP.	No land acquisition for the WWTP
Investment Cost	Moderate 700,000 USD	Highest 920,000 USD	Lowest 580,000 USD
Conclusion	In comparison of the three alternatives, option 1 is not feasible as on the technical aspect, thus it will not be considered. Among other remaining options 2&3, option 2 follows the current urban planning. However, it will cause more environmental impact, land acquisition and investment cost. In addition, it is noted that the management for a small wastewater plant inside a residential is difficult in terms of mobilizing adequate resources for the appropriate functions of the WWTP. In consider all aspects, the option 3 is selected.		

3.2.2 Component 2: Environmental sanitation improvement

Rehabilitation of the central lake of Lao Cai city.

The central lake of Lao Cai city is located inside Nhat Son Park with total area of about 5.4ha. The main works include:

- ✓ Dredging the lake bed with the total area of 5.4 ha to the depth of 5.2
- ✓ Repairing the damaged sections of the lake embankment
- ✓ Constructing drainage system for the lake

Table 3.5. Alternative analysis for Component 2 of Lao Cai Subsubproject

	Option 1	Option 2	Option 3
Description	Upgrade work: (i) Dredging the lake, without treatment of the inflow wastewater into the lake	- Upgrading activities: (i) dredging (ii) construction of interceptor to collect and waste water to the Ngoi Dum WWTP, being constructed under original MCDP; rain water will be discharge into the lake.	Upgrading work include: (i) dredging (ii) construction of interceptor connecting to combined system and then the waste water will be separated from rainwater, and conveyed to Ngoi Dum for treatment. (ii) Construction of one pumping station to pump water from Ngoi Dum stream to supplement water for the lake
Technical	Least difficult as no interceptor and pumping is needed	Moderately difficult as it require the design for the interceptor for wastewater collection	Most difficult as it require the design for the interceptor for wastewater collection and pumping station for supplementing of lake water.
Environment	Highest negative impact as the waste water will still discharge into the lake after renovation.	- Acceptable, however a small amount of wastewater will be diluted into rain water and discharged into the lake	This has highest positive environmental impact as no waste water is discharged into the lake
Social	No land acquisition, social impact to local resident is similar as the construction is carried out in the park, separated from residential area	No land acquisition, social impact to local resident is similar as the construction is carried out in the park, separated from residential area	No land acquisition, social impact to local resident is similar as the construction is carried out in the park, separated from residential area
Investment Cost	Lowest Est. 630,000 USD	Moderate Est. 1,400,000 USD	Highest Est. 2,550,000 USD
Conclusion	In comparison of the three alternatives, the social are similar. Regarding technical side, option 1 is least and option 2 is most difficult. On the environmental side, option 3 has the highest positive environmental impacts, however, it includes highest investment cost. The environmental aspect of the option 1 is not ensured while option 2 is acceptable on environmental aspect and it has lower investment cost compared to option 3. In consideration of all aspects, option 2 should be selected.		

3.2.3. Component 3: Urban Roads and Bridges

This component aims to built a new across Ngoi Dum Stream. The investment is expected to improve connection between residential neighborhoods of N19 and N20 between 2 sides of Ngoi Dum Stream and reduce traffic pressure on the nearby bridges of Kim Tan and Tran Hung Dao. Below are considerations for choosing the best option of the new bridge.

Table 3.6. Alternative analysis for location of Ngoi Dum Bridge

	Option 1 (selected)	Option 2
Description	The bridge is about 340 distant to Kim Tan bridge, and in line with the city urban master plan.	The bridge is next to Kim Tan bridge
Technical	Similar as technical design is the same	Similar as technical design is the same
Environment	Similar as the amount of civil work and baseline is the same	Similar as the amount of civil work is the same
Social	No land acquisition It can reduce high traffic load at the current Kim Tan bridge In addition, connectivity is higher than option 2 as it connect the local communities at the two side of the new bridges.	No land acquisition It can reduce high traffic load at the current Kim Tan bridge. But the connectivity lower than option 1 as the new bridge is next to the old bridge.
Investment cost	Similar	Similar
Conclusions	On the location of the Ngoi Dum bridge, the two alternatives are similar regarding the technical, cost and environmental aspects. However, the social impact of option 1 is better as it has the higher connectivity for local residents at the two side of the proposed bridge. Therefore, option 1 is selected.	

CHAPTER 4. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

4.1 Environmental Impact Assessment

When the subproject is completed, the overall impact will be positive. Construction of Ngoi Dum bridge will improve traffic connections in the city area as well as traffic connection in both sides of the Ngoi Dum stream and thus stimulate socio-economic development of the area.

In the old town area, benefits will arise from reduced flooding, improved street drainage, and rehabilitated road pavements. People in the subproject's area will benefit from improved sanitary conditions. The city's population generally, and road users specifically, will benefit from improved road access and connectivity at intra-city, intercity and regional level. Nevertheless, the subproject will cause some negative impacts (temporarily or permanently) on the local environment and local population and effective implementation of mitigation measures will be necessary.

4.1.1 Positive Impact

In recent years, the drainage system of the city has degraded causing flooding, inundation to many areas in the city like in Kim Tan, Coc Leu wards, affecting lives of people, causing environmental pollution, generating traffic problem, further damaging the infrastructure. Therefore, upgrading of the drainage system, specifically the canals and sewers, is necessary. It helps lessen inundation and improve the environment.

Presently, the city has no centralized wastewater treatment plant. Domestic wastewater is drained naturally to surrounding areas or transported by sewers to discharge directly into the natural watercourses (Red River, Ngoi Dum River, and Ngoi Duong River). Investment on collection and treatment of a part of domestic wastewater of the city will partially help resolve urgency of wastewater pollution in the area. In particular, this will also improve surface water quality of Ngoi Dum downstream, and reduce loading pressure that is causing surface water pollution in Red River.

Therefore, the implementation of the subproject will result in the following specific benefits:

- Gradually implementing the Lao Cai Socio-Economic Masterplan to 2020 with vision to 2030
- Improving infrastructure conditions via activities of upgrading internal roads, constructing water supply systems, sewage, power system; building bridge over Ngoi Dum Stream to connect N19 and N20 roads.
- Enhancing the rainwater drainage capacity, wastewater collection and treatment; improving environmental sanitation and utilities supply.
- Improving environment and landscape of Nhac Son Lake; via the activities of lake dredging, improving drainage system to reduce flood, construction of wastewater collection system and improving sanitation conditions.
- Improving regional landscape by construction of main internal road in Van Hoa commune and rehabilitation of Nhac Son Lake area

4.1.2. Potential negative impacts

4.1.2.1 Type and Scale of Subproject Impacts

Based on the analysis of baseline data, field visits, and discussion with the stakeholders, the potential negative impacts on the physical, biological, and socio-economic environment of the

subproject have been identified. Table 4.1 summarizes the potential impacts by the subproject subcomponents, and the level of impacts was assigned as follows: None (N) -no impact; Low (L) - Small works, minor impacts, localized, reversible, temporary; Medium (M) -Small works in urban/sensitive areas, medium scale works with moderate impacts of which most are reversible, reducible and manageable, localized, temporary; High (H) -Medium scale works in small urban /sensitive area, large scale works with significant impacts (socially and/or environmentally) of which many are irreversible and require compensation.

In general, all the subproject activities to be carried out under Component 1 (Basic Infrastructure Upgrading and Service Improvement), Component 2 (Water Supply and Environmental Sanitation), and Component 3 (Urban Roads and Bridges) will involve small and/or medium scale civil works of which most of the potential negative impacts are reversible, temporary, and localized, and could be mitigated through the application of good engineering and construction management practices and with close supervision and monitoring of contractor performance and consultation with local communities. However, type and nature of the impacts varied significantly with the nature and scale of the activities, locations, and its environmental and social setting, human behaviors, and time factors. In this context, Section 4.3 discussed the assessment of the overall subproject impacts as well as site-specific impacts of the subcomponents. Annexes 3 and 4 are attached as per GoV EIA requirements. These respectively outline environmental quality analytical results and baseline data and theoretical formulae and calculations.

Table 4.11 Level of Potential Negative Impacts of Lao Cai Subproject by Component/ Subcomponents

Phases	Physical environment			Biological environment		Social environment				Others	
	Air, noise, vibration	Land, soil, water	Solid waste, sludge	Forest, natural habitats	Fish, aquatic life	Land acquisition, resettlement	Indigenous Peoples	Physical Cultural Property	Liveli-hood, community disturbance	Flood/ traffic/ safety	Off-site impacts
Component 1: Basic Infrastructure Upgrading and Service Improvement in Van Hoa Community.											
<p>Construction and upgrading of infrastructure in Van Hoa: (i) Construct 09 main internal asphalt roads with the total length of 6.1 km, and width from 16.5 to 24.0 m; (ii) Construction of the separate drainage system along the main road: (1)The storm water drainage has the total length of 11.0 km including: 7.9 km box culvert with the dimension of BxH=500x600 - 600x800; and 3.1 km pipe with D= 750-1000; (2) The wastewater collecting pipe is 4.0 km long, D= 225 - 315, the pressure wastewater pipelines connecting 3.7 km, D=110; 02 pumping station capacity Q = 10-20 m³/h to convey the waste water to the Dong Pho Moi Waste Water Treatment Plant (WWTP); (iii)Construct a distribution and service water supply system with the total length of 3.7 km; D = 50-110;(iv) Provision of power supply, lighting and trees planting for the constructed road</p> <p>Land acquisition of 9.4 ha; there are 117 households affected, with 454 people; there are 33 households of the vulnerable group and 25 households will have to relocate</p>											
Pre-construction	N	N	N	L	N	M	M	L	M	N	N
Construction	M	L	M	L	L	N	N	M	M	M	M
Operation	L	L	N	N	N	N	N	N	N	L	N
Remarks	<p><i>Pre-construction:</i></p> <ul style="list-style-type: none"> - Impacts from small or medium scale constructions can be mitigated by ECOPs (see note (2) below this table) - Specific activities including land acquisition, UXO. - The need to ensure minimum clearance of tree cutting of nearby forest area; minimize impacts on local communities due to local flooding and road safety during construction; - Ground leveling could create drainage problems in the area if inadequate attention is given during detailed design; soil erosion, slope protection; large amount of debris and earthworks, soil erosion, water pollution to Red river aquacultural lakes; -Relocation of 5 graves, a physical and cultural resources impact <p><i>Construction:</i> Disposal of 146,500 m³ non-contaminated excavated soil, social disturbance during construction; discharge of waste water during operation period.</p> <p><i>Operation:</i> Specific activities including: local water discharge.; maintenance of water pipelines, and sewer system</p>										
Component 2: Environmental sanitation improvement:											
<p>Component 2.1 Rehabilitation of the central lake of Lao Cai city: The central lake of Lao Cai city is located inside Nhap Son Park with total area of about 5.4ha. The main work include: (i)Dredging the lake bed with the total area of 5.4 ha, existing depth of 3.7-5.2m to the depth of 5.2 m; (ii) Repairing the damaged sections of the lake embankment, with the estimated total length of 100 m; (iii) Constructing drainage system for the lake including: interceptor with the length of 539 m, D=560; 01 overflow chamber; box culvert of 149 m long and BxH=2.0x2.0 m; 01 pumping station with capacity 324 m³/h ; and wastewater pressure sewer pipe of 1.5 km long and D= 315 conveying wastewater to Ngoi Dum WWTP, which is being constructed under the MCDP original project</p> <p>No land acquisition required.</p>											

Phases	Physical environment			Biological environment		Social environment				Others	
	Air, noise, vibration	Land, soil, water	Solid waste, sludge	Forest, natural habitats	Fish, aquatic life	Land acquisition, resettlement	Indigenous Peoples	Physical Cultural Property	Liveli-hood, community disturbance	Flood/ traffic/ safety	Off-site impacts
Pre-construction	N	N	N	N	N	N	N	N	N	N	N
Construction	M	M	M	N	M	N	N	M	M	M	M
Operation	N	L	L	N	N	N	N	N	N	N	N
Remarks	<p><i>Pre-construction:</i> Small and medium scale works whose impacts can be mitigated with ECOPs (see Note (2) below) Site- specific impacts include: - UXO, soil erosion, water pollution in Ngoi Dum, waste, etc. <i>Construction:</i> - Construction, management and disposal of 67,000m³ sludge and 2,200m³ soil (not contaminated), impact to landscape of park; odor during dredging and transportation, impact on aquaculture activities. - impacts on local residents and traffic due to dense population and small local roads and inappropriate disposal of small amounts of contaminated sludge; <i>Operation:</i> Specific issues may include (a) to ensure effective O/M; Implementation of a city sanitation program for the subsubproject will strengthen active participation of local people.</p>										
<p>Component 2.2: Rehabilitation of drainage system and resurfacing the remaining streets roads: (i) Rehabilitate the old sections of the existing drainage and dredging the sludge inside the existing drainage of 71 km; (ii) Construction of 5.2 km drainage with D=600-1000 at flooding locations, associated with resurfacing the remaining streets roads with the total length of 48.0 km at 10 wards as Duyen Hai, Kim Tan, Bac Cuong, Nam Cuong, Coc Leu, Pho Moi, Binh Minh, Bac Lenh, Pom Han, Lao Cai Wards No land acquisition</p>											
Pre-construction	N	N	N	N	N	N	N	N	N	N	N
Construction	M	L	L	N	N	N	N	N	M	M	L
Operation	L	L	L	N	N	N	N	N	N	L	N
Remarks	<p><i>Pre-construction and construction:</i> - Impacts from small or medium scale constructions can be mitigated by ECOPs (see note (2) below this table). - Specific issues include (a) impacts on local residents and traffic due to dense population and small local roads. <i>Operation:</i> Site specific issues include the need to ensure effective O/M; Maintenance and management during operation of drainage system</p>										
<p>Component 3: Urban road and bridge: Construction of a bridge across Ngoi Dum stream. The bridge is 48 m, and the approaching roads at the two ends of 62 m. The main bridge is designed with expected working load HL93, pre-stress reinforced concrete structure, spans diagram L = 3x15(m), bridge size K=7+2x0,5m (no pavements for pedestrians).. No land acquisition</p>											
Pre-construction	N	N	N	N	N	N	N	N	N	N	L
Construction	M	M	M	N	M	N	N	N	L	M	L

Phases	Physical environment			Biological environment		Social environment				Others	
	Air, noise, vibration	Land, soil, water	Solid waste, sludge	Forest, natural habitats	Fish, aquatic life	Land acquisition, resettlement	Indigenous Peoples	Physical Cultural Property	Liveli-hood, community disturbance	Flood/ traffic/ safety	Off-site impacts
Operation	L	N	N	N	N	N	N	N	N	L	N
Remarks	<p><i>Pre-construction and construction:</i></p> <ul style="list-style-type: none"> - Impacts from small or medium scale constructions can be mitigated by ECOPs (see note (2) below this table). - Specific impacts include (a) the impact on the neighborhood and traffic due to high population density and the narrow roads in the locality. - Impact to water quality of Ngoi Dum stream <p><i>Operation:</i> Traffic safety; Specific impacts include the needs to ensure the O / M efficiency; Site specific issues include boat safety</p>										
<p>Notes:</p> <p>(1) Following criteria are used to assess degree of impacts: No (N) -no impact; Low (L) - small, site-specific, temporary impacts which are adjustable; Medium (M) -small works in towns/sensitive areas; medium work with moderate impacts which most of them can be reversible, minimized and managed, site-specific and temporary. High (H) - medium scale works in small towns/sensitive areas; large scale works with significant impacts (environmental and social) which many of them cannot be reversible and needs compensation; both M and H need supervision and implementation of mitigation measures as well as safeguards sanctions.</p> <p>(2) Small and medium scale works with site-specific and temporary impacts that can be mitigated by application of advanced construction methods and sound management. It also needs strict supervision and community consultation.</p> <p>Severely affected households: those households who loss over 20% of their land (or equal to 10% or more of productive land).</p> <p>Displaced people (DP): those who are affected by involuntary land acquisition that results to:</p> <ul style="list-style-type: none"> - Relocation or loss of shelter - Loss of assets or access to assets; - Loss of income sources or means of livelihood, regardless of displacement or not; and - Restricted legal access to parks or protected areas, causing adverse impact on their livelihoods. <p>Vulnerable group: Those are affected differently by the subproject's adverse impacts and/or having difficulty in access to the benefits of the subproject and compensation, including livelihood restoration and compensation for assets, when compared with the rest of APs. Vulnerable people include people, regardless of gender, ethnicity, age, physical or mental disability, disadvantaged economic or social status, may be more severely affected by relocation in terms of economic or material regards compared to others and who may be more limited than other in capacity to claim compensation or resettlement assistance and related development benefits.</p>											

4.1.2.2. Impact assessment for investments on Component 1

4.1.2.2.1. Impact during Preparation Stage

Land acquisition

Land acquisition, displacement and resettlement will affect the PAHs both physically and mentally, even causing social problems and prolonged litigation. Relocating to the new places, these households might be affected severely by the new living environment at the resettlement sites and they need time to integrate into a new life, particularly new relations and works. detailed impacts are assessed in the Section 4.2.

Unexploded Ordinance (UXO) Impact

Vietnam has experienced two wars against France and the United States, and Lao Cai was one of the fiercest battles. Besides, Lao Cai was also the battleground during the conflict with China in 1979. Therefore, the risk of landmines and bombs remaining underground from the war period is high. Lao Cai city has significantly been developed during the last 15 years, and most of the subproject areas have been cleared from UXOs. However, the risks of UXOs remain. Without conducting detection and dismantlement before proceeding with clearance, excavation and construction activities, the risk of landmine exploded causing serious damage to people and assets exist prominently. Therefore, UXO detection and clearance must be carried out before commencement of any construction work.

Clearance of vegetation:

Within the subproject area, apart from residential land and infrastructure, there is a farming area of 72,894.5m² including rice fields, vegetables, gardens and production forest land. The site clearance will, therefore, require cutting down trees which are mainly bamboo, casuarina, eucalyptus, fruits and subsidiary crops.

Social impacts due to clearance of vegetation in the subproject are detailed in the social impact assessment. Clearance of biomass will be required for the construction of the 9 roads in Van Hoa commune. The areas to be cleared are not natural habitats and have no biodiversity and very low ecological values, therefore, the impact is expected to be insignificant. About 5000 perennial trees such as fruits, bamboo, 450 timber trees and annual crops of rice, corn, potato in an area of 5.6ha will be cleared. Tree cutting will generate a certain amount of organic solid wastes of estimated 43 tons and most of this amount will be reused as organic fertilizer and fire fuel by local people. The remaining amount will be collected and treated by Lao Cai URENCO on a contractual basis. Therefore, the impact due to solid wastes is assessed as minor.

4.1.2.2.2. Component 1- Impact during Construction Stage

a. Generic Environmental Impacts

Construction of the roads and drainage system will be carried out in the same area and is connected to each other, so the impacts are assessed together using an “Alignment Sheet” approach. According to the technical design, about 6.633 km of the new roads will be constructed with the 4 lane standards for mountainous areas. The road surface will be asphalted. The main activities will involve site clearance; demolition of old works; removal of unsuitable soil (50,055 m³); excavation of the road base (0.55 million m³); rock excavation (0.3 million m³); embankment construction; and transportation of excavated materials. The construction boundary will be clearly marked. Key impacts are assessed as follows:

Noise

During construction, there will be a number of noise pollution sources due to operations of the many types of machines and vehicles. However, the noise level is different for different machines, and the workers on construction sites will be mostly affected because they will be working in the nearest proximity to the source of noise emission. The noise level is calculated as below:

$$L_p(X) = L_p(X_0) + 20 \log_{10}(X_0/X)$$

In which:

$L_p(X_0)$: noise level at distance 1m from the source (dBA)

$L_p(X)$: noise level at the calculated point

X : calculated point

$X_0 = 1m$

For each construction investment in the sub-basins B1, B2, and B3, accumulated noise level is calculated based on the separate noise levels of the machinery and equipment. The accumulated noise level is calculated following the formula below:

$$L_{\Sigma} = 10 \times \lg \sum_i^n 10^{0,1L_i}$$

In which:

- L_{Σ} : Accumulated level

- L_i : Source of noise i

- n : Number of sources of noise

The distance selected for assessment of noise level to the surrounding residential areas is from 20m to 50m. The results of noise level of each construction and transportation machinery and equipment as well as the accumulated noise level are calculated and presented in the table 4.2.

Table 4.2. Accumulated noise level generated by the machinery and equipment

No.	Transport vehicles and construction machinery	Noise level at distance of 1m from the source		Noise level at distance of 20m from the source	Noise level at distance of 50m from the source
		Interval	Average		
01	Bulldozer		93.0	67.0	59.0
02	Roller	72.0 - 74.0	73.0	47.0	39.0
03	Excavator	72.0 - 84.0	78.0	52.0	44.0
05	Grader	80.0 - 93.0	86.5	60.5	52.5
06	Road paver	87.0 - 88.5	87.7	61.7	53.7
07	Truck	82.0 - 94.0	88.0	62.0	54.0
08	Concrete mixer	75.0 - 88.0	81.5	55.5	47.5
09	Mobile crane	76.0 - 87.0	81.5	55.5	47.5
	Accumulated noise level		84.5	58.5	50.5
	National Technical Regulation 26/2010/BTNMT applying for normal areas: 6 AM to 9PM is 70 dBA; from 9PM to 6AM is 55 dBA;				
	According to the Ministry of Health (MOH standard): noise at the production area 85 dBA for 8 hours of noise exposure				

Comparing the noise limits of the machinery with the National Technical Regulation on Noise-QCVN 26:2010/BTNMT and MOH standard shows that in general, the noise levels at the distance of 20m from the noise source are lower than the allowable limits. Such noise levels are assessed as medium since most of the construction sites are more than 20m far from the residential areas,

and the households in Van Hoa commune are located quite scattered and only few of them are located near the construction site. A sensitive site considered to be impacted is Van Hoa pagoda during the construction of N10 road, which is located 150m from the construction site. Therefore, the noise impacts caused by transport vehicles and construction machinery are assessed as moderate for the workers directly involved in construction activities and moderate for some households living within 20m of the construction sites.

Impacts on Air Environment

Air pollution could happen during construction due to dust, emissions and noise of machines. However, this is interrupted activities and in short period of time given the small to moderate scope and scale of the subproject. The scheduled the subproject will be implemented in 24 months from July 2017 until June 2019; construction will be divided into several contracts and implement in different times. Summary of earthwork volume and construction time of the component 1 is presented in the table 4.3.

Table 4.3. Amount of earthwork volume and construction time of the Components 1

No	Work	Total dredged and excavated amount (m ³)	Total amount for backfilling (m ³)	Amount of organic soil that cannot be salvaged and has to be transported to the disposal sites (m ³)	Construction duration (month)
1	2	4=5+6	5	6	7
1	4 roads in original MCDP	172,000	267,000	95,000	24
2	5 roads in MCDP-AF	323,000	87,000	236,000	24
	Total	495,000	354,000	141,000	

- *Dust from excavation:*

Dust emission during dredging, filling, grounding depend on volume of excavation works. Dust emission is calculated based on pollution coefficient and volume of excavation and filling. According to the WB's guidelines (*Environmental Assessment Sourcebook, Volume II, Sectoral Guidelines, Environment, World Bank, Washington D.C 8/1991*) the pollution coefficient E is calculated as below:

$$E = k * 0,0016 * \frac{\left(\frac{\bar{u}}{2,2}\right)^{1,4}}{\left(\frac{M}{2}\right)^{1,3}} \quad (1)$$

In which: E - Pollution coefficient (kg/ton).

k - Molecular structure, average value 0,35.

\bar{u} - Medium wind speed at the site.

M - Average moisture of the material.

From the average k, \bar{u} , M we calculate the E= 0,00299 (kg/ton).

BOX model is applied to estimate the emission flux in the construction area. The model is presented in the following formula:

$$PC = B + \frac{qL}{uH}$$

Formula 5.2

In which:

- PC Pollutant concentration (mg/m³)
- B Baseline air concentration (mg/m³)
- q Quantity of dust/emission generated (mg/s.m²)
- u Measured wind speed meters per second (m/s)
- L Area of construction site (m²)
- H Plume height (m)

The calculated results of dust emissions in each sub-basin are presented in the table 4.4:

Table 4.4. Total dust emissions of the construction works

No	Construction works	Sub-Total (m ³)	Dust emissions	Dust concentration of baseline environment (mg/m ³)	Accumulated dust concentration (mg/m ³)	Technical Regulation QCVN 05:2013/ BTNMT
1	4 roads in original MCDP	172,000	514.28		0.21	0.3
2	5 roads in MCDP-AF	323,000	965.77		0.39	

The results in the table 4.4 show that the accumulated dust amount caused by construction activities depends not only on the volume of dredged materials but also on the dust concentration of the baseline environment as well as the site of construction area. The calculation results show that the earthwork and dredging process will generate an amount of dust in the air that exceeds the permissible limit of the national technical regulation QCVN 05:2013/BTNMT at the construction sites of the 9 roads.

However, the dust volume is mostly dust fallout; with heavier weight, they quickly settle down to the ground. Therefore, the concentration of dust in the air will be reduced quickly by distance, starting from the construction site location. In addition, the scope of construction is not very large, and will be scheduled for different times and phases. The construction of roads will have direct dust impacts on the residents along these roads, Van Hoa padoda and Canh Chin Village graveyard. These impacts are assessed as moderate and site-specific within the scope of earthwork and only last during construction period.

Dust and emission impacts caused by transportation

A part of the dredged materials will be used for backfilling, while the remaining will be transported to the designated disposal sites. The dredged materials will be transported by trucks with the load capacity of 10 tons.

The statistical results of material volume to be transported to the disposal sites, the transportation vehicles, routes, and average transportation distance in kilometer per day are shown in table 4.5

Table 4.5. Calculation of construction waste transportation under Component 1.

no	Work	Transport volume (m ³)	Transport trips (trip)	Construction time (month)	Daily average trips (trip)	Transport distance (km)	Transport routes
1	4 roads in original MCDP	95,000	21,500	24	30	11	Internal roads - Red River dyke road - Dinh Bo Linh Street - District Road 157 (Km8)
2	5 roads in MCDP-AF	236,000	40,375	24	56	11	Internal roads - Red River dyke road - Dinh Bo Linh Street - District Road 157 (Km8)
	Total	331,000	61,875	24	86	11	

According to the rapid assessment of the World Health Organization (WHO), the volume of dust and emissions generated by the transportation process is calculated and shown in the following table:

Table 4.6. Emission factor and pollution load by material transportation

	Total dust	SO ₂	NO _x	CO
Emission factor of WHO (g/km)	1.35	4.15	14.4	2.9

(Source: Aleaxander P. Econompoulos (1993), *Assessment of Sources of Air, Water and Land*)

From the calculated average transport distance per day and using the above emission factor, the pollution load of dust and emissions for total of construction site in Component 1 are calculated and demonstrated in the following table.

Table 4.7 Calculating pollution load of dust and emissions by vehicles transporting

No	Content	Daily average pollution load (g/day)				Transporting route
		TSP	SO ₂	NO _x	CO	
1	Emission factor of automobiles (g/km) according to WHO Rapid Assessment	1.35	4.15	14.4	2.9	Internal road - Red River dyke road - Dinh Bo Linh Street - District Road 157 (Km8)
2	Pollution load from the subproject	2,554.20	7,851.80	27,244.80	5,486.80	
3	Average pollution load per hour	0.30	0.91	3.15	0.64	

The results in the table above show that the volume of dust and emissions generated by the material transport vehicles on site is relatively high (QCVN 05:2013/BTNMT on National Technical Regulation on Ambient Air Quality). The people participating in traffic and living along the transportation routes from the construction sites to disposal sites such as Internal road - Red River dyke road - Dinh Bo Linh Street - District Road 157 (Km8) are subject to these impacts. The impact is assessed as moderate.

Impacts on surface water

Impacts by wastewater during the construction

Wastewater during the construction, from concrete maintenance, concrete mixing, machinery and equipment cleaning etc. contains hazardous substances like cement, lubricant, oil, sludge etc. are toxic for the aquatic life and pollute water sources and environment. However, such wastes could easily be collected for treatment.

Wastewater from mortar preparing and concrete maintenance: At present, there is no ration ??? available to calculate; however, according to the forecast and actual situation at the construction sites, the amount of this type of wastewater will be small and would not be enough to form a wastewater stream. Most of it will penetrate into the materials and gradually evaporate.

It is calculated that construction activities generate about 7.5m³ a day. The nature of construction wastewater is high sediment content containing some toxic contaminants in cement, concrete additives and relatively high pH level. However, the proportion of sediment in construction wastewater is quite large and easy to deposit. Therefore, the mitigation measures for this type of wastewater is to collect and treat in sedimentation ponds and then reuse the water for construction activities. The impact is considered as insignificant.

Impacts caused by wastewater containing grease and oil

Wastewater containing grease and oil comes from the maintenance/repair, washing point/stations for vehicles before letting them to main roads. Its volume depends on the number of vehicles in traffic and the weather (in rainy season, the vehicles require more frequent washing activity); According to the standard 3.4 - TCVN 4513:1988, the water amount needed for cleaning a big vehicle is from 300l to 500l. With 45 equipment and vehicles to be used for construction under Component 1, an amount of 960 litters of grease and oil per year equivalent to 2.6 lit/day would be generated.

This type of wastewater contains high content of grease and oil; therefore, if it leaks into the waterbodies around the construction sites (rivers and lakes to be dredged or other waterbodies surrounding the sites), it will affect the water quality by reducing the amount of dissolved oxygen in the water, leading to impacts on the growth and development of the aquatic species In an large area of construction site of 9.5 ha, the impact is assessed as moderate.

Impacts caused by workers' domestic wastewater

Domestic wastewater mainly contains residual, suspended substances (SS), organic substances (BOD₅, COD), nutrients (N, P) and pathogenic micro-organisms. Assuming the water volume used by a worker is 100 l/day (*according to WHO*), the amount of wastewater is 85% ÷ 95% of the water amount supplied (*according to the Wastewater Treatment, Science and Technology Publishing House, Hanoi, 2002*) and the maximum number of workers in peak time at Component 1 site is 200 workers/day, the maximum volume of domestic wastewater will be:

$$100 \times 10^{-3} \times 200 \times 90\% = 18 \text{ (m}^3\text{/day)}$$

Domestic wastewater is characterized by residual, suspended solids, organic matter such as BOD, COD... and microorganisms (which can carry many pathogenic microorganisms). The calculation results of pollutant loads and concentrations in domestic wastewater are shown in the table 4.8.

Table 4.8. Pollutant loads and concentrations in untreated domestic wastewater

No.	Indicators	Pollutant discharge (g/person/day)	Pollutant load (g/day)	Pollutant concentration (mg/l)	
				Not yet treated	Technical Regulation QCVN 14:2008 Column B
1	BOD ₅	45 - 54	12,500-16,200	500-600	50
2	COD	72 - 102	21,600-30,600	800-1133	-
3	TSS	70 - 145	21,000-43,500	778-1611	100
4	Oil	10 - 30	3,000-9,000	111-333	20
5	Total N	6 - 12	1,800-3,600	66.7-133.3	50
6	Ammonia (N-NH ₄)	2.4 - 4.8	720-1,440	26.7-53.3	10
7	Phosphor	0.8 - 4.0	240-1,200	8.89-44.4	10
8	Total Coliform	10 ⁶ - 10 ⁹	200x10 ⁶ -200x 10 ⁹	1.56x10 ⁶ - 1.56x10 ⁹	5000 (MNP/100ml)

Source: WHO, 1993.

The data presented in the table above are calculated following the formula below:

$$C = \frac{C_0 \cdot Q}{Q}$$

In which:

C: the concentration of pollutant in wastewater, (mg/L)

C₀: pollutant load, (g/day)

Q: discharge of wastewater, (m³/day)

The calculation results in Table 4.8 show that the parameters of domestic wastewater that has not been treated are above the permissible limits stipulated in the National Technical Regulation QCVN 14:2008/BTNMT on domestic wastewater quality. However, domestic wastewater would mainly be generated at the workers' camps in Component 1; therefore, the collection and treatment can easily be carried out. The impact from domestic wastewater is therefore assessed as moderate.

* *Impacts of rainwater runoff*

Rainwater runoff quality depends on the cleanliness of the atmosphere and the amount of surface substances that are washed away from the construction sites. Its volume, whereas, depends on the weather conditions in the area. During the rain, soil, sand and waste substances are gone with the rainwater runoff to get into the surrounding roads and water basins. At the construction sites, the rainwater runoff quality depends only on the construction site surface as the air quality there is fairly good.

Rainfall runoff biggest day on the whole area of implementation of the component 1 can determined as follows:

$$Q_{\max} = F \cdot W \text{ (m}^3\text{/day)}$$

F - Project area (m²): F = 94,097m²

W - the largest daily rainfall during the year (m/day)

According to the Lao Cai Meteorological Center, the largest daily rainfall during the year in the Lao Cai city is 217 mm

$$Q_{\max} = 94,097 \text{ m}^2 \times (217/1000)\text{m} = 20,419 \text{ m}^3\text{/day}$$

It contains mainly suspended substances and oil, lubricant washed away by rain, especially at the stage of construction when the construction site surface is not yet completed and easy to be washed away and eroded. The impact from rainwater runoff is therefore assessed as moderate

Generation of solid wastes

**** Domestic solid waste***

The volume of domestic solid waste per capita in Vietnam is from 0.35 to 0.8 kg per day (according to Solid Waste Management, Construction Publishing House). Based on the consumption demands, development level of the locality and living conditions in the workers' camps, the volume of domestic solid waste per capita is calculated at 0.35 kg per day. The total number of workers on the construction sites during high time is 200 workers. The maximum volume of domestic solid waste produced during this period is calculated as follows:

$$200 \times 0.35 = 75 \text{ (kg/d)}$$

Such amount of solid waste would cause negative impacts on surface and ground water, unpleasant smell at the sites when it is disintegrated and washed away by rain. Inorganic substances such as bottles, nylon bags and other things in water cause impacts to the landscape and environment, and water quality and decrease of oxygen diffusion into water, thereby affecting the aquatic life. This amount will be handled by Lao Cai URENCO and treated in Tong Mon landfill and therefore the impact is considered moderate.

**** Construction solid wastes***

Solid wastes from the construction include mainly cement bags, mortar, metal pieces etc. Their volumes depend on many factors including the construction procedure, subproject management, sources of construction materials supply, etc. Therefore, it is difficult to estimate the exact volume of these wastes; however, they can be controlled and managed by collecting for reuse or sale of scraps.

Apart from the abovementioned solid wastes, within the subproject scope, there is also a large amount of solid waste generated from the excavation and dredging activities.

According to the Result on analysed sludge samples at the central lake in Nhac Son part at Table 2.13 (Chapter 2 of the report), the heavy metals content such as As, Cd, Pb, Zn and Cu in 3 samples have volume was lower than QCVN 43:2012/BTNMT on National Technical Regulation on Sediment Quality

However, these wastes will be assessed in the section regarding site-specific impacts and mitigation measures of the report. Most of construction waste is reused and the impact is assessed as moderate

**** Hazardous wastes***

During construction, the required maintenance activities for machinery and vehicles will generate a certain amount of oily rags and waste oil and grease etc. This type of waste generation depends on the quality and operation frequency of construction machinery and vehicles.

Based on the estimate of quantity and types of construction vehicles and machines, construction duration under Component 1, it is estimated that about 1.2 m³ of waste spent oil and 7 kg of oily rags and used light bulbs will be generated each month.

All the hazardous wastes must be collected, stored as regulated and only authorized organizations permitted transport and treatment. Inappropriate management of solid and hazardous waste could contribute to an unhealthy environment or act as source of disease, especially vector borne as well as pollute air and water environments. The impact from hazardous waste is therefore assessed as moderate and requires proper management.

Impacts on soil

Construction solid wastes including cardboards, metal scraps, plastic boxes, excavated soil etc. if not treated would cause impacts on the soil environment. However, these kind of solid wastes are not classified as hazardous wastes and they are relatively easy to be collected and treated. Therefore, their impacts on the environment are insignificant.

Domestic waste from workers' camps are easily decomposed, generating bad odor. Without treatment, if wastes are directly disposed to the environment, soil will be polluted. However, such wastes are mostly concentrated in the workers' camps and thus are easy to collect and treat.

Solid waste containing oil is hazardous waste. Although the volume of this type of waste is small, if they are not properly collected and treated but discharged into receiving soil environment, they will cause adverse impacts on soil environment such as hardening soil, killing microorganisms in the soil, and severely affecting vegetation cover.

Wastewater from the construction containing cement, and wastewater from repair and washing points containing harmful factors like oil and lubricant when absorbed by the soil would make it compact and hardened.

Large volume of rainwater runoff would wash away the top soil; dissolve some nutrition substances in it especially when the covering plants are cut down, thereby negatively impacting the soil quality in a moderate level.

Impact on Ecological and Natural Habitats

The construction of the 9 roads in Component 1 will incur primarily impacts on the terrestrial ecosystems in the area which are mainly human made such as farming areas, hilly production forests, home gardens etc. The impacted include mainly human related species. The ecological survey found that several gardened trees including lemon, jackfruit, pomelo, farmed plants including rice, corn, sweet potato and planted trees along the to-be-constructed roads such as acacia will be affected. Though these impacts are inevitable during the construction, they are evaluated as minor and site specific within the subproject construction sites.

As described, among the nine roads to be constructed, eight will pass through the residential areas and agricultural areas along the foot of the hills. The N9 road is designed to go through two hills with a total length of about 250m, of which 100m passing the hillside, and 150m passing hilltop (4.13ha). The hills are currently covered by small plantation forest with mainly acacia. This is production forest planted by the people primarily for the purpose of greening the barren hills and as raw material for paper production. Therefore, construction of the road will reduce the area of production forest (4.13 ha), locally affecting the plantation ecosystem. The impact is assessed as small.

Risks and accidents

Work accident

In general, work accidents could happen at any stage of the subproject construction. Their reasons include the following:

- Environmental pollution can cause fatigue, dizziness or fainting for workers.
- Construction activities, unloading/loading and transportation of materials etc. without appropriate concentration would cause labor or traffic accidents.
- Accidents caused by carelessness, lack of protecting equipment, or lack of awareness of labor safety compliance.

Considering the scale and scope of Component 1, it is estimated that the impact of work accident is considered minor.

Fire and explosion, leakage and spillage accidents.

Fire and explosion accidents could happen during the transportation and storage of fuel, or by the lack of safety of the temporary power supply, causing damages to people and assets during the construction. Their specific reasons are as follows:

- Temporary material and fuel storage for construction (petrol, DO oil, FO oil, welding gas etc.) is the source of fire/explosion, which could cause serious damages in terms of people, socio-economy and environment;
- Temporary power supply system for construction machines and equipment may cause electric shock, leakage, explosions. causing economic damages and accidents to workers;

It is necessary that the investment owner shall apply all necessary fire and explosion as well as leakage and spillage prevention measures to ensure labor safety for workers. These activities shall be practised regularly and therefore the risk of such accidents will be minimized.

Considering the scale and scope of Component 1, it is estimated that the impact of work accident is considered minor.

b. Site-specific Impacts on Sensitive Receptors

Traffic safety risks

By design, total excavated volume is 495,000 m³, of which the material volume can be used for backfilling is 354,000 m³ and the amount that will be transported to the disposal site is 141,000m³. It is calculated that during the construction period of 24 months 86 transporting trips will be required per day on average (using 10 ton trucks).

Therefore, transportation of materials will increase traffic pressure on the roads, especially on transport routes such as Internal road - Red River dyke road - Dinh Bo Linh Street - District Road 157 (Km8). The site survey along this route indicated that the roads are of good quality and have medium traffic rate. However, the operation of 10 ton trucks on these roads will have the following impacts:

- Cause risks of traffic safety for the people
- Cause degradation to road infrastructure
- Increase the amount of dust and emissions with potential environment and human health impacts as well as the people living along the routes (see the detailed assessment of Section impacts of dust and emissions from active transportation of Component 1)

These impacts are assessed as temporary during construction period but the magnitude of impact is assessed as moderate and require a good management traffic management plan and close coordination with local authorities to ensure the potential impacts on traffic be mitigated to an acceptable level.

Risks of soil erosion and landslides due to construction of N9 road

The hydro-topographical features of Lao Cai Province in general and the subproject site in particular include steep terrain and high annual precipitation that concentrates in June, July and August (140mm/month on average). As N9 road will cross the foothills and tophill, risks of soil erosion and landslides would be likely if proper construction plans and measures are not implemented. When the excavation, filling and road construction disturb the soil balance or even destroy the soil structure and local geography, high rainwater will flow down from the high mountains, cut across the road, leading to the high risks of landslides and soil erosion. Materials will be swept down to foothills and flowed to Red River, increasing the river contamination. There fore negatively impacting the soil quality in a moderate level.

Impacts on Physical Cultural Resources

The subproject will not exert any major infringements on the important Physical Cultural Resources (PCRs). Nevertheless, the construction process of different items will be likely to affect part of these works' activities, including the inconvenience of access that residents when they want to visit these places; smoke and dust may become a nuisance to residents and Cultural and religious works that can be affected by the subproject operations are listed:

Relocation of graves: There are 5 graves in Canh Chin Village Graveyard that need be displaced due to construction of the N9 Road (Canh Chin Village, Van Hoa commune). To the Vietnamese, grave is the religious and spiritual matters which should be respected carefully. Household and individual graves are considered PCRs, and the Bank's OP/BP 4.11 applies for this subproject. However, this consultation with the households affected by grave relocation reveals that people are still willing to move the graves to another location to give land for construction if the subproject owner supports sufficiently to ensure the grave relocation. The level of this impact caused by this activity is moderate and localized.

Impacts on Van Hoa Temple: The temple is located in Canh Chin village, Van Hoa commune near the N10 road construction site. Construction of the road will exert negative impacts on the temple due to: i) Increased dust, exhaust gases, noise, vibration, construction wastes, hazardous waste, domestic wastes, and wastewater due to construction activities; ii) Clogging of local drainage canal leading to localized flooding; iii) Potential safety risks to the temple goers during construction; iv) Increased traffic congestion and risks of traffic accidents due to construction and transportation; v) Interference with religious events and practices at the temple due to construction activities; vi) Social conflicts between workers and visitors to the church such as scandal.

Impacts on irrigation canals and agricultural activities

Construction of the roads in Van Hoa commune will affect the irrigation canals in this area. The execution work of the roads may block the canals, spread soils to the irrigation canal and the vegetable fields causing sedimentation in the canals and arable agricultural land if there is no strict erosion and sedimentation management measures. However, construction activities will be completed within 18 months. Therefore, this impact is assessed as moderate and temporary.

The construction activities may cause disruption of the local agricultural cultivating and harvesting activities, damages to the vegetable crops. However, given that construction scale is moderate, at different sections, and with mobilization of construction machines and transportation vehicles, this impact is considered moderate.

4.1.2.2.3. Component 1 - Impact during Operation Stage

a. Road Safety, Air, Noise

Road safety is likely to be the key impacts during operation of road in Van Hoa during the first few years when transportation of rural population (bicycles, carts, etc.) are mixed with motor vehicle operations (cars, motorcycles, trucks, etc.) and level of traffic accident would be increased. Experience in the country suggested that this condition can be managed; however, improving knowledge of local people on road use regulations and practices as well as monitoring and enforcement of driver speed and behavior can help mitigating the impacts and therefore the impact is considered minor.

b. Impacts during operation Stormwater drainage and Wastewater collection system

Leaks and Overflows:

The leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water. Depending on the elevation of groundwater, leaks in gravity mains may also allow groundwater into the sewer system, increasing the volume of wastewater requiring treatment and potentially causing flooding and treatment bypass. Substantial leaks due to breakage or joint

disconnection of the wastewater interceptors may trigger land subsidence causing damages to roads and other properties. Overflows occur when the collection system can not manage the volume of wastewater, for example due to high flows during rain events or as the result of power loss, equipment malfunctions, or blockages. The excess flows may contain raw sewage, industrial wastewater, and polluted runoff. Since the groundwater is used for water supply of the city the risks of groundwater pollution and land subsidence due to leaks and overflows are assessed as moderate.

Offensive odors:

Another impact of the stormwater drainage and wastewater collection systems is the offensive odors. Moreover, wastewater collection system in sewer, canal route would generate a large amount of sludge during operation, hence these systems need to be dredged periodically. The odor from school toilets is mainly NH₃, affecting Residential Area. The impacts of odor can be controlled through some measures combined with design and regular clean in operation. Given the scale and location of the drainage and sewer systems, the level of impact is anticipated to be low.

c. Water supply system

For water supply system in operation phase, most impacts are positive on the environment and human health. However, the water supply system can also create a negative impact when the system encounters problems, especially pipeline breakages. When the pipe is broken, dirt and microorganisms in the soil will go into the pipeline system and to the storage tank of the household and may directly affect the health of people who use the water supplied. At the same time dirt will can cause blockage in equipment reduce the system's efficiency.

Also, if the long water supply pipeline is not sanitized and maintained in long time residue to the pipeline wall will cause blockage reducing access to clean water for households. However, this impact is assessed to be low.

d. Impacts during operation 2 pumping station (PS)

There are 02 pumping station capacity $Q = 10-20 \text{ m}^3/\text{h}$ to be conduction to convey the wastewater to the Dong Pho Moi wastewater treatment plant.

Impacts by odor and gases from PSs

Wastewater from resident land will concentrate into areas where the PS are located. Thus, these areas will regularly bear odors and emissions generated from wastewater such as CH₄, H₂S, etc. However, the impact is considered insignificant as these small-scaled

Impact from PSs waste sludge

In addition, waste sludge will be generated during the PSs. The amount of sludge may not be large but its component may include organic pollutants. Therefore, this sludge needs to be periodically dredged and handled as regulated. As the scale of these treatment facilities are small, the amount of the waste sludge are small. In addition, these are treatment facilities for domestic wastewater, thus, the sludge would be of high organic content like BOD, COD; but not heavy metal, chemicals like industrial waste. Thus, the magnitude of impacts from waste sludge is assessed as low.

e. Other Impacts

Possible local flooding, soil erosion, and landslide: Construction of road across a terrain will change the natural water flow in the area and this may affect local flooding. The drainage issues should be carefully examined during detailed design to ensure that adequate drainage is provided and that slope protection and soil erosion measures are effective and the road safety is in line with Government standards for mountainous area, especially after heavy rain. Regular inspection and maintenance of drainage will be necessary.

Land slide and subsidence risk: there is one section of one road (N9 road, about 250 passing through hills). On the two sides of this road section are the slopes generating from the leveling of the hill. During operation, there could be a risk on land slide. The design of the slope should consider this carefully. Therefore the impact is considered minor.

4.1.2.3. Impact Assessment for Investments under Component 2

The civil works under this component will include:

- Dredging lake bed with total area of 5,4ha; repairing the damaged embankments of lake; Constructing interceptor sewers D560mm - Length 539m to collect wastewater, manholes, 01 overflow chambers, box-culverts 2.0x2m - length 149m; 01 pumping stations with capacity 324 m³/h and wastewater pressure sewers D315mm - length 1,5km to lead wastewater to Ngoi Dum WWTP.
- Dredging and rehabilitation of roadsides drainage culverts (71km); addition of the drainage culverts (5,2km) at flooding locations, associated with resurfacing the remaining streets roads of 10 ward as Duyen Hai, Kim Tan, Bac Cuong, Nam Cuong, Coc Leu, Pho Moi, Binh Minh, Bac Lenh, Pom Han, Lao Cai Wards with total length of the roads is 48km.

The activities will be carried out in the old city area (Duyen Hai, Kim Tan, Bac Cuong, Nam Cuong, Coc Leu, Pho Moi, Binh Minh, Bac Lenh, Pom Han, Lao Cai wards). The activities will be carried out in the old city area (Pho Moi, Coc Leu, Kim Tan, Duyen Hai, etc.) at different locations and different time and the potential impacts will be localized, temporary, and can be managed. The key impacts are discussed below.

There are no land acquisition and compensation activities in this Component.

4.1.2.3.1 Impact during Preparation Stage

Impacts by UXO

The subproject involves lake excavation works in the areas that were bombed during the French war period. Lao Cai city was also the war zone during the conflict with China in 1979. However, this area was cleared from the UXOs. Nevertheless, the risks of UXOs remain. Therefore, identification and removal of the remaining UXOs are important so as to avoid any potential threat to works and safety for local people and workers. For this component, UXO issue needs to be carefully considered and removed before construction activities can commence.

4.1.2.3.2. Impact during Construction Stage

a. Generic Environmental Impacts

There are some general and site-specific environmental and social impacts during the construction of the works in Component 2. General impacts are similar to those identified for the construction of the works in Component 1, including the following:

Impacts on Air Quality

Impacts by dust and emissions from earthwork

According to the calculation, the volume of soil and excavated soils and sediment for the works of Component 2 is 73,200 m³, in which some 3,500 m³ are materials that could be reused for backfilling at some locations. The remaining 70,000 m³ is sediment with organic matters to be transported to the disposal site in Cau Sum hamlet, Van Hoa Commune, Lao Cai City. This 4.7ha disposal site is recommended by the Provincial Department of Construction. It is a lowland surrounded by protection forested hills. As planned by the city, the filled lowland will be forested as well.

The excavation, backfilling and transportation of these materials to disposal site will cause dust and emissions, affecting the air quality in the area. The dust and emissions include:

Dust from the excavation

The sediment dredging in water bodies is commonly called wet dredging and it will not generate dust. However, according to the description of the project, the dredging will be conducted in a successive manner (lake is divided into 4 cells, each of approximately 4.3 hectares) and dredging operations conducted one by one; cell is embanked and water is pumped out. Dredged sludge will be stored in the dredged cell to dry and then transported to the landfill. Therefore, the dredging would generate dust.

Based on the calculation method of dust volume arising from excavation in Component 1, the total amount of dust generated in Component 2 is presented in the table 4.9:

Table 4.9. Total dust amount by subcomponent in the Component 2

No	Construction works	Total earthwork volume (m ³)	Total amount of generated dust	Dust concentration in the baseline environment (mg/m ³)	Accumulated dust concentration (mg/m ³)	QCVN 05:2013/ BTNMT
1	Rehabilitation of Central lake	72,300	216.18	0.024-0.035	0.09	0.3
2	Improving sewage system and resurfacing remaining roads	17,700	52.92		0.02	

The calculation results in the table above show that the excavation of Construction works in Component 2 will increase the amount of dust in the air. Compared to the national standards QCVN05: 2013/BTNMT, the dust emission is still within the allowable thresholds. However, if the amount of dust is resonant with the amount of dust generated from other activities, such as transportation and travel, it is likely that levels of dust in the air and the area will exceed the national standards and measures to minimize the impact of dust need to be taken. The impact is considered as small.

Dust and emissions from earthwork machinery and equipment

Applying the similar calculation as for Component 1, the amount of exhaust gas emissions generated by operation of the construction machines and equipment by each construction work is shown in the table 4.10.

Table 4.10. Total amount of dust and emissions generated by the machinery and equipment during construction period

No.	Construction works	Excavated and dredged volume (m ³)	Machine working shift (shift)	Emission loads (kg)			
				Nox	CO	SO ₂	Dust
I	Rehabilitation of Central lake	72,300	60	113.4	28.38	1134	28.38
II	Improving sewage system and resurfacing remaining roads	17,700	15	28.35	7.09	283.5	7.09

With dust and emissions loads as calculated in the table above, applying the BOX model, we can calculate the emission concentration at the construction site. Calculation results are shown in the following table:

Table 4.11. Dust and emission concentrations generated from the operation of excavation machinery and equipment

No.	Construction works	Average NO ₂ - 1 hr (mg/m ³)		Average CO- 1hr (mg/m ³)		Average SO ₂ - 1 hr (mg/m ³)		Average TSP- 1 hr (mg/m ³)	
		Concentration in baseline environment	Accumulated concentration	Concentration in baseline environment	Accumulated concentration	Concentration in baseline environment	Accumulated concentration	Concentration in baseline environment	Accumulated concentration
I	Rehabilitation of Central lake	0.02-0.031	0.007	4.2-5.5	0.002	0.15-0.031	0.066	0.024-0.035	0.002
II	Improving sewage system and resurfacing remaining roads		0.002		<0.001		0.016		<0.001
	QCVN 05:2013		0.2		30		0.35		0.3

Calculation results in the Table 4.11 above show that the amount of dust and gases generated by the operation of the equipment involved in the construction is much smaller than the permitted standards in QCVN 05: 2013 / BTNMT.

Dust and emission impacts caused by transportation of excavated materials

The statistical results of excavation material volume to be transported to the disposal sites, the transportation vehicles, routes, and average transportation distance in kilometer per day are shown in the Table 4.12

Table 4.12. Calculation of waste transport under Component 2

No	Work	Transport volume (m ³)	Transport trips (trip)	Construction time (month)	Daily average trips (trip)	Transport distance (km)	Transport routes
1	Rehabilitation of Central lake	68,700	8,588	24	12	15	Hoang Lien Street - Pho Moi Bridge - Dinh Bo Linh Street - District Road 157 (Km8)
2	Improving sewage system and resurfacing remaining roads	12.180	1,523	24	2	7	Inner city streets - Pho Moi Bridge - Dinh Bo Linh Street - District Road 157 (Km8)

Applying the emission factors and pollutant loads due to the transportation process according to the rapid assessment of the World Health Organization (WHO), the volume of dust and emissions generated at Component 2 is calculated and shown in Table 4.13

Table 4.13. Calculation of pollution load of dust and emissions by transportation vehicles

No	Content	Daily average pollution load (g/day)			
		TSP	SO ₂	Nox	CO
1	Emission factor of automobiles (g/km) according to WHO Rapid Assessment	0.473	18.9	1.89	0.473
2	Pollution load from the subproject	1,351.12	3,551.62	12,135.36	2,985.10
3	Average pollution load per hour	0.08	0.21	0.70	0.17

The results in the table above show that the volume of dust and emissions generated by the transport vehicles due to transportation of construction spoils and wastes on sites is relatively high. The people participating in traffic and living along the transportation routes from the construction sites to disposal site such as Hoang Lien street - Pho Moi Bridge - Dinh Bo Linh Street - District Road 157 (Km8) and Inner city streets will be impacted. Therefore, the impact is assessed as moderate.

Impact by noise

With the mobilized equipment for the construction of works similar to those in Component 1, the impacts of noise during construction of works under Component 2 are considered as varied from low to moderate as most of the construction areas are far from residential areas and this impact will be mainly related to the workers directly working at the construction site. This impact could be mitigated by application of appropriate management and construction practices.

Impacts on surface water

Impacts on surface water by dredging activities

Construction process requires excavation of 90,000 m³ of material, of which 80,880 m³ of the dredged materials cannot be used for leveling and thus will be transported to the disposal site. As described above, the successive dredging is applied in Nhac Son Lake by cells (details provided in Section 1.2.6). The dredging activities have some potential environmental and social impacts as follows:

- ✓ The process of dredging will increase the turbidity in the river water of the Central lake, causing reduction of capability to receive light, reduce photosynthetic efficiency and saturation of oxygen in water. Due to the fluctuation of water, the dirt will be removed from the sludge and diffused into water at different levels, leading to contamination of water environment. Slow and with interval dredging might because ecosystem is slow to recover;
- ✓ The sediment transportation by truck from dredging sites to the disposal site of waste materials might cause leakage and spillage of sludge along the transport route, thereby affecting environment, landscape, and traffic safety. Therefore, regulations and specific measures for transporting sludge is required in order to reduce the risk of sludge leakage and spillage. For example, dredged sludge must be dried before, coverage is compulsory for transporting sludge, etc. Hence, the impacts on environment will be reduced to an acceptable level.

Impacts by wastewater generated from the construction process

With the volume of works to be constructed under Component 2, the calculated results showed that the daily average volume of wastewater from the construction process is about 32 m³. This wastewater is characterized by high concentration of suspended solids, and can be contaminated with the concrete mixtures and high pH level. Therefore, this source of wastewater must be treated

using appropriate method such as sedimentation ponds. Given the spatial scope of the civil works under this component, the impact is considered small.

Impacts by domestic wastewater from workers

During the construction process of the works under Component 2, the estimated total number of workers to be involved in all construction sites at peak time is about 100 people/day. Applying the same calculation for the Component 1, the maximum amount of domestic wastewater is:

$$100 \times 10^{-3} \times 100 \times 90\% = 9 \text{ (m}^3\text{/day)}$$

Domestic wastewater is characterized by suspended solids, organic matter such as BOD, COD, and microorganisms, which can carry many pathogenic microorganisms. The calculation results of pollutant load and concentrations in domestic wastewater are shown in Table 4.14.

Table 4.14. Pollutant loads and concentrations in untreated domestic wastewater

No.	Indicators	Pollutant discharge (g/person/day)	Pollutant load (g/day)	Pollutant concentration (mg/l)	
				Not yet treated	QCVN 14:2008 Column B
1	BOD ₅	45 - 54	4500 - 5400	39.09-46.91	50
2	COD	72 - 102	7200 - 10200	62.55-88.61	-
3	TSS	70 - 145	7000 - 14500	60.81-125.97	100
4	Oil	10 - 30	1000 - 3000	8.69-26.06	20
5	Total N	6 - 12	600 - 1200	5.21-10.42	50
6	Ammonia (N-NH ₄)	2.4 - 4.8	240 - 480	2.08-4.17	10
7	Phosphor	0.8 - 4.0	80 - 400	0.69-3.47	10
8	Total Coliform	10 ⁶ - 10 ⁹	100x10 ⁶ - 100x10 ⁹	0.87x10 ⁶ - 0.87x10 ⁹	5000 (MNP/100ml)

However, according to the assessment, although large volume generated, but it is scattered throughout the construction sites and the source is mainly from workers' camps, thus the collection and treatment could be managed. Therefore, the impact is considered small.

Generation of solid waste

Domestic solid waste

The total number of workers involved in the construction sites under the component at peak time is about 100 people. Therefore, the maximum amount of domestic solid waste generated during this period is calculated as follows:

$$100 \times 0.5 = 50 \text{ (kg/day)}$$

The environmental impacts caused by solid waste have been described as for Component 1. To minimize the impacts of domestic solid waste generated, during the construction process, the contractor must fully comply with the regulations on solid waste management as outlined in the ECOP of this report. The impact is assessed as moderate.

Construction solid waste:

Solid wastes are mainly: cement packages, spilled grout, debris, metal scrap, etc. The volume of this solid waste was difficult to estimate accurately (estimated 50kg). But it could be controlled through the daily amount generated. Also this kind of solid waste could be reused or sold as scrap, therefore this impact is evaluated as small and generated within construction area only.

In addition to the above-mentioned solid waste, with subproject particular, the solid waste arising from dredging activities also generated a large amount. However, this waste will be assessed in

the section concerning site-specific impacts and mitigation measures in this report. Therefore this impact is moderate.

Hazardous wastes

The required maintenance activities for machinery and vehicles will generate a certain amount of oil rags and spent oil and grease etc. Based on the estimate of quantity and types of construction vehicles and machines, construction duration in Component 2, it is estimated that about 0.5m³ of spent oil and 6 kg of oily rags and used light bulbs will be generated each month.

All the hazardous wastes must be collected, stored as regulated and only authorized organizations permitted transport and treatment. Inappropriate management of solid and hazardous waste could contribute to an unhealthy environment or act as source of disease, especially vector borne as well as pollute air and water environments. Therefore, the subproject needs to manage generated waste appropriately. This impact is considered small.

Risks and incidents:

The impacts by risk and incident for the construction activities in Component 2 were assessed similarly to the construction activities in Component 1 and include the potential risk of work accidents, explosion incident, material leakage, fire incidents, etc. The extent of impacts by these risk and incident are evaluated as infrequent and scale of impacts would be within the construction site. The impact is considered as insignificant

b. Site-specific Impacts on Sensitive Receptors

Impacts on ecological environment

The impacts on the ecological environment during the construction process in Component 2 are mainly the impacts on terrestrial and aquatic ecosystems in the Central lake at Nhac Son Park. These impacts may include temporary impacts during the construction stage but there are long-term impacts as well. During the dredging process the terrestrial ecosystem is affected regarding mainly the species living in the park Nhac Son, including plants such as willows, Lagerstroemia, flamboyant tree. As for aquatic ecosystem, the entire 5.4ha water area of the lake will be affected and all the species will be affected, as they include barb species, tilapia, grass carp and common carp, shrimp, crab, goby fish. In addition, 5 orders, 11 families, 33 genera of phyla: *Cyanobacteriophyta*, *Chlorophyta*, *Euglenophyta* and *Bacillariophyta* will also be affected.

The magnitude of impacts on the aquatic ecosystem in the lake depends on the dredging construction methods to be applied. Aquatic ecosystems can change completely if measures dredging is conducted simultaneously across the entire 5.4ha lake. However, as mentioned in Chapter 1 Section 1.2.6 of this report the dredging is executed on partial and successive manner and dredged cells are sheet piled. Species will be able move into areas that are not dredged. Also, all the species found in the lake are absolutely not on the list of species in need of protection under the Vietnam Red Book or IUCN and most fish are raised by human. This impact should be assessed as minor to moderate.

Impact on recreational activities in Nhac Son Park

As described, Nhac Son Park is functioning as sightseeing and entertainment site for local people. According to the management team Nhac Son Park, on average 300 visitors come to the Park everyday for sightseeing, leisure and sporting activities. Therefore when the lake dredging operations are carried out, the environmental landscape area will change and entertainment activities as well as other activities in the park are likely to be interrupted. The social impact will be assessed as medium. However, if the dredging is done in accordance with the design, and the partial and successive construction method and the construction area are well fenced to prevent mud splattering around, the level of impact the landscape and environment will be minimized, people can still have partial access to the park services. Operations of the construction machines

and transportation of the dredged materials may pose safety risks for the people enjoying leisure time and activities in the park.

Impact on the operation of the public service works in the park and surrounding area

According to the survey results, the lakeside is paved with marble and planted with different types of trees to create landscape for the park. In addition, in the park area there are a number of public works such as Lao Cai Children’s Palace (next to Le Quy Don Street), children’s playground (and corner of Hoang Lien Street and Trung Do Street); Lao Cai Library (corner of streets of Hoang Lien and Le Quy Don) and 3 other restaurants. In the roads around the park there Civil Servant Training School, Kim Tan Secondary School (on Le Quy Don Street); cultural center and job center for Lao Cai City (Hoang Lien Street), Office of Department of Internal Affairs (Trung Do Street) along with more than 60 households living on 4 surrounding streets.

During the construction, all these infrastructure works will be affected by construction activities such as dust, emissions, damages to the paved areas, which affect the quality of works as well as the health and safety risks for the people having access to these works. However, the extent of this impact is assessed as medium.

Lakeshore erosion risks during construction

Currently the central lake is already embanked and lakeside paved with marble, however, there is damage to several embankments. Also, a small isle in the lake is connected to the shore with a concrete bridge for pedestrians; a restaurant is doing business on the isle at the moment. Therefore, when conducting dredging the lake without erosion prevention solutions, the risk of erosion is very likely, especially in the area around the isle and concrete bridge. Any damage to the bridge will affect the safe access to the restaurant as well as visitors’ activities.

According to construction plans designed in the FS report the process of dredging will be done partially and the dredged cells will be reinforced with sheet piles. After dredging, the project will conduct repairment to all degraded and damaged embankments, therefore, this impact is considered moderate.

Odor impact and gas emissions arising from the dredged material:

The lake sediments are characterized by high concentration of organic matter, which is deposited for long time in water. Therefore in anaerobic conditions, the decomposition of organic matter will produce odors and toxic gases such as CH₄, H₂S. The bottom sediment dredged will enable these gas to be freed and go into the atmosphere contributing to the increase of greenhouse gases, and especially create the odor nuisance for the surrounding people. However, this impact is inevitable for the dredging of bottom sediment. The partial and successive method of construction will reduce the concentration of odors and emissions into the environment. With the surface area of 5.4ha to be dredged, this impact assessment is minor.

Traffic management

In Component 2, works in Rehabilitation of the Central lake and Rehabilitation of drainage system will require large amount of transporting vehicles. This implies potential impacts on local road infrastructure and road safety. Calculation of transportation of materials using planned routes in Component 2 is presented in the table 4.15.

Table 4.15. Calculation of transportation of materials for each work in Component 2

No	Construction work	Amount to be transported (m ³)	Distance (km)	Truck load (ton)	Total trips (trip)	Construciton duration (month)	Daily trips (trip/day)	Transporting route

1	Rehabilitation of Central lake	68,700	15	10	8,588	24	12	Hoang Lien Street - Pho Moi Bridge - Dinh Bo Linh Street - District Road 157 (Km8)
2	Improving sewage system and resurfacing remaining roads	12,180	7	10	1,523	24	2	Inner city streets - Pho Moi Bridge - Dinh Bo Linh Street - District Road 157 (Km8)

From the calculated results in the table above shows that the transportation of materials will increase traffic pressure on the roads, especially on transport routes of Inner city streets - Pho Moi Bridge - Dinh Bo Linh Street - District Road 157, Hoang Lien Street.

Survey results showed that these existing routes to be used for transporting materials are in good condition. Such routes will pass through many neighborhoods, therefore, during transport of materials through they will potentially:

- ✓ Cause risks of traffic safety for the people.
- ✓ Cause degradation to road infrastructure.
- ✓ Increase the amount of dust and emissions with potential environment and human health impacts as well as the people living along the routes.

These impacts are assessed as temporary during construction period but the magnitude of impact is assessed as high and require a good management traffic management plan and close coordination with local authorities to ensure the potential impacts on traffic be mitigated to an acceptable level.

Impacts on Physical Cultural Resources and Sensitive Receptors

The construction of the different items under this component will likely impact some PCRs and other 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 4.16. List of affected cultural works under Component 2

<i>No</i>	<i>Activity of Component 2</i>	<i>Sensitive PCRs</i>	<i>Potential impacts</i>
1	Rehabilitation of Central lake	Lao Cai Children's Palace Children's playground, and pedal boat lake water recreation	Increased exhaust gases, dust, noise, vibration, construction wastes, waste water, risks of traffic safety, and construction accidents to local communities.
		Lao Cai Library	Increased exhaust gases, dust, noise, vibration, construction wastes.
		3 other restaurants in the park	Increased exhaust gases, dust, noise, vibration, construction wastes, wastewater, and the risks of traffic and construction accidents to customers to the restaurants.
		Civil Servant Training School Kim Tan Secondary School	Increased exhaust gases, dust, noise, vibration.
		Office of Department of Internal Affairs and more than 60 households living on 4 surrounding streets	Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to local communities.
	Resurfacing Phan Boi Chau	Thuong Temple:	Construction of the road will exert

<i>No</i>	<i>Activity of Component 2</i>	<i>Sensitive PCRs</i>	<i>Potential impacts</i>
	Street, Lao Cai Ward	It is located at Cluster 7, Phan Boi Chau Street, Lao Cai Ward, 5m to the construction site. Tan Bao Pagoda: Located adjacent to Thuong temple, Tan Bao Pagoda also located on the roadside, 5m to the construction site	negative impacts on the temple due to: Increased dust, exhaust gases, noise, vibration, construction wastes, hazardous waste, domestic wastes, and wastewater due to construction activities; Clogging of local drainage canal leading to localized flooding;
	Resurfacing Nguyen Hue Street, Lao Cai Ward	Mau Temple: Mau Temple is located at Cluster 4, Lao Cai Ward, 15m from the construction site	Potential safety risks to the temple goes during construction; Increased traffic congestion and risks of traffic accidents due to construction and transportation;
	Resurfacing Soi Tien Street, Coc Leu Ward	Con Leu Church: Coc Leu Church located on Son Tung Street, Coc Leu Ward, 50m from the construction site	Interference with religious events at the temple due to construction activities

4.1.2.2.3. Impact during Operation Stage

During the operational phase, impacts are evaluated mainly as positive, meeting the objectives of the subproject in improving the conditions of environmental sanitation as well as basic condition infrastructure of water supply and drainage for the area. The main positive effects brought by this component in the operational phase include: Improved environmental and ecological conditions in Nhac Son park and improved local sanitation conditions through residential wastewater separation and transport to the Ngoi Dum treatment plant for treatment before discharge into Ngoi Dum Stream. Moreover, the upgraded and repaired roads in 10 wards of Lao Cai City also contribute to improving the conditions for local infrastructure and limit traffic accidents.

Apart from the positive impacts, the operation of subproject will incur some social and environmental impacts if specific mitigation measures are not in place.

For the Central Lake

When the lake is dredged, the lake depth increases and the risk of safety for people especially young children walking around the lake also increases. The improved water quality in the lake may encourage people to swim in hot weather as well.

The rehabilitated Central Lake will increase the number of people and activities in the park especially relating to 3 restaurants and entertainment spots such as Children's Cultural Palace and children's playground. Without proper management, the waste littering in the park as well as a direct discharge into the lake are very likely to occur. This will contribute to reduced quality of water and sediment to the lake. However, this impact is considered minor.

In addition, the lake will be the deposition and accumulation of organic matter in the water, especially mud, garbage washed down. When accumulated in the lake and decomposed over time organic matters will produce certain amount of CH₄, H₂S. However, this impact is considered insignificant as the accumulation of organic matter in the lake is not large, and the lake will be dredged regularly.

For the roads to be upgraded

Because the routes selected to be upgraded are now seriously degraded, the resurfaced roads will increase the access and traffic conditions and the number of vehicles on these roads may increase.

That means the increase of environmental pressure on the air, the dust caused by the operation of the vehicle as well as the risk of traffic safety. However this impact is considered negligible.

For the wastewater collection and sewage system

The upgrading and construction of wastewater collection drainage and system in Component 2 will improve environmental sanitation and also create some other negative effects including:

- Sludge accumulated in the sewage system: The amount that will be accumulated and increased over time in the system after the work is commissioned. Sludge in sewage system consists of mainly impurities and organic matter (in BOD, COD, TSS) in water and washed out topsoil layer. Therefore this sludge is characterized by high concentration of organic matter and bacteria (E. coli, Coliform) and a number of other pollutants. Therefore, without regular dredging and maintenance this sludge will cause sewage blockages and affect the environment and landscape. The degree of this effect depends very much on the operational mechanism and management. If the maintenance and dredging is done regularly, this impact is considered negligible or medium otherwise.
- The sewage system will receive domestic wastewater from residential areas. Therefore, in this area odor and some gas emissions such as CH₄, H₂S will occur regularly. However, the sewage lines are mostly installed along the main roads to Ngoi Dum WWTP in an large open space, the generated gases are expected to be diluted quickly in the air. Therefore, this impact is considered negligible.

4.1.2.4. Impact assessment for investmens on component 3

Works will include:

- Construction of a bridge across Ngoi Dum stream. The bridge is 48 m, and the approaching roads at the two ends of 62 m.
- The main bridge is designed with expected working load HL93, pre-stress reinforced concrete structure, spans diagram L = 3x15(m), bridge size K=7+2x0,5m (no pavements for pedestrians).

With the above mentioned activities, the anticipated social and environmental impacts are as follows:

4.1.2.4.1 Impact during Preparation Stage

Land acquisition

No land acquisition for the construction of this bridge. The approaching roads will be built on public land, connecting with the two existing roads at the two sides.

Impacts by UXO

The construction sites located in Kim Tan and Bac Cuong wards, Lao Cai city have been much affected by human activities and the Ngoi Dum bridge location in Ngoi Dum stream. UXOs detection and mine clearance have been already conducted before. Experience in implementation of the some project in Lao Cai city shows that no remaining UXOs have been detected, and during the construction no UXOs were found. However, this is a risk to be considered as this kind of hazard, once taking place, may cost human lives and properties. Therefore, UXOs should have been cleared before commencement of the construction.

4.1.2.4.2. Component 3- Impact during Construction Stage

The Ngoi Dum Bridge will be constructed of steel precast reinforced concrete. The main activities will involve site clearance; removal of unsuitable soil; excavation of road base; rock excavation; embankment construction; and transporation of filled materials. The construction boundary will be clearely marked. The key impacts are assessed as follows:

a. Generic Environmental Impacts

There are some general and site-specific environmental and social impacts during the construction of the works under Component 3. The general impacts are similar to those identified for the construction of the works in Component 1 and Component 2, including the following:

Impacts on air quality

Impacts by dust and emissions from earthwork

According to the calculation, the volume of excavated soil and sludge for construction of Ngoi Dum bridge of component 3 is 1,170 m³, in which some 270 m³ is dredged materials that could be reused for backfilling at some locations. The remaining 900 m³ is sludge and organic soil to be transported to the Van Hoa disposal site. The excavation, backfilling, and transportation of these materials will cause dust and emissions, affecting the air quality in the area.

Dust caused by excavation activities:

Applying the formula as in Component 1, the amount of dust dispersed in Component 2 is calculated as below:

$$\Rightarrow \Sigma_{\text{dispersed dust}} = 1,170 \text{ m}^3 \times 0.3 \text{ kg/m}^3 = 351 \text{ kg dust}$$

This dust is mainly the gravity dust capable of quickly deposited, therefore during the construction period of 20 months, this impact of dust is considered low and the scope of impact mainly concentrates around the area of bridge construction, especially 2 bridgeheads in Dao Duy Tu street (Kim Tan Ward) and Ngo Minh Loan Street (Nam Cuong Ward).

Dust and emissions generated by excavators

With 1,170 m³ soil to be excavated and using similar calculation method in Component 1 and 2, the amount of dust and emissions generated by fuel combustion of the excavators is calculated in the following table:

Table 4.17. Estimated amount of dust and emissions generated by the excavating machines in Component 3 (kg)

	NO_x	CO	SO₂	DUST
Pollution coefficient	1.89	0.473	18.9	0.473
Pollution load	1.14	0.36	79.81	0.36

In a 20 month period of time, the amount of emissions arising from the dredging equipment is assessed as low and the impact is considered negligible.

Dust and emissions from the organic soil and sludge transportation vehicles

Of the 1,170 m³ of excavated soil, only 900 m³ of organic soil and sediment need to be transported to the disposal sites. Applying the calculation method as for the Component 1, the amount of dust generated from the road surface due to the transport process is calculated at 118 kg, which will affect the extent along the transport route from the construction sites to the disposal sites. People and other subjects along the transport route will be mainly affected. However, the level of impact is considered small due to wide scope of construction and long construction period.

Dust and emissions from transportation of construction materials

From the demand for materials used in construction works in Component 3, a total of 113 trips is calculated. Material suppliers can be found near the construction area in the towns and the average distance for transportation is 18km. Thus, the total of transport distance is 113 trips x 18 km x 2 ways = 4068 km. The amount of dust and emissions generated by the fuel combustion process of the transport vehicles is calculated and shown in the table 4.18.

Table 4.18. Emissions of the transport vehicles of construction materials for Component 3

No	Load	Emissions load generated from driving vehicles (g)					
		<i>Dust</i>	<i>SO₂</i>	<i>NO_x</i>	<i>CO</i>	<i>VOC</i>	<i>Pb</i>
1	Emission factor as WTO Rapid Assessment (g/km)	1.35	4.15	14.40	2.90	0.80	0.25
	Emission load generated from the subproject activities (g)	427	205	4103	892	117	68
2	Average emission load per hour (g/h)	0.13	0.79	2.11	0.46	0.08	0.003

This load of dust and emissions shows that this impact is low and within limits by QCVN05: 2013/BTNMT because of long construction time and dispersing in various locations. The subjects affected are mainly residential sites in bridge heads and along the transport route from the construction site to the disposal site (approximately 11km long) including riverside road, as roads, Cau Moi Street, Dinh Bo Linh Street and Provincial Road 157. The extent of this impact is considered small.

Impacts by welding process

The bridge construction involves usage of welding machines for attaching steel components. This welding process will create welding fumes, CO and NO_x pollutants from welding rods. Epidemiology studies have shown that a large number of welders experience some type of respiratory illness. Respiratory effects seen in full-time welders have included bronchitis, airway irritation, lung function changes, and a possible increase in the incidence of lung cancer. Pulmonary infections are increased in terms of severity, duration, and frequency among welders. Although epidemiological studies have demonstrated an increase in pulmonary illness after exposure to welding fumes, little information of the causality, dose-response, and possible underlying mechanisms regarding the inhalation of welding fumes exists. Even less information is available about the neurological, reproductive, and dermal effects after welding fume exposure.

According to Pham Ngoc Dang (2000), the concentration of toxic gases in the process of electric welding of metal materials is presented in the table 4.19.

Table 4.19. Pollutant in metal welding

Pollutant	Welding rod diameter (mm)				
	2,5	3,25	4	5	6
Fume (containing other pollutants) (mg/rod)	285	508	706	1.100	1.578
CO (mg/rod)	10	15	25	35	50
NOx (mg/rod)	12	20	30	45	70

Source: Pham Ngoc Dang (2000), *Ambient Environment, Science and Technology Publishing House.*

According to calculations, the construction process requires at least 300 welding rods with diameter of 4 mm.

Thus the pollution load from the welding process is calculated and shown in the table 4.20:

Table 4.20. Average Pollution load for welding per year

Pollutant	Pollution factor (mg/rod)	Pollution load (g)
Fume (containing other pollutants) (mg/rod)	706	211,8
CO	25	7,5
NOx	30	9

The results in the table shows that the amount of welding fumes and gases CO, NOx is not significant in an open space of construction area. Nevertheless, the epidemiology studies above suggest that great care should be given to the welders during construction. Therefore, this impact is assessed as moderate.

Noise Impact

Similar to the Component 1 and 2, the impact of noise arises mainly from vehicles transporting construction materials and equipment. Machinery and equipment used in Component 3 include bucket-wheel excavators, earth scraper, and trucks, etc.

The noise assessment for Component 1 has shown that beyond 20m from the noise source (construction equipment), the noise level remained within limits specified by QCVN 26/2010 applying for normal areas of 70 dBA.

Survey results showed that the closest distance from the construction to the residential areas in Ngo Minh Loan street is about 10m, and Dao Duy Tu street is about 20 m. Also, located in Dao Duy Tu Street is the Children Hospital of Lao Cai approximately 100m from the bridge position. Hence, those who are likely to be affected by noise during the construction process mainly include direct workers and about 6 households at 2 sides of the bridge. The biggest noise is expected to be generated in the operation of devices such as stake driver, truck and bulldozer.

With the scale of the bridge and the construction period in 20 months, the construction machinery equipment are employed in differently times and noise test are done periodically for these equipmet, this impact is assessed as medium.

Impacts of solid waste

Domestic solid waste

With 50 workers working in the construction sites under Component 2, the amount of solid waste generated is calculated as:

$$50 \times 0.5 = 25 \text{ (kg/day)}$$

The amount of solid waste is distributed to several construction sites; therefore, the amount of solid waste in each work field is not too much. However, due to the easily decomposable nature of domestic solid wastes, if they are not managed well and efficiently collected, they will affect the surface and ground water, causing unpleasant odors. To minimize the impact, Contractors must comply with mitigation measures as outlined in ECOP and have to sign contract with local waste collection and treatment entities for daily waste collection and treatment as regulated. And therefore, the impact is considered small.

Construction solid waste:

With the scale of construction work, the volume of solid waste is estimated as small (about 8kg/construction site/day) and can be reused or sold. The impact is considered as insignificant.

Hazardous wastes

Based on the estimate of quantity and types of construction vehicles and machines, construction duration in Component 3 it is estimated that about 0.3 m³ of spent oil and 5 kg of oily rags and used light bulbs will be generated each month.

All the hazardous wastes must be collected, stored as regulated and only authorized organizations permitted transport and treatment. Inappropriate management of solid and hazardous waste could contribute to an unhealthy environment or act as source of disease, especially vector borne as well as pollute air and water environments. Therefore, the subproject needs to manage generated waste appropriately. The impact is assessed as minor to moderate.

Impacts of wastewater

Impacts of domestic wastewater

Approximately, there are 50 workers working in Component 3. The maximum volume of domestic wastewater in peak time is calculated as follows:

$$50 \times 10^{-3} \times 100 \times 90\% = 1.5 \text{ (m}^3\text{/day)}$$

Domestic wastewater contains many impurities, suspended solids, organic matter as BOD, COD, and microorganisms (which can carry many pathogenic microorganisms). Absence of appropriate wastewater collection and treatment measures will cause pollution to the surface water of the receiving sources. The calculation results of pollutant loads and concentrations are the same as the results for the Component 1 and 2. The scope of the impact is within the workers' camps; however, the volume is not large, easily to be collected and treated. Hence, the degree of impact is assessed small.

wastewater from construction activities

The wastewater generated from the construction process is mainly from concrete mixing and maintenance. According to calculations, an amount of wastewater is approximately 1.2 m³/day generated in Ngoi Dum bridge construction. This waste water, if not well collected and managed, will affect stream water and soil environment in 2 sides of Ngoi Dum. However, as this waste water mainly contains high suspended solids and alkaline, this impact is rated at moderate.

wastewater containing grease and oil

Wastewater containing grease and oil comes from the maintenance/repair, washing point/stations for vehicles before letting them to main roads. This waste water amount, albeit small, that contain oil and grease, if not collected, will be flowing into Ngoi Dum Stream and affect its water quality and aquatic ecosystems. However, according to the results calculated in accordance with ISO 4513: 1988, the amount of wastewater generated during construction is about 0.48m³/day, so the impact is considered minor and contractors still need to comply with the mitigation measures outlined in ECOP.

Impacts on Natural Habitats and Ecological

Ngoi Dum Stream is a primary tributary of Red River on the right bank. The stream is currently functioning as a drainage for rain water and wastewater in Lao Cai City. The survey results showed that the quality of the stream water flowing through the city of Lao Cai is currently declined due to wastes from human activities. This reduced the biological diversity in aquatic ecosystems.



Figure 4.1. Ngoi Dum stream passing through the bridge is polluted due to direct waste and wastewater discharge from the residential areas

With the scale and design of Ngoi Dum Bridge, the foundation ditches are located on the banks of the streams. However during the construction process, part or all of the flow will be blocked for construction of on bank structures as well as the girder to connect piers.

The blocking of the flow will affect the hydrological regime of the river and also hinders the process of moving and foraging of some aquatic species, particularly vertebrates species of fish or shrimp in stream. The impact magnitude depends on the construction method, if only part of the flow is blocked and the flow is still ensured, this impact is considered negligible as species organisms can still move through. If the entire stream is blocked for construction, the impacts include reduced drainage of the stream (causing the sewage deposited on the upstream bridge) and damaged living habitat for aquatic species and level of impact is assessed as high.

Construction activities of the bridges on Ngoi Dum Stream would cause loss and disturbance of benthic habitats due to construction of the bridge foundations and an increase in suspended solids in the water column due to dredging. Increased water turbidity results in a decrease in light penetration, adversely affecting phytoplankton productivity. The zoobenthos at the bridge foundations will be removed due to dredging, and their habitats will be lost. These impacts in turn will affect food availability for other secondary consumers in the areas such as fish. However, dredging and construction of the bridge foundations will be conducted in temporary steel coffer dams which limit habitat loss and reduce suspended solids in water. This habitat loss and disturbances would be very small compared to the whole natural benthic habitats in the area. The zoobenthos can recolonize in 3 months after the construction phase. There are no rare or protected species listed in the Red Book living in this area. In fact, the section of Ngoi Dum stream passing through the city and this bridge is polluted due to direct discharge of wastes and wastewater from the residential areas. Therefore, the level of impact on the aquatic organisms is low.

Impacts on local roads

As calculated in the section of impacts on air quality, the construction activities under Component 3, number of vehicles transporting dredged materials from the sites to the disposal sites as well as the amount of construction materials are not considerable. However, as most of the transport vehicles are heavy vehicles that will pass through local roads in the area on their way to the construction sites, it is unavoidable that they will affect the local infrastructure. The duration of impact will take place throughout the construction process and concentrate at the construction sites. Overall, the magnitude of impact is assessed as moderate.

By design, total excavated volume is 1,170 m³, of which the material volume can be used for backfilling is 270 m³ and the amount that will be transported to the disposal site is 900m³. It is calculated that during the construction period of 20 months are 13 transporting trips (using 10 ton trucks). Therefore, transportation of materials will increase traffic pressure on the roads, especially on transport routes such as riverside road, as roads, Cau Moi Street, Dinh Bo Linh Street and Provincial Road 157. The extent of this impact is considered small.

b. Site-specific Impacts on Sensitive Receptors

** Impact on groundwater quality*

According to the evaluation, in all the activities of construction, pile drilling activity is likely to cause largest impacts to groundwater quality. These impacts are evaluated as follows:

The impact of the use of additives during Pile Drilling

The construction of the abutment requires deep bore piling through the complex shallow aquifers and has risks of contamination by potentially hazardous additives and drilling liquid spilled into the boreholes. By design, the construction of bored piles uses bentonite to form a protective layer on the surface of the wall of borehole and to prevent drilling mud pollution to the solution, and the deposition of drill cuttings at the bottom of the hole.

Some other characteristics of bentonite include the increase in viscosity and density. It is often mixed with additives when bentonite produced by Vietnam's oil and gas industry is used as a drilling fluid. These are chemicals potentially toxic to the environment, when accumulating in water or soil.

Once going through the shallow water aquifers (12 ÷ 20 m), part of the pile body with bentonite containing additives, will be submerged in the water aquifer complex. Bentonite with potentially toxic additives will seep into this complex and intrude into water vessels carrying pollutants from the pile. It results in subsequent pollution after the time of construction. The longer the bentonite residues in the drill holes, the more polluted the groundwater is.

The risk of groundwater contamination caused by the penetration of the contaminants through the borehole wall

The purpose of using the protective casing is to protect geological layers from collapse upon impact from the construction activities taking place at the top. The diameter of the casing will be 5 -10cm larger than the diameter of drill holes. The length of casing will be about 5-7m deep in the ground. During construction, contaminated surface water will overflow in gaps between the casing and the hole drilled underground. When penetrated, dirt can contaminate the groundwater.

** Subsidence risk in pier construction phase*

As the bridge is crossing the river, the pier construction process without conducting thorough surveys regional geological background or designing process that does not comply with the technical regulations or the construction process, the risk of subsidence and slope collapse can easily occur.

Subsidence or landslides can also incur fatal work accidents as well as bridge structure.

Therefore, thorough geological survey must be conducted at construction site; the experienced and fully equipped contractors should be selected for pier construction process which will be monitored closely to avoid subsidence and landslide mud as well as other safety issues.

** Impacts on sensitive receptors*

The sensitive receptors of impacts during construction of the bridge are the Children Hospital of Lao Cai which is located approximately 100m from the bridge construction site, the residential areas in Ngo Minh Loan and Dao Duy Tu Streets. The health and safety of the people and children may be adversely affected by increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to local communities.

4.1.2.4.3. Impact during Operation Stage

a. Road Safety, Air, Noise

Road safety is likely to be the key impacts during operation of Ngoi Dum Bridge during the first few years when transportation of rural population (bicycles, carts, etc.) are mixed with motor vehicle operations (cars, motorcycles, trucks, etc.) and level of traffic accident would be increased. Experience in the country suggested that this condition can be managed however improving knowledge of local people on road use regulations and practices as well as monitoring and enforcement of driver speed and behavior can help mitigating the impacts.

In a longer term when traffic volume is high, generation of dust, exhausted gases, noise, and vibration could be an additional issue but this could be mitigated through a long term planning.

b. Induced development: There are various social impacts that may occur due to land use changes and/or induced development (increase solid waste, illegal use of right of ways, etc.); however, this is likely to be a long-term issue. During the first few years, these impacts will be minor however improving people knowledge on socio-economic development opportunity and risks related to social issues could help reducing potential negative impacts to local population.

4.2. Social impact assessment

Lao Cai is a junction of many domestic and international trade and tourism routes in the North-West region. Three routine tourism routes are Hanoi - Lao Cai - Sapa, Hanoi - Lao Cai - Bac Ha, and Hanoi - Lao Cai - Kunming (China). Along with the city development, the number of tourists is increasing over the years. The need for public service and facility therefore increases. Investment in public sanitation system and road upgrading in the area will meet both tourists' and local community's demands and improve city landscape and service quality.

Together with traffic network of the city invested in recent years, the construction of roads in Van Hoa and Ngoi Dum bridge will complete the traffic system in the area, facilitate economic development for everyone, and meet the people's needs for public services, life comforts and/or cultural events. Roads in Van Hoa and Ngoi Dum bridge is also in accordance with master development plan of the Lao Cai City, completing the city.

Ngoi Dum bridge construction and upgrading of urban roads of Lao Cai city in wards: Duyen Hai, Kim Tan, Bac Cuong, Nam Cuong, Coc Leu, Pho Moi, Binh Minh, Bac Lenh, Pom Han, Lao Cai Wards made by the subproject will improve the quality of traffic in the city as well as enhance the economic development of the city.

4.2.1 The positive impacts on the subproject area

MCDP Subproject is to provide sustainable water environment for long-term socio-economic growth of Lao Cai province. Specifically, the subproject will focus on improving the quality of traffic and ensure the ability of rainwater and domestic wastewater drainage in different areas of the city and gradually to prevent the deterioration of environment for examples through the Central lake of Lao Cai city dredging and to satisfy the expansion of the city to the suburbs through the upgrading of social infrastructure in Van Hoa commune.

According to the overall urban planning of Lao Cai province by 2030 and vision to 2050, aims to creates sustainable prosperity based on building a developed economy of city together with improved social life, protected environment meeting standards of urban area Grade 1 and serving as an important role in the key economic zone in the Northern region and of the whole country.

Therefore, the basic and key social objective of the subproject is to protect existing ecological environment, support environment sanitation of residential areas along Red rivers, dredging lakes to increase the storage capacity and form chains of modern and civilized urban ecology areas with sustainable ecological systems in city; This will be a premise for Lao Cai to become a new urban area associated with tourism services, improved environmental and social living environments in all aspects.

Short-term objectives of the Subproject

- Upgrade basic infrastructure and improve services, improve living conditions for low-income residents in the subproject's area. Construction and upgrading of technical infrastructure of Van Hoa residential areas: upgrading of internal roads, construction of water supply systems, sewerage, electricity supply for residential areas.
- Improving environmental sanitation, improving the regulation lake in center of Lao Cai city (Central lake of Lao Cai city);
- Upgrade and renovate the water drainage routes, upgrade surface of urban remaining roads of Lao Cai city in wards: Duyen Hai, Kim Tan, Bac Cuong, Nam Cuong, Coc Leu, Pho Moi, Binh Minh, Bac Lenh, Pom Han, Lao Cai Wards in order to increase the service capability, ensuring environmental conditions.;
- The investment items of subproject positively contributed to the works of raising the people's living conditions, reducing poverty, gradually develop essential infrastructure for urban areas. The subproject create premise and motivation to concretize the policies of Lao

Cai province and city in planning and urban development, improving people's living conditions.

4.2.2. Identification of potential negative impacts

Component 1: Tertiary Infrastructure Upgrading and Services Improvements - Renovate and invest on infrastructure in Van Hoa (roads, water supply, electric supply, water drainage)

Infrastructure construction in Van Hoa commune will cause the impact of land acquisition in the commune. The total land area acquired by the subproject is about 9.5ha (94,781.6m²), including: 72,894.5m² agricultural land (including paddy land, crop land, forest land and garden land), 7,992.7 m² residential land and 13,894.4m² other types of land (including public land, reclamation land, lakes and ponds) of 117 households with 454 persons directly affected by the subproject. In the 18 ethnic minority affected households including: Giay ethnic groups, Dao, Tay, Nung and Muong ethnic groups, there are 03 ethnic minority households lost 100% of residential land and 06 households lost some residential land. 9 remaining households affected only on agricultural land.

Adverse Impacts on Involuntary Resettlement

In the subproject preparation stage, a close collaboration with ODA Lao Cai PMU and the Consultant with the local authorities concerned at the ward / commune, the technical consultant to consider the choices of building design. Each option has tried to minimize the impact of resettlement especially those who are vulnerable.

Table 4.21. Estimated Subproject Affected Households

Level of impacts	Area (m²)	Quantity
1. Impacts by permanent land acquisition	94,781.6	
- Impacts by residential land acquisition	7,992.7	
- Impacts by agricultural land acquisition	72,894.5	
- Other land	13,894.4	
2. Impacts on assets on land		
- Housing	5,200	
- Other works (auxiliary buildings, sheds, water tanks, wells, etc)	2,600	
- Perennial trees		5,450
- Crops/Vegetable	7,283.4	
- Fishery	3,226.5	
- Rice	30,801.2	
- Grave		5

Based on preliminary research, there are 117 households with 454 directly affected by the project. Within the project area, there are 25 households who will lose over 50% of their residential land, among them 09 HHs will lose almost 100% of the residential land; all these HHs' remaining land is not enough to rebuild houses so relocation is required. Besides, there are 4 households whose residential land will be affected from 20% to less than 50% and 32 households whose residential land will be affected at less than 20%; all these HH's remaining land is enough to rebuild houses so relocation is not required. There are 18 HHs of ethnic minorities who are affected by acquisition of residential and/or agricultural land. For ethnic minorities households, an EMDP has been produced in a separated report and will be implemented with the RP. Table 4.22 show details of the PAPs.

Table 4.22. Impacts to household

The level of impacts by permanent land acquisition	Household	Affected person
- Impacts by residential land acquisition	117	454
- Impacts by agricultural land acquisition	59	316
- Impact due to the acquisition of 20% or more of agricultural land	117	470
- Impact to vulnerable households lost more than 10% of land	26	61
- Impacts to tree and vegetable	117	454
- Affected HH to be resettled	25	75
- Impact to houses and architectural works	61	138
- Impact to business	09	20

Impacts on Non-land Assets (Local livelihood and Quality of Life)

Apart from land acquisition, the project interventions will have some impacts, both positive impacts (e.g. reduction of pollution; improvement of urban landscape and aesthetic impacts) and adverse impacts (e.g. 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 during construction phase.

Incoming labor and local social concerns

It is estimated that the subproject would mobilize about 420 workers, many of whom would be hired locally in the subproject local communities. Therefore, worker camps would be required for only about 300 workers, contractors, and engineers at the different construction sites. It is expected that the biggest worker camps would be for about 50 workers during peak construction periods. Due to limited construction activities and areas, worker camps may not be required for construction of the storm water pump station, stormwater and wastewater sewers, tertiary sewer lines. The main potential social problems associated with worker camps could be: (i) potential impact of spreading infectious disease from employees to local communities and vice versa; (ii) potential impact of prostitution, drugs and gambling; (iii) potential conflict between workers and local communities because of differences of culture, behavior; and iv) sexual abuse and assault of girls due to influx of workers employed by the construction company in the area. However, with the shortage of labor for the construction, local workers in the city will have the opportunity to participate in the construction. Therefore, the impact is assessed as moderate.

Gender related issues

Gender gaps often happen in the water and sanitation sectors. Although in the city most of the households have access to tap water, in suburban Van Hoa commune, a small number of households have access to tap water (about 12% only) while most of them are using traditional wells and other sources of water, so women and girls are typically responsible for obtaining and treating water (SDC). The water component is likely to bring greater benefits to women. The same can be said about sanitation. Improved access to sanitation leads to better health and less illness. This would reduce work burden for women to take care of sick family members.

The survey results showed that 56.5% of respondents stated that women is responsible to manage money in the HH and 79.7% of respondents stated that women are responsible for daily household tasks. Some family issues are decided by both male and female. 70.2% of households stated that both wife and husband jointly decide on buying vehicles or houses. 72.4% of spouse decide on borrowing bank's loan or investment, business. 73% of spouses decide on studying and occupation of their children. The participation in community activities and local organizations show that there is gender difference. Male often participates in both activities more than female. 54% of respondents stated that males play main role in community activities while the proportion of

females is 21.6%. Similarly, the proportion of males participating in local organizations is 54.7% and the proportion of females is 23.4%.

For ethnic minority households, the interviews found that important issues within families are discussed and consensus in solution is achieved. At EM households, men often work outdoor such as farmers or seasonal hired workers, etc. Meanwhile, women tend to stay home to do other job such as weaving, embroiding, or raising animals. If EM women work as hired persons, they would choose the farming job which do not require working far from home. Basically, there is reasonable assignment of work to generate incomes within the EM households. EM children, mael or female, enjoy relatively good care. There is no sign of violence or discrimination on EM women and children.

Meaningful consultation with both of men and women during project preparation and implementation would ensure the project design and implementation be more successful. In addition, it is necessary to ensure that women and female-headed households have equal access to project benefits. So the project will have some results indicators with sex-disaggregated data to ensure both man and women are benefited from the project.

4.3. Induced Impact

The existing land use along the 9 road alignments under Component 1 residential, agricultural, and garden land. When these new roads are built and operated, land use along the total road alignments of 6.1km will be changed in the tendency that residential houses will be built along the road alignments. As the result, agricultural land will be changed to urban residential area. In the future, the area along the road alignments will be change to urban residential area in accordance with the city's Masterplan. The existing houses that are closest to the alignments will remained to be several rows back from the new road after new houses are built on existing agricultural land along the alignments thus land price of these existing residential houses are not expected to increase abruptly. Therefore, the potential induced impacts would be under control. Therefore, there are no foreseeable induced adverse potential environmental impacts that could happen in the areas along the roads after it is built.

CHAPTER 5. PROPOSED MITIGATION MEASURES

Several strategies (avoidance, minimization, rectification, and/or compensation) have been applied to mitigate the potential negative impacts identified in Chapter 4. During the preparation of the subproject, effort has been made to avoid potential adverse impacts on resettlement and land acquisition by reducing scope and/or modification of the basic design of the subproject investment. In developing the mitigation measures, the strategies to minimize and/or rectify the impacts have been applied and where appropriate compensation has been incorporated. The proposed mitigation measures to reduce the impacts due to land acquisition and resettlement are described in the subproject RP.

This chapter identifies the mitigation measures for addressing the key subproject impacts during pre-construction, construction (which include site clearance, ground leveling, construction, and site closure), and operation phases. Given that most of the key impacts will occur due to civil works and transportation of construction/waste materials, many of the potential negative impacts on physical, biological, and social environment could be mitigated through a set of general measures that are typically applied to most of construction projects to minimize impacts such as noise, dust, water, waste, etc.

As part of the Environmental and Social Management Plan (ESMP) for the subproject these general measures will be translated into a standard environmental specification to be included (as an annex) to the construction contract, namely the Environmental Codes of Practice (ECOPs) (Annex 5), and it will be applied to mitigate typical impacts of the civil works. Section 5.1.2 briefly explains the scope and content of the ECOPs (see Chapter 6).

However, for Lao Cai MCDP-AF subproject there are also site-specific impacts that require site-specific measures both during construction and operation stages. Section 5.2 discusses site-specific measures during construction for the subcomponents that require mitigation measures beyond those identified in the ECOPs. Section 5.3 describes site-specific measures to mitigate impacts of the key subcomponents during operation phase. These measures are incorporated into the ESMP of the subproject (Chapter 6).

During the preparation of the subproject, lessons from the original MCDP subproject have been taken into account to minimize the potential adverse impacts on resettlement and land acquisition by working closely with local government planners and making use of resettlement sites under development by Lao Cai City.

5.1. MITIGATION MEASURES FOR ENVIRONMENTAL IMPACTS

5.1.1. Mitigation measures during the Pre-Construction Phase

Without land acquisition, the major impacts of this phase include resettlement, grave relocation, public infrastructure encroachment, air pollution, generation of waste and waste incurred from the site clearance, the risks posed by UXO, generation of waste oil and the pollution caused by stormwater runoff.

a. Mitigation of UXO risks and impacts from demolition and ground leveling for site plan preparation

The UXO remove activities need to complete before starting construction activities, the several steps should follow during UXO remove:

- Coordinate with the appropriate agencies, usually the specialized army unit of the province, at the design stage to identify if UXO is a potential threat to works.
- Based on the findings, PMU will sign contact with an authorized agency for doing the detailed survey and removing UXOs.

- Ensure that the civil work activities on the site will be started only after PMU is certified that the subproject areas have already been cleared from UXOs.

b. Mitigation Measures for Relocation of Graves

There are 05 household graves which will need to be relocated at Van Hoa commune for construction of 09 Roads under Component 1 of the subproject. Compensation for the removal of these graves is included in the RP of the subproject and will include the cost for buying of land for re-burial, excavation, relocation, reburial and other related costs which are necessary to satisfy customary religious requirements. Compensation in cash will be paid to each affected family or to the affected groups as a whole as is determined through a process of consultation with the affected community. The level of compensation will be decided in consultation with the affected families/communities. All costs of excavation, relocation and reburial (6,000,000 VND/grave) will be reimbursed in cash. Graves will be exhumed and relocated in culturally sensitive and appropriate ways. During implementation, the Subproject Owner will make early announce to the households whose graves are affected so that they can arrange their embodiment in consistence with the spiritual practices of the people and compensate to the affected household as required in the subproject RP and ESMP.

c. Air pollution, Waste, Noise and vibration

Although these impacts in this phase is small, the mitigation measures during the clearance, transportation of materials and emissions from the operation of the machines would also need to be applied by constructors as instructed in ECOPs. For example:

vehicles transporting materials and waste must comply with the general traffic regulations, canvas covered to prevent dropping materials. Simple measures such as watering 2 times/day, increasing the number of day shifts in order to reduce the density of construction vehicles in the same time etc.

The volume of waste and rubbish arising from the activities emitting create space, demolishing existing buildings must be gathered, collected and transported to the landfill subproject which is approved by local authorities. Representatives of the PMU and construction units must have a memorandum of understanding, and a close cooperation in the process of transporting the waste from the subproject area to the disposal sites.

- Sources of noise and vibrations in the Subproject preparation stage is mainly the operation of construction machines when in motion of clearance space, demolition of existing buildings. Volume motion, demolition are not great, and thus the impacts from this activity is negligible. Measures to mitigate noise and vibration in the ground preparation phase will be implemented as follows:
 - Use equipment with lower noise levels (in operation of emition create space, demolition, displacement power poles).
 - Do not dismantled at night, from 22h-6 am the following day.

5.1.2 Mitigation measures of generic impacts during the construction phase

ECOPs describe typical requirements to be undertaken by contractor and supervised by the construction supervision engineer during construction. They have been designed for this subproject to be applicable to the range of small to medium sized urban works to be financed. The ECOPs will be included as an annex in the bidding and contract documents (BD/CD) during detailed design stage. Scope and content of the ECOPs is as follows:

Scope: Construction activities for small works governed by these ECOPs are those whose impacts are of limited extent, temporary and reversible, and readily managed with good construction practices.

The measures identify typical mitigation measures for the following aspects:

- ✓ Dust generation
- ✓ Air pollution
- ✓ Impacts from noise and vibration
- ✓ Water pollution
- ✓ Drainage and sedimentation control
- ✓ Management of stockpiles, quarries, and borrow pits
- ✓ Solid waste
- ✓ Management of dredged materials
- ✓ Disruption of vegetative covers and ecological resources
- ✓ Traffic management
- ✓ Interruption of utility services
- ✓ Restoration of affected areas
- ✓ Worker and public safety
- ✓ Communication with local communities
- ✓ Chance findings

a. Mitigation of Impacts from Dust, Emission, Noise, Vibration, and Offensive Odors

During construction, there will be a number of noise sources due to operations of many types of machines and engines could be higher than standard, the following measures are proposed to control Dust, Emission, Noise, Vibration from construction activities:

- Maintain the level of emission at construction sites within the permissible limit provided for in QCVN 05: 2013/BTNMT: National Technical Regulation on Ambient Air Quality;
- Only use transportation vehicles with valid registry;
- Neatly gather construction materials and wastes. Arrange for the workers to collect and gather construction materials and wastes to the designated places at the end of each day or shift;
- Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25oC, or in windy weather. Avoid overwatering as this may make the surrounding muddy;
- Do not overload the materials/soils and stones to extreme heights onto trucks, as this may result in drops along transportation routes. Tightly cover the trucks carrying wastes and bulk materials before getting out of construction sites or quarries and borrow pits so as to restrict scattering along transportation routes;
- Put temporarily gathered materials and waste heaps with a volume of about 20m³ within barriers or covered so as to avoid dust dispersion;
- Transport wastes out of construction sites to the designated locations for reuse or to the disposal sites in the soonest possible time;
- Burning waste will be prohibited at the construction sites;
- Do not put vehicles and machines to run idle in more than 5 minutes;
- Avoid preparation of construction materials such as mixing concrete near local people's houses or other sensitive works like pagodas, school gates, or offices;
- Locate vehicle washing stations at the exit/entrance of big construction sites such as the

areas for Central lake, Ngoi Dum Bridge, and the 9 roads in Van Hoa commune;

- Periodically wash the trucks used for transporting materials and construction wastes;
- Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas. Night construction must be informed to the community at least 2 days in advance;
- Perform the method of successive construction for each sewer section in construction sites of long sewer lines;
- Observe and secure construction progress correctly;
- Set up 2.5m-high fences of corrugated iron around the construction sites such as the areas for the Ngoi Dum bridge, Central lake.

b. Domestic waste

The number of workers in the construction phase is not too much, so the amount of domestic waste is insignificant, approximately 75 kg/working day. Domestic waste generated on the site shall be managed as the following steps: i) provide dustbins at work site; ii) waste category for reuse; iii) domestic waste and garbage from worker camps need to be collected by hygienic manner through service provision of local companies.

- Garbage bins: need to meet the requirement of Ministry of Construction QCVN 07:2010/BXD as detail: i) volume of garbage bin will be 100 liters and no exceed 1m³; ii) garbage bin with coverage; iii) location of garbage bins will be every 100 meters; iv) waste standing on garbage bin will not allow to over 24h; v) daily clean the bins is required.
- Provide dustbins and mobile septic tanks at work site, which is estimated that about 4-6 dustbins will be provided for each construction sites. The temporary areas, if any, will provide the mobility dustbins.
- Disposal of solid wastes into canals, stream, other watercourses, agricultural field and public areas is prohibited

c. Construction-generated solid waste

Construction waste will be temporary storage on the site before transporting to waste disposal, the contractors must ensure the following i) must keep the safety distance of 250m from any canals, water bodies; ii) must keep the safety distance (200 m) from any sensitive residential areas; iii) located within the RoW of the subproject; iv) covering storage areas during rainy times and v) temporary storage on the sites will be no longer than 48 hours.

- Construction wastes will be disposed at area where are approved by Lao Cai PPC for handling such waste.
- According to PPMU, Tong Mon landfill to be constructed has enough land for disposal of material of Lao Cai subproject.
- Waste transport vehicle also need to comply with mitigation measures for transport vehicles stated in Item of Dust and exhaust generation.

d. Hazardous waste

They are included boxes, cans contain asphalt, petrol, fuels, paints etc. These types of waste need to be collected transported and treated by a company, which has a work permit to treat hazardous waste according to MONRE's Circular No. 36/2015/TT-BTNMT dated 30 June 2015, the detail requires as bellowing:

- Storage of hazardous substances must in the places, which are facilitated with: i) roof; ii) concrete ground and water resistant; iii) edge around the storage areas; iv) away from water

bodies and high fire risk areas;

- Weekly records on volume of generated hazardous substances;
- Sign contact with company which has a work permit to treat hazardous waste according to MONRE's Circular No. 36/20115/TT-BTNMT dated 30 June 2015 for transport and treatment.

e. Waste water from work camps, drainage from equipment and truck maintenance and construction site

- Undertake excavation and ground leveling where possible during dry season, to reduce the run off water from the construction site which lead to increase content of SS and pollutants in surrounding water bodies;
- Water run off in the construction site need to flow to manholes to deposit sediment before discharging into environment;
- Provision of gird to prevent the solid waste from entering into water flow;
- Construction sites shall be designed to ensure that surface run-off from the construction site does not flow directly into surrounding water bodies;
- All equipment shall be kept in good working order and serviced regularly. Leaking equipment shall be removed immediately from site and repaired;
- Provide the facilities in the site including latrines, holding areas, garbage bins. Waste from latrines will be collected and treated properly through an economic contract with local environmental companies;
- Covering material storage areas should be implemented during rainy times, Temporary storage of construction waste on the sites will be no longer than 24 hours and it must be covered;
- Washing instruments/vehicles next to the water bodies is forbidden to avoid leaching of waste, sludge, soil, oil contaminated water.

f. Ecological and Natural Habitats

- The devegetation and ground leveling is carried out only within the project site; the contractor is prohibited to over-clear the plants outside, especially in the areas of production forest.
- At least 30 days prior to construction, the contractor must notify construction schedule to the local people who are farming and having aquaculture activities to salvage on their reclaimed land.
- When undertaking construction on the roads passing through the hills, or water bodies, contractors must take measures to prevent the risk of landslides to minimize impacts on surrounding ecosystem.
- During construction, the contractor must strictly prevent the backfill materials and construction materials from being washed into the aquatic environment and damaging organisms .
- The contractor is strictly forbidden from gathering materials and construction equipment in the agricultural areas or near water bodies such as lakes, ponds etc.
- Oil and hazardous waste should be strictly controlled. Contractors and workers are not allow to release grease and oil into surrounding environment.

5.1.3. Measures to mitigate site-specific impacts under component 1-Basic infrastructure

upgrading and service improvement

a. Construction Phase

Traffic safety risks

The estimated total number of 10-ton vehicles will be mobilized for transporting excavated soil and solid waste are about 86 turns per day. Excavated soil disposal will be transported to Tong Mon disposal site (6 km from the Lao Cai city); part of the excavated soil, 354,000 m³ will be used for backfilling.

The Traffic Management Plan shall include, but not limited to these following measures:

- Coordinate with the local authority to inform local people on the construction plan prior to construction;
- Contractor should provide lighting at construction site at night; a security guard staff at construction sites to moderate vehicle go out and in the construction site;
- Place speed limits signs at a distance of 100m from the construction site. Place additional signs if construction site is within 20 m from the gate of any schools, markets, hospitals, narrow roads, etc., arrange worker to guide the traffic in rush hours;
- Collect and tidy up the waste and wastewater containing cement at the sedimentation traps, ditches regularly to limit the amount of solids entering receptors;
- Use water-tight tank trucks for transporting wet/dam materials;
- Cover the materials tightly before leaving the construction site;
- Do no overload material on the trucks.

Measures to mitigate Risks of soil erosion and landslides due to construction of N9 road

As the 9 roads are crossing foothills and tophill, risks of soil erosion and landslides are significant if proper construction plans and measures are not implemented. When the excavation, filling and road construction disturb the soil balance or even destroy the soil structure and local geography, high rainwater will flow down from the high mountains, cut across the road, leading to high risks of landslides and soil erosion. Materials will be swept down to foothills and flowed to Red River, increasing the river contamination.

Therefore, several mitigation measures should be undertaken:

- Anti-erosion and slope protection measures should be incorporated in contractor bidding documents and construction plans, especially for N9 road.
- Develop appropriate construction plans to avoid rainy season.
- In a long duration of construction (24 months), the contractor should prepare a flood protection and risk management plan before rainy season.

Measures to mitigate Physical Cultural Resources

Construction of N10 road would have the potential impacts on the Van Hoa Temple which is located 150m to the construction site. The following mitigation measures would be required:

- Inform the temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction.
- Prohibit gathering of construction materials within 100m in front of the temple.
- Construction activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management.

- Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as temple.
- Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the temple.
- Clean the construction area after each working.
- Set up construction and traffic warning signs at the construction site.
- Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes.
- Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session.
- Cover the incomplete trenches under construction at end of the working day.
- Provide night lighting system with luminously painted fence and night lamp.
- Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible.
- Immediately address any issue/problem caused by the construction activities and raised by the temple.

5.1.2.2. Operation phase

a. Operations of roads

After construction is completed, there will be operations of various vehicles on the new road. Key short term impacts would include an increase in traffic and pedestrian accidents, due to higher standard road allowing more and faster traffic; premature failure of pavements, drainage structures due to inadequate maintenance.

Other impacts would be possibly localized flooding related soil erosion and landslide.

To mitigate these impacts the following measures will be carried out by the city road maintenance agency:

- Ensure that traffic safety provisions, including signs, lights, and pavement markings, that were installed during construction are permanently and effectively maintained, and renewed as necessary.
- Ensure the city's operations and maintenance plan, and related budget, includes the work and resources required to maintain the road in its as-completed condition.
- Ensure, with the assistance of the traffic control authority, that overloaded vehicles do not use the road.
- Ensure effective road inspection for any signs of damages, soil erosion and landslide for immediate repairing actions.

b. Impacts during operation Stormwater drainage, Wastewater collection system and Water supply system and O2 Pumping station

Operations of stormwater drainage and wastewater collection systems under subproject would have impacts on the areas: (i) by the operation of the pumping stations (noise, vibration); (ii) the probability of flooding due to congestion of drainage sewer section; (iii) affected by odors from sludge which is dredged periodically; (iv) impacts from disposal of dredged septage; (v) impacts on the aquatic environment due to temporary receiving wastewater discharged from untreated sewer section (this ends when wastewater treatment plants commence stable operations). Mitigation measures are as follows):

➤ *Minimize the pollution caused by the operation of the pumping stations:*

The pumping stations with the large capacity often cause vibration and noise at high levels. Pump sets would be placed in a separate room. The pumps would be installed with equipment to prevent vibration and noise. Specifically:

- *Technical measures when installing:* (i) Construct proper machine room for pump sets; (ii) Foundation to put the machine would be built with high-quality concrete; (iii) Install anti-vibration buffer made from rubber; (iv) Install silencers equipment.
- *Management and maintenance measures:* (i) The pumps would be examined the balance and adjusted if necessary; (ii) Periodic maintenance and lubrication to minimize noise.
- *Measures to minimize environmental pollution caused by fuel leakage during the operation of pumping stations:* (i) Do not store fuel at the pumping stations to minimize the possibility of fuel leakage to the receiving source; (ii) Feeding the fuel into the pumps would be done in careful manner to avoid fuel spillage; (iii) Lubricant, greasy rags from maintenance and operations of the pumps must be entirely collected and transported to appropriate treatment areas.

➤ *Minimize pollution due to congestion of drainage sewers:* (i) The management of stormwater drainage and wastewater collection systems should be focused and examined regularly to detect the congested drainage sewer sections and carry out dredging; (ii) Conduct periodic planning decentralization and dredging sewer sections and manholes in order to minimize the flow congestion (every 6 months).

➤ *Control disposal of sludge:* Similar to the construction phase, those who manage the water drainage systems would have contracts with relevant authorities of sludge dredging from the sewer sections and manholes and then transport to the landfill by specialized tank trucks to avoid odor emission and spillage during transportation.

5.1.4. Measures to mitigate site-specific impacts under Component 2

5.1.4.1. Construction Phase

Measures for Impacts on ecological and habitat

To minimize the impact on the central lake ecosystem during dredging and renovation, some mitigation measures to be implemented include:

- The dredging is conducted only during the dry season;
- Prior to the dredging, inform those people who are farming fish in the lake for harvesting;
- Strict implement construction measures for dredging as designed. In particular the area of 5.4ha, the dredging will be carried out on a successive basis by dividing the area of the lake to be dredged into 4 cells which are dredged one after one. Before dredging Larsen piles for embankment of the cell are installed and water is pumped out, then proceed to dredge to the design depth (+80.80). After complete dredging for the first cell, continue to conduct dredging next cell. With this approach, the ecosystem of the lake will be maintained and not altered dramatically (by maintaining the water level in the lake at a depth of 2.5 - 3.0 m) and the impact on the landscape and environment around will be minimized.
- Prior to the dredging and construction contractors should carry out embankments around the lake and the islet to limit the erosion in the process of dredging that would affect the lake ecosystem.
- It is strictly forbidden for contractors to gather equipment around the lake as well as carry out repairs of machinery and equipment within Nhac Son Park.
- Strict management of generated waste, especially grease and greasy rag that must be

collected immediately to prevent leakage into the surrounding environment;

- Workers are strictly prohibited to discharge wastes into the environment, particularly into the lake
- Limiting the concentration of multiple devices at the same time in the lake to minimize the impact of noise, vibration, dust and emissions to species at site

Impact on recreational activities operation of the public service works in Nhac Son Park and surrounding area

To minimize the impacts on day daily activities, i.e leisure and sporting, of the local people in the park, the following measures should be followed throughout the construction process:

- With successive and partial dredging method, fence the dredging area and along the transporting route for dredged material from the lake to the site exit gate (aluminum sheet fence) with a minimum height of 2 m is to limit people from entering the area of dredging.
- To install warning signs in the area of dredging.
- No parking of construction equipment and vehicles inside the park area.
- All vehicles for construction and transportation of materials must be washed before going out of the site.
- Regularly wash transport routes for dredged material from the site.
- The dredged material, before removed from the construction site, must be dry to prevent leaking / scattering along the transport route.
- The dredged materials, prior to removal out of the construction site, must be dry to prevent leakage/scattering along the transportation route.
- Restrict the simultaneous operation of vehicles of construction at site to minimise impact of noise, dust and emissions.
- The transporting vehicles should work within its load and be well covered before departing from the site to avoid the spread of dust as well as damage to surrounding infrastructure.

Lakeshore erosion risks during construction

- Prior to dredging, the construction contractor should undertake embankment around the lake and the isle to prevent erosion during dredging
- No parking of construction and transporting vehicles near lakeshore.
- Restrict the use of large dredging equipment in dredging lakeshore as well as around the isle, especially at the bridge connecting the shore to the isle.
- Once the dredging is completed check and repair any damage to the lake shore caused by construction activities.

Odor impact and gas emissions arising from the dredged material:

The lake sediments are characterized by organic matter content, which is sent for a long time in the water. So in anaerobic conditions, the decomposition of organic matter will generate odors and toxic gases such as CH₄, H₂S. The dredged bottom sediments will allow the gas is released into the atmosphere and contribute to increased greenhouse gas emissions, and especially create nuisance odors for those around them. If detected bad odor should be eliminated with spraying bio products to the dredged material.

Traffic safety risks: Mitigation measures are required to ensure traffic safety and limit damage to the roads and, clean environment on the streets and surrounding environment along transport

routes for dredged material, including Inner city streets - Pho Moi Bridge - Dinh Bo Linh Street- District road 157, Hoang Lien Street:

- Clean up the transport vehicles before leaving construction site. Do not load to a height of 10cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users.
- Do not park vehicles in the roads longer than necessary. Do not allow construction vehicles and materials to encroach upon the pavements.
- Maintain the required speed limit and do not overuse horn.
- Periodically registry and supervise the quality of transport vehicles as required by the government regulations.
- Comply with the traffic safety regulations while participating traffic
- Clean up wastes dropped off on road
- Assign staff to guide the traffic during transportation, unloading, and loading of construction materials, equipment, and wastes.
- Place stockpile materials at a designated place tidily and successively according to construction schedule.
- Spray water three times per day to reduce dust during dry days if required.
- Reinstall the road surface if occurring the damages during construction

Measures to mitigate impacts on sensitive receptors under Component 2

The construction process of Component 2 will be likely to affect part of these works’ activities, including the safety and inconvenience of access that residents when they want to visit these places; smoke and dust may become a nuisance to esidents and cultural and religious works that can be affected by the subproject operations are listed in the table 5.1.

Table 5.1: Measures to mitigate impacts on sensitive receptors under Component 2

Road	Issues/Impacts	Mitigation measures
 <p data-bbox="201 1554 520 1621"><i>Lao Cai Children’s Palace</i> Children’s playground</p> <p data-bbox="201 1653 520 1720">Located in Nhap Son Park, 30m from the Central lake</p>	<p data-bbox="593 1312 861 1608">Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to the children and local people.</p>	<ul style="list-style-type: none"> - Inform the Lao Cai Children’s Palace Children’s playground of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Accelerate the progress in order to reduce construction time, and schedule construction to avoid activities during weekends and holidays. - Clean up the transport vehicles before leaving construction site. Do not load to a height of 10cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users. - Do not park vehicles within 200m from the Children’ Place and playground. Do not allow construction vehicles and

Road	Issues/Impacts	Mitigation measures
		<p>materials to encroach upon these places.</p> <ul style="list-style-type: none"> - Maintain the required speed limit and do not overuse horn, and comply with the traffic safety regulations while participating in the traffic. - Clean up wastes dropped off on road. - Clean the construction area after each working. - Assign staff to guide the traffic during transportation, unloading, and loading of construction materials, equipment, and wastes. - Place stockpile materials at a designated place tidily and at least 500m from the palace and playground. - Spray water three times per day to reduce dust during dry days if required.
<p>Lao Cai Library</p> <p>Located in Nhap Son Park, 15m from the Central lake</p>	<p>Increased exhaust gases, dust, noise, vibration, construction wastes, and traffic safety</p>	<ul style="list-style-type: none"> - Inform the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Accelerate the progress in order to reduce construction time. Construction activities should not be excuted after 5:00pm. - Do not park vehicles within 100m from the library. Do not allow construction vehicles and materials to encroach upon this place. - Maintain the required speed limit and do not overuse horn, and comply with the traffic safety regulations while participating in the traffic - Place stockpile materials at a designated place tidily and at least 500m from the library. - Spray water three times per day to reduce dust during dry days if required. - Clean the construction area after each working.
<p>Royal Restaurant</p>	<p>Increased exhaust gases, dust, noise, vibration,</p>	<ul style="list-style-type: none"> - Inform the restaurants of the construction activities and their potential

Road	Issues/Impacts	Mitigation measures
 <p>ASEAN Restaurant</p>  <p>Viet Plaza Restaurant 3 other restaurants in the park Located in Nhac Son Park, 0-50m from the Central lake</p>	<p>construction wastes, and the risks of traffic and construction accidents to customers to eat at the restaurants</p>	<p>impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction.</p> <ul style="list-style-type: none"> - Accelerate the progress in order to reduce construction time. Construction activities should not be excuted after 5:00pm. - Place stockpile materials at a designated place tidily and at least 500m from the restaurants. - Do not park vehicles within 100m from the restaurants. Do not allow construction vehicles and materials to encroach upon this place. - Always ensure clear, easy, and convenient access to the restaurants. - Spray water three times per day to reduce dust during dry days if required. - Clean the construction area after each working.
 <p>Civil Servant Training School Kim Tan Secondary School</p>	<p>Increased exhaust gases, dust, noise, vibration</p>	<ul style="list-style-type: none"> - Inform the school management, Office of Department and 60 households living on 4 surrounding streets of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering.
 <p>Office of Department of Internal Affairs and more than 60 households living on 4 surrounding streets</p>	<p>Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to local communities</p>	<ul style="list-style-type: none"> - Prohibit use of construction methods that cause noise during school learning hours. - Sprey sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Immediately address any

Road	Issues/Impacts	Mitigation measures
<p data-bbox="279 571 486 604">Thuong Temple</p>  <p data-bbox="279 862 486 896">Tan Bao Pagoda</p>  <p data-bbox="295 1164 470 1198">Mau Temple</p>  <p data-bbox="279 1478 486 1512">Coc Leu Church</p> 	<p data-bbox="598 280 858 414">Construction of the road will exert negative impacts on the temple due to:</p> <p data-bbox="598 436 858 728">Increased dust, exhaust gases, noise, vibration, construction wastes, hazardous waste, domestic wastes, and wastewater due to construction activities;</p> <p data-bbox="598 750 858 840">Clogging of local drainage canal leading to localized flooding;</p> <p data-bbox="598 862 858 952">Potential safety risks to the temple goes during construction;</p> <p data-bbox="598 974 858 1142">Increased traffic congestion and risks of traffic accidents due to construction and transportation;</p> <p data-bbox="598 1164 858 1288">Interference with religious events at the temple due to construction activities</p>	<p data-bbox="890 190 1428 257">issue/problem caused by the construction activities and raised by the schools.</p> <ul style="list-style-type: none"> <li data-bbox="890 302 1428 470">- Inform the temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. <li data-bbox="890 504 1428 593">- Prohibit gathering of construction materials within 100m in front of the temple. <li data-bbox="890 627 1428 761">- Construction activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. <li data-bbox="890 795 1428 929">- Environmental training for the workers includes codes of conducts when working in pubic areas and sensitive receptors such as temple. <li data-bbox="890 952 1428 1052">- Sprey sufficient water to suppress dust during dry and windy days at least three times a day at the area of the temple. <li data-bbox="890 1075 1428 1142">- Clean the construction area after each working. <li data-bbox="890 1164 1428 1232">- Sett up construction and traffic warning signs at the construction site. <li data-bbox="890 1254 1428 1388">- Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. <li data-bbox="890 1422 1428 1556">- Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. <li data-bbox="890 1579 1428 1680">- Cover the incomplete trenches under construction at end of the working day. <li data-bbox="890 1702 1428 1769">- Provide night lighting system with luminously painted fence and night lamp. <li data-bbox="890 1792 1428 1926">- Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. <li data-bbox="890 1960 1428 2049">- Immediately address any issue/problem caused by the construction activities and raised by the temple.

4.1.2.2.3 Component 2 - Impact mitigation measures during Operation Stage

For the Central Lake

The operation may cause some negative impacts on the environment. However, these impacts are considered minor, localized, and can be controlled if fully applying mitigation measures. The negative impacts are mainly related to the sedimentation in lake over time, impacts on air quality due to accumulation of organic materials in the sediments and damage to the embanked lake slope. It is necessary to develop measures to protect safety of people visiting and playing at the park Central lake and increase their awareness of environmental protection.

- Regularly check and monitor the damage of slope around the lake.
- Check and monitor the deposition of organic materials/soil and sand sediments; if the amount is high, it is necessary to dredge to ensure storage of the lake, at the same time, limit emissions such as CH₄, H₂S,... generated by the decomposition of organic matters in the sediments.
- Install and maintain warning boards about (1) the lake depth and (2) prohibition of swimming in the lake in and around the lake.
- Increase education and communications to increase people's awareness of environmental protection for and around the lake.
- Prohibit throwing domestic waste and other solid waste into the lake.

For the wastewater collection and sewage system

The management of stormwater drainage and wastewater collection systems should be focused and examined regularly to detect the congested drainage sewer sections and carry out dredging.

Conduct periodic planning decentralization and dredging sewer sections and manholes in order to minimize the flow congestion (every 6 months).

Control disposal of sludge: Similar to the construction phase, those who manage the water drainage systems would have contracts with relevant authorities of sludge dredging from the sewer sections and manholes and then transport to the landfill by specialized tank trucks to avoid odor emission and spillage during transportation.

5.1.5. Measures to mitigate site-specific impacts under Component 3

5.1.5.1. Construction Phase

Measures to mitigate for use of additives during Pile Drilling

The use of drilling mud during pile driving is necessary. Water-based drilling mud most commonly consists of bentonite clay (gel) with additives such as barium sulfate (barite), calcium carbonate (chalk) or hematite. Strict control on its use is of great importance to minimize the risk of polluting the surrounding environment and groundwater quality.

- Install or build a container to contain and circulate the drilling mud and recollect them to avoid leakages to the outside environment.
- All additive ridden soil should be collected, transported and treated as hazardous wastes generated during construction.

*** *Subsidence risk construction phase***

- Prior to construction, the contractor should develop an appropriate construction plan minimize impacts on the flow of Ngoi Dum Stream with proper flow diversion measures.
- In the entire construction process, construction activities should be limited during rainy season and accelerated during dry season, especially the embankment and the construction of bridge abutments.

- During or after the rain, ensure that all heavy construction vehicles and machinery such as trucks and cranes are halted and parked away from the stream banks to avoid erosion risks.
- Ensure the constant presence of supervision consultants and contractors during construction to monitor the potential risk of erosion and landslides for prompt, specific and appropriate responses.
- Construction equipment and construction material should be gathered at least 100 meters away from the stream banks to avoid contamination and blockage to the stream as well as increase in sedimentation.

*** Measures to Natural Habitats and Ecological**

- The construction of the bridge and as well as structures at both sides should be only proceeded in the dry season to minimize the possibility of washed material by rainwater into Ngoi Dum Stream flow.
- Strictly prohibit contractors to discharge waste into Ngoi Dum Stream, especially sludge sucked out from bored piles affecting stream water quality and growth and development of aquatic organisms.
- Do not gather construction materials as well as machinery and equipment near the stream (at least 50m away).
- Strictly prevent hazardous waste, waste oils or particularly greasy rags from entering the flow.
- Limit the use of construction vehicles on stream as piling, bored drilling, cranes, as the operation of these vehicles inevitably release grease and cause vibration and noise in the water that affect the growth of aquatic species.
- During construction on the two banks and installation of beam the contractor should use booms around the construction area to limit the spreading of leaked grease and enable the recollection and treatment.
- If flow is blocked for construction, partial blockage is required to ensure flow as well as to not obstruct the movement of aquatic species.

*** Mitigation measures for impacts on sensitive receptors under Component 3**

There are several sensitive receptors around the Ngoi Dum Bridge construction site, as described and assessed in Chapter 4 and the mitigation measures include:

Table 5.2: Measures to mitigate Physical Cultural Resources by Component 3

No.	Road	Issues/Impacts	Mitigation measures
	 <p>Children Hospital of Lao Cai</p> <p>Located 100m from the bridge construction site</p>	<p>Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents when local communities come to Hospital</p>	<ul style="list-style-type: none"> - Inform the hospital of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Accelerate the progress in order to reduce construction time, and schedule construction to avoid activities during weekends. - Clean up the transport vehicles before leaving construction site. Do not load to a height of 10cm higher than the truck

			<p>body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users.</p> <ul style="list-style-type: none"> - Do not park vehicles within 200m from the hospital. Do not allow construction vehicles and materials to encroach upon this place. - Maintain the required speed limit and do not overuse horn, and comply with the traffic safety regulations while participating in the traffic. - Clean up wastes dropped off on road. - Clean the construction area after each working. - Assign staff to guide the traffic during transportation, unloading, and loading of construction materials, equipment, and wastes. - Place stockpile materials at a designated place tidily and at least 500m from the hospital. <p>Spray water three times per day to reduce dust during dry days if required.</p>
	 <p>Residential areas in Ngo Minh Loan and Dao Duy Tu Streets</p> <p>Located 30-50m from the bridge construction site</p>	<p>(i) Increased exhaust gases, dust, noise, vibration, construction wastes</p> <p>ii) Inconveniences to locals' business activities as access to business establishments may be obstructed;</p> <p>iii) Risks of landslides and subsidence damages to existing</p> <p>iv) Safety risks to vehicles and community, especially at night</p>	<ul style="list-style-type: none"> - Inform the residents on the two streets of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Construction site should be properly fenced to ensure safety for the people. Access to the bridge site from local people should also be restricted. - Ensure that vehicles and equipment as well as waste materials and construction materials should be gathered at least 100m from the houses. - The excavated materials and construction waste should be quickly collected and transported to the designated sites for not impacting local human health. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around

			<p>the school and dispose in a designated site.</p> <ul style="list-style-type: none"> - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes.
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5.1.5.2. Operation phase

Tree planting: Tree shall be planted on the road connected to the bridge to avoid the dazzle caused by the headlights of cars/vehicle in the night. Various kinds of planted trees must be green growth in four seasons and the shady must be at least 5m distant per tree. In addition, trees shall be also planted on the sidewalk for purpose of either increasing aesthetic or reducing noise pollution caused by vehicles.

Lighting system: be suitable installed at the construction sites, well- Operated at night to enable warning for traffic & people surrounding.

Road marking paint: traffic lane mark with continuous line, 0.2m width and painted with reflective paint.

5.2. MITIGATION MEASURES FOR SOCIAL IMPACTS

5.2.1 Involuntary Resettlement

Potential adverse social impacts due to acquisition of land and other assets trigger World Bank's OP 4.12. In compliance with the provision of the policy, the subproject require the preparation of RP to address impacts caused by land acquisition. The RP addresses the relocation and livelihood impact of the Subproject on directly impacted communities and households. The Lao Cai PPC and authorized PMU ensured that any involuntary resettlement will be carried out in accordance with the agreed RPF/RPs. To meet the World Bank Policy requirements, payment for all assets (including land, structures, crops, and other assets) at replacement cost. Displaced people's living should be restored to at least the pre-subproject level. In the community meetings, local authorities expressed their appreciation with regards to the World Bank's policy to restore livelihood of the affected people and to assist poor and vulnerable households. The Resettlement Plan includes the special attention to gender and vulnerable group issues in accordance with the WB policy on Involuntary Resettlement. In this respect, the RP addresses the vulnerable group, gender and poverty issues particularly among the directly impacted households.

5.2.2 Ethnic Minority

The SA confirmed that EM communities including Dao, Giay, Tay, Nung, Muong, Hoa, Thai, Sa Pho and Mong are present in the proposed subproject area and could be potentially affected. A process of free, prior informed consultation with affected EM's communities of the Subproject during the subproject design was carried out and will be done during the subproject implementation to ensure there is a broad community support for the subsubproject implementation. EMDP was prepared on the basis of a) social assessment conducted for affected ethnic minority communities, and results of the environmental impact assessment; b) consultation with ethnic minority peoples present in the subproject areas and c) consultation with key subproject stakeholders, including local authorities and villages leaders. The report's objective is to ensure that (i) affected EM peoples receive culturally appropriate social and economic benefits, and (ii) when there are potential adverse effects on EM, the impact are identified, avoided, minimized, mitigated, or compensated for.

5.2.3 Plans prepared for social impact mitigation

A Resettlement Plan (RP) and a Ethnic Minorities Development Plan (EMDP) have been produced

for this subproject in order to minimize impacts caused by land acquisition and other social impacts. The RP, dealing with work items of the Component I of the Subproject will take place within 4 hamlets of Van Hoa Commune, presents the eligibility criteria for compensation of land and assets affected by the subproject, description of the income restoration program, implementation arrangement, implementation plan, estimated cost, monitoring and assessment, participation in consultation of the community and grievance redress mechanism.

The EMDP is also addressing building of urban roads within the construction site of the Component I. This construction directly affects residents living in Van Hoa and preliminary research discovered that there are EM according to characteristics defined in OP 4.10 policy of the WB and in the Vietnamese Government's regulations.

Details of the social assessment, mitigation framework, measures and budget estimates can be found in separate RP and EMDP prepared for the subproject.

5.2.4. Control of social impacts by construction activities

- Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on safety in construction;
- Register the list of workers with the local authorities for temporary residence;
- Inform the community about construction plan at least 2 months before commencement of the construction;
- In case electricity and water supplies are to be disrupted, the PMU must inform PAHs at least 2 weeks in advance;
- Avoid construction operations at night time. Where construction at nighttime is inevitable the community must be informed at least 2 days in advance ;
- Construction should be performed within the shortest possible time, carry out construction in stages to minimize the impacts on local community;
- Construction site should be kept tidy and safe;
- Wooden planks must be placed over the open ditches to provide temporary access to roadside houses and shops;
- Hire local laborers to carry out simple tasks;
- Workers must be instructed on environmental issues, safety and health before construction tasks are assigned;
- Workers are requested to follow a Code of Conduct as follows:
 - Use adequate safety gear provided;
 - Smoke at designated places only. Do not litter construction sites;
 - Storing or use of weapons and toxic substances is prohibited;
 - Do not cut trees outside construction sites or set fire to waste on-site(except invasive plants);
 - Drinking of alcohol during working hours is prohibited;
 - Do not operate construction plant if not authorised to do so;
 - Do not engage in quarrelling, fighting, gambling or social evils such as drug use, prostitution;

Medical checkups for workers are to be periodically performed. People with highly infectious diseases shall not be employed.

5.2.6. Measures to secure safety and health for communities

- 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 Project 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 the open pits, channels to prevent accident;
- Sufficient lighting will be provided when construction is carried out at night;
- Apply speed limits at 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.

5.2.8. Measures for other social impacts

A number of adverse social impacts during construction and operation phases of Lao Cai 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.

Specific measures for these impacts are developed in Chapter 6. Environmental and Social Management Plan below.

CHAPTER 6. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

6.1. BASIC PRINCIPLES

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

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

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

The Lao Cai City Water Supply Company, URENCO, and the Department of Transport will be responsible for implementation of the mitigation measures during operation stage of the subproject and they will ensure that the mitigation measures are implemented and adequate budget is provided. The Provincial Steering Committee (PSC) chaired by the Chairman or Vice Chairman of the Provincial People's Committee (PCP) will provide the overall policy guidance and oversight of the subproject implementation. Roles and responsibility of the specialized agencies and the Departments of Planning and Investment, Natural Resources and Environment (DONRE) will also be critical.

In terms of laying out the mitigation measures of the ESMP, there are two fundamental parts to this ESMP. Firstly, the City has developed and will use Urban Construction Environmental Codes of Practice (ECOPs). These ECOPs cover typical generic low-level impacts that can be expected to occur in a wide range of construction activities of the subproject. They include mitigation measures for these impacts and a process for including them in the construction contracts of contractors. During the detailed design of technical specifications for each contract, the technical design consultant will incorporate into the contract the parts of the ECOPs specific to that contract, as well as the specific measures identified in the ESMP.

Secondly, all site-specific impacts that are either not covered in the general ECOPs or of an order of magnitude that require mitigation measures not covered in the ECOPs, are described in more detail in the ESMP. The mitigation measures are derived from the more detailed analysis of Chapter 5.

Activities to be carried out to mitigate impacts due to land acquisition and resettlement or impacts that relate to ethnic minorities are presented separately (RP, EMDP) and they will be carried out and monitored separately.

Some components of the subproject will finance environmental measures, above and beyond mitigation measures as described in the ESMP. This is the case for Component 4 which will finance the PMUs ESMP program, including safeguard training, and environmental and

resettlement monitoring.

6.2. KEY MITIGATION MEASURES

6.2.1. Urban Construction Environmental Codes of Practice (ECOPs)

The mitigation measures for common negative impacts during the construction phase are presented in Tables 6.1 in the form of Environmental Codes of Practices (ECOP).

ECOP, together with relevant type-specific and site-specific mitigation measures will be included in the construction contract signed between the PMU and the Contractor. In addition, each contractor will be required to prepare Site-specific Environmental Management Plan (SEMP) to cover all measures that the contractor will carry out to address potential impacts and risks associated with the works that they are contracted to implement.

- Impacts on air quality because of dust, exhaust, noise, and vibration
- Wastewater
- Solid waste
- Reduced water quality
- Flooding risks
- Water pollution
- Erosion and Sedimentation
- Traffic Disturbance and Safety Risks
- Impacts on organism, aquatic system
- Impacts on urban landscapes,
- Impacts on Cultural Heritages
- Social Impacts
- Community Health and Safety
- Workers' Health and Safety
- Hazard Risk
- Chance findings

Table 6.1 Mitigation Measures Extracted From Urban Works ECOPs

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
<p>Impacts on air quality because of dust, exhaust, noise, and vibration</p>	<ul style="list-style-type: none"> - Maintain emission level at construction sites below the allowable limits set in QCVN 05: 2013/BTNMT - Only use machines with emission levels meeting TCVN 6438-2005 and with valid registration; - Load and gather materials and waste neatly. Arrange workers to collect and gather construction materials and wastes to designated places at the end of each day or shift; - Where a construction site is near residential houses or public buildings, spray roads with water at least three times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°C, or in windy weather. Avoid over watering as this may make the surrounding muddy; - Cover trucks carrying wastes and bulky materials tightly before leaving construction sites; - Do not overload materials/ soil and stone as they will drop along transportation routes and cause dust and accidents. Trucks carrying wastes and bulky materials must be tightly covered; - Guard or cover loads of materials or waste loads with volume of 20m³ or more to avoid dust dispersion; - Avoid preparation of construction materials, such as concrete mixing, near local peoples' houses or other sensitive structures such as pagodas, schools, medical stations or offices. Transport wastes out of construction sites to designated locations for reuse or to disposal sites as soon as possible; - Avoid temporary on-site loading of dredged materials from canals. If temporary loading is unavoidable, implement pollution control measures such as covering, putting in bags, or isolation. Inform communities in advance so they can be prepared for odour and nuisance problems; - Burning wastes at construction sites is prohibited, except burning invasive plants if found at sites; 	<p>QCVN 05: 2013/BTNMT; TCVN 6438-2005; Decision. 35/2005/QD-BGTVT; QCVN 05:2013/BTNMT; QCVN 26:2010/BTNMT; QCVN 27:2010/BTNMT</p>	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant (CSC)

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - Turn off vehicles and machines if parking longer than two minutes. Wash the vehicles used for transporting materials and construction wastes periodically at designated areas; - Set up areas for vehicle washing at the exit/ entrance of centralised construction sites to prevent the dusts from trucks spreading onto streets. Apply speed limits at 40 km per hour or lower to trucks when running on inner-city roads or through residential areas. Acceleration and horn flaring are prohibited near sensitive areas such as hospitals, schools, sites of religious practice, etc. - Avoid to implement activities that likely generate loud noises and vibration from 6 pm. to 7 am. of the next day if the construction site is near residential areas or health care facilities. If construction at night time is unavoidable, inform communities at least two days in advance; - Place machines generating high level of noise as far as possible from residential areas so noise levels at the receptor areas can be maintained at below 70dBA, i.e. Avoid activities that generate loud noises during sensitive hours, or install mufflers onto devices to reduce noise. Inspect, maintain and clean construction plants periodically; - Schedule transportation plans how to avoid a large number of machines and equipment being at the same time and at the same site; - Apply successive construction method to construct routes with relative long alignments such as canals, secondary drains/ sewers, and tertiary sewers; - Install and maintain 2.5-metre high solid fences at construction sites with significant volume of earthworks or near sensitive receptors; - Where possible, get power supply from the existing grid instead of using generators to avoid loud noise generated by diesel generators; - Provide dust marks for the workers and enforce the use when working in dusty conditions. 		
Generated waste water	<ul style="list-style-type: none"> - Toilets must have septic tanks for wastewater treatment before being discharged into the environment; - Mobile toilets or septic-tank toilets should be provided for the workers at centralized construction sites; - Load construction materials in elevated sites to avoid flooding. Cover material piles; 	<ul style="list-style-type: none"> - QCVN 14:2008/BTNMT - QCVN 08-MT:2015/BTNMT 	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - Avoid temporary loading of excessive volume of construction materials at one time at construction sites; - Store excavated materials only at designated areas approved by the Construction Supervisor. Protect such storages to avoid direct contact with surface runoff; - Minimize quantity of fuel stored at sites. Fuel storage area must be at least 20 m far from any water sources, roofed, fenced, on provided with impermeable and bound ground to control spill; - Do not maintain vehicles or replace oil at sites. Collect and store wasted oil in plastic containers with lid; Place these containers on impermeable and bound surface for spill control; - Locate workers' camps at least 10m far from any surface water bodies; - Provide adequate sanitation facilities and bathrooms with proper drains for the workers. Wastewater must be collected and treated before being discharged into the environment. Ditches must be cleaned up periodically; - Create sedimentation traps and maintain them periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; - Inspect, dredge, and clear the drains at sites and the surrounding areas periodically to prevent sedimentation and blocking; - Wastewater from designated truck washing areas, equipment washing areas, etc., if any, must be collected and treated before being discharged into the environment; - At completion of construction works, refill and seal safely the drains, ditch etc. soak pits and septic tanks, dismantle contractor's site office and any areas disturbed during construction, reinstate the disturbed areas d before handing over the site. Remove and transport to acceptable disposal site the soil contaminated with oil, if any; - Set up toilets in the camp areas and large construction sites for the workers to use. There are separately toilets for male and female workers, one toilet room for every 25 workers. When construction is over, these toilets will be refilled and sealed safely; - Domestic wastewater generated at workers' camps must be collected and treated before being discharged into the environment. 		

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
<p>Generated solid waste</p>	<p>Non-hazardous Waste Management</p> <ul style="list-style-type: none"> - Solid wastes will be managed in accordance with Decree No. 59/2007/ND-CP dated 09 April 2007 on solid waste management and Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and waste materials; - Minimize garbage generation; - Carry out waste separation at source; - Promote reuse and recycling. Materials such as glass, wooden plates, steel, plastic, scaffolding materials, site holding, packaging materials, etc. shall be collected and separated for reuse for other projects or sold for recycling; - Provide garbage bins at construction sites, site offices and camps; the bins shall be covered with lids, weather-proof and scavenger proof to avoid dispersion of bad odors, leachate leakage, attracting flies, mice and other vermince; - Collect wastes and tidy up construction sites at the end of each working day/ shift. Transport wastes out of the construction sites as soon as possible; - Collect all wastes and residual materials and transport them to the disposal sites by Quang Binh URENCO (the certified contractor) or for use later; - Cau Rao River as stipulated in the specific mitigation measures. <p>Hazardous Waste Management</p> <ul style="list-style-type: none"> - All hazardous waste (waste oil, grease, organic solvents, chemicals, oil paints, etc.) must be temporarily stored, handled, and transported and disposed off in accordance with Circular No. 36/2015/TT-BTNMT dated 30 June 2015 by the Ministry of Natural Resources and Environment on hazardous waste management; - Hazardous waste shall be transported out of sites in cooperation with an approved and authorized partner; - Collect and store used oil and grease separately in specialized containers. Place these containers in safe and fire-free areas with impermeable floors, roofs, at safe distances from fire sources; - Return unused or rejected tar or bituminous products to the suppliers or manufacturers. 	<p>Decree 59/2007/ND-CP</p> <p>Decree 36/2015/TT-BTNMT</p>	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
<p>Reduced water quality</p>	<ul style="list-style-type: none"> - 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; - 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; - 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; - Maintain vehicles and replace oil at designated workshops only. Do not perform these activities at sites; - 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; - 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; - Provide sedimentation pits and ditches at big construction sites; - Provide appropriate toilets for the workers; - Avoid carrying out excavation and backfilling in rainy weather; - Collect and transport materials and wastes generated during excavation and backfilling materials to designated sites for reuse or final disposal as soon as possible; - Temporary loading of construction materials or concrete mixing are allowed only at places where at least 50m far from any ponds, lakes, rivers, streams, or other water sources, or at maximum possible distances between temporary loading locations and canals; - 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; 	<p>QCVN 14:2008/BTNMT QCVN 08-MT:2015/BTNMT</p>	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - 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. 		
Flooding Risks	<ul style="list-style-type: none"> - Check the existing drains within and surrounding the construction sites, improve them before levelling to ensure that rainwater can be drained properly; - 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; - Clean up the existing drains regularly. 		<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant
Erosion and Sedimentation	<ul style="list-style-type: none"> - 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; - Transport wastes out of the sites within the shortest time possible but should not later than two days; - Install and maintain sedimentation traps within and/ or surrounding centralized construction sites. Remove soil, stones and wastes periodically from traps to maintain their functions; - Gather materials and wastes neatly to limit the amount of materials being swept away by rainwater; - Carry out leveling and rolling after waste disposal at the disposal sites to minimize erosion; - 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; - Level the disturbed areas to prevent erosion; - Strictly avoid disturbance or damages to the existing vegetation and trees. 		
Traffic Disturbance and Safety Risks	<ul style="list-style-type: none"> - Install and maintain sign boards, fences, signal lights to direct traffic to ensure traffic safety. Ensure adequate lighting at nighttime; 	Traffic Safety Law 23/2008/QH12	- Project Owner

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - Before transportation, trucks must be covered very carefully, materials must not be loaded to 10cm higher than the truck body so that materials are not dropped or scattered onto roads, causing dust and accident risks; - Place speed limit signs at 100m from construction sites. Place additional signs if construction site is within 20 m from the gates of any schools, markets, hospitals, pagodas, densely populated areas, narrow roads, etc., arrange worker to guide traffic in rush hours; - Coordinate with the police for traffic diversion as necessary; - Collect and tidy up wastes and wastewater containing cement at the sedimentation traps, ditches regularly to limit the number of solids entering receptors; - Avoid loading and unloading materials during rush hours; - Only use vehicles with valid registration. Trucks must be covered to prevent materials from dropping along the routes that cause dusts and accidents; - Do not park construction vehicles on the roads longer than needed. Vehicles should be parked only for loading and unloading of materials and wastes; - Plan and implement construction activities at nighttime at locations where traffic is too busy in order to reduce traffic disturbance and traffic safety risks. 	<p>Construction Law 50/2014/QH13 – Circular 22/2010/TT-BDX</p>	<ul style="list-style-type: none"> - Contractors - Construction Supervision Consultant
<p>Social mitigation measures through worker management</p>	<ul style="list-style-type: none"> - Inform the community at least 2 weeks before commencement of the construction. In case electricity and water supplies are to be disrupted, the PMU must inform PAHs of the same at least 2 days in advance. - Employ local laborers for simple tasks. Instruct workers on environmental issues, safety and health before construction tasks are assigned. It is advisable to communicate to migrant workers on local customs, practices and habits in order to avoid conflicts with local people. - The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area. - The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. Conduct sensitization campaigns with both workers and communities on these issues, liaison with local organizations to 	<p>Decree No. 73/2010/ND-CP on administrative penalization of violations against security and social affairs</p>	<ul style="list-style-type: none"> - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<p>ensure monitoring, and a grievance redress system to which the community can refer to.</p> <ul style="list-style-type: none"> - The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers. - Workers temporarily residing at the camps and rented houses must be registered with the local authorities for temporary residence. - Train workers on issues related to social security, social evils, diseases and epidemics, prostitution and drug use, environment, safety and health, HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months. - Prohibit workers from: <ul style="list-style-type: none"> - Consuming alcoholic drinks during working time - Quarreling and fighting - Gambling and indulging in social evils such as drug use and prostitution - Disposing of garbage indiscriminately 		
Impacts on Existing Infrastructure and Services	<ul style="list-style-type: none"> - Only use vehicles with sizes and loads within permissible limits set for the roads along such vehicles' routes; - Inform the affected households at least two days in advance when water or power is cut off for construction; - The Contractors shall be responsible for repairing and restoring all damages of the road and bridge due to overload transportation; - Arrange workers to observe crane drivers when operating with bulky items such as large pipes or cranes in order to avoid damages to electric lines or any other nearby existing infrastructure; - Reinstate all disturbed or damages infrastructure, including road surfaces and footpaths; - The Contractors will be responsible for repairing, recovering, and compensating at their own costs for all damages caused to existing infrastructure at the contractors' faults; 		<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - Reinstatement of the road surfaces and sidewalks disturbed by construction after construction has been completed. 		
Impacts on organism, aquatic system	<ul style="list-style-type: none"> - Minimize disturbance caused by construction activities, especially at areas having green trees or vegetation. Do not use chemical substances to clear vegetation; - Do not pile up materials and wastes at vegetation covered areas. - Embank construction areas to limit impacts on water sources - Do not destroy vegetation and green trees outside construction areas - If possible, transplant green trees to other places before constructing pipelines on pavements 	Environment Protection Law 55/2014/QH13	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant
Impacts on urban landscapes	<ul style="list-style-type: none"> - Place the signboard “Sorry to disturb” at the construction sites located in popular areas; - Keep the disturbed areas to be minimal; re-establish vegetation covers as soon as construction is completed; - All facilities are maintained in neat and tidy conditions and the sites shall be kept free of litter; - Fence the construction sites with solid materials if the construction sites are exposed to sensitive sites or exposed to tourist areas; - 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.; - Collect and transport excavated materials and construction wastes to the disposal sites within 24 hours; - Clean up the construction sites daily if the sites are located in populated areas; - Wash vehicles periodically to prevent dust dispersion onto roads. 		<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant
Impacts on Cultural Heritages	<ul style="list-style-type: none"> - When construction activities are carried out near any cultural and historical sites such as pagodas, churches, temples, the Contractors shall schedule construction to avoid festivals or special events that may take place such as full moon days and public holidays. When carrying out the works in such areas, the Contractors shall implement good site management practice, including cleaning up of the sites regularly, loading materials in a tidy manner, and transport wastes out of the sites as soon as possible. 	<ul style="list-style-type: none"> - Law on Cultural Heritage No. 32/2009/QH12 - Decree 98/2010/ND-CP 	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - If the cultural sites and/ or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Project's Owner will need to make necessary design changes to accommodate the request and preserve the site; - Decisions concerning management of the findings shall be communicated in writing by relevant authorities. 		
Social Impacts	<ul style="list-style-type: none"> - The Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on construction safety. - Register workers with the local authorities for temporary residence. - Inform communities about construction plans at least two weeks before construction commencement. - In case that electricity and water supply is to be disrupted, the PMU must inform PAHs at least two days in advance. - Avoid construction at night time. Where this is inevitable, inform the nearby communities at least two days in advance. - Construction should be performed within the shortest possible time, and carry out construction in various phases to minimize impacts on local communities. - Construction sites should be kept tidy and safe. - Wooden planks must be placed over open ditches to provide temporary access to roadside houses and shops. - Hire local workers to carry out simple tasks. - Instruct workers on environmental issues, safety and health before construction tasks are assigned. - Request workers to follow Code of conducts: <ul style="list-style-type: none"> + Use adequate safety gears provided + Smoke designated places only. Do not litter the construction sites + Do not store and use weapons and toxic substances; + Do not cut the trees outside the construction sites, set fire, burning waste on-site (except invasive plants); 	No. 22/2010/TT-BXD	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - + Do not drink alcohols during working hours; - + Do not operate construction plants if not authorized - + Do not quarreling, fighting, involving in gambling or social evils such as drug use, prostitution; - Provide medical check-up for workers periodically. Do not employ people with highly infectious diseases shall. 		
Community Health and Safety	<ul style="list-style-type: none"> - The Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on labor safety in construction operation; - In case of epidemic outbursts, the Project shall cooperate closely with the local authority to carry out 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 channels to prevent accidents; - Provide sufficient lighting when construction is carried out at nights; - Apply speed limit at 20km/h within 200m from the construction; - Where possible, place the machines generating high level of noise as far as possible from residential houses and public areas so as noise level is kept below 70dBA; - Use static compactors when constructing near weak structures. 	Circular 22/2010/TT-BXD of MOC on safety in construction	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant
Workers' Health and Safety	<ul style="list-style-type: none"> - Provide training to workers on environment, safety and health, including raising awareness on HIV/AIDS and other infectious diseases. - Provide adequate protective clothing and gears such as masks, helmets, boots/ shoes, gloves, goggles, belts, life vests, lifebuoys, etc. (depending on work nature) and request the workers to use when working. - Install and maintain power lines, switches etc. safely at site offices, construction sites and camps. Do not lay electrical cables on the ground or water surfaces. Provide safe plugs for electric wires. Place outdoor electric panels in protection cabinets. - Apply speed limits to vehicles traveling inside construction sites - Provide fire extinguishers, first aid kits, and medicine cabinets with medicines for common local diseases at site offices and camps. 	Law on labor safety and sanitation 84/2015/QH13	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - Provide the workers' camp with clean water, electricity and mobile toilets. Protect workers' beds with mosquito nets. - Clean up the camp, kitchen, bathing place and mobile toilets regularly and keep them in good hygienic conditions. Clear flows of drainage ditches around the camp periodically. - Store fuels and chemicals safely in areas with impermeable ground, roofs and surrounding banks, equipped with safety warning signs located at least 20m from the camps and at the end of prevailing winds. 		
<p>Hazard Risk</p>	<ul style="list-style-type: none"> • 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; • 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; • In case of accidental leakage or spillage of diesel/ chemicals/ chemical wastes, the Contractor(s) shall follow response procedures immediately: <ul style="list-style-type: none"> - 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; - The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/ leaked; - Should the accidents/ incidents generate serious environmental pollution (e.g. spillage/ leakage of toxic or chemicals, large scale spillage/ leakage, or spillage/ leakage into the nearby water bodies, the Contractor(s) shall immediately inform the PMU; - 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; - The Contractor(s) shall arrange maintenance staff 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); 	<p>Law on labor safety and sanitation 84/2015/QH13</p>	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<ul style="list-style-type: none"> - Depending on the nature and extent of the chemical spill, site evacuation may be necessary; - 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; - 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; - 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. 		
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"> - 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, Sport and Tourism takes over; - Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property of Viet Nam (within 24 hours or less); - Relevant local or national authorities 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 	<ul style="list-style-type: none"> - Law on Cultural Heritage (2002) - Law on Cultural Heritage (2009) <i>for supplementary and reformation</i> - Decree No. 98/2010/ND-CP <i>for supplementary and reformation</i> 	<ul style="list-style-type: none"> - Project Owner - Contractors - Construction Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	<p>relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;</p> <ul style="list-style-type: none"> - 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; - Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage. 		

6.2.2 Site-Specific Mitigation Measures

Table 6.2 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 6.2 Site Specific Impacts and Mitigation Measures - Component 1

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
Component 1					
1	 <p>Relocation of 5 Graves</p>	<p>There are 05 household graves which will need to be relocated at Van Hoa commune for construction of 09 Roads under Component 1 of the subproject.</p> <p>The level of the impact caused by this activity is only small</p>	<ul style="list-style-type: none"> - Compensation for the removal of these graves is included in the RP of the subproject and will include the cost for buying of land for re-burial, excavation, relocation, reburial and other related costs which are necessary to satisfy customary religious requirements. Compensation in cash will be paid to each affected family or to the affected groups as a whole as is determined through a process of consultation with the affected community. The level of compensation will be decided in consultation with the affected families/communities. All costs of excavation, relocation and reburial (6,000,000 VND/grave) will be reimbursed in cash. Graves will be exhumed and relocated in culturally sensitive and appropriate ways. During implementation, the Subproject Owner will make early announce to the households whose graves are affected so that they can arrange their embodiment in consistence with the spiritual practices of the people and compensate to the affected household as required in the subproject RP and ESMP. 	- PMU	- PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
	<p><i>UXO risks</i></p>	<p>-</p>	<p>The UXO remove activities need to complete before starting construction activities, the several steps should follow during UXO remove:</p> <ul style="list-style-type: none"> - Coordinate with the appropriate agencies, usually the specialized army unit of the province, at the design stage to identify if UXO is a potential threat to works. - Based on the findings, PMU will sign contact with an authorized agency for doing the detailed survey and removing UXOs. - Ensure that the civil work activities on the site will be started only after PMU is certified that the subproject areas have already been cleared from UXOs. 	<p>- Contractor</p>	<p>- PMU, CSC, IEMC</p>
<p>2</p>	 <p><i>Impacts on Physical Cultural Resources</i></p>	<ul style="list-style-type: none"> - Construction of N10 road would have the potential impacts on the Van Hoa Temple which is located 150m to the construction site 	<ul style="list-style-type: none"> - Inform the temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Prohibit gathering of construction materials within 100m in front of the temple. - Construction activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. - Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as temple. 	<p>- Contractor</p>	<p>- PMU, CSC, IEMC</p>

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
			<ul style="list-style-type: none"> - Sprey sufficient water to suppress dust during dry and windy days at least three times a day at the area of the temple. - Clean the construction area after each working. - Sett up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at end of the working day. - Provide night lighting system with luminously painted fence and night lamp. - Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Immediately address any issue/problem caused by the construction activities and raised by the temple 		
	<i>Traffic safety risks</i>	<ul style="list-style-type: none"> - The estimated total number of 10-ton vehicles will be mobilized for 	The Traffic Management Plan shall include, but not limited to these following measures:	- Contractor	- PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
		<p>transporting excavated soil and solid waste are about 86 turns per day. Excavated soil disposal will be transported to Tong Mon disposal site (6 km distance from the Lao Cai city); part of the excavated soil, 354,000 m³ will be used for backfilling</p>	<ul style="list-style-type: none"> - Coordinate with the local authority to inform local people on the construction plan prior to construction; - Contractor should provide lighting at construction site at night; a security guard staff at construction sites to moderate vehicle go out and in the construction site; - Place speed limits signs at a distance of 100m from the construction site. Place additional signs if construction site is within 20 m from the gate of any schools, markets, hospitals, narrow roads, etc., arrange worker to guide the traffic in rush hours; - Collect and tidy up the waste and wastewater containing cement at the sedimentation traps, ditches regularly to limit the amount of solids entering receptors; - Use water-tight tank trucks for transporting wet/dam materials; - Cover the materials tightly before leaving the construction site; - Do no overload material on the trucks. 		
	<p><i>Risks of soil erosion and landslides due to construction of N9 road</i></p>	<ul style="list-style-type: none"> - As the 9 roads are crossing foothills and tophill, risks of soil erosion and landslides are significant if proper construction plans and 	<ul style="list-style-type: none"> - Anti-erosion and slope protection measures should be incorporated in contractor bidding documents and construction plans, especially for N9 road. - Develop appropriate construction plans to avoid rainy season. 	<ul style="list-style-type: none"> - Contractor 	<ul style="list-style-type: none"> - PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
		measures are not implemented.	- In a long duration of construction (24 months), the contractor should prepare a flood protection and risk management plan before rainy season.		
Component 2					
	<i>Traffic safety risks</i>	<ul style="list-style-type: none"> - Mitigation measures are required to ensure traffic safety and limit damage to the roads and, clean environment on the streets and surrounding environment along transport routes for dredged material, including Inner city streets - Pho Moi Bridge - Dinh Bo Linh Street- District road 157, Hoang Lien Street. 	<ul style="list-style-type: none"> - Clean up the transport vehicles before leaving construction site. Do not load to a height of 10cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users. - Do not park vehicles in the roads longer than necessary. Do not allow construction vehicles and materials to encroach upon the pavements. - Maintain the required speed limit and do not overuse horn. - Preriodically registry and supervise the quality of transport vehicles as required by the government regulations. - Comply with the traffic safety regulations while participating traffic - Clean up wastes dropped off on road - Assign staff to guide the traffic during transportation, unloading, and loading of construction materials, equipment, and wastes. - Place stockpile materials at a designated place tidily and successively according to construction schedule. 	- PMU	- PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
			<ul style="list-style-type: none"> - Spray water three times per day to reduce dust during dry days if required. - Reinstall the road surface if occurring the damages during construction 		
	 <p data-bbox="226 675 577 738">Lao Cai Children's Palace Children's playground</p> <p data-bbox="226 778 611 842">Located in Nhap Son Park, 30m from the Central lake</p>	<ul style="list-style-type: none"> - Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to the children and local people. 	<ul style="list-style-type: none"> - Inform the Lao Cai Children's Palace Children's playground of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Accelerate the progress in order to reduce construction time, and schedule construction to avoid activities during weekends and holidays. - Clean up the transport vehicles before leaving construction site. Do not load to a height of 10cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users. - Do not park vehicles within 200m from the Children' Place and playground. Do not allow construction vehicles and materials to encroach upon these places. - Maintain the required speed limit and do not overuse horn, and comply with the traffic safety regulations while participating in the traffic. - Clean up wastes dropped off on road. 	<ul style="list-style-type: none"> - Contractor 	<ul style="list-style-type: none"> - PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
			<ul style="list-style-type: none"> - Clean the construction area after each working. - Assign staff to guide the traffic during transportation, unloading, and loading of construction materials, equipment, and wastes. - Place stockpile materials at a designated place tidily and at least 500m from the palace and playground. - Spray water three times per day to reduce dust during dry days if required. 		
	<p>Lao Cai Library</p> <p>Located in Nhac Son Park, 15m from the Central lake</p>	<ul style="list-style-type: none"> - Increased exhaust gases, dust, noise, vibration, construction wastes, and traffic safety 	<ul style="list-style-type: none"> - Inform the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Accelerate the progress in order to reduce construction time. Construction activities should not be excuted after 5:00pm. - Do not park vehicles within 100m from the library. Do not allow construction vehicles and materials to encroach upon this place. - Maintain the required speed limit and do not overuse horn, and comply with the traffic safety regulations while participating in the traffic - Place stockpile materials at a designated place tidily and at least 500m from the library. - Spray water three times per day to reduce dust during dry days if required. 	<ul style="list-style-type: none"> - Contractor 	<ul style="list-style-type: none"> - PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
			<ul style="list-style-type: none"> - Clean the construction area after each working. 		
	 <p>3 other restaurants in the park</p> <p>Located in Nhap Son Park, 0-50m from the Central lake</p>	<ul style="list-style-type: none"> - Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to customers to eat at the restaurants 	<ul style="list-style-type: none"> - Inform the restaurants of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Accelerate the progress in order to reduce construction time. Construction activities should not be executed after 5:00pm. - Place stockpile materials at a designated place tidily and at least 500m from the restaurants. - Do not park vehicles within 100m from the restaurants. Do not allow construction vehicles and materials to encroach upon this place. - Always ensure clear, easy, and convenient access to the restaurants. - Spray water three times per day to reduce dust during dry days if required. - Clean the construction area after each working. 	<ul style="list-style-type: none"> - Contractor 	<ul style="list-style-type: none"> - PMU, CSC, IEMC
	 <p>Civil Servant Training School</p>	<ul style="list-style-type: none"> - Increased exhaust gases, dust, noise, vibration 	<ul style="list-style-type: none"> - Inform the school management, Office of Department and 60 households living on 4 surrounding streets of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. 	<ul style="list-style-type: none"> - Contractor 	<ul style="list-style-type: none"> - PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
	 <p>Office of Department of Internal Affairs and more than 60 households living on 4 surrounding streets</p>	<ul style="list-style-type: none"> - Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to local communities 	<ul style="list-style-type: none"> - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering. - Prohibit use of construction methods that cause noise during school learning hours. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Immediately address any issue/problem caused by the construction activities and raised by the schools. 		
	<p>Thuong Temple</p>  <p>Tan Bao Pagoda</p>	<p>Construction of the road will exert negative impacts on the temple due to:</p> <ul style="list-style-type: none"> - Increased dust, exhaust gases, noise, vibration, construction wastes, hazardous waste, domestic wastes, and wastewater due to construction activities; 	<ul style="list-style-type: none"> - Inform the temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Prohibit gathering of construction materials within 100m in front of the temple. - Construction activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. 	<p>- Contractor</p>	<p>- PMU, CSC, IEMC</p>

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
	 <p>Mau Temple</p>  <p>Coc Leu Church</p> 	<ul style="list-style-type: none"> - Clogging of local drainage canal leading to localized flooding; - Potential safety risks to the temple goers during construction; - Increased traffic congestion and risks of traffic accidents due to construction and transportation; - Interference with religious events at the temple due to construction activities 	<ul style="list-style-type: none"> - Environmental training for the workers includes codes of conducts when working in pubic areas and sensitive receptors such as temple. - Sprey sufficient water to suppress dust during dry and windy days at least three times a day at the area of the temple. - Clean the construction area after each working. - Sett up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at end of the working day. - Provide night lighting system with luminously painted fence and night lamp. - Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Immediately address any issue/problem caused by the construction activities and raised by the temple. 		

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
Component 3					
	Impacts on ground and surface water	<ul style="list-style-type: none"> - The use of drilling mud during pile driving is necessary. Water-based drilling mud most commonly consists of bentonite clay (gel) with additives such as barium sulfate (barite), calcium carbonate (chalk) or hematite. 	<ul style="list-style-type: none"> - Install or build a container to contain and circulate the drilling mud and recollect them to avoid leakages to the outside environment. - All additive ridden soil should be collected, transported and treated as hazardous wastes generated during construction 	- Contractor	- PMU, CSC, IEMC
	<i>Subsidence risk construction phase</i>	<ul style="list-style-type: none"> - Risks of land subsidence at the two stream bank sides at the bridge construction site 	<ul style="list-style-type: none"> - Prior to construction, the contractor should develop an appropriate construction plan minimize impacts on the flow of Ngoi Dum Stream with proper flow diversion measures. - In the entire construction process, construction activities should be limited during rainy season and accelerated during dry season, especially the embankment and the construction of bridge abutments. - During or after the rain, ensure that all heavy construction vehicles and machinery such as trucks and cranes are halted and parked away from the stream banks to avoid erosion risks. - Ensure the constant presence of supervision consultants and contractors during construction to monitor the potential risk of erosion and landslides for prompt, specific and appropriate responses. 	- Contractor	- PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
			<ul style="list-style-type: none"> - Construction equipment and construction material should be gathered at least 100 meters away from the stream banks to avoid contamination and blockage to the stream as well as increase in sedimentation. 		
	 <p>Children Hospital of Lao Cai</p> <p>Located 100m from the bridge construction site</p>	<ul style="list-style-type: none"> - Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents when local communities come to Hospital 	<ul style="list-style-type: none"> - Inform the hospital of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Accelerate the progress in order to reduce construction time, and schedule construction to avoid activities during weekends. - Clean up the transport vehicles before leaving construction site. Do not load to a height of 10cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users. - Do not park vehicles within 200m from the hospital. Do not allow construction vehicles and materials to encroach upon this place. - Maintain the required speed limit and do not overuse horn, and comply with the traffic safety regulations while participating in the traffic. - Clean up wastes dropped off on road. - Clean the construction area after each working. 	<ul style="list-style-type: none"> - Contractor 	<ul style="list-style-type: none"> - PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
			<ul style="list-style-type: none"> - Assign staff to guide the traffic during transportation, unloading, and loading of construction materials, equipment, and wastes. - Place stockpile materials at a designated place tidily and at least 500m from the hospital. - Spray water three times per day to reduce dust during dry days if required. 		
	 <p>Residential areas in Ngo Minh Loan and Dao Duy Tu Streets</p> <p>Located 30-50m from the bridge construction site</p>	<ul style="list-style-type: none"> - Increased exhaust gases, dust, noise, vibration, construction wastes - Inconveniences to locals' business activities as access to business establishments may be obstructed; - Risks of landslides and subsidence damages to existing - Safety risks to vehicles and community, especially at night 	<ul style="list-style-type: none"> - Inform the residents on the two streets of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 months before start of the construction. - Construction site should be properly fenced to ensure safety for the people. Access to the bridge site from local people should also be restricted. - Ensure that vehicles and equipment as well as waste materials and construction materials should be gathered at least 100m from the houses. - The excavated materials and construction waste should be quickly collected and transported to the designated sites for not impacting local human health. - Sprey sufficient water to suppress dust during dry and windy days at least three times a day at site. 	<ul style="list-style-type: none"> - PMU 	<ul style="list-style-type: none"> - PMU, CSC, IEMC

No	Sensitive receptors and their relation to subproject activity	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
			<ul style="list-style-type: none"> - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. 		

The details on the DMMP Central Lake and Disposal Site:

For addressing the impacts of disposal of the dredged sediment from Central Lake, the contractors are requested to prepare a specific dredging material management plan (DMMP) and submit the same to the Supervision Consultant for approval before starting the work. The dredging plan will indicate volumes, physical-chemical-biological properties of dredged material, dredging procedures, temporary gathering of dredged materials, control of polluting material during temporary gathering and transportation, pollution control, and risks at disposal sites. The detailed guidelines on DMMP are provided in Appendix 1.

6.2.3 Site-Specific Mitigation Measures during Operation Phase

Component 1:

a. Operations of roads

After construction is completed, there will be operations of various vehicles on the new road. Key short term impacts would include an increase in traffic and pedestrian accidents, due to higher standard road allowing more and faster traffic; premature failure of pavements, drainage structures due to inadequate maintenance.

Other impacts would be possibly localized flooding related soil erosion and landslide.

To mitigate these impacts the following measures will be carried out by the city road maintenance agency:

- Ensure that traffic safety provisions, including signs, lights, and pavement markings, that were installed during construction are permanently and effectively maintained, and renewed as necessary.
- Ensure the city's operations and maintenance plan, and related budget, includes the work and resources required to maintain the road in its as-completed condition.
- Ensure, with the assistance of the traffic control authority, that overloaded vehicles do not use the road.
- Ensure effective road inspection for any signs of damages, soil erosion and landslide for immediate repairing actions.

b. Impacts during operation Stormwater drainage, Wastewater collection system and Water supply system and 02 Pumping station

Operations of stormwater drainage and wastewater collection systems under subproject would have impacts on the areas: (i) by the operation of the pumping stations (noise, vibration); (ii) the probability of flooding due to congestion of drainage sewer section; (iii) affected by odors from sludge which is dredged periodically; (iv) impacts from disposal of dredged septage; (v) impacts on the aquatic environment due to temporary receiving wastewater discharged from untreated sewer section (this ends when wastewater treatment plants commence stable operations). Mitigation measures are as follows):

➤ *Minimize the pollution caused by the operation of the pumping stations:*

The pumping stations with the large capacity often cause vibration and noise at high levels. Pump sets would be placed in a separate room. The pumps would be installed with equipment to prevent vibration and noise. Specifically:

- *Technical measures when installing:* (i) Construct proper machine room for pump sets; (ii) Foundation to put the machine would be built with high-quality concrete; (iii) Install anti-vibration buffer made from rubber; (iv) Install silencers equipment.
- *Management and maintenance measures:* (i) The pumps would be examined the balance and adjusted if necessary; (ii) Periodic maintenance and lubrication to minimize noise.
- *Measures to minimize environmental pollution caused by fuel leakage during the operation of pumping stations:* (i) Do not store fuel at the pumping stations to minimize the possibility of fuel leakage to the receiving source; (ii) Feeding the fuel into the pumps would be done in careful manner to avoid fuel spillage; (iii) Lubricant, greasy rags from maintenance and operations of the pumps must be entirely collected and transported to appropriate treatment areas.

➤ *Minimize pollution due to congestion of drainage sewers:* (i) The management of stormwater drainage and wastewater collection systems should be focused and examined regularly to detect

the congested drainage sewer sections and carry out dredging; (ii) Conduct periodic planning decentralization and dredging sewer sections and manholes in order to minimize the flow congestion (every 6 months).

➤ *Control disposal of sludge:* Similar to the construction phase, those who manage the water drainage systems would have contracts with relevant authorities of sludge dredging from the sewer sections and manholes and then transport to the landfill by specialized tank trucks to avoid odor emission and spillage during transportation.

Component 2:

a. For the Central Lake

The operation may cause some negative impacts on the environment. However, these impacts are considered minor, localized, and can be controlled if fully applying mitigation measures. The negative impacts are mainly related to the sedimentation in lake over time, impacts on air quality due to accumulation of organic materials in the sediments and damage to the embanked lake slope. It is necessary to develop measures to protect safety of people visiting and playing at the park Central lake and increase their awareness of environmental protection.

- Regularly check and monitor the damage of slope around the lake.
- Check and monitor the deposition of organic materials/soil and sand sediments; if the amount is high, it is necessary to dredge to ensure storage of the lake, at the same time, limit emissions such as CH₄, H₂S,... generated by the decomposition of organic matters in the sediments.
- Install and maintain warning boards about (1) the lake depth and (2) prohibition of swimming in the lake in and around the lake.
- Increase education and communications to increase people's awareness of environmental protection for and around the lake.
- Prohibit throwing domestic waste and other solid waste into the lake.

b. For the wastewater collection and sewage system

The management of stormwater drainage and wastewater collection systems should be focused and examined regularly to detect the congested drainage sewer sections and carry out dredging.

Conduct periodic planning decentralization and dredging sewer sections and manholes in order to minimize the flow congestion (every 6 months).

Control disposal of sludge: Similar to the construction phase, those who manage the water drainage systems would have contracts with relevant authorities of sludge dredging from the sewer sections and manholes and then transport to the landfill by specialized tank trucks to avoid odor emission and spillage during transportation.

Component 3:

Tree planting: Tree shall be planted on the road connected to the bridge to avoid the dazzle caused by the headlights of cars/vehicle in the night. Various kinds of planted trees must be green growth in four seasons and the shady must be at least 5m distant per tree. In addition, trees shall be also planted on the sidewalk for purpose of either increasing aesthetic or reducing noise pollution caused by vehicles.

Lighting system: be suitable installed at the construction sites, well- Operated at night to enable warning for traffic & people surrounding.

Road marking paint: traffic lane mark with continuous line, 0.2m width and painted with reflective paint.

6.3 Responsibilities for the implementation

The operating unit has responsible for implementing environmental mitigation measures during operation of the subproject. Responsibilities for the implementation areshown in the table 6.3.

Table 6.3. Responsibilities for implementation of mitigation measures in operation phase

No	Items	Subproject owner	Representative of subproject owner	Operator
1	Pipelines	Lao Cai PPC	Lao Cai PMU	URENCO
2	Pumping stations			
3	Sewers			
6	Central Lake			Lao Cai Department of Transportation
7	Ngoi Dum bridge			

6.3.1 Role and Responsibilities for ESMP Implementation

a. Implementation Arrangement

The tables and figures 6.1 summarize the roles and responsibilities of the key parties and their relationships regarding the implementation of the ESMP (Table 6.4).

- Contractors will beresponsible 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 costsare included in the CSC service contract;
- IEMC will be responsible for overall environmental monitoring which includes support to the PMU in implementing environmentalsupervision and monitoring, and responsible for reporting on the implementation through monitoring reports.

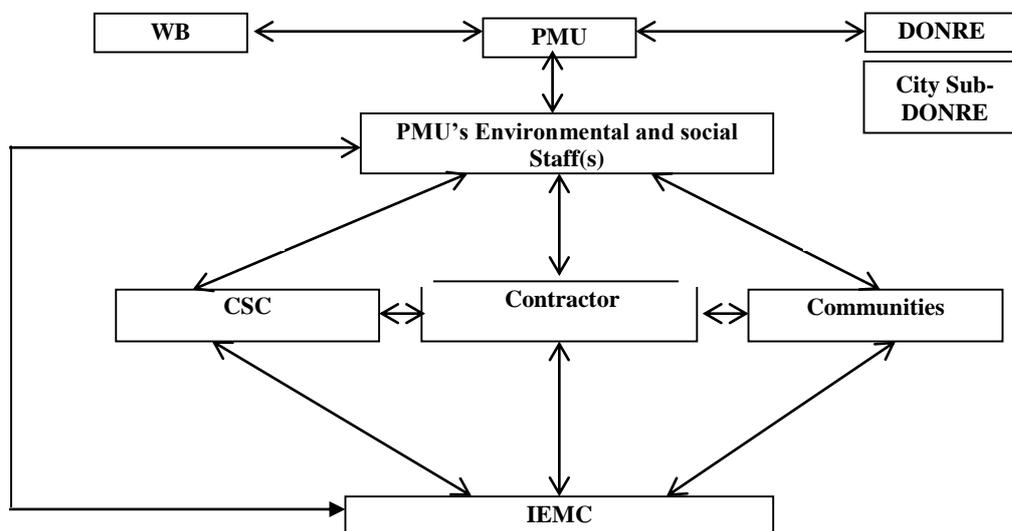


Figure 1. Organization chart for ESMP Implementation

Table 6.4. Roles and responsibilities of key parties

Community/ Agencies	Responsibilities
PMU	<ul style="list-style-type: none"> - 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. - 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.
PMU Environmental and Social Staff(s) (ES)	<ul style="list-style-type: none"> - 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 RP monitoring 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 and resettlement issues of the subproject; and (vii) preparing environmental and social performance section on the progress and review reports to be submitted to the DONRE and the World Bank.
Construction Supervision Consultant (CSC)	<ul style="list-style-type: none"> - 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 staff (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. - The CSC will also assist the PMU in reporting and maintaining close coordination with the local community.
Contractor	<ul style="list-style-type: none"> - The contractor will assign Environmental and Social Staff(s) to carry out Environmental and Social mitigation measures proposed in ESIA/ESMP. - 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. - 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 contractor’s compliance with health and

	<p>safety requirements, the CESMP requirements, and the environmental specifications (ECOP).</p> <ul style="list-style-type: none"> - Take actions to mitigate all potential negative impacts in line with the objective described in the CESMP. - Actively communicate with local residents and take actions to prevent disturbance during construction. - Ensure that all staff and workers understand the procedure and their tasks in the environmental management program. - Report to the 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.
Independent Environmental Monitoring Consultants (IEMC)	<ul style="list-style-type: none"> - IEMC will, under the contract scope, provide support to PMU to establish and operate an environmental management system, offers suggestions for adjusting and building capacity for relevant agencies during subproject implementation and monitor the CESMP implementation in both construction and operation phases. IEMC will also be responsible to support PMU to prepare monitoring reports on ESMP implementation. - The IEMC will have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the subproject.
Local community	<ul style="list-style-type: none"> - Community: According to Vietnamese practice, the community has the right and responsibility to routinely monitor environmental performance during construction to ensure that their rights and safety are adequately protected and that the mitigation measures are effectively implemented by contractors and the PMU. If unexpected problems occur, they will report to the CSC and PMU.
Province and City People's Committees (PPCs/DPCs), Provincial DONRE	<ul style="list-style-type: none"> - Oversee implementation of subprojects under recommendations of DONRE and PMU to ensure compliance of Government policy and regulations. DONRE is responsible for monitoring the compliance with the Government environmental requirements.

b. Environmental Compliance Framework

(i) 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 Staff of the CSC;
- Carry out any corrective actions instructed by the Environmental Staff 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 Staff 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.

(ii) 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.

(iii) Independent Environmental Monitoring Consultant (IEMC)

In order to minimize the environmental impacts during construction phase of the Subproject, the Subproject owner shall ensure that environmental quality monitoring requirements are established for the subproject. An IEMC appointed by PMU shall carry out the monitoring.

- IEMC will be responsible for carrying out environmental sampling, monitoring and marking report during all phases of the subproject. Environmental quality monitoring will be report periodically to PMU and World Bank (respectively every 03 months for PMU and every 6 months for WB in construction phase).
- IEMC will also supply specialized assistance to PMU and ES in environmental matters.

(iv) 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

(v) 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.

(vi) Environmental Claims and Penalty System

In the compliance framework, if non-compliance with environmental regulations are discovered by CSC/ES/IEMC/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 IEMC/CSC/PMU not detected of non-compliance with environmental regulations of the contractor, they will be responsibility payment to repair the violation.

(vii) Reporting Arrangements

ESMP monitoring and reporting requirements are summarized in Table 6.5.

Table 6.5. Regular Reporting Requirements

No.	Report Prepared by	Submitted to	Frequency of Reporting
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	Every three-month
6	PMU	WB	Every six-month

6.3.2 Environmental Quality Monitoring Program

a. 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 6.6; 6.7 and 6.8):

Preparation stage and construction:

Table 6.6. Scope of environmental monitoring during construction

No.	Monitoring items	Pre-construction	Construction phase	Applied standard
I	Ambient noise/vibration monitoring			
	1. Parameter	Leq, L50, Lmax	Leq, L50, Lmax	QCVN 26/2010/BTNMT
	2. Frequency	01 location/day, 03 time/h	Every 3 month; 01 location/day, 03 time/h	
	3. Monitoring position	Baseline environmental locations should be established in line with the construction sites at the time of monitoring.		
II	Ambient air monitoring			
	1. Parameter	TSP, CO, NO ₂ , SO ₂ , HC, microclimate	TSP, CO, NO ₂ , SO ₂ , HC	QCVN 05 :2013/BTNMT, QCVN 06:2009/BTNMT
	2. Frequency	1 location/day	Once per 3 months	
	3. Monitoring position	Baseline environmental locations should be established in line with the construction sites at the time of monitoring.		
III	Surface water/wastewater quality monitoring			
	1. Parameter	pH, temperature, DO, TSS, T-N, T-P, BOD ₅ , COD, oil and grease, Coliform	pH, temperature, DO, TSS, BOD ₅ , COD, DO, oil and grease, Coliform	QCVN 08:2008/BTNMT; QCVN 14:2008/BTNMT; QCVN 24:2009/BTNMT
	2. Frequency	1 location/day	Once per 03 months	
	3. Monitoring position	Baseline environmental locations should be established in line with the construction sites at the time of monitoring.		
IV	Dredged sludge: If required as indicated in the dredge material management plan			
	1. Parameter	Cu, Pb, Zn, Cd, As	Cu, Pb, Zn, Cd, As	QCVN 03:2008/BTNMT
	2. Frequency	As needed	As needed	
	3. Monitoring position	As defined in the dredge material management plan		
V	Traffic: during construction, the contractor monitor and report the traffic route and driving performance.			

Table 6.7. Estimated numbers for soil, water, and air sampling and analysis for the environmental monitoring

Construction Phase	Ngoi Dum Bridge	Road routes in Van Hoa commune	Central lake	Other road routes in wards	Total samples
Construction time	18	18	18	12	
Waste/Surface water sample (1 time)	6	6	3	12	
Sludge sample (1 time)	1	0	6	0	
Air sample (1 time)	3	9	3	10	
Total monitoring times	3	3	3	3	
Total waste/surface water samples	24	24	18	48	114
Total sludge/soil Samples	6	0	36	0	42
Total air samples	18	54	18	60	150

Table 6.8 Estimated cost for environmental sample collection and analysis (Exchange rate: 1 USD = 22,600 VND)

No.	Sample	Unit price (VND)	Quantity	Total (VND)	Total (USD)
I Air sample					
1	TSP	75,708	150	11,356,200	502.5
2	CO	447,223	150	67,083,450	2968.3
3	NO ₂	430,848	150	64,627,200	2859.6
4	SO ₂	503,446	150	75,516,900	3341.5
5	HC	1,223,239	150	183,485,850	8118.8
6	Noise	62,125	150	9,318,750	412.3
Total I				411,388,350	18203.0
II Surface water/wastewater					
1	temperature	84,630	114	9,647,820	426.89
2	pH	101,041	114	11,518,674	509.68
3	DO	115,240	114	13,137,360	581.30
4	TSS	192,275	114	21,919,350	969.88
5	BOD5	297,782	114	33,947,148	1502.09
6	COD	334,547	114	38,138,358	1687.54
7	Grease/Oil	1,419,905	114	161,869,170	7162.35
8	Coliform	1,352,767	114	154,215,438	6823.69
Total II				444,393,318	19663.42
III Sludge sample					
1	Cu	382,480	42	16,064,160	710.80
2	Pb	375,174	42	15,757,308	697.23
3	Cd	380,342	42	15,974,364	706.83
4	Hg	379,197	42	15,926,274	704.70
5	Zn	380,474	42	15,979,908	707.08
Total III				79,702,014	3526.64
Total				935,483,682	41393.08

To ensure that waste generation due to developing road routes in Van Hoa commune and Ngoi Dum bridges create facilities to acceptable negative impacts as anticipated in the ESIA, annual monitoring program has been developed and it will be carried out by the agencies which are responsible for operations and using their own operating cost. The monitoring results will be submitted to the

Government as well as WB. ESU assisted by IEMC will prepare a detailed monitoring plan with the concerned agencies at least three months before construction has completed. The program should also include a 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, salinity, total suspended solid (TSS), dissolved oxygen (DO), and coliform bacteria. Monitoring of water quality at the water supply intake and measure to protect proper land use of the watershed should also be considered.

Table 6.9. Scope of environmental monitoring during the first year of operation

No.	Monitoring Items	Remarks
1	Route No. D1 in Van Hoa	2 times, 6 month/times after operation
2	Route No. T1 in Van Hoa	2 times, 6 month/times after operation
3	Route No. T3 in Van Hoa	2 times, 6 month/times after operation
4	Route No. T6B1 in Van Hoa	2 times, 6 month/times after operation
5	Route No. T7 in Van Hoa	2 times, 6 month/times after operation
6	Route No. T8 in Van Hoa	2 times, 6 month/times after operation
7	Route No. T9 in Van Hoa	2 times, 6 month/times after operation
8	Route No. N10 in Van Hoa	2 times, 6 month/times after operation
9	Route No. N13 in Van Hoa	2 times, 6 month/times after operation
10	Bridge over Ngoi Dum stream in Kim Tan	2 times, 6 month/times after operation

6.4. CAPACITY BUILDING PROGRAM

6.4.1 Technical Assistance support for the implementation of safeguards

An assessment of safeguards implementation capacity of existing PMU staff indicates 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 staff, 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.

6.4.2 Training programs proposed

Table 6.10 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/IEMC 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, IEMC 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 staff, ESU staff, 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 subsubproject/contracts.
- ✓ *Training frequency:* The basic training programs proposed in Table 6.10 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 staff 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 6.10. Training Programs for Capacity Building on Environmental Supervision and Management

I. Objects	SUBPROJECT MANAGEMENT UNIT (This could be jointly organized for all three PMUs)
Training course	Environmental supervision, monitoring and reporting
Participators	Environmental staff and technical staff
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"> ✓ General environmental management relating to subproject including requirements of WB, DONRE, cooperating with relevant enterprises ✓ Requirements on environmental supervision; ✓ Supervision and implementation of mitigation measures; ✓ Community participation in environmental supervision ✓ Guide and supervise contractor, CSC, and community representatives in implementation of environmental supervision. ✓ Forms used in environmental supervision; ✓ Risk response and control;

I. Objects	SUBPROJECT MANAGEMENT UNIT (This could be jointly organized for all three PMUs)
	<ul style="list-style-type: none"> ✓ Other areas to be determined; ✓ Receiving approach and submit forms.
Responsibilities	PMU, IEMC with support of the Technical Assistance team for the implementation of safeguards
II. Objects	CSC, CONTRACTOR, COMMUNE/WARDS AUTHORITIES, COMMUNITY REPRESENTATIVES
Training course	Implementation of mitigation measures
Participators	CSC; on-site construction management staff; environmental staff 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"> ✓ Overview of environmental monitoring; ✓ Requirements of environmental monitoring; ✓ Role and responsibilities of contractors and CSC ✓ Content and methods of environmental monitoring; ✓ Response and risk control; ✓ Propagate monitoring forms and guide how to fill in the forms and risk report; ✓ Other areas to be determined; ✓ Preparation and submission of report
Responsibilities	PMU, IEMC with support of the Technical Assistance team for the implementation of safeguards
III. Objects	COMMUNITIES AND WORKERS
Training course	Environmental sanitation and safety
Participators	Representatives of community and/or worker leaders (as appropriate)
Training frequency	As appropriate
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"> ✓ Preliminary presentation on environmental protection and environmental overview ✓ Key issues that require community and workers attention to minimize safety risks (roads, waterways, equipment, machines, etc.) as well as reduce pollution (dust, fume gases, oil/grease spill, waste management, etc.)

I. Objects	SUBPROJECT MANAGEMENT UNIT (This could be jointly organized for all three PMUs)
	<ul style="list-style-type: none"> ✓ Management of environmental safety and sanitation in work sites and worker camps; ✓ Mitigation measures at construction site and work camps; ✓ Safety measures on electricity, mechanical, transportation, air pollution; ✓ Other areas to be determined; ✓ Procedures to deal with emergency situation
Responsibilities	Contractor, PMU, with support from IEMC

6.5. Estimated ESMP Cost

Table 6.11 provides an estimated cost for ESMP implementation (excluding the resettlement cost and RP and EMDP independent monitoring). The ESMP cost¹ 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 SEMP 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 cities' operations and maintenance budgets.

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 6.12 provides an estimated IEMC and environmental quality monitoring cost in line with the country practices for reference. However the final cost will be updated during the detailed design.

Table 6.32 Estimated Cost for ESMP implementation (million USD) during the subproject implementation

	Cost (millions of \$US)	Source of funds
(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

Environmental and social impact assessment

(d) Environmental quality monitoring	0.03	WB
(e) Independent Environmental Monitoring Consultant (IEMC)	0.08	WB
(f) Safeguards capacity building program	0.25	WB

Table 6.4 An estimated cost for IEMC (Exchange rate: 1 USD = 20,800 VND)

No	Content	Unit	Quantity	Unit price	Total	Total
				(VND)	(VND)	(USD)
1	Specialist salary	Month_ person	15	35,000,000	525,000,000	23,230
2	Local stays and allowance	Day_ person	120	500,000	60,000,000	2,655
3	Travelling expenses	Turn_ person	20	400,000	8,000,000	354
4	Office supply	Monitoring period	8	35,000,000	280,000,000	12,389
5	Office and communication	Monitoring period	12	35,000,000	420,000,000	18,584
6	Environmental quality monitoring				935,483,682	41,393
	Total				2,228,483,682	98,605

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

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

The second level *The CPC*. Upon receiving a complaint from a household, the CPC will have 15 days (or 30 days in case of remote and mountainous areas) 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 Provincial People's Committee (PPC).

The third level *The PPC*. Upon receiving a complaint from the household, the PPC will have 30 days (or 45 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The PPC is responsible for filing and storing documents for all complaints to be submitted.

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

The Forth level City/Provincial Court. In case a complainant brings his/her case to a city/provincial court and the court rules in favor of the complainant, the city/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 CPC/PPC, the complainant will be refunded the amount of money that has been paid to the court.

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

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

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

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

- The date and time of the complaint.
- The name, address and contact details of the complainant.
- A short description of the complaint.

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

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

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

Independent environmental and monitoring consultants, who have enough the specialized capacity, would be selected by Ha Nam CIW PMU through bidding. Independent monitoring consultants are responsible for checking the procedures and decisions on settling complaints. Independent monitoring consultants may propose additional measures to address any outstanding complaints. While checking the procedure for complaint resolution and reviewing the decision on complaint resolution, the independent monitoring agencies are required to closely coordinate with the Vietnam Fatherland Front, whose members are responsible for monitoring law enforcement of local complaints.

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

Based on the assessment of the potential negative impacts discussed in Chapter 4 and the mitigation measures proposed in the chapter 4 of EIA report and the part 6, this chapter presents the Environmental and Social Management Plan (ESMP) for the subproject. The ESMP identifies actions to be carried out under the subproject including the environmental monitoring program and the implementation arrangements, taken into account the need to comply with the Government's EIA regulations and the World Bank (WB)'s safeguard policies, including those of the World Bank Group's Environmental, Health, and Safety Guidelines.

CHAPTER 7. PUBLIC CONSULTATION AND INFORMATION DISLCOSURE

7.1.PUBLIC CONSULTATION PROCESS

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

Those affected by the subproject include those resettled and those in the nearby communities affected by subproject impacts, intended beneficiaries of the subproject, key interest groups – depends upon the subproject, local NGOs/Mass organizations, including women's unions, local authorities and other stakeholders.

Public consultation in preparation of the subproject ESIA also must comply with the requirements in the Government's Decree No. 18/2015/ND-CP dated 14 February 2015 on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan, and Circular No. 27/2015/TT-BTNMT dated 29 May 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan.

The objectives of public consultation were as follows:

- To share all information on the items and tentative activities of the Subproject with local community and stakeholders;
- To gather opinions/comments and concerns from local authorities and the community on local particularities and environmentally sensitive matters in the subproject area, especially matters that the environmental assessment impact group has not been aware of. On such basis, the concerns of the local community may be proposed for proper settlement during the selection of subproject design options;
- To collect opinions/comments from the local community on the Subproject's tasks in the preparation of the ESIA as well as comments on the draft ESIA to adequately and precisely assess environmental impacts and propose the most effective and feasible mitigation measures for negative environmental impacts.

Information disclosure and public consultations are conducted during the subproject preparation and implementation processes to ensure that affected households and key stakeholders are timely informed about land acquisition, compensation and resettlement. This is also an opportunity for the affected people to participate and express their opinions with regards to resettlement implementation programs. The resettlement preparation in coordination with the representatives of the DPCs, Town PC and CPCs in the subproject area, and leaders of the villages organizes public meetings and consultations in order to inform and guide about the next steps in a timely manner. Organizations and individuals concerned about land acquisition and impacts and resettlement had and will take part of the public meetings and consultations. Representatives of mass organizations in the subproject that area attended the meetings and consultations included the Vietnam Women's Union, and Fatherland Front and Vietnam.

Key topics covered in the public consultations are as followings:

1. Disseminate key information related to policies of the World Bank, the Government and the subprojects.
2. Provide locals with subproject on resettlement, environment, gender as well as ethnic minority issues through village loudspeaker system and subproject information brochures/leaflets;
3. Collect opinions and feedback of the local communities regarding the subproject implementation;
4. In the community consultation, needs to introduce and public all information of subproject and WB's safeguard policies, collect opinions and comments of the residents on design and resettlement options as well as their aspirations and expectations are recorded;
5. Respond questions to local communities concerning the subproject and safeguard policies;
6. CPCs and PMU provided answers to questions to local residents related to subproject and local policies;
7. Local communities, representatives of the CPC's and other stakeholders' contributions

This is an A project, thus according to WB's requirements, consultation is implemented into two times during environmental and social impact assessment process.

The public consultation was carried out with local communities and authorities at project area including 11 wards/commune including. Kim Tan, Binh Minh, Pom Han, Bac Cuong, Nam Cuong, Bac Lenh, Coc Leu, Lao Cai, Duyen Hai, Pho Moi and Van Hoa. The first consultation was conducted from from 4-11 July 2016, which provide informations on the projects investmens and scope of ESIA process, and the anticipated potential impact. The second consultation was conducted from 24-31 August 2016 on the first draft of the ESIA. Public consultations were conducted through questionairs and public consultation meetings. The public consultation meetings were held at the Ward/Commune PC.

About two weeks prior to public consultation, the consultant informed the local authority about the prpoposed additional investment and cooperated with the local authority to invite the affected people and representatives of the affected HHs to attend public consultation meeting.. Attending the meeting were representatives of the People's Committee, the Veterans Association, the Vietnam Fatherland Front, Women's Union, Youth Union, administration officials, head of residential areas and affected households by the subproject. The number of participants in the first and second consultations was 315 and 444 respectively. The results of the two public consultation meetings are described in the following Table 7.1 and 7.2

7.2 Public Consultation Results

Table 7.1 Summary of result of the 1st public consultation results

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
1	Van Hoa commune 4/7/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 05 people - Affectec households: 30 	<ul style="list-style-type: none"> - The people were disseminated on subproject information. - They supported for subproject implementation. - Have job-placement assistance. - Need to implement the adequate compensation policies for the affected households. - During the implementation of subproject, the environmental protection measures need implementing strictly to avoid affecting people health, and environmental pollution - Ensure sustainability and avoid damage to local infrastructures during the subproject implementation when implementing subproject. 	<ul style="list-style-type: none"> - This issue will be considered during the ESIA process - This issue will be considered and addressed in the RP. - This issue will be addressed in the ESIA report and included in the bidding documents of construction packages - This issue will be addressed in the ESIA report and included in the bidding documents of construction packages
2	Binh Minh ward 4/7/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 03 people - Affectec households: 26 	<ul style="list-style-type: none"> - People agreed with subproject implementation - The existing environmental situation in the subproject area is not polluted, so the environment needs to be kept clean during construction of subproject. - Ensure traffic situation in the area. - In the subproject construction, Contractor must ensure good drainage system to avoid flood 	<ul style="list-style-type: none"> - These issue will be addressed in the ESIA process and included in the bidding documents of construction packages

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
			when raining. - When getting environmental problems, it need to be solved immediately. - Construction supervision need to implemented by households.	
3	Pom Han ward 5/7/2016	- Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 04 people - Affectec households: 25	- Most of people were disseminated the subproject information; Only some people have not known subproject's information but they are also informed in meeting. The community supported for subproject - During the construction, ensure no impacts on traffic and travel needs of the people. - Ensure electrical system, water resource, drainage system when implementing subproject. - Prevent the noise pollution in the at the subproject construction site - Minimize the disturbance to the life of local people - For the construction process, there are some impacts on the atmosphere, water and living organisms and affect traffic. That should be prevented. - Recommend the subproject to keep a clean environment and social security.	- These issues will be addressed in the ESIA process and mitigation measures will be included as requierments in the bidding documents of construction packages.
4	Nam Cuong ward 5/7/2016	- Representatives People's Committee, the Veterans	- The people were disseminated on subproject information.	- PMU and consultant records all opinions of

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
		<ul style="list-style-type: none"> - Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 06 people - Affectec households: 24 	<ul style="list-style-type: none"> - They supported for subproject implementation. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people. - Contractor ensures that there is no impacts on traffic system in area. - The existing environmental situation in the subproject area is not polluted. - When implementing subproject, avoid the damages for residences and ensure infrastructure. - Subproject is carried out timely 	<ul style="list-style-type: none"> - participants. - These issues will be addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction contractors. - The construction duration will be shortening as appropriate.
5	Bac Cuong ward 6/7/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 05 people - Affectec households: 22 	<ul style="list-style-type: none"> - They supported for subproject implementation. - Avoid damage to local infrastructure when implementing subproject. - There must be mitigation measures for dust, scattered material mitigation and protect people's health; contractor must commit to protect environment. - Do not construct at night and noon, to avoid affecting the daily life of the community. 	<ul style="list-style-type: none"> - PMU and consultant agreed and acquired all people's opinions. - These issues will be addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction contractors. - The construction duration will be shortening as appropriate.
6	Bac Lenh ward 6/7/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union 	<ul style="list-style-type: none"> - They supported for subproject implementation. - Ensure infrastructure when implementing subproject. - There must be mitigation 	<ul style="list-style-type: none"> - PMU and consultant agreed and acquired all people's opinions. - These issues will be

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
		administration officials, the Vietnam Fatherland Front, Women's Union: 04 people - Affectec households: 28	measures for dust, scattered material mitigation and protect people's health; contractor must commit to protect environment. - Do not construct at night and noon, to avoid affecting the daily life of the community.	addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction contractors. - The construction duration will be shortening as appropriate.
7	Kim Tan ward 7/7/2016	- Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 06 people - Affectec households: 26	- The people should be involved in the construction monitoring process. - Ensure infrastructure when implementing subproject. - There must be mitigation measures for dust, scattered material mitigation and protect people's health; contractor must commit to protect environment. - Do not construct at night and noon, to avoid affecting the daily life of the community.	- PMU and consultant agreed and acquired all people's opinions. - These issues will be addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction contractors. - The construction duration will be shortening as appropriate.
8	Duyen Hai ward 7/7/2016	- Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 03 people - Affectec households: 31	- The people were disseminated on subproject information. - The people should be involved in the construction monitoring process. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people.	- PMU and consultant agreed and acquired all people's opinions. - These issues will be addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
			<ul style="list-style-type: none"> - Ensure infrastructure when implementing subproject. - The existing environmental situation in the subproject area is not polluted. - Avoid impacts on the livelihoods of the people. - Implementation of subproject is on schedule. 	<ul style="list-style-type: none"> contractors.
9	Lao Cai ward 8/7/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 05 people - Affectec households: 21 	<ul style="list-style-type: none"> - The people were disseminated on subproject information. - They supported for subproject implementation. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people. - The existing environmental situation in the subproject area is not polluted. - Avoid impacts on the livelihoods of the people. - Implementation of subproject is on schedule. 	<ul style="list-style-type: none"> - PMU and consultant agreed and acquired all people's opinions. - These issues will be addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction contractors.
10	Coc Leu ward 11/7/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 04 people - Affectec households: 25 	<ul style="list-style-type: none"> - The people were disseminated on subproject information. - They supported for subproject implementation. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people. - Ensure that the subproject implementation is not affect on traffic situation in 	<ul style="list-style-type: none"> - PMU and consultant agreed and acquired all people's opinions. - These issues will be addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction contractors.

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
			<p>the area.</p> <ul style="list-style-type: none"> - Do not construct at night and noon, to avoid affecting the daily life of the community. - Avoid impacts on the livelihoods of the people. - Implementation of subproject is on schedule. 	
11	Pho Moi ward 11/7/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 05 people - Affectec households: 26 	<ul style="list-style-type: none"> - The people were disseminated on subproject information. - They supported for subproject implementation. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people. - Ensure infrastructure when implementing subproject. - Implementation of subproject is on schedule. 	<ul style="list-style-type: none"> - PMU and consultant agreed and acquired all people's opinions. - These issues will be addressed in ESIA process and mitigation measures will be included as requirements in the bidding documents and contracts for construction contractors.

Table 7.2 Summary of result of the 2nd public consultation results

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
II. Second public consultation results				
1	Van Hoa commune 24/8/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 04 people - Affectec households: 65 	<ul style="list-style-type: none"> - The people were disseminated about the subproject's implementation contents. - Recommend contractors comply with measures to minimize the environmental impacts as presented in the draft ESIA report. - Do not construct at night and noon, to avoid affecting the daily life of the community. - Need to implement the adequate compensation policies for the affected households. 	<ul style="list-style-type: none"> - These issues have ben considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors - Subproject owners and consultant will monitor to ensure that contractors comply with measures proposed in the ESIA report. - Monitoring plan will be made to contractor perform on schedule and ensure quality of works.
2	Binh Minh ward 24/8/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 06 people - Affectec households: 38 	<ul style="list-style-type: none"> - In the area, the people supported for subproject implementation. - To water to reduce dust; To install signs in construction sites. - Do not construct at night and noon, to avoid affecting the daily life of the community. - Desire subproject is quickly deployed to benefit people. - Recommend contractors to resigster for temporary stay of workers with local 	<ul style="list-style-type: none"> - These issues have ben considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors - The units will be coordinated to ensure the subproject is developed soon. - PMU and environmental consultant will

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
			authorities	supervise the registration of contractors staying temporarily absent to ensure security and order in the locality.
3	Pom Han ward 25/8/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 04 people - Affectec households: 35 	<ul style="list-style-type: none"> - Most of people were disseminated the subproject information; Only some people have not known subproject's information but they are also informed in meeting. - During the construction process, ensuring no impact on traffic and travel needs of the people. - Ensure safety for the systems of electricity, roads, water supply when implementing subproject. - Prevent the noise pollution to the local people during construction process - Recommend the subproject to keep a clean environment and social security. 	<ul style="list-style-type: none"> - The units will be coordinated to ensure the subproject is developed soon. - These issues have ben considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors
4	Nam Cuong ward 25/8/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 06 people - Affectec households: 35 	<ul style="list-style-type: none"> - The people were disseminated about the subproject's implementation contents. - The people should be involved in the construction monitoring process. - Ensure that the subproject implementation is not affect traffic situation in the area. - Avoid impacts on the 	<ul style="list-style-type: none"> - PMU and consultant agreed and acquired all people's opinions. - The people are encouraged to participate in the construction monitoring process - Construction Supervision Unit will control strictly the construction process to ensure works quality.

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
			livelihoods of the people,. - Ensure work quality, avoid making failure of the works after operating in a short time.	- These issues have been considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors.
5	Bac Cuong ward 26/8/2016	- - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 05 people - Affectec households: 31	- The people supported for subproject implementation and desire that subproject is quickly deployed to benefit people. - Avoid damage and compensation to the damage of local infrastructure when implementing subproject. - There must be mitigation measures for dust, scattered material mitigation and protect people's health; contractor must commit to protect environment.	- These issues have been considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors. - Subproject owners and consultant will monitor to ensure that contractors comply with measures proposed in the ESIA report.
6	Bac Lenh ward 26/82016	- Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 04 people - Affectec households: 32	- Avoid impacts on public works such as electricity, communications. - Ensure infrastructure when implementing subproject. - There must be mitigation measures for dust, scattered material mitigation and protect people's health; contractor must commit to protect environment.	- These issues have been considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors. - Subproject owners and consultant will monitor to ensure that contractors comply with

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
				measures proposed in the ESIA report.
7	Kim Tan ward 29/8/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 06 people - Affectec households: 28 	<ul style="list-style-type: none"> - The people understand the negative impacts of the subproject. However, the impacts are temporary so the people will coordinate with the contractor to implement subproject. - Avoid damage and compensation to any damage on local infrastructure when implementing subproject. - There must be mitigation measures for dust, scattered material mitigation and protect people's health; contractor must commit to protect environment. 	<ul style="list-style-type: none"> - These issues have ben considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors. - Subproject owners and consultant will monitor to ensure that contractors comply with measures proposed in the ESIA report.
8	Duyen Hai ward 30/8/2016	<ul style="list-style-type: none"> - Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 03 people - Affectec households: 28 	<ul style="list-style-type: none"> - The people were disseminated on subproject information and support the subproject implementation. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people. - Ensure infrastructure when implementing subproject. - Avoid impacts on the livelihoods of the people. - Implementation of subproject is on schedule. 	<ul style="list-style-type: none"> - These issues have ben considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors. - Subproject owners and consultant will monitor to ensure that contractors comply with measures proposed in the ESIA report.
9	Lao Cai ward	<ul style="list-style-type: none"> - Representatives People's Committee, the 	<ul style="list-style-type: none"> - The people were disseminated on 	<ul style="list-style-type: none"> - These issues have ben considered in the

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
	30/8/2016	Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 05 people - Affectec households: 33	subproject information. They understand the negative impacts of the subproject. However, the impacts are temporary so they will coordinate with the contractor to implement subproject - Avoid impacts on public works such as electricity, communications. - Ensure infrastructure when implementing subproject. - Avoid impacts on the livelihoods of the people.	draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors. - Subproject owners and consultant will monitor to ensure that contractors comply with measures proposed in the ESIA report.
10	Coc Leu ward 31/8/2016	- Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 04 people - Affectec households: 27	- The people were disseminated on subproject information. - The people should be involved in the construction monitoring process. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people. - Avoid impacts on traffic system in the area. - Avoid impacts on the livelihoods of the people.	- These issues have been considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction contractors. - Subproject owners and consultant will monitor to ensure that contractors comply with measures proposed in the ESIA report.
11	Pho Moi ward 31/8/2016	- Representatives People's Committee, the Veterans Association, Youth Union administration officials, the Vietnam Fatherland Front, Women's Union: 05 people - Affectec households: 36	- The people support on subproject implementation. - Avoid impacts on public works such as electricity, communications. - The people should be involved in the construction monitoring	- These issues have been considered in the draft ESIA report and mitigations measures will be included as requirements in the bidding documents and contracts to construction

No	Location, Time	Participants	Community's opinions	PMU and Consultant's responses
			process. - The environmental impacts are negligible, but contractors must also pay attention to avoid impacts on the livelihoods of the people.	contractors. - Subproject owners and consultant will monitor to ensure that contractors comply with measures proposed in the ESIA report.

7.3 Responses And Commitments Of Subproject Owner

The Subproject Owner agrees on and acknowledges opinions/comments from the People's Committees of Wards/Communes and their local residents. The Subproject Owner and the Consultant have reviewed and incorporated those opinions/comments in the report and finalized the ESIA report on the basis of fully acquiring opinions/comments of the People's Committees of Wards/Communes 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 ESIA 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.

7.4. Information Disclosure

The draft ESIA had been published at the offices of Lao Cai City People's Committee and the People's Committees of subproject wards and communes on November 29, 2016.. Basing themselves on the contents of the ESIA, the local people could get the Subproject information and contribute their opinions/comments on environmental issues of the Subproject.

The draft ESIA was also sent to the World Bank office in Vietnam for its disclosure in the World Bank's Operations Portal on November 30, 2016.

CHAPTER 8. CONCLUSIONS, RECOMMENDATIONS AND COMMITMENT

1. Conclusions

The “Lao Cai City Subproject of the Medium Cities Development Project (MCDP) - Additional” to increase access to improved urban infrastructure service and traffic line conditions, overcoming inundation, bettering the natural environment and also contributing to protection of water quality in such basins as the Central lake in Nhat Son Park in the areas of Lao Cai city. The project implementation is absolutely in line with directions and policies of the Communist Party and the Government of Vietnam during the process of industrialization and modernization for sustainable development. Environmental significance of this Project is undeniable.

The ESIA report has presented impacts of each activity in all the project phases. Impacts on each subject and by each generation source have been quantified to the best extend. Proposed mitigation measures are feasible and highly efficient. However, to ensure remaining impacts at acceptable levels, environment monitoring will be carried out to provide more proper and timely corrective actions. Public consultation has been implemented as per requirements with participation of the PCs’ representatives and communities of all affected communes and wards in the project areas.

During preparation of the ESIA report, Vietnam national technical standards and regulations and the WB’s policies are complied with strictly.

2. Recommendations

The Employer look forward to attention and support of the project leaders, the World Bank, relevant authorities and departments of various sectors and at various levels during the project implementation, particularly during site clearance and compensation. Environmental protection actions and remedial actions for environmental incidents and risks are greatly encouraged, and close collaboration is desired for such actions. In addition, the Employer look for co-operation, comments, and inputs from relevant agencies and local communities during the project implementation.

The Employer recommend that Lao Cai PPC, the DONRE, and relating agencies and organizations should strengthen environmental management in the locality.

3. Commitments

3.1. General Commitments

The Employer commit to complying with applicable Vietnam law and regulations on environmental protection: Law on Environmental Protection 2014, and other relevant legal documents (Decree No. 18/2015/ND-CP dated 14 February 2015 by the Government on environmental protection assessment, strategic environmental assessment, environmental impact assessment and environmental protection plan; Decree No. 38/2015/ND-CP dated 24 April 2015 by the Government on management of waste and discarded materials; Decree No. 88/2007/ND-CP dated 28 May 2007 by the Government on urban drainage and urban zones, etc.), and the WB’s safeguard policies during the project implementation.

The Employer commit to implement fully all mitigation measures for negative impacts of the project on the environment during the pre-construction, construction and operation phases as presented in Chapters 5 and 6 of this report.

The project activities will be under monitoring and inspection of competent authorities such as Lao Cai DONRE, Lao Cai PPC, and other relevant agencies for the project development and environmental protection.

The Employer commit to disclose the approved ESIA report for the subproject so that compliance with environmental protection commitments in the approved ESIA report can be monitored.

3.2. Commitments to Environmental Standards and Regulations

The Employer commit to comply strictly environmental standards and regulations as below:

Exhaust emission: Vietnam standard QCVN 05:2013/BTNMT- Air quality - National technical regulation on ambient air quality;

Wastewater: It is committed to provide mitigation measures and operate the wastewater treatment system properly to ensure that treated wastewater quality will meet requirements of Vietnam standard QCVN 14:2008/BTNMT (column B): National technical standards on domestic wastewater quality;

Noises: Noises will be controlled in accordance with Vietnam standard QCVN 26:2010/BTNMT on noises.

Solid wastes: Solid wastes will be collected and treated strictly to ensure that there will be no dispersion and spillage of wastes to the ambient environment that meets environmental sanitation requirements stipulated in Decree No. 59/2007/ND-CP dated 09/4/2007 by the Government on solid waste management, Decree No. 38/2015/ND-CP dated 24/04/2015 by the Government on management of wastes and discarded materials, etc.

Hazardous wastes: Circular No. 36/2015/TT-BTNMT dated 30/5/2015 by the MONRE on management of hazardous wastes will be followed.

3.3. Commitments to Environmental Pollution Control and Management

Environmental management and environmental pollution control will be prioritized throughout the construction and operation phases;

The Employer commit to co-operate with competent agencies during the project design, construction, and operation of treatment systems and environmental protection facilities;

During the operation phase, the Employer commit to implement an environmental pollution management and control at the project sites as presented in the report and periodic reports submitted to Lao Cai DONRE,;

The Employer commit to provide compensation and remedial actions for environmental pollution in cases of any environmental incidents and risks incurred during the project implementation;

The Employer commit to complete the project scope of work, especially construction works and supply of environmental pollution control and treatment facilities and equipment after the ESIA report is approved.

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8. The World Bank's Environmental Safeguards Policies.
9. Polistic Press (2005) Vietnam Law on Environmental Protection.
10. Standards/Regulations related to Environment in Vietnam

APPENDIX 1: MCDP AF Lao Cai Dredged Materials Management plan

1. Location of Dredging, Volume and Characteristics of Dredged Materials

Dredging area: Central lake of Lao Cai city is located inside Nhac Son Park. The volume of dredging sludge estimated about 72,300m³.

Several other areas such as Constructing drainage system for the lake 09 main roads in Van Hoa commune, storm water drainage, wastewater collecting, 02 pumping station, water supply system, Rehabilitate the old sections and dredging the sludge inside the existing drainage; Construction of a bridge across Ngoi Dum stream generate about 513,870 m³ of excavating soil.

2. Final Disposal Site

Based on analysis result of sediment/soil samples in Chapter 2, the quality of sediment/soil samples is within allowable limits according to QCVN 03-MT:2015/BTNMT – National technical regulation on allowable limits of heavy metal in soils (forestry land) and QCVN 43:2012/BTNMT – National technical regulation on sediment quality

The disposal site is away from 7 km to 15 km from dredging area.

Although a separate management plan is prepared for the excavated materials of the entire project, disposals of the excavated materials will also follow the above principles. During construction phase additional tests for deeper layer will also be carried out by the contractors.

3. Contractor's Dredging Management Plan

The Contractor is required to prepare a Contractor's Dredging Management Plan (CDMP) and submitted to the Environmental Consultant of the Construction Supervision team and the PMU Environmental Officer for review and approval. The CDMP will include, but not limited to the followings:

- 1) The Scope of Works in the Contract package, construction method and schedule
- 2) Volume and quality of water quality and sediment quality in the dredging area covered by the contract
- 3) Water users that may be affected by the dredging and embankment lining
- 4) Materials uploading and transportation method: indicate proposed route of the transport from the dredged site to the disposal area, time of operation, type of vehicles/trucks and proposed measures to reduce the leakage of the dredged materials from the transport trucks,
- 5) Schedule to inform the nearby communities about the project, disclosure of name and contact number for possible complaints.
- 6) Potential social and environmental impacts, including the site-specific impacts and risks
- 7) Mitigation measures to address the potential impacts and risks. The mitigation measures should be proposed based on ESIA/ECOP, ESMP, the potential impacts and mitigation measures presented in Section 4 and 5 of this Plan and the following requirements:
- 8) Environmental Quality Monitoring plan carried out by the contractor (particularly pH, DO, TSS, BOD, salinity etc. for water and heavy metals including pH, Hg, As, Cd, Cu, Pb, Zn and Cr, Organic Materials and Mineral Oils for sediments and soil.
- 9) If the content of the heavy metals in the dredged materials exceeds the national standards, the contractor need to follow Circular No. 36/2015TT-BTNMT of MONRE dated 30 June 2015 providing detailed regulations on management of hazardous wastes to dispose the dredged materials in the designated landfill with hazardous waste treatment facility.
- 10) For soil and sediment: The number of samples taken will follow the following guidelines

Table 1 . The number of Sediment samples

<i>Volume of dredged (m³)</i>	<i>No of Sediment Samples</i>
Up to 25,000	3
25,000 to 100,000	4-6
100,000 to 500,000	6-10
500,000 to 2,000,000	10-20
For each 1,000,000 above 2,000,000	Additional 10

At least one water, soil and sediment sample must be taken for each contract package

- Consultation with affected community about the draft CDMP
- Excavated soil are separated from dredged materials from source. Excavated soils will be reused on-site and off-site as much as possible and transported to the nearest disposal site appraised under ESIA, or identified and approved during detail engineering design or construction phase;
- The mitigation measures are adequate to address the potential social and environmental impacts associated with various steps and activities, areas of influence and receptors of dredging, temporary storage, transportation and final disposal of the dredged materials.
- Field survey are carried out by the Contractor during the preparation of the CDMP in order to identify if there are additional sensitive receptors not identified previously under CCSEP and proposed additional site-specific mitigation measures accordingly.
- Contractor's environmental monitoring plan are included
- Commitments to carry out corrective actions when excessive pollution is determined, or when there are complaints about environmental pollution, social impacts from any stake holders

4.Potential Impacts and Mitigation Measures for Dredging and Embankment lining

Impacts and Description	Mitigation Measures
<i>At dredging and temporary loading areas</i>	
<p><i>Odour and air pollution, nuisance</i></p> <p>Decomposition of organic matters under anaerobic conditions generates strong odour-generated gases such as SO₂, H₂S, VOC etc. When the muds are disturbed and excavated, these gases are released much faster into the air. Exposure to odour pollution affect the health of workers, local residents and cause public nuisance</p>	<p>Inform the community at least one week before dredging is started</p> <p>Minimise the duration of temporary loading of dredged materials on-site</p> <p>temporary loading materials must be transported to the disposal site within 48 hours</p> <p>Load the materials on-site tidily</p> <p>Do not load the materials temporarily outside the construction corridor determined for each canal section</p> <p>Avoid loading the sludge in populated residential areas or near public buildings such as kindergarten. Load the sludge as far from the houses and buildings as far as possible</p> <p>Cover the temporary sludge loads when loading near sensitive receptors or longer than 48 hours unavoidable</p>

Impacts and Description	Mitigation Measures
<p><i>Dust and nuisance</i></p> <p>Temporary loading of sludge at the construction site cause nuisance to the public Dry and wet mud may be dropped along the dredging area and on transportation route causing nuisance to the public and traffic safety risks</p>	<p>Avoid temporary loading of dredged materials on-site</p> <p>Dredged materials must be transported to the final disposal sites earliest possible and no later than 48 hours from dredging.</p> <p>Use truck with water-tight tank to transport wet/damp dredged materials;</p> <p>All trucks must be covered tightly before leaving construction site to minimise dust and mud dispersion along the road</p>
<p><i>Traffic Disturbance</i></p> <p>The placement and operation of dredging equipment and construction plants on the ground, temporary loading of the dredged materials may obstruct or disturb traffic and cause safety risks for the people travelling on the canal-side road, particularly on canal-crossing bridges which are usually very narrow</p>	<p>Arrange worker to observe and direct excavators driver when traffic is busy</p>
<p><i>Social Disturbance</i></p> <p>Concentration of workers and equipment, construction plants, temporary loading of materials and wastes, traffic disturbance, dusts and odour pollution etc. will disturb daily activities and the lives of local residents</p> <p>Conflicts may also be arisen if workers, waste, materials, equipment etc. are present outside the construction corridor</p>	<p>Inform the community at least one week before construction is started</p> <p>Monitor to ensure that physical disturbances are within the construction corridors only</p> <p>Contractor recruit local labours for simple works, brief them about project environmental and safety requirements before started working</p> <p>Contractor register the list of workers who come from other localities to the commune at the construction site</p> <p>Led the water leaked from wet/damp dredged materials going back to the river, not to affect garden or agricultural land</p> <p>Keep the areas to be disturb minimal</p> <p>Enforce workers to comply with codes of conducts</p>
<p><i>Landslide and soil subsiding risks at dredging area</i></p> <p>Relative deep excavation or cut and fills on the embankments that create slopes may lead to landslide and soil subsiding at the slops or excavated areas, particularly in rainy weather</p> <p>Deep excavation also cause risks to the existing buildings nearby, particularly the weak structures or located too close to the deep excavation area.</p>	<p>During field survey for the preparation of CDMP, the contractor in coordination with the Environmental Officer of PMU and the Environmental Consultant of the CES identify weak structures that may be at risk and determine appropriate mitigation measures accordingly</p> <p>Consider and select appropriate dredging method that allow minimising soil subsiding risks, for example carry out stepped</p>

Impacts and Description	Mitigation Measures
	excavation, stabilise slopes in parallel to dredging Apply protective measures such as sheet piles at risky locations
<p><i>Water Quality Degradation</i></p> <p>Turbidity in water will be increased when the mud is disturbed; Water leaked from dredged material and surface runoff through disturbed ground also contain high solid contents. Muddy water entering irrigation ditch will cause sedimentation. Aquatic life in the canal would also be affected by turbid water.</p>	<p>Build coffer dams surrounding the dredging area and pump the water out before starting dredging</p> <p>If dredging is carried out directly onto the water, dredge at intervals to allow suspended materials to resettle before continuing.</p> <p>Observe water colour at 20 m upstream and stop dredging when water colour there started to change</p>
<p><i>Increased Safety risk for the Public</i></p>	<p>Place stable barriers along the construction corridor boundary to separate the site with nearby structures</p> <p>Place warning signs and reflective barriers along the construction area, at dangerous locations and within sensitive receptors</p> <p>Ensure adequate lighting at</p>
<p><i>Health and Safety risk to the workers</i></p> <p>The health of workers may be affected due to exposure to odour and other contaminants from sludge</p> <p>Risk of being drown</p>	<p>Within two weeks before dredging is started, the contractor will coordinate with local authority to identify good swimmers or those who can dive in the locality, and hire at least one of them at each canal construction site deeper than 3 m and there are workers working on or near water surface.</p> <p>Provide and enforce the workers to use masks. If and when working in the water, protective cloths, rubber boots, gloves and hats must be wore.</p>
<p><i>Others</i></p>	<p>Other relevant measures specified in ECOP or proposed by the contractors as necessary</p>
<p>Material loading and transportation</p>	
<p><i>Dust and nuisance, traffic safety risks</i></p> <p>Dust or wet materials may be dropped along the transportation route</p>	<p>Use water-tight tank trucks for transporting wet/dam materials</p> <p>Cover the materials tightly before leaving the construction site</p> <p>Do no overload material on the trucks</p>
<p>At final disposal site</p>	
<p><i>Landslide and soil subsiding risks at final Disposal site</i></p> <p>Landslide and subsiding risk may happen on slopes created at the final disposal site of</p>	<p>Level the materials after being disposed off</p> <p>Slopes of the dumps will not be steeper than 45°</p> <p>Build/create the walls to protect slopes</p>

Impacts and Description	Mitigation Measures
dredged materials if the slopes created are too high, steep or unstable	Create and maintain drainage at the foot of each dump higher than 2 m
<p><i>Soil and Water Quality Pollution</i></p> <p>The disposal of salty soil would not affect the existing soil quality</p> <p>No risks of subsidence and landslide for residential areas around this area</p> <p>No impacts on river water quality.</p>	<p>Apply measures that ensure rainwater onto the materials is not mix with the surface runoff from the surrounding to overflow uncontrolled at the site; rainwater will be infiltrated onto the ground on-site. This can be done by the following mitigation measures:</p> <p>Build drainage ditches surrounding the designated disposal area</p> <p>Use impermeable materials to cover the walls surrounding the materials to isolate it with the surrounding</p> <p>Other measures proposed by the contractors to meet pollution control targets</p>

5. Specific Guidance for Dredging at Central Lake

- Identifying the available land for disposing the dredged materials. The plan should also identify the possible lands to be appropriated for the disposal of dredged materials. Public land, land for construction of rural roads, public works, private land, etc. may be used, with an agreement with the project affected households. It should also meet local plans for land use.
- Preparing for a transportation plan. In case, the dredge disposal area is far away from the dredged sites, the DMP shall set out a transportation plan including: (a) methods of transportation (pipeline, barges, hopper barges) and uploading to the disposal area. If trucks are used, indicate proposed route of the transport from the dredged site to the disposal area, (b) time of operation, (c) type of vehicles/trucks and proposed measures to reduce the leakage of the dredged materials from the transport trucks, (d) contractors' responsibilities for cleaning the roads and carry out remedial works if necessary, and (e) a communication plan for the nearby communities including contact number for possible complaints.
- Plan for managing the disposal areas including: (a) plan for reducing the drainage, (b) construction of the perimeter dykes, (c) construction of sub-containment area, if applicable, (d) planned thickness of the dredged materials (typically less than 1.5 meters), (e) any measures to protect ground water and soils (e.g., installation of PVC membrane).
- Designing the Draining for Disposal lands. As the dredged materials are in the state of mud at first and soil particles are suspended for 24 to 48 hours. All drainage water from disposal land shall be driven to the drains and discharged back to the river. In order to limit the negative impacts of mud (produced by dredging) on the environment as well as the water quality of the canals, the dredged sediment will be transported to a containing area which is appropriately located and properly design with an adequate size. The dredged spoil will be pumped to the disposal land and then overflow to a settlement pond, where turbidity and total suspended solids are settled. After some time, effluent is returned to the river. A typical design of the dike around each disposal may be as follows: Height: 2m, Footing width: 5 m, and Surface width: 1m. The plan should set out a basic layout.
- Monitoring the Disposed Dredged Materials. A plan for monitoring the dredged materials as well as water quality of effluent would be required. As stated before, an intensive monitoring would be required if the dredged materials contains higher content of the heavy metals and other harmful materials than the national thresholds.

- In order to mitigate the issue of turbidity during dredging operation, the DMP shall set out dredging equipment and/or techniques suitable to the particular site. On laying dredging machines on a barge, contractors can use a proper mud –stopping net for enclosing the dredging site and keeping back mud on land, not to let it goes back to the canal. If the disposal site for dredge materials is located far away from the dredger, a suction dredger should be used to transfer all the mud and soil in water to the disposal sites. The length of dredging sections should be limited less than 1 km and the dredging should be done one by one.
- At the completion of the contract, carry out an assessment on dredged materials, and determine the use of the dredged materials for activities such as: (a) construction (roads and dykes), (b) basis for individual houses, and (c) gardening

APPENDIX 2. Review of Linked Subprojects Of Lao Cai MCDP-AF

Project Name	Tong Mon Landfill and Lao Cai City Waste Treatment Plant
Description	<p><u>Scope of work:</u> Tong Mon Landfill is located in Tong Mon Hamlet, Dong Tuyen Commune of Lao Cai City. The treatment plant has been constructed as part of the landfill.</p> <p><u>Tong Mon Landfill:</u> The landfill has an area of 46ha with waste handling capacity of 70 tons/day. Operating from 1999, its capacity is designed to serve for 25 years until 2024. Domestic solid waste is collected twice 1 day and compacted to a thickness of 0.8 to 1.0 m each layer. After being sprayed with water using enzyme technology (EM 10-12 l/m³), waste is often covered with a layer of soil 7 - 10cm thick. The landfill is managed by Lao Cai Urban Environment JSC (Lao Cai URENCO).</p> <p><u>Lao Cai Waste Treatment Plant (WTP)</u> The investment project of waste treatment plant is part of the rural infrastructure and tourism project in Lao Cai Province and the plant was built within Tong Mon Landfill. The project aims to handle the entire waste collected from 3 urban sites of Lao Cai City and Bat Xat town, Sapa town, which will be processed into organic fertilizer, mineral fertilizers and recovery of recyclable materials to minimize the amount of waste to be landfilled and improve environmental sanitation.</p> <p>The plant has a capacity of processing 100 tons of waste per day, to the maximum capacity of 147 tons/day. The waste treatment zone is planned with a total area of 30 hectares, of which the construction area of each work item under the plant is 4 hectares, the rest is the current landfill and planned for expansion and greenery belt.</p> <p><u>Construction period for the WTP: 2013-2015</u></p> <p><u>Funding source:</u> The WTP is co-funded by AFD funding of 66.3 billion VND and Lao Cai provincial budget of 14.95 (total 4 million USD)</p> <p><u>Relationship with Lao Cai MCDP-AF</u> The domestic waste generated during the pre-construction, construction phase and waste from developed urban site of MCDP-AF subproject will be transported and handled at the Lao Cai WTP and Tong Mon Landfill. In case that the WTP is still not operational by the completion time of the MCDP-AF, waste collected will be disposed in Tong Mon landfill without processing.</p>
Current status	Tong Mon landfill is operational since 1999.
Status of EIA	Environmental Protection Commitment (EPC) for the Tong Mon landfill and EIA for the WTP have been prepared separately by Lao Cai URENCO, in 1999 and 2012 respectively. They have been evaluated by Lao Cai DONRE, and approved by Provincial People’s Committee.
Detail of EMP	As stated in the Tong Mon EPC, environmental monitoring is conducted on weekly basis and the monitoring reports by a independent consultant firm are produced on semi-annually and transferred directly to Lao Cai DONRE for review and inspection. As of December 2016, the 1 st monitoring report has been

	<p>prepared and submitted (June 2016) while the second report is being drafted.</p> <p>According to the monitoring report, 02 samples of surface water, 02 samples of wastewater and 03 samples of air quality have been taken and analysed for required parameters such as BOD, COD, Pb, Arsenic, CO, SO₂, NO₂ etc. in accordance with Vietnamese environmental regulations for landfills. The test results proved that all parameters are within allowable limits set by Vietnam standards (e.g. QCVN 25:2009/BTNMT -National Technical Regulation on Wastewater of the Solid Waste Landfill Sites). (A copy of test results is annexed to the Report).</p> <p>An environmental unit in Lao Cai URENCO is responsible for the overall compliance for environmental regulation of the landfill. The unit consists of 4 staff who are environmental and technical engineers and working daily. An Operational Manual and Work Conduct Policy for the landfill were introduced. They include operation and maintenance procedures, emergency responses and usage of toolkits.</p>
Assessment of cumulative impact	The project contribute to enhancement of the overall efficiency of the proposed MCDP-AF by handling domestic waste for the entire project life from pre-construction to operation phase. This will help minimize waste littering and improve the local environment.
Recommendation	<p>Cooperation between Lao Cai MCDP-AF PMU and Lao Cai URENCO need to be established in order to:</p> <ul style="list-style-type: none"> - Exchange information on actual capacity and operation of the WTP. - Exchange information on environmental mitigation compliance of both projects.
Project Name	Dong Pho Moi Wastewater Treatment Plant
Description	<p>Scope of work:</p> <p>The Dong Pho Moi WWTP project is located in the east part of Dong Pho Moi Industrial Park in Pho Moi Ward, 4km from the center of Lao Cai City. It includes two phases:</p> <p><u>Phase 1 (2012-2015):</u></p> <ul style="list-style-type: none"> - Construction of wastewater treatment plant with capacity of 500m³/day - Construction of wastewater collection system inside the Dong Pho Moi Industrial Park. By design, wastewater is collected from 18 operational companies, 6 under construction and 12 to be constructed (36 in total). Most wastewater is generated from agro-product processing firms. Treated wastewater will satisfy standard QCVN 24:2009/BTNMT - Column B for industrial wastewater before discharging to a small 300m long stream and then the Red River. - The WWTP consists of the following components: Protective coarse bar screen, wastewater collector tank, cooling equipment, conditioning tank, primary physio-chemical treatment system, and extended aeration biological system for activated sludge waste treatment. <p><u>Phase 2 (by 2020):</u>, 1000m³/day after 5 years of operation or based on actual demand.</p> <p><u>Wastewater treatment diagram</u></p> <p>Wastewater → screening bar → collector tank → wastewater conditioning tank</p>

	<p>→ coagulation system → aerobic biological tank → secondary tank → recipient source → sludge waste treatment by pressing and drying.</p> <p><u>Funding source:</u> The WWTP is funded by Lao Cai provincial budget with total investment of VND 50 billion (2.1 million USD)</p> <p><i>Relationship with Lao Cai MCDP-AF</i> As it locates 3.7km from Van Hoa Commune, the wastewater in Van Hoa Commune in MCDP project's SP-C1: Basic infrastructure upgrading and service improvement at Van Hoa area will be conveyed and treated in this WWTP.</p>
Current status	The WWTP has been completed but being inactive due to lack of wastewater. Among key reasons are some of the connection lines for collecting wastewater are under construction and most of operational firms in the IP are currently transporting goods only instead of manufacturing and/or food processing.
Status of EIA	EIA was prepared by Project Owner, evaluated by Lao Cai DONRE, and approved by Provincial People's Committee.
Detail of EMP	<p>As indicated in the EIA, during the operation phase, solid waste from the WWTP is transferred to the waste collection point in the industrial park for treatment. Noise impact and odor nuisance are minimized with barriers to keep noise level under 85 dB within acceptable level for industrial facilities. An unit of 10 staff led by an environmental engineer is responsible to the operation of the WWTP.</p> <p>The environmental monitoring and management program is underway during operation phase. As stated in the EIA, environmental monitoring reports are produced daily, monthly, quarterly and yearly and transferred directly to Lao Cai DONRE for review and inspection. At the moment, there is no monitoring report produced.</p>
Assessment of cumulative impact	At the moment the wastewater treatment plant is not running and the capacity of 500m ³ /day suffices to receive domestic wastewater from Van Hoa Area both in quantity and quality. The project is contributing to enhancement of the overall efficiency of the proposed MCDP-AF by connecting with the sanitation infrastructure in Van Hoa Area and solving domestic wastewater. This will help minimize discharge and potential contamination from Van Hoa into the Red River and improve the local environment.
Recommendation	<p>Cooperation between Lao Cai MCDP-AF PMU and Dong Pho Moi IP Management Board need to be established in order to:</p> <ul style="list-style-type: none"> - Exchange information on actual capacity and operation of the WTTP for appropriate design and construction of collection pipeline from Van Hoa Area. - Exchange information on environmental mitigation compliance of both projects.

Subproject Name	Red River Embankment Dyke in Van Hoa Commune, Lao Cai City
Description	<p>Scope of work</p> <ul style="list-style-type: none"> - Subproject category: Class B; - Total investment: 1,050 billion VND (46 million USD) - Funding source: Central and local governments - Duration of subproject: 2016 – 2018 - Project Owner: Lao Cai Department of Planning and Investment - Construction works include: <ul style="list-style-type: none"> i) Construction of embankment dyke of right side Red River of 6,6km long. ii) Construction of discharge gates from road culverts to the river iii) Ground levelling of 40ha as predicated in the provincial masterplan iv) Road construction on the bank with length of 5.73km. Construction of internal roads of 2.3km <p><u>Relation to Lao Cai MCDP-AF Subproject</u></p> <p>As it locates in Van Hoa Commune, the impact area is within the MCDP subproject's SP-C1: Basic infrastructure upgrading and service improvement at Van Hoa area. The roads that will be constructed will be connected with the MCDP infrastructure. The The runoff water collected by the MCDP subproject will be discharged to this newly embanked river section.</p>
Current status	Under construction and will be completed in 2018
Status of ESIA/ESMP	The EIA report has been approved by Lao Cai PPC. Its ESMP is being implemented by the Subproject Owner and monitored by Lao Cai Department of Natural Resources and Environment
Assessment of cumulative impact	<p>The Red River Embankment Subproject in Van Hoa commune of Lao Cai provides soil erosion, create space and improve urban landscape, creating land for production and people's life. Long term benefits of the completed subproject include the socio-economic development of Van Hoa Commune in particular and Lao Cai city in general.</p> <p>As the subproject will be halfway to completion by the time the proposed Lao Cai MCDP is undertaken, certain cumulative impacts during construction and operation phase need to be considered including: impacts on dust, noise, traffic due to construction activities and material transportation, the increase in traffic in the area, interruption of basic utility provision and business and potential harms to the completed roads.</p> <p>- <u>Impact on dust, noise, traffic due to construction activities and material transportation</u></p> <p>The construction time of this subproject and that of MCPD-AF appear coinciding in the same area of Van Hoa commune. This will augment the impacts of noise, dust and traffic during construction phase. These impacts are assessed as short timed and site-specific. In the post-construction phase, this will help improve the efficiency of the subproject through an additional investment which have not yet been included in MCDP-AF subproject. Therefore the cumulative impact is assessed as positive.</p>

	<p>An area of about 40ha including 18.6ha of river land, 20.9ha of farming land and 0.5ha of residential land will be acquired. 215 households will be affected in which 55 will be relocated to the Van Hoa Resettlement Sites No.1 and No.2. However, the subproject will create a 7.2ha for residential purpose that will serve around 600 households and the impacts of land clearance will be reduced significantly.</p> <p>Lao Cai PPC policy of resettlement is applied for this subproject.</p>
Recommendation	<p>Cooperation between Lao Cai MCDP-AF PMU and Lao Cai Department of Planning and Investment Project Owner need to be established in order to:</p> <ul style="list-style-type: none"> - Exchange information on actual schedule of construction works. - Exchange information on environmental mitigation compliance of both projects.
Subproject Name	Road D1,D2,D3 in Van Hoa Urban Area
Description	<p>Scope of work:</p> <ul style="list-style-type: none"> - D1 Road: constructed from 2013 and completed in 2015, from the roundabout to Giang Dong Bridge - Construction of Road D2 (15 m wide road, 384m long) from the roundabout to Red River embankment road. Construction commences in December 2016 and Project Owner is Lao Cai Department of Planning and Investment - Construction of Road D3 (7.5 m wide road, 294m long) from the roundabout to end of Red River embankment road toward Pho Moi. Construction commences in December 2016 and Project Owner is Lao Cai Department of Transport - Funding source: Lao Cai provincial budget - Total investment: VND 55 billion (2 million USD) - Duration of the subproject: 2016 - Q1/2018 <p>Relationship with MCDP-AF</p> <p>As it locates in Van Hoa Commune, the impact area is within the MCDP subproject's SP-C1: Basic infrastructure upgrading and service improvement at Van Hoa area. The roads either completed or to be constructed will be connected with the MCDP-AF infrastructure.</p>
Current status	At the moment, the subproject is in the stage of site clearance and construction preparation.
Status of EIA	EIA was prepared by investor, appraised by Lao Cai DONRE, and approved by Provincial People's Committee.
Detail of EMP	<p>Mitigation measures during site clearance; construction and operation stages were proposed in the EIA report.</p> <p>The environmental monitoring and management program is also proposed with the frequency of every 3 months during construction phase and every 6 months during operation phase.</p> <p>Responsibilities of stakeholders involved in the environmental management and monitoring were also mentioned in the EIA report</p>
Assessment of cumulative impact	The construction of roads and utilities infrastructure is planned to commence before or at the same time with the MCDP subproject's SP-C1: Basic infrastructure upgrading and service improvement at Van Hoa area. This will

	<p>augment the impacts of noise, dust and traffic during construction phase. These impacts are assessed as short timed and site-specific. In the post-construction phase, this will help improve the efficiency of the subproject through an additional investment of some necessary components which have not yet been included in the MCDP-AF subproject. Therefore the cumulative impact is assessed as positive.</p>
Recommendation	<p>Cooperation between Lao Cai MCDP-AF PMU and Lao Cai Department of Planning and Investment and Department of Transport as Project Owners need to be established in order to:</p> <ul style="list-style-type: none">- Exchange information on actual schedule of construction works.- Exchange information on environmental mitigation compliance of both projects.