Initial Environmental Examination

July 2012

VIE: Greater Mekong Subregion Corridor Towns Development Project

Prepared by the Provincial People's Committee of Quang Tri and Tay Ninh for the Asian Development Bank.

CURRENCY EQUIVALENTS
(as of 26 July 2012)

Currency unit	–	dong (D)
D1.00	=	$0.0000479
$1.00	=	D20,853

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	affected people
BOD	–	Biological Oxygen Demand
COD	–	Chemical Oxygen Demand
CTDP	–	Corridor Towns Development Project
DAFO	–	District Agriculture and Forestry Office
DHUP	–	Division of Housing and Urban Planning
DIC	–	District Information and Culture
DoF	–	Department of Forestry
DPWT	–	District Public Works and Transport Office
DNREO	–	District Natural Resource and Environment Office
EA	–	Environmental Assessment
EIA	–	Environment Impact Assessment
ECC	–	Environmental Compliance Certificate
EMP	–	Environment Management Plan
EMMU	–	Environment Management and Monitoring Unit
ESIA	–	Environment and Social Impact Assessment
EA	–	Executing Agency
EWEC	–	East West Economic Corridor
FS	–	Forest Strategy
GMS	–	Greater Mekong Sub-Region
IEE	–	Initial Environment Examination
IUCN	–	International Union for Conservation of Nature
IWRM	–	Integrated Water Resource Management
MAF	–	Ministry of Agriculture and Forestry
MIC	–	Ministry of Information and Culture
MoNRE	–	Ministry of Natural Resources and Environment
MPCTC	–	Ministry of Post, Construction, Transport and Communication
MPWT	–	Ministry of Public Works and Transport

MP	–	Ministry of Planning and Investment
MRF	–	Material Recovery Facilities
MRC	–	Mekong River Commission
NAPA	–	National Adaptation Plan of Action
NBSAP	–	National Biodiversity Strategy and Action Plan
NGOs	–	Non Government Organization
NLMA	–	National Land Management Authority
NPA	–	National Protected Area
NTA	–	National Tourism Authority
NTFP	–	Non-Timber Forest Product
PAFO	–	Provincial Agriculture and Forestry Office
PEI	–	Poverty Environment Initiative
PIC	–	Provincial Information and Cultural Office
PIU	–	Project Implementation Unit
PMU	–	Project Management Unit
PNREO	–	Provincial Natural Resource and Environment Office
PLMO	–	Provincial Land Management Office
PPI	–	Provincial Planning and Investment Office
PPH	–	Provincial Public Health Office
PPA	–	Provincial Protected Area
PWREO	–	Provincial Water Resources and Environment Office
RBC	–	River Basin Committee
REA	–	Rapid Environment Assessment
TSS	–	Total suspended solids
SEC	–	Southeast Economic Corridor
UDAA	–	Urban Development and Administration Authority
UXO	–	Unexploded Ordnance
WREA	–	Water Resources and Environment Agency
DARD	–	Department of Agriculture and Rural Development
DT	–	Department of Transport

WEIGHTS AND MEASURES

h	–	hectare
km	–	kilometer
Kg	–	kilogram
mm	–	millimeter

NOTE

In this report, "$" refers to US dollars unless otherwise stated.

I. EXECUTIVE SUMMARY

1. The towns of Dong Ha, Lao Bao, and Moc Bai are the three subproject locations for the Corridor Towns Development Project (CTDP) in Viet Nam. Viet Nam together with Cambodia and Lao PDR are the countries that form the GMS CTDP (ADB TA 7644-REG). Through infrastructure developments in the three subproject towns in Viet Nam the goal of the CTDP is to help develop the existing East-west Economic Corridor (EWEC) and Southeast Economic Corridor (SEC) from transportation corridors into economic corridors as part of the overall economic development of the Greater Mekong Sub-region.

2. The initial environmental examination (IEE) of the CTDP subprojects in Viet Nam presented herein consolidates the initial three IEEs that were prepared for each subproject town. The consolidated IEE has been re-formatted and edited pursuant to the requirements of ADB's SPS (2009).

A. Subprojects Summary

3. The CTDP in Viet Nam is an ADB Category B project at the feasibility design phase, and is defined by the following subprojects and infrastructure investments:

Subproject	Subproject component
Dong Ha	Hieu River Embankment Protection
	Dong Ha River Port Rehabilitation
	Upgrade Urban Road Network & Drainage
	Materials Recovery Facility
Lao Bao	Improved Solid Waste Management – New Sanitary Landfill
	Upgrade Urban Road Network & Drainage
Moc Bai	Improved Wastewater Treatment – New WWTP
	Waters Supply System – New WTP
	Upgrade Urban Road Network & Drainage
	Materials Recovery Facility

4. The riverbank of the Hieu river in Dong Ha will be fortified with modern slope stabilization materials and techniques. The rehabilitated riverbank will reduce chronic erosion, and beautify and improve community access to the river in the town.

5. The closed Dong Ha river port will be rehabilitated and re-opened for commercial use. The investment will include a new wharf, upgraded storage building, new motorcycle parking lot, upgraded administrative facilities, and domestic and process waste management.

6. The new sanitary landfill near Lao Bao will supplement the existing two smaller dumpsites in Lao Bao and Khe Sanh. The new landfill will include a liner and a leachate treatment facility. The quality of treated leachate and the receiving environment for disposal have not been finalized.

7. The new water treatment plant in Moc Bai will provide much needed potable water to the border community. The WTP will use groundwater for raw water to produce treated water to meet GoV drinking water standards.

8. The new wastewater treatment system in Moc Bai will collect and treat wastewater from the border community. The WWTP will administer primary anaerobic wastewater treatment. The treated effluent will meet GoV discharge standards before being discharged to drainage canals leading to the Vam Co river.

9. The road upgrades in Dong Ha, Lao Bao, and Moc Bai will occur to networks of small roads throughout the towns. The road upgrades will consist of road widening, upgraded surfacing, installation of lights, trees, and upgraded lateral drainage.

10. Modern, material recovery facilities (MRF) will be constructed in Dong Ha and Moc Bai. The MRFs will make safer and more efficient existing solid waste picking and sorting by the community. The MRFs will be contained in specially designed buildings that provide central solid waste depot sites.

B. Potential Impacts of Subprojects

11. In general the examination of the pre-construction, construction, and operational phases of the subprojects, which included input from community stakeholder meetings, indicates that the potential environmental impacts of the subproject investments in Viet Nam will be short-term civil construction-related which can be mitigated. The construction impacts of elevated dust, noise, traffic disruptions, erosion and sedimentation, liquid and solid waste, erosion, and public and worker safety can be mitigated and managed effectively with good construction management practices.

12. Potential long-term environmental impacts of the infrastructure developments concern the operation of the waste water treatment plant (WWTP) and sanitary landfill. The potential impacts of the WWTP arise from uncertainties with the sensitivity of groundwater to WWTP operations, and the assimilative capacity of the drainage canals and Vam Co river which will receive the treated effluent. The sensitivity of groundwater, and down-slope surface waters to the operation of the new sanitary landfill needs to be clarified at detailed design stage. The expected quality and disposal procedure for the treated leachate from landfill also needs to be clarified at detailed design stage.

13. Potential impacts of the Hieu river embankment protection and the rehabilitation of the river Port in Dong Ha focus on the construction impacts of both investments on water quality, aquatic biota, and river use, and the potential impact of the operation of the rehabilitated port on river navigation and safety, and other community uses of the river. Other potential impacts of the re-commissioned port include increased local traffic to/from the port, and worker and public safety. Mitigation measures have been specified to isolate and minimize the construction-related impacts, and potential community-related impacts of the operation of the port.

14. Standard civil construction practices will be applied to mitigate environmental and community-related disturbances associated the upgrades to the urban roads in the Dong Ha, Lao Bao, and Moc Bai.

15. Data and information on the presence/absence of critical wildlife habitat, or rare or endangered species at the subproject sites need to be supplemented during the detailed design phase. Protected areas such as the DaKrong nature reserve, and the La Go Sa Mat national park will not be affected by any subproject investment.

16. Potential induced environmental impacts of the subprojects are increased natural resource consumption and environmental degradation which could stem from the planned impact of the CTDP of socioeconomic development in the towns. These induced environmental impacts would potentially accumulate regionally along and adjacent to the EWEC and SEC.

C. Conclusions

17. The consolidated IEE concludes that the description of the feasibility design of the subprojects combined with available information on the affected environments is sufficient to identify the scope of potential environmental impacts of the project. However, clarification of the affected environments is needed which can occur during the detailed designs of the subprojects.

18. Individual Environmental Management Plans (EMP) for the subprojects are found under separate cover. The EMPs provide detailed impacts mitigation and environmental monitoring plans, and the institutional responsibilities and capacity needs for the environmental management of the subprojects. The EMPs will need to be updated to meet the detailed designs of the subprojects.

TABLE OF CONTENTS

II. INTRODUCTION

A. Project Overview

19. GMS Corridor Towns Development Project (CTDP) aims to facilitate the transformation of transport corridors in the Greater Mekong Sub-region (GMS) into full fledged economic corridors through urban infrastructure improvement and institutional capacity strengthening in selected corridor towns in Vietnam, Cambodia, and Lao PDR. The participating corridor towns in Viet Nam are Dong Ha and Lao Boa which are situated at the east end of the east-west economic corridor (EWEC), and Moc Bai which is situated at the southern end of the south-east economic corridor (SEC) (Figures 1 & 2). The corridor towns of Lao PDR and Cambodia are also located along the EWEC and SEC.

20. A focus on corridor towns development is a new approach to maximize economic benefits of increased trade and traffic flows along major transport corridors in the GMS. Several corridor towns are located so strategically that they can boost up investment and economic activities. With a necessary advantageous environment including proper strategic economic development plan and adequate infrastructure aside from public service, in combination with sufficient institutional capacity of oriental organization and investment management as well as in future development, corridor towns can successfully attract private sector investment in economic infrastructure such as commercial centers, agro-business, agricultural processing zone, industrial parks, transport terminals and logistics facilities. Corridor towns will play an important role in local economic activities.

21. The key institutional and organizational challenges faced by corridor towns arise from the fact that essential urban service is insufficient due to inadequate urban infrastructure investments and limited institutional capacities at both provincial and district levels. Improvements to transport connectivity along the EWEC and SEC have resulted in growing cross border movements of people, goods and services. It has also created considerable development pressure on provincial and district governments to provide adequate urban infrastructure and formulate a development plan to meet the local demands as a result of increased trade and traffic flows along transport corridors in Vietnam.

22. The CTDP will develop infrastructure investments in the Dong Ha, Lao Bao, and Moc Bai in Viet Nam. Moc Bai is just across the border of the SEC corridor town of Bavet in Cambodia (Figure 2). Lao Bao is the sister border city of Dansavanh in Lao LDR along the EWEC (Figure 1). The IEEs for the corridor towns of Cambodia and Lao PDR are found under separate cover.

1. Definition of terms:

23. In the IEE presented herein a *subproject* refers to one of the three corridor towns (i.e., Dong Ha, Lao Boa, & Moc Bai) and is comprised of all of the infrastructure investments that will occur in that town. A *subproject investment* or *component* refers to a single infrastructure investment such as a port rehabilitation, improved wastewater treatment, or MRF.

24. The infrastructure investments (components) of the subprojects in Dong Ha, Lao Bao, and Moc Bai are summarized in Table 1.

Figure 1. Corridor towns of Lao Bao and Dong Ha at eastern end of EWEC.

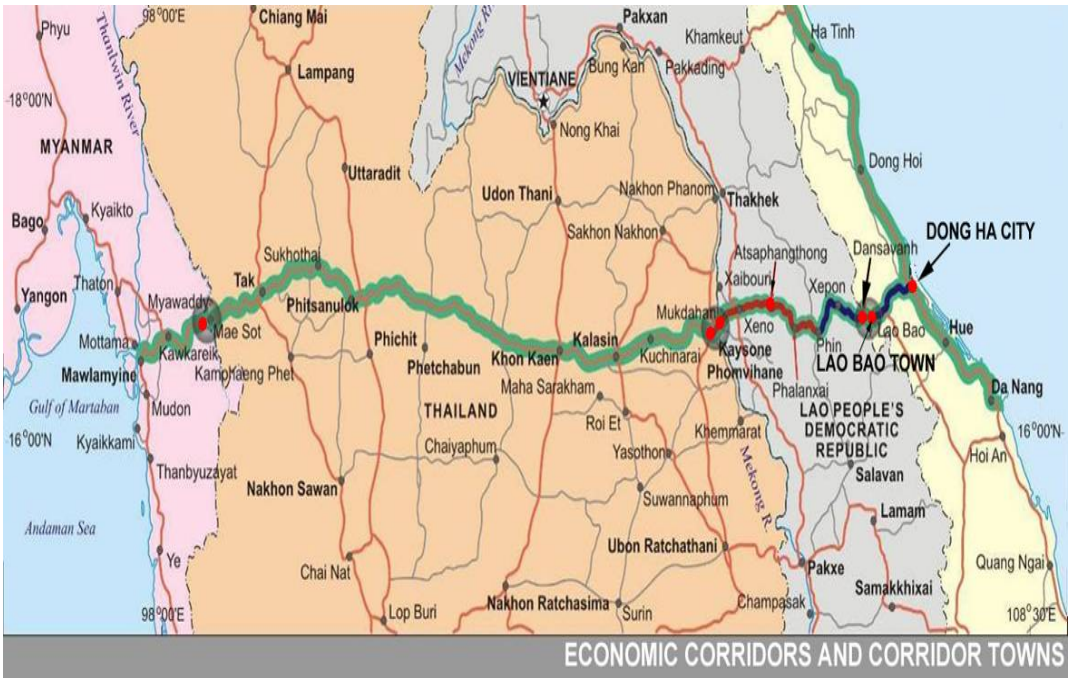


Figure 2. Corridor town of Moc Bai at southern end of SEC.

Table 1. Summary of components of three subprojects of Viet Nam

Subproject	Subproject component
Dong Ha	Hieu River Embankment Protection • Four sections of embankment of a total of 5.9 kms fortified with concrete and stone gabion baskets
	Dong Ha River Port Rehabilitation • New 86m wharf replacing old wharfs • Upgraded internal road • Upgraded 218m of embankment • Water supply & sewerage with 25 pipeline • Guard house, gate, admin building & fence
	Upgrade Urban Road Network & Drainage • Four roads widened (total of 12.4 kms) with increased design speed & sidewalks • Upgraded lateral drainage
	Materials Recovery Facility • Greater volume & diversity of solid waste recovered with modern techniques
Lao Bao	Improved solid waste management – new sanitary landfill • Three cell landfill • Leachate treatment & collection system • Access road
	Upgrade Urban Road Network & Drainage • Up to 20 road segments widened (total of 8.4 kms) with increased design speed & sidewalks • Upgraded lateral drainage
Moc Bai	Improved Wastewater Treatment – new WWTP • Sewer drainages • Eight pump stations 9000m^3/d WWTP
	Waters Supply System – new WTP • 7000m^3/d WTP • Treated pump stations • 45 km distribution network (100-500dia)
	Upgrade Urban Road Network & Drainage • Six road segments widened (total of 14.9 kms) with increased design speed & sidewalks • Upgraded lateral & surface drainage system
	Materials Recovery Facility • Greater volume & diversity of solid waste recovered with modern techniques

B. Assessment Context

25. The CTDP was assigned Environmental Category B which requires an initial environmental examination (IEE) pursuant to the ADB's safeguard policy[1], and environmental assessment guidelines[2]. A category B project will have potential adverse impacts that are less adverse than those of category A project, are site-specific, largely reversible, and can be mitigated with an environmental management plan[3]. The government of Viet Nam (GoV) will require an EIA be prepared for the subprojects (see below).

26. The detailed designs for the infrastructure components in the three towns have not been prepared. The original IEE and EMPs were prepared based on information on the construction and operational phase activities of the town subprojects available at the feasibility stage of the CTDP. The IEE was prepared using preliminary data and information on sensitive ecological and cultural receptors that exist at the different town sites.

C. Consolidated IEE

27. The IEE presented herein combines the original three IEEs that were prepared for the three town subprojects. The IEEs were consolidated to simply the environmental safeguard documentation for the CTDP by reducing duplication of information. The original EMPs for the subprojects have been revised as stand-alone documents and are found under separate cover. The three EMPs will be updated where necessary to meet the future detailed designs of the corridor town subprojects.

III. POLICY, LEGAL, AND REGULATORY FRAMEWORK

28. The three subprojects in Viet Nam will be implemented according to the directives set down for use of Official Development Assistance (ODA) by GoV Decree No. 131/2006/ND-CP which was promulgated November 9, 2006, and in accordance with the provisions of the for the project.

A. ADB Safeguard Policy

29. The ADB Safeguard Policy Statement (ADB 2009) clarifies the rationale, scope and content of an EA and is supported by technical guidelines (e.g., Environmental Assessment Guidelines 2003). Projects are initially screened to determine the level of assessment that is required according to the following three environmental categories: Category A for projects that normally cause significant or major environmental impacts that are irreversible, diverse or unprecedented such as hydroelectric dams (an Environmental Impact Assessment is required); Category B projects which have potential adverse impacts that are less adverse than those of category A, which are site-specific, largely reversible, and for which mitigation measures can be designed more readily than for category A projects (an Initial Environmental Examination is required); and Category C projects that are likely to have minimal or no negative environmental impacts. An environmental assessment for Category C projects is not required but environmental implications need to be reviewed.

[1] ADB, 2009. Safeguard Policy Statement, ADB Policy Paper.
[2] ADB, 2003, Environmental Assessment Guidelines.
[3] Footnote 2, pg 19.

B. Viet Nam Regulatory Framework for Environmental Assessment

30. The Viet Nam Law on Environmental Protection (LEP 2005) prescribes the requirements for environmental assessment (EA) for development and domestic project interventions that affect the natural and social environments. Government Decree 29/2011/ND-CP on strategic environmental assessment (SEA), environmental impact assessment (EIA), environmental protection commitment (EPC) in conjunction with Circular 26/2011/TT-BTNMT on stipulation of specific articles of Decree 29 both elaborate the EA requirements specified by the LEP (2005). Decree 29 and Circular 26 are implemented in conjunction with Decree 80/2006/ND-CP, and Decree 21/2008/ND-CP (see below).

31. The updated screening criteria of Decree 29 distinguish projects that require an Environmental Impact Assessment (EIA) from projects requiring the simpler Environmental Protection Commitment (EPC). The difference between the two processes reflects the level of assessment, and final review & appraisal that is required. From Decree 29, the CTDP-VIE will require an EIA due to the complete subproject description of Dong Ha, the class and length of road upgrades in all three subprojects, and the volume of groundwater that extracted for the upgraded water supply system in Moc Bai.

C. Subproject Executive

32. The executing agency (EA) of Dong Ha and Lao Bao subprojects is the Provincial Peoples Committee (PPC) of Quang Tri. The EA for Moc Bai subproject is the PPC of Tay Ninh. The implementing agencies (IA) for the three subprojects are the City Peoples Committees (CPC) for Dong Ha, Lao Boa, and Moc Bai. Pursuant to Decree 131, and in support of Circular No. 04/2007 of the Ministry of Planning & Investment (MPI), a Project Management Unit will be established by the EA for the subprojects. The PMU will be supported by a local Project Implementation Unit (PIU) for each subproject. A project Steering Committee will be established to coordinate implementation of the subprojects.

33. The Department of Natural Resources and Environment (DoNRE) of Quang Tri and Tay Ninh are responsible for management and protection of the environment in the subproject provinces. The Ministry of Natural Resources and Environment (MoNRE) is the national environmental agency which provides policy and guideline support to the provincial DoNREs, and who also is responsible for administering GoV EA safeguards to development projects of national or interprovincial significance.

D. Applicable Laws, Policy, Environmental Standards, & Guidelines

34. The following are key directives for environmental assessment and protection in Viet Nam:

- Law on Environmental Protection No. 52/2005/QH11, in effect on June 12, 2005;
- Law on Water Resources No 08/1998/QH10.
- Biodiversity Law 20/2008/QH12 dated 13th November 2008
- Cultural Heritage Law 28/2001/QH10 dated 29th June 2001

- Land law No.13/2003/QH11 dated 26th November 2003

- Decree No. 29/2011/ND-CP, dated April 18, 2011, on Regulating Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment.

- Circular No. 26/2011/TT-BTNMT dated on 08/12/2011 by the Ministry of Natural Resources and Environment on Guidance for Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitment.

- Decree No.12/2009/ND-CP which replaces Decree No. 16/2005/ND-CP and Decree No. 112/2006/ND-CP on Investment Management on Construction Projects.

- Decree No.21/2008/NĐ-CP dated on 28/02/2008 about Amendment and Addition of Some Articles In Decree No.80/2006/NĐ-CP dated on 09/8/2006 by the Government.

- Decree No.59/2007/NĐ-CP dated on 09/4/2007 by the Government about Solid Waste Management.

- Decree No.04/2007/NĐ-CP dated on 29/01/2007 by the Government about Amendment and addition of some articles in Decree No.67/2003/NĐ-CP dated on 13/6/2003 by the Government.

- Decree 110/2002/ND-CP, supplementing some Articles of Decree 06/1995 on Labour Code of Occupational Safety and Health

- Decree 06/1995, Elaborating Provisions of Labour Code on Occupational Safety and Health.

- Decree No.140/2006/NĐ-CP dated on 22/11/2006 by the Government which regulates Environmental Protection n Designing, Approval nd Implementation of Development Strategies, Plans, Programs and Projects.

- Decree No.12/2009/NĐ-CP on Investment Management of Construction Projects.

- Decree No.80/2006/NĐ-CP dated on 09/8/2006 about Guiding for the Implementation of Some Articles in the Law On Environmental Protection (2005).

- Decree No.149/2004/NĐ-CP dated on 27/7/2004 about Issuing Permits for Water Resource Exploration, Exploitation and Utilization and Permits for Discharge to Water Bodies.

- Decision No.16/2008/QĐ-BTNMT dated on 31/12/2008 by the Ministry of Natural Resources and Environment about Promulgation of the National technical Regulations for the Environment.

- Decision No.18/2007/QĐ-BTNMT dated on 05/11/2007 about Promulgation of Statistic Indicator System for the Field of Natural Resources and Environment.

- Decision No.23/2006/QĐ-BTNMT dated on 26/12/2006 about Promulgation of the List of Hazardous Waste.

- Decision No.27/2004/QĐ - BXD dated on 09-11-2004 by the Minister of Ministry of Construction on the promulgation of TCXDVN 320:2004 "Landfill for hazardous waste – Design standards"

- Decision No.22/2006/QĐ-BTNMT dated on 18/12/2006 about Obligations to Apply Vietnamese Standards for the Environment.

- Decision No.233/2006/QĐ-TTg dated on 18/10/2006 about Approving the National Program on Labor Protection, Safety and Sanitation up to 2010.

- Decision No.1222/QĐ-BTNMT dated on 20/09/2006 about Organization of Reception and Progressing Recommendations from Individuals, Organizations and Enterprises on Aspects which are Managed by Ministry of Natural Resources and Environment.

- Decision No.35/2002/QD-BKHCNMT dated on 25/6/2002 about Promulgation of Series of Vietnamese Standards for the Environment.

- Decision No.60/2002/QĐ-BKHCNMT dated on 07/8/2002 about Promulgation of the Guidance for Disposal of Hazardous Wastes.

- Decision No.3733/2002/QĐ-BYT issued by Ministry of Healthcare dated on 10/10/2002 About the Application of 21 Labour Health and Safety Standards

- Decision No.155/1999/QĐ-TTg dated on 16/7/1999 by the Government on Promulgation of the Management Mechanism for Hazardous Waste.

- Decision No.505 BYT/QĐ, dated on 13/4/1992 by the Ministry of Healthcare on the Regulation for Allowed Concentrations.

- Circular No. 16/2009/BTNMT and No. 25/2009/BTNMT on Promulgation of Vietnamese National Standards.

- Circular No.10/2007/TT-BTNMT dated on 22/10/2007 about Guidance for Assurance and Control of the Quality of Environmental Monitoring.

- Circular No.12/2006/TT-BTNMT dated on 26/12/2006 by the Ministry of Natural Resources and Environment on Guidance for Practice Conditions, Procedures for Application, Registration, Endorsement and Issuing the Code for Hazardous Waste Management.

Environmental Standards and Regulations

Water quality:

- QCVN 01:2008/BYT – National technical regulations on quality of drinking water
- QCVN 08:2008/BTNMT – National technical regulations on quality of surface water
- QCVN 09:2008/BTNMT – National technical regulations on quality of groundwater
- QCVN 10:2008/BTNMT – National technical regulations on quality of about coastal water
- QCVN 14:2008/BTNMT – National technical regulations on quality of domestic wastewater
- QCVN 24:2008/BTNMT– Industrial wastewater discharge standards
- QCVN 02:2009/BYT: - National standard of domestic water supply
- TCVN 5502:2003 – Supplied water – Requirements for quality
- TCVN 6773:2000 – Water quality – Water quality for irrigational purposes
- TCVN 6774:2000 – Water quality – Water quality for aquaculture protection
- TCVN 7222:2002 – Water quality for concentrated domestic WWTP
- TCVN / QCVN - Standard methods for analyzing environmental quality

Air Quality:

- QCVN 05:2008 – Standards for ambient air quality
- QCVN 06:2008 – Maximum allowable concentration of hazardous substances in the ambient air
- TCVN 6438:2001 – Maximum permitted emission limits of exhausted gases from vehicles

Solid Waste Management:

- TCVN 6696:2009 – Solid waste – Sanitary landfill. General requirements for environmental protection.
- QCVN 07:2009– National technical regulations for classification of hazardous wastes
- QCVN 25:2009 – National technical regulations for wastewater of solid waste sites
- QCVN 15:2008/BTNMT: - National regulation on allowable pesticide residues in soil
- QCVN 03:2008/BTNMT: - National regulation heavy metals concentrations in soil

Vibration and Noise:

- QCVN 26:2010/BTNMT: national technical standard for noise
- TCVN 6962: 2001 Allowable vibration level for public and residential areas
- TCVN 6962:2001: - Allowable vibration and shock from construction activities

International Guidelines

- World Bank Group, 2007. Environmental Health and Safety Guidelines, Wash. DC.
- AWWA Standard Methods for Measurement & Analysis Environmental Quality

IV. DESCRIPTION OF SUBPROJECT INVESTMENTS

35. Table 2 lists the seven different infrastructure investments of CTDP-VIE.

Table 2. Summary of infrastructure developments of the three subprojects

Infrastructure Investment	Subproject
1) Hieu River Embankment Protection • Four sections of embankment of a total of 5.9 km fortified with concrete and stone gabion baskets	Dong Ha
2) Dong Ha River Port Rehabilitation • Wharf replacement, upgraded internal road • Upgraded embankment, water supply & sewerage, guard house, gate, admin building & fence	Dong Ha
3) Improved solid waste management – new sanitary landfill • New cells, leachate treatment & collection system	Lao Bao
4) Improved Wastewater Treatment – new WWTP • Sewer drainages, pump stations, & 9000m^3/d WWTP	Moc Bai
5) Waters Supply System - new WTP • 7000m^3/d WTP, pump stations, 45 km distribution network	Moc Bai
6) Upgrade Urban Road Network & Drainage • Urban roads widened (total of 35.4 kms) with increased design speed & sidewalks, upgraded lateral drainage system	Dong Ha, Lao Bao, Moc Bai
7) Materials recovery facility	Dong Ha,

• Higher volume with modern efficient technology	Moc Bai

A. Need for Subprojects in Dong Ha, Lao Boi, and Moc Bai

1. Dong Ha

36. Dong Ha is strategically located at the beginning of East-West Economic Corridor. However, being a relatively young city, the development of the urban infrastructure of Dong Ha city is very limited, many areas are without road connections, do not have water supply systems, no stormwater and drainage collection system and power supply system. According to the approved building plan in 2005 and socio-economic development plan for Dong Ha city by 2020, the demand and potential growth of Dong Ha city are huge but the investment progress is slow. Many projects have registered for investment even completed the land clearance but then were not pursued. One of the main reasons for these conditions is the limited investment capital for the province's infrastructure. Therefore, the involvement in the CTDP-VIE is a good opportunity for Dong Ha city to obtain the capital investment support for its priority urban infrastructure

2. Lao Bao

37. The PPC Quang Tri Province envisions Lao Bao border town as contributing to the development of an important trade and traffic link between Vietnam, Lao PDR, and Thailand. Lao Bao is situated in the Huong Hoa District, a mountainous border district bounded in the north by Quang Binh province and by Lao PDR in the south and west. The other key town in Khe Sanh. Huong Hoa district is strategically located along the East-West Economic Corridor (EWEC) of the GMS, which is considered to be the trans-Asia route connecting the district through the Lao Bao border gate with neighboring countries of Lao PDR, and Thailand.

38. While strategically located the urban and environmental infrastructure of Huong Hoa district are inadequate to meet the requirements of a growing population and the demands for urban sector development. Consequently, the district’s economic growth rate is relatively low compared with the other districts and cities in the region.

39. Recently, several environment and sanitation projects funded by the GoV, WB, ADB, UN-Habitat have been implemented in the area including road, water supply, drainage, sewerage and solid waste management. Therefore, participating in the CTDP-VIE is a good opportunity for Lao Bao and Khe Sanh towns to obtain investment support for essential urban infrastructure such as the improvement and widening of urban roads, flood control and drainage structures and solid waste management. The improvement of solid waste management through the new sanitary landfill, and upgraded urban roads will help promote Lao Bao and Khe Sanh towns as attractive and competitive areas for private sector investment.

3. Moc Bai

40. Similar to Lao Bao, Moc Bai is strategically located along the Trans-Asia road or southern economic corridor (SEC) which provides the transport connectivity of Tay Ninh province from the south, northeast to Bavet and Poipet, Cambodia and into Thailand. There is considerable development potential for the Moc Bai area. However, the level of investment and operations by industry locators is relatively slow.

41. A number of potential industry locators which have registered for investment in the area have yet to commence their operations despite the clearances issued them by the local authorities. Among the reasons cited for the delays in operations of industry locators is the inadequacy of urban infrastructure particularly urban access roads and drainage, water supply and wastewater treatment. In order to become attractive and competitive for investment that leads to socioeconomic development, Moc Bai needs to improve its basic infrastructure. The initial focus should be on wastewater treatment, water supply, and urban roads.

B. Hieu Riverbank Protection – Dong Ha

1. Existing Conditions

42. Total length of Hieu river within Dong Ha town territory is about 10km, with complex flow, the river has two curved sections, the first located at 600m downstream of railway bridge, the second located at Dong Ha overpass, from railway bridge to the overpass has been bent an angle of about 120. The first section has the most severe erosion. City Peoples Committee approved the construction of embankments 180 m of stone structure in 2002.

43. In general, two sides of Hieu river is quite flat, average leveling about +2.5 m to +3.0 m, while some coastal areas of low leveling, at about + 0.5m to +1.0 m at two ends of Dong Ha bridge. Width of river at average water level (0.0 m) is about 200 meters. Largest width of river is about 300 m, where narrowest is 90 m.

44. Upstream of Dong Ha Bridge, Hieu River divides into two branches forming an island with an area of 2.0ha. Leveling around +2.3 m. The geological characteristics of the project are determined by the direction from top to bottom and results as follows:

- Layer 1: medium-heavy brown, gray brown clay, medium textured tight, semi-hard state, distributed along the upper river, from 2.5 to 3.0 m thickness of alluvial origin (alQ).
- Layer 2: light white, yellow clay, poor texture, soft, distributed beneath layer 1 and on river surface,1-2m thick, alluvial origin (alQ).
- Layer 3: smooth sand, light gray, discrete structures, alluvial origin (alQ), wide distribution, thickness of 5 - 7m.
- Layer 4: dark gray clay, less tight structure, soft, alluvial origin, underground, thickness> 7m.

45. The Hieu river is a major tributary of the Thach Han river which has a basin area of 539 km^2. The river flows through Dong, Cam Lo, Gio Linh and part of Trieu Phong district. The section of the Hieu river flowing through Dong Ha is 15 km.

46. One of the most pressing needs of Dong Ha city is the renovation and protection of the Hieu River embankment to mitigate flood occurrences particularly in the residential areas and the commercial establishments in the town center, and the environment and health risks to urban residents particularly the poor households and vulnerable groups. In the absence of river embankment and protection measures, Dong Ha city suffers from annual flood occurrences resulting in the loss of lands for residential and commercial purposes.

47. Dong Ha is located among three rivers defined by the Hieu river, Thach Han river, and Vinh Phuoc river. However, the Hieu river has the largest influence because 10 km of the river traverses the city. Every year flooding erodes both sides of the Hieu river embankment which threaten the lives and properties of the urban residents. Annual flooding has resulted in the displacement of residential houses and the reduction in economic activities of the business sector.

48. So the primary objectives of the riverbank improvements are to mitigate annual flooding, prevent erosion, and make the riverbank an attractive feature of Dong Ha that is accessible to residents and visitors

2. Components of Hieu Riverbank Protection

49. The natural characteristics of the Hieu riverbank will be maintained as much as possible. Figure 3 shows the location of the riverbank that will be fortified. The embankment works for the Hieu river will occur within Dong Giang, Dong Thanh, ward 1, ward 2 and ward 3 of Dong Ha city, and be divided into four specific riverbank sections described as follows:

Section No. 1:
The work will occur north bank of river in Dong Giang ward, Dong Ha city along Tran Nguyen Han street Total length of embankment work is 1,198 m which will consist of:

1) Stone gabion basket embankment from K0÷K0+50,8, 50.8 m

2) Concrete embankment from K0+50,8÷K1+198, 1,147 m

Section No. 2:
The work will occur in Ward 3, Dong Ha city on right bank of Hieu river along Ba Trieu street from beginning of the line to the railway bridge. Total length of embankment work 2,211 m consisting of:

1) Stone gabion basket embankment from K2+160,8÷K2+210,8, 50 m

2) Concrete embankment from K0÷K2+160,8, 2,161 m

Section No. 3:
The work is in ward 1 and ward 3, Dong Ha city on the south bank of Hieu river along Ba Trieu street from railway bridge to Dong Ha bridge. Total length of embankment work is 1.474 m consisting of:

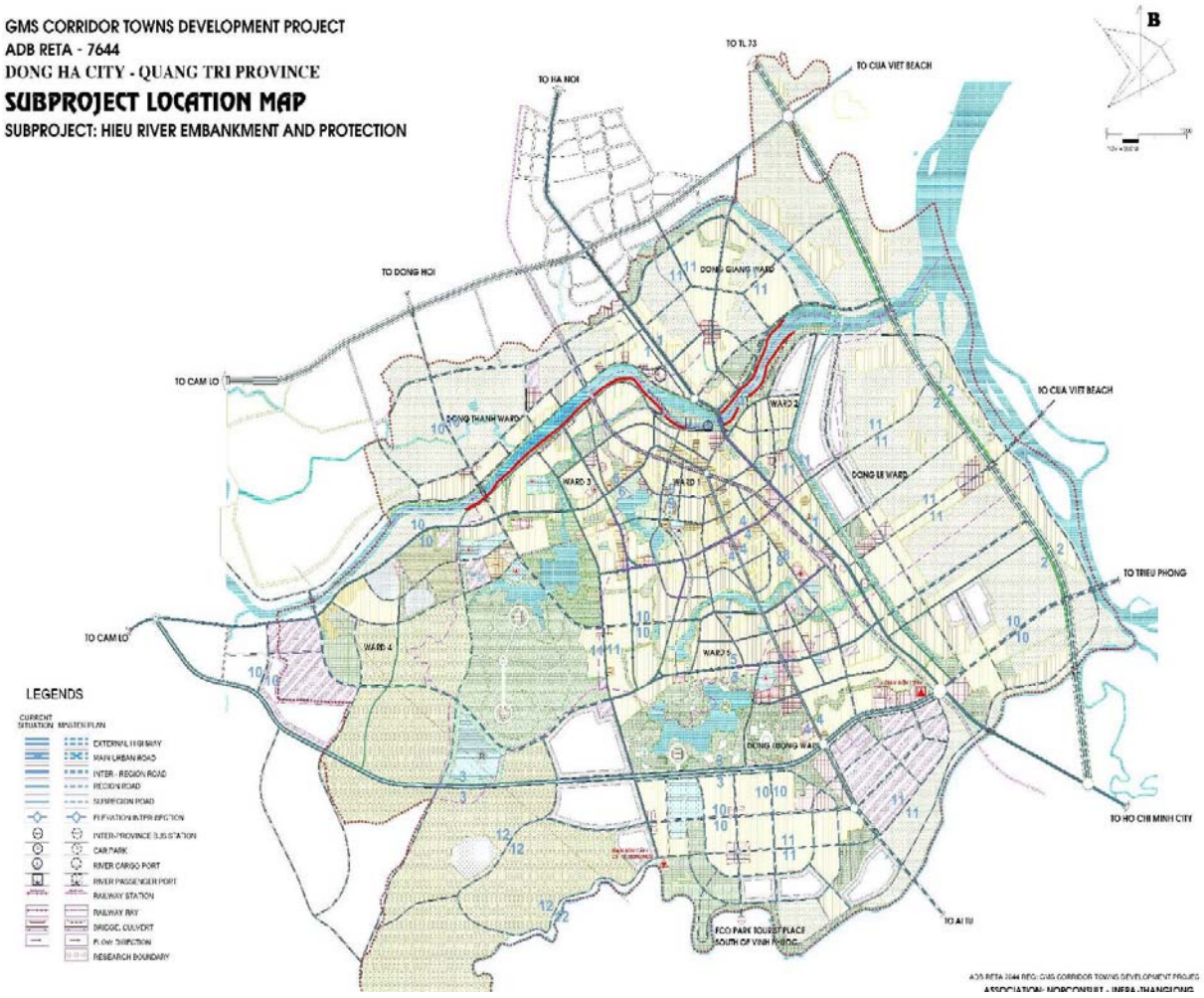
1) Stone gabion basket embankment from K0÷K0+252,3, 252 m
2) Concrete embankment from K0+252,3÷K1+421,9, 1,170 m

Section No.4:
The work will occur in ward 2, Dong Ha city on the south bank of Hieu river along Bui Thi Xuan street from Dong Ha bridge to the end of the line. Total length of embankment (excluding Dong Ha port and Quang Tri Navy team) is 1,065 m which will consist of:

1) Stone gabion basket embankment from K0(K0+57,7, 57.7 m

2) Concrete embankment from (K0+57,7÷K0+200,2) and from (K0+429,7 ÷ K1+294,4), 1,007 m.

Figure 3. Sections (red) of Hieu river riverbank that will be fortified in Dong Ha



C. River Port Rehabilitation – Dong Ha

1. Existing Conditions

50. Presently, there are 2 river ports operating in Dong Ha defined by the: (i) Cua Viet River Port which was constructed with 2 wharves that are 128 m in length and 42,000 m^2 in area, 7,200 m^2 for storage space which is to be used for transportation vehicles with capacity of less than 2,000 DWT; and (ii) Dong Ha River Port, established in 1975 which is no longer operational and is in need of rehabilitation and upgrading.

51. Since 2000, there has been an increasing demand for freight services from industry locators and manufacturers including the other economic sectors in Dong Ha city. The Cua Viet port continue to provide port services for heavy industrial goods and products, however, its capacity to accommodate medium and light products and goods has become very limited

52. The strategic location of the Dong Ha River Port provides favorable conditions for port services for medium and light commodities that are coming from neighboring cities and

provinces and from neighboring countries like Lao PDR and Thailand. The location of the Dong Ha River port makes it easily accessible through the national road and railways.

53. Dong Ha port is 230 m long. From up-river downwards the port includes 4 wharves with different structures. First reach is a sloped roof port of 90m. Water depth at edge is 2.5m. Next section is straight roof segment 31m long with Z-type steel wall. The remaining two sections of 51m consist of timber piers and steel sheet piles without head beam 4m long at the end.

54. Currently, the slope roof section is being rented by local residents for sand exploitation for regional construction needs. Water in front of Z-type steel wall reaches 4-5m. However, steel stakes are currently stained and rusty, other equipment including berth and ships supports are not available. Therefore, this section is considered temporary without minimum conditions to ensure ships safety. The steel sheet pile wall foundation has deteriorated. The surface of port is sunk about 0.4-0.6m, with lots of crack running parallel with port edge, crack width about 5-10cm, some over 15cm. Some areas are still sinking.

55. The 51m section with timber piers is totally destroyed. The upper edge of port has collapsed about 15m. The loose aggregate fill area broken down and fallen into the river. After long use and exposure to water movement and tides the timber piers are decayed and broken rendering this section of port un-useable.

56. Temporary access from National Road 1A exists, however, the access is temporary and not sustainable. Existing parking inside the port is ad hoc, poor without adequate surfacing, and prone to flooding. The port currently uses two, 20 tonne cranes obtained from Cua Viet port which are inadequate. Onsite storage of port cargo is also inadequate.

2. Components of Port Rehabilitation

57. Specific sections and components of the river port (Figure 4) to be upgraded are summarized as follows:

a. Wharf:

58. A new 86m section will be built with sheet piles and and straightened. The two old timber and Z-shape steel wharfs will be removed.

b. Internal Road:

59. To improve safety and convenience for traffic the internal port road will be upgraded with M300 cement concrete.

c. Riverbank Protection:

60. Riverbank protection will be established under the wharf, to avoid floods from l washing away the foundation for the wharf and the inside port area. The protection will consist of an angled concrete wall (M350) approximately 40 cm thick. The 218m embankment from the foot of Dong Ha bridge will be fortified with armour stone.

d. Storage Facilities

61. A 742 m^2 storage building with additional storage areas will be constructed. The rehabilitated existing storage building is suitable for this providing an additional 1200 m^2 of covered storage. The storage building will be made of concrete, steel structures and steel plates with a roof height of 8 meters. There will be approximately 4000 m^2 of open air storage.

e. Gate Guard House:

62. Main gate will be widened to 6m with an electric electric gate installed. A rectangular guard house will be constructed with dimensions 4.8 x 3-9m.

f. Fence & Green Belt:

63. A 2.5 m open mesh steel fence will be installed around property with barbed wire on the top. A green belt will be established along the perimeter of the port area. In this zone, locally suitable trees and bushes will be planted. This belt will be wider along the side against the bridge/city, allowing larger shielding trees. There will also be green belts between the administration buildings and goods storage and
handling areas.

g. Parking Area:

64. A steel truss-supported steel roof will cover the motorcycle parking lot that will be constructed which will be 3.1 x 19m.

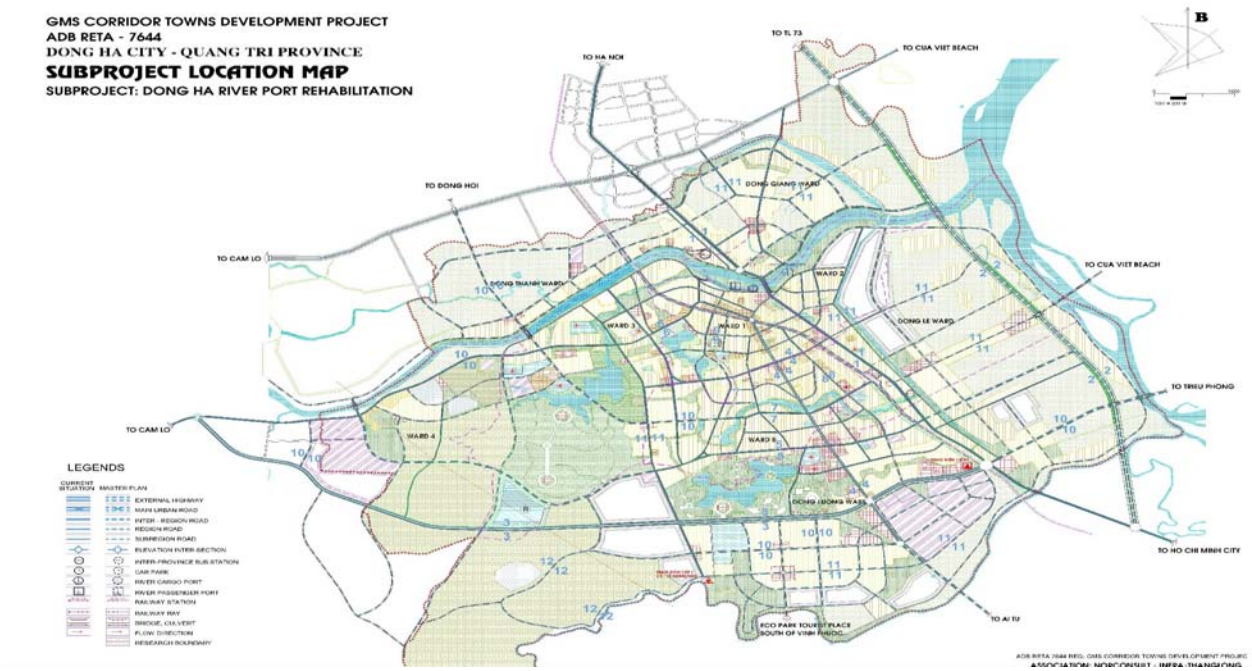
h. Management Office:

65. A 150m^2 office will be constructed including 5 rooms.

i. Water Supply & Sewerage:

66. Domestic water will be supplied from city network. Rain water will run-off to the river naturally. Domestic wastewater will go to a septic tank before disharged to the river. Procees water (oils and grease) will go to the city wastewater network.

Figure 4. Location of river port improvements in Dong Ha



D. Solid Waste Management and Sanitary Landfill – Lao Bao

1. Existing Conditions

67. Domestic solid waste is mainly from offices and residential areas in Khe Sanh town and Lao Bao including commercial and service areas that comprise a organic content. The average daily amount of solid waste collected from Khe Sanh town and Lao Bao is 0.5 kg / person and 0.3 kg / person in rural areas with a total estimate 13.4 from Khe Sanh and Lao Bao towns (Source: Quang Tri, DoNRE). However, the proportion of solid waste actually being collected and disposed of is very low accounting for 30% - 40%.

68. The volume of industrial, commercial solid waste is about 5 tons / day. At present, the industrial solid waste is sorted out from the source. The industrial solid waste is also collected and discharged together with domestic solid waste. In 2005, Lao Bao, Khe Sanh town established an environmental team to collect domestic and industrial solid waste.

69. Collected solid waste is transferred to the landfill in Tan Kim hamlet, Lao Bao town and buried in Khe Sanh afforestation yard with treatment by burning and burying. Both landfills are temporary and unhygienic, and thus a source of environmental pollution. In particular, the current solid waste landfill of Khe Sanh town located in the high level a rea which is the head of many springs supplying water for some rivers. Thus, the risk of pollution is higher. In addition, the communes in the study area had no solid waste burial sites and they were settled by the local people by burning or composting as fertilizer for plant.

70. The current solid waste management (SWM) in the towns of Lao Bao and Khe Sanh is inadequate to address the requirement of a growing urban population and the expanding urban areas. In addition domestic an industrial waste solid wastes generated in the special economic trade economic zone (SETZ) in Lao Bao also include hospital and medical wastes. The existing treatment system is disposal at an uncontrolled dumpsite outside Khe Sanh with perceived significant substantial negative environmental impacts. There are no designated facilities for handling hazardous or medical wastes. The two towns are in need of an upgraded SWM system including waste collection and treatment.

2. Components of Upgraded Solid Waste Management

a. Access Road:

Total length of required access road is 5029 m according to the following general specifications:

- Type of construction: Traffic road
- Road level: V level mountain road
- Design speed: 30 km/h
- Horizontal layout:
- Road surface width: 4.0 m
- Roadside width: 1.25m X 2 sides (improving each side more 1m)
- Roadpavement width: 6,0 m

b. Landfill Site:

71. Based on the topographic surveys carried out at the site, the features of the sanitary landfill are described below. The propose site is indicated in Figure 5.

72. It is proposed that two small valleys be utilized to allow for a deeper landfill with a simple operation and a confined location. The solid waste disposal is implemented in separate cells, each with 3-5 years operation. Since the landfill will be in the valleys, the first cell will be a lower section followed by the next cell in the upper section. When cells are full they will be covered with impermeable soil that has been excavated and stored. Thus, most of the rainwater will drain to the surrounding area and the quantity of leachate into the environment is reduced.

73. A municipal waste cell is estimated to be will be completely worked-out in the first phase and the hole used for a period of 3 to 5 years. The second, third and fourth cells will be constructed afterwards and the implementation of which will depend upon the master land use plan. Technical parameters of the sanitary andfill are summarized below

i. Landfill cells.

74. It is proposed that 4 municipal landfill cells will be established to operate until 2030 where each hole can work for up to 5 years. The second landfill will be constructed when the first cell is nearly filled. The cells will have various average height and volumes
The initial cell will be approximately 6,000 m^2.

c. Barrier/fencing:

75. The safeguard barrier is constructed to surround the landfill and connected facilities. The proposed measure is 2.5m high mesh wire fence with supporting pillar and barbed wire on top. The purpose is to prevent unauthorized access (i.e waste pickers and animals) and windblown litters such as papers, plastic bags, when the landfill starts its operation.

d. Buffer zone:

76. The buffer zone of trees and bushes around the landfill will be established with a width of 20m in order to (a) limit the view of the landfill from outside the surrounding areas;; (b) serve as landscape of the area; (c) prevent the spread of dust, odor and noise from the landfill to the surrounding areas; (d) control the wind and minimize blowing of litters form the landfill to the surrounding areas.

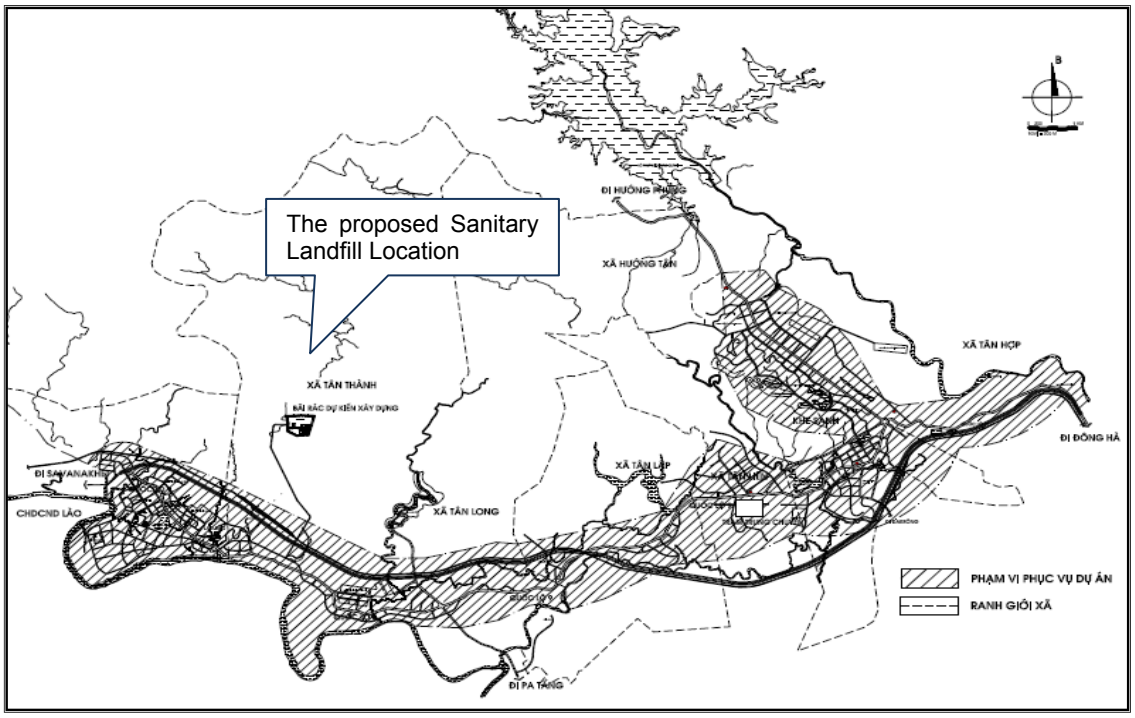
e. Stormwater cutoff system.

77. At the landfill perimeter there will be an established storm water cut-off with open ditches to collect the storm water from adjacent areas and leading it to discharge in the areas outside the landfill site. Consequently, only rainfall at the landfill area will enter the leachate collection system.

f. Operator house:

78. This include spaces for office, kitchen, canteen, sleeping and relaxing area, toilets and showers for the staff, all of which will be located near the entrance gate. The operator house shall be equipped with electricity and water system, telephone and television set. The first aid equipments shall also be provided in this house. This house shall have a size of 18x16m.

Figure 5. Sanitary Landfill near Lao Bao



g. Garage and Workshop:

79. Garage will be located near the operator house to protect cars, waste compressing and delivery trucks. In the garage, there shall be a workshop for maintenance and repairs for the landfill equipments. Garage and workshop takes the size of 9mx 6mx 9m + 27m = 297sq.m.

h. Monitoring input of solid waste:

80. The safeguard house is located near the entrance road in order to facilitate monitoring of the volume and sources of the solid waste transported to the landfill. All the solid waste are weighed and its components need to be registered then directed to the landfill holes which are classified based on type of solid waste including hazardous waste. The safeguard house takes the size of 5m x 5m size = 25sq.m.

i. Water supply:

81. Total water needs for operation of the landfill are estimated to be 15 m^3/day
Currently, the only source is from Lao Bao supply system with capacity of 3,000 m^3/day which does not distribute water to the planned landfill site. Therefore, water supply for daily activities in the landfill site will be taken from local groundwater resources. A groundwater well and treatment plant which can work at capacity of 15m^3/day will be established to serve the water users need of the landfill site.

j. Leachate Collection & Treatment:

i. Collection

82. The geological survey concludes that the soil under the 1m top layer of earth/topsoil is silt/clay from 1-3 m and clay from 2-5 m deep. This condition will normally prevent leachate seeping uncontrollably into the ground polluting the groundwater. This indicates that an additional artificial liner would not be required. However, since the Vietnamese Regulations require that a new landfill must have a 2mm HDPE liner at the bottom regardless of the soil type and condition a liner will be established.

83. So an additional liner of 2mm HDPE has to be added on the local soil. It will belocated on slopes of 1:5 and must be anchored on the upper side in a ditch, which will alsofunction as a cut-off for storm water. On top of the liner, must be a geo-textile and a leachate drainage system.

84. In addition to an impermeable bottom liner, a drainage system must be installed on top of this to collect leachate and to avoid standing water in the landfill. This will also prevent water pressure on the under laying bottom seal. The drainage should preferably be a continuous layer of soil like river gravel, etc. With this, a fishbone pattern of collection/drainage pipes may be established, with an internal distance of approximately 20m. In the lowest end of the landfill, leachate central collection pipes will be installed, pulling down by gravity the leachate to the treatment plant located downstream the landfill.

85. Volume of leachate will be minimized through strict and planned separation of clean rain-/surface water and polluted seepage. The treatment has best effect on concentrated leachate. In general. eachate has unpredictable properties compared to other waste water types and this calls for specialized design and planning. Leachate is difficult to treat adequately as many plants worldwide have experienced problems achieving satisfactory treatment results.

ii. Treatment

86. Based on review of many relevant leachate treatment plants the following features of leachate treatment plant are proposed:

- Initial retention/evaporation,
- Re-circulation to the landfill area when applicable (dry season)
- pH-adjustment when applicable
- Initial aeration
- Subsequent settling lagoons; and
- Final polishing in wetlands

87. The treatment plant will be designed for leachate from the initial 10 years of operation, and the input will be at an average rainfall in maximum month. This is due to the fact that the landfill body will represent a substantial retention volume, distributing the water volumes from rainfall over time. When the last 2 cells are put into operation, the treatment plant may be extended with a second phase.

k. Landfill Gas (LFG)

88. Landfill gas extraction and utilization will be occur with initial investment in the sanitary landfill.

l. Hazardous waste management

89. Lao Bao Hospital (with 300 patient beds) is expected to have medical solid waste incinerator established to treat all its infectious solid waste. After incineration the waste ashes are inert and will be transported to the regular landfill. Infectious waste must be regulated, securing that all infectious and hazardous waste from the health system is adequately managed and disposed.

90. Currently, no HW treatment facilities are available in the province. It is recommended that a separate system for collection and disposal of HW is established. This can be an existing open truck, taking frequent collection rounds for HW. At the landfill site a separate storage area should be established, enabling safe disposal or storage until treatment facility will be available. For certain HW types, a special small landfill area with extra liner is included for secure land filling.

91. Landfill cells for hazardous solid waste: Hazardous industrial solid waste, will be disposed at separate specific landfill cells according to established principles. Almost all the hazardous industrial solid waste will be handled by the industry itself or the board of industrial zone management. A part of the post-processed hazardous waste will be transported to the landfill It is designed with the HDPE geomembrance liner (2mm thick) and geosynthetic clay liner (GCL) to minimize solid waste leachate absorbed into the environment.

92. It is expected that three landfill cells will be constructed to process hazardous solid waste. Each landfill cell can operate for a period of 2-3 years. The hazardous landfill cell has the size of 40x14x4 which is equivalent to the area of 640sq.m. In the first phase, the first landfill cell will be constructed.

m. Septic sludge management

93. According to Vietnamese regulations, entities operating a SWM system must also provide septic sludge collection and disposal services. Consequently, some components for this must be added: a vacuum tank truck for collection and treatment facilities at the disposal site.

i. Sludge Treatment:

94. The best management system of sludge treatment is using tanks to avoid the waste water entering the landfill. Then the sludge water will be treated together with the leachate. This strategy is designed in detail in the proposed consultation of the sludge treatment in which it will be deposited in two tanks with their volume of 30m³.

95. The upper deposit waste water layer will be transferred to anaerobic tank by automatic flowing pipe, the deposit sludge will be pumped to landfill 1 for municipal solid waste through the HDPE pipe with thickness of 250mm. This pipe system is designed to be under earth and connected with landfill hole by floating pipes. The sludge transporting pipe system will be calculated efficiently enough to transfer all solid waste to first landfill cell.

n. Solid Waste Collection & Transportation equipment

96. Solid waste bins of 120L, 240L and 660L are regulated, designed and arranged. The bin is required to be manufactured from HDPE and avoid ultraviolet ray in the sunlight. A vehicle designed to compact solid waste is arranged to collect and transport solid waste. Rubbish handcarts and garbage trucks are provided to collect solid waste from surrounding and remote areas and the alleys and tracks. These trucks can carry two 240L bins and one 660L bin.

E. Wastewater Treatment – Moc Bai

1. Existing Conditions

97. Moc Bai does not have a functioning wastewater collection system as well as wastewater treatment plant. Wastewater is disposed into open drain canals that flow to natural streams and to the open farm lands. The inadequacy of the present wastewater collection system in Moc Bai is causing undue health and environment problems to the urban residents, the business sector and industry locators. The absence of a wastewater treatment facility is seen to endanger local economic development as this would create an unsanitary urban environment. It also reduces the level of attractiveness and competitiveness of Moc Bai which is an emerging economic corridor town in SEC.

2. Components of the Wastewater Treatment System

98. The Moc Bai wastewater collection and treatment will be undertaken by industry locators in designated treatment stations with their respective treatment capacities, as follows:

- Wastewater Treatment Station 1 : = 2.500 m3/day
- Wastewater Treatment Station 2: = 4.500 m3/day
- Wastewater Treatment Station 3: = 4.000 m3/day
- Wastewater Treatment Station 4: = 4.000 m3/day
- Wastewater Treatment Station 5: = 4.500 m3/day
- Wastewater Treatment Station 6: = 2.800 m3/day
- Wastewater Treatment Station 7: = 3.200 m3/day
- Wastewater Treatment Station 8: = 9.500 m3/day

99. In urban residential areas, wastewater collection and treatment will be managed in a systematic manner and in designated suitable locations. The wastewater system includes:

1. Wastewater treatment plant with capacity of 2.000 m_3/day for Ben Cau is proposed to be located in the southern side of the District.

2. Wastewater treatment plant with capacity of 9.000 m_3/day is proposed to locate in the urban southern area.

3. Wastewater treatment plant with capacity of 500 m_3/day is to be established for the urban residential areas.

4. For the sub-urban areas, the wastewater must be processed in septic tanks.

100. Local drainage routes will lead to the nearest rivers, canals or local reservoirs. The wastewater collection system is to be established in a designated suitable area within the

Moc Bai BGEZ along National Highway 786 (in the South of Dia Xu canal). This includes the establishment of a new wastewater treatment facility with a capacity of 9,000 m^3 /day in the southern part of BGEZ.

3. Location and Site

a. Wastewater Collection System

i. Drainage system:

101. Collection sewer network shall be situated along traffic roads.

ii. Pump stations:

102. Eight pump stations shall be provided which corresponds to 8 automatic collection systems. Specific sites are located in planned areas with urban trees, and (ii) The proposed site for pump station, including the wastewater pump will be situated in a 160 m^2 lot.

iii. Pressure sewer system:

103. The pressure sewer system shall be responsible for transporting wastewater from the pump station to treatment plants located along traffic roads.

b. Wastewater Treatment Plant

104. The wastewater treatment plant will be located in the southern part of BGEZ. This location has the following advantages:

- Isolated from urban areas, and thus preserving the landscape.
- The site is an open agricultural land which facilitates land acquisition and resettlement and therefore reduces investment cost.
- Its location is close to where it can receive sewage flows such as irrigation canals. These canal are lined up along TL786 that will create favorable conditions for treated sewage discharge.
- The sewage collection from pump station to treatment plant is facilitated as well as the investment cost in transferring sewer discharge will be reduced.
- A steady and continuous supply of electricity for the wastewater treatment plant is expected due to its nearness to the power source.
- This site is aligned to the requirements of the Master Plan of Moc Bai BGEZ and will create opportunities for future land development in anticipation of the increasing demands for wastewater collection and treatment.
- The proposed area for the WWTP of 50,000 m^2 (200mx250m) includes a treed buffer zone. Eight pump stations will be established corresponding to 8 automatic sewage collection tanks. Their specific sites will be situated in the urban planning area with trees. And

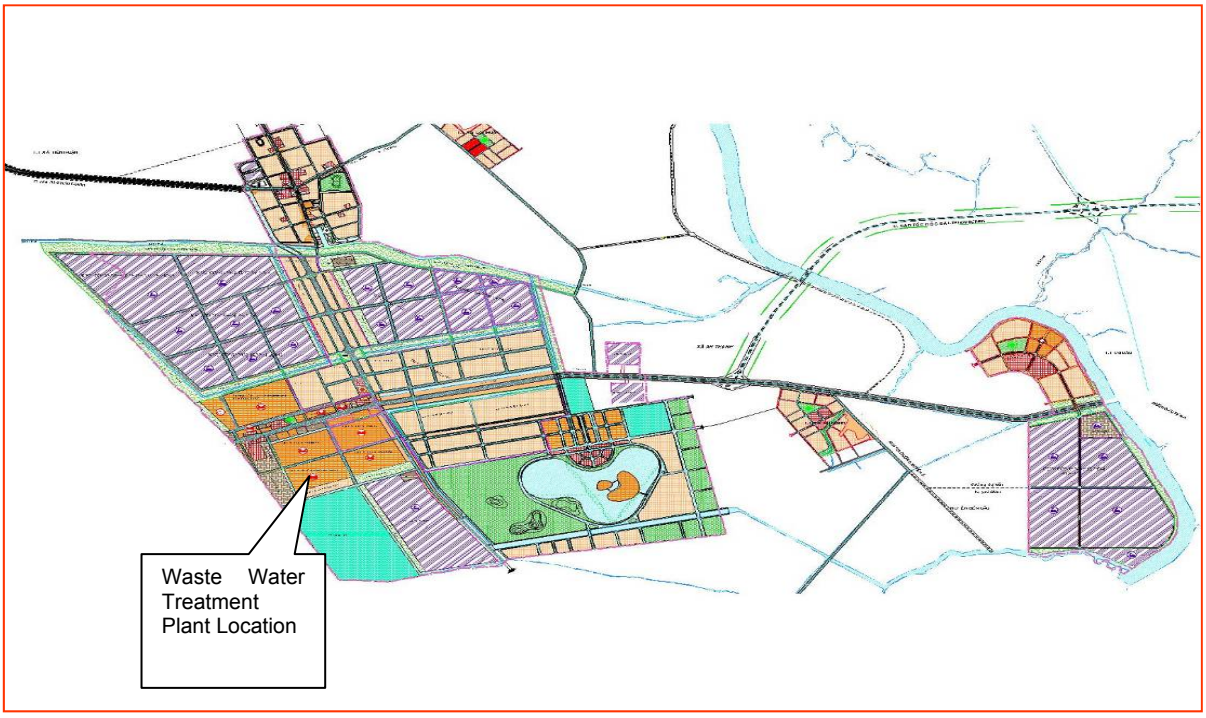
- The needed area for sewage collection station is 160m2 (16mx10m). In this proposed site, sewage pump stations, transformers and electrical panels will be installed for the purpose of electricity supply and pump control.

c. Waste Water Treatment Plant

105. Following the Master Plan for Moc Bai Economic Zone to 2020, the WWTP will be located beside TL786, south of the border gate zone (Figure 6). The proposed capacity of the WWTP is 9000 m^3/day with an area of 50,000 m^2 (200m x 250m). The area includes buffer zone with a complete treed perimeter. The site will be leveled from the height of 0.7m to 2.2m.

106. The location is situated outside the planned Moc Bai Economic Zone and isolated from the urban area, which will act protect the urban landscape. The proposed site is a rice field which restricts social costs to land acquisition without need for resettlement. The site is close to, and can access irrigation canals for treated sewage discharge.

Figure 6. Location of WWTP in Moc Bai



F. Water Supply System - Moc Bai

1. Existing Conditions

107. The current water supply system of Ben Cau has a capacity of 3,000 m^3/day which exceeds the original technical design capacity of 1400 m^3/day. Over time, the water supply system has become insufficient to provide the current requirements of local residents and commercial establishments. The water distribution system coverage is currently inadequate to address the increasing demand for clean water. The projected demand is estimated at 11,000 m^3/day in 2015 and 30,000 m^3/day in 2020. The present water system capacity of 3,000 m^3/day is going to be inadequate to meet future requirements.

108. The Moc Bai Water Supply subproject will restore the existing water supply system in Ben Cau and establish additional water supply system to increase the present capacity of 3,000 m^3/day to 10,000 m^3/day in 2015. The subproject will provide the water demands of the Moc Bai town including that of the industrial and commercial users. About 60,000 residents will be supplied with sanitary water that will result in reducing water-borne and health risk in Moc Bai.

109. Currently, most residents in the area use private drilled wells at shallow level ranging from 20 to 30 m, or deep wells ranging from 40 to 50 m with water for direct usage without any treatment. Water quality has not been tested.

110. The system in Ben Cau uses raw water from deep groundwater. Water after treatment is supplied to households via transport and distributing network. The facilities of the system are as follows:

- The raw water supply system consists of wells, pumping stations and raw water collecting pipelines:

- The water treatment plant is located along provincial road 786, near Dia Xu Canal. The treatment plant is not in good condition and is inefficiently operated. In the future, the existing treatment plant will no longer meet the demand in terms of flow, quality as well as economic efficiency.

2. Components of New Water Supply System

a. Factors for Selection of Location Water Treatment System

111. The location shall be selected based on the following environment-related criteria:

1. For the raw water exploitation area the selected area must ensure:

- an exploitation volume of 30,000 m^3/day without affecting the water source quality causing deformation to the stratum and polluting the surrounding environment; and

- the raw water quality must ensure the most optimal exploitation and treatment costs.

3. For the water treatment plant:

- the area where the plant is located must have stable geologic structure.

- the isolation distance must meet Viet Nam Standards on environment.

3. Raw Water System:

112. Currently, Ben Cau WTP is sole provider of raw water. At 2020, the anticipated demand of 30,000 m^3/day will require an additional 24 new groundwater boreholes at Ben Cau WTP. This expansion will be divided into 2 phases with the phases increasing capacity to 7,000 m^3/ day.

113. Establishment of 8 additional well pumps for requirement for 7,000 m^3/ day , among 24 existing pumping stations, each with a capacity of 60-65m^3/h. Pipeline system has diameter of 150-500 mm with its total length of about 3,500m.

i. Location of Wells

114. The wells are located in Ben Cau town, near the existing wells of the water treatment plant in Ben Cau town. This location was drilled and evaluated to check for possible long-term industrial use of over 30,000 m_3/day and night. The raw water quality is relatively good. A license was granted by the relevant agency to exploit underground water at a capacity of 13,000 m^3/ day and night.

4. Water Treatment Plant

115. The WTP is located in an area of approximate 3 ha in Moc Bai border gate economic zone, parallel with the road TL786 (in the east) and bordering the road N2 in the North. The location is located in the area planned in 1999. The site consists of fields and gardens, therefore, not difficult for construction. The location is also relatively flat and it is not too costly to treat the road foundation

116. The new water plant (7000 m^3/day) will be located near the current Ben Cau WTP. Features of new plant will include:

- Aeration
- Contactor & deposit basin
- Rapid filter (sand)
- Reservoirs
- Water treatments pump station.
- Chemical system (chlorine, alum feed)
- Transformer.
- Administration house.
- Lifebuoy
- Local road.

5. Transmission and Pipe Distribution Network

117. The distribution network includes a pipeline system (100mm to 500mm) of about 45 km. Compensation for land losses, and site clearance have been thoroughly assessed and studied by the project and a general solution is proposed in a separate report.

G. Upgrades to Urban Road Networks – Dong Ha, Lao Bao, & Moc Bai

1. Dong Ha

a. Existing Conditions

118. The road network in Dong Ha City is traversed by 3 national roads; i) National Road (NR)1 with a length of 7.5 km is the main transport route connecting the city to the northern and southern part of the central region, ii) NR 9 which is a major transport link along the East-West Economic Corridor (EWEC), and iii) NR9D which is leading to the western side of Dong Ha city.

119. The total length of the interior urban road is about 40 kms. There has been improvements and rehabilitation made on several road segments. However, with the rapid growth of the urban population the new areas emerging as potential sites for residential houses and commercial establishments require better roads and drainage. structures to anticipate future urbanization trends and requirements of the urban communities. The improvement and widening of 30 km of interior urban roads would be required to address future demands.

120. Most of the roads in Dong Ha are in poor condition with surface of local soil making them difficult to use during the long rainy season. Other roads are too narrow and lack drainage, and are not adequate for a future town development. The subproject includes improving several of these roads. Furthermore, several of the roads are in undeveloped areas.

121. For Dong Ha city, the types of urban roads that would require improvement and widening include:

1) Interior roads that are meant to support the planned development toward urbanization, and

b. Urban road near or along the Hieu river embankment that would complement the Dong Ha River embankment protection component.

2. Components of the Road Upgrades

122. The improvements to urban road and drainages in Dong Ha city will be implemented at the following six road sections (Figure 7). Table 3 summarizes the range in specifications of the road upgrades. The roads upgrades are not major engineering interventions. The relatively simple upgrades of the CTDP-VIE focus on road widening allowing two vehicles at design speed, improved roadbed and surfacing, and treed, & lighted sidewalks (Figure 8).

1) Hoang Dieu route (4.85 km) in the Wards of Dong Giang and Dong Thanh.
2) Ba Trieu route (5.20 km) in Ward 1, 3, 4.,
3) Ward 2 to Dong Le, Dong Luong route (6.6 km), and
4) Thanh Nien Road & Ong Niem Bridge (2.35 km) in Dong Giang ward.

5) Le Thanh Tong route (650 m), and
6) Truong Chinh route (950 m):

Table 3. Range of key specifications of upgrades to roads in Dong Ha

Standard	Unit	Specifications
Road grading		Secondary main urban road
Design speed	km/h	40 - 60
Minimum horizon curve radius	m	60 - 125
Roadbed width	m	16.0 – 34.0
Pavement width	m	8 - 16
Sidewalk width (treed)	m	4.0 – 6.0
Separating strip width	m	0 - 2
Design load	mt	10 - 12

Figure 7. Location of road upgrades in Dong Ha

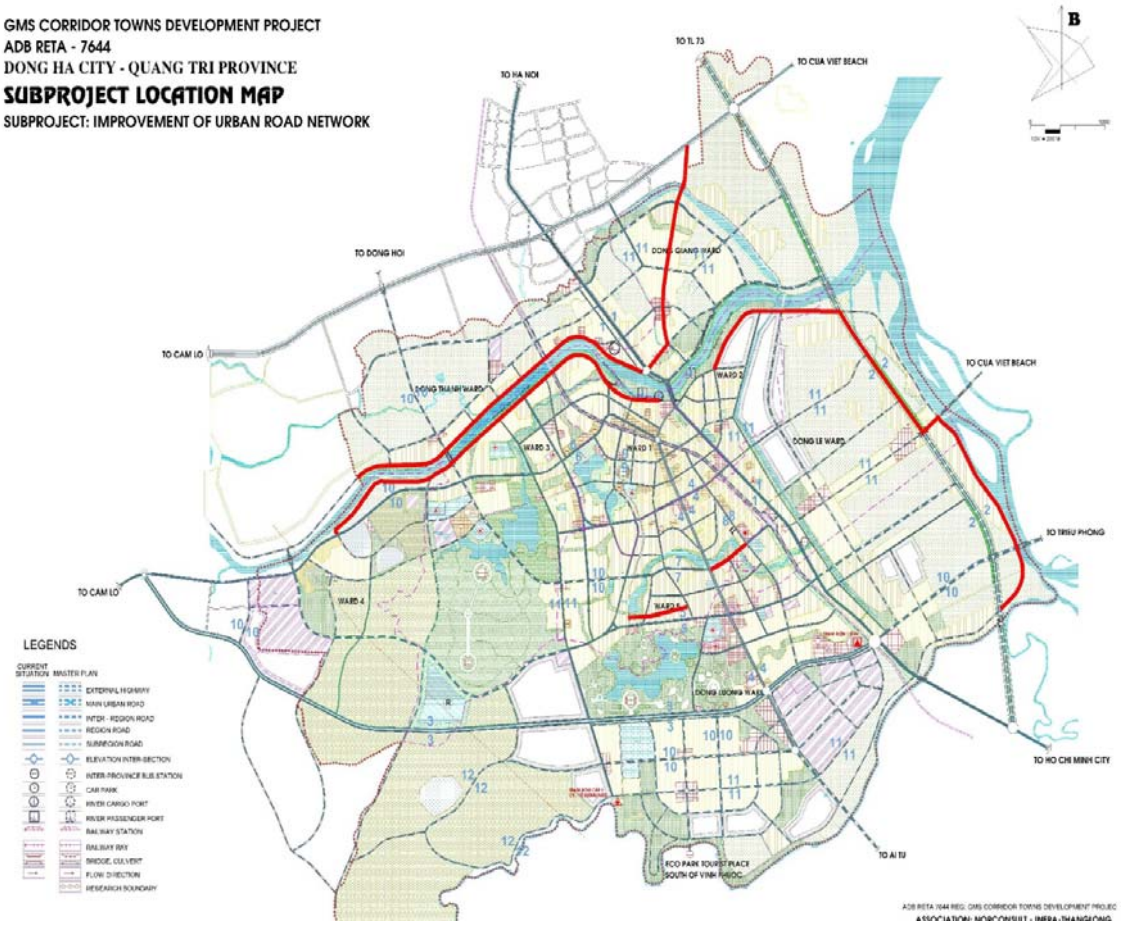
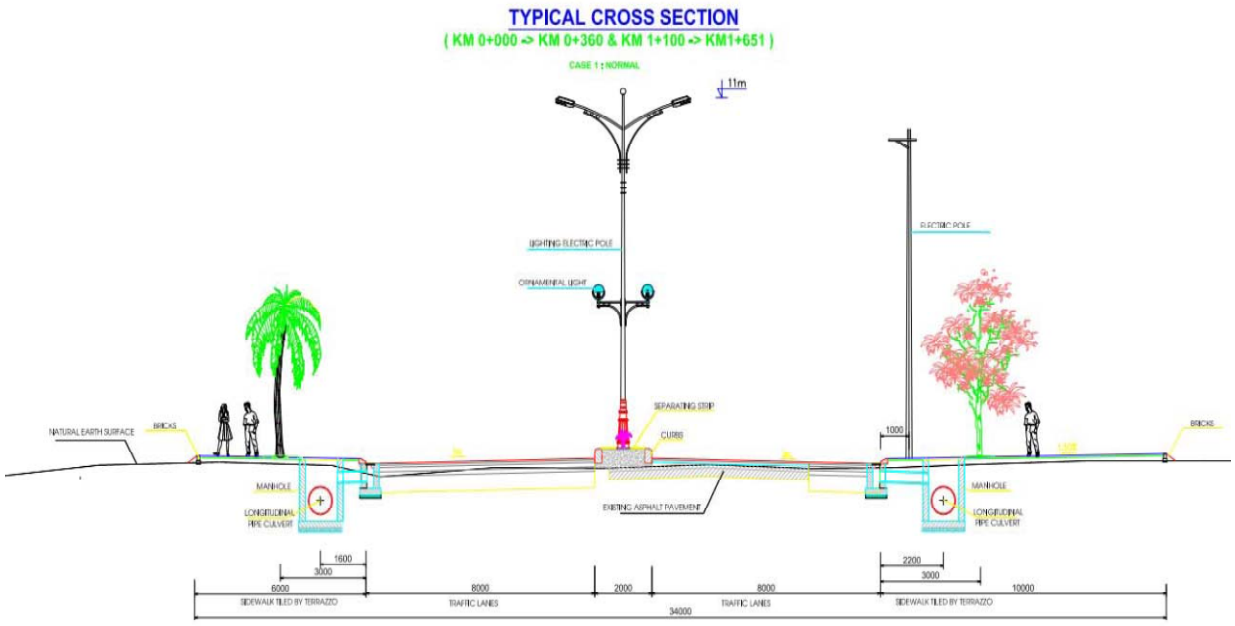


Figure 8. Conceptual road upgrade for Dong Ha, Lao Bao, and Moc Bai towns



3. Lao Bao

a. Existing Conditions

123. The road requiring upgrades are located in the towns of Khe Sanh and Lao Bao, Huong Hoa district (Figure 9). Substantial portions of the urban road network in Lao Bao are in poor condition and in the state of deterioration due to limited maintenance. These urban roads are mostly earth roads which are hardly passable by motor vehicles during rainy season. Along Sepong river there is currently no road, so this road will be important for the town development. The 19.30 km of upgrades are divided into 5 routes.

i. Khe Sanh Urban Area

1) Hung Vuong Road is 3.1 km with a current road base width of 30 m, and made of asphalt/concrete.

2) Doan Khue and Truong Cong Kinh Road is 1.7 km long with a current road base width of 11.5 , made of cement/concrete.

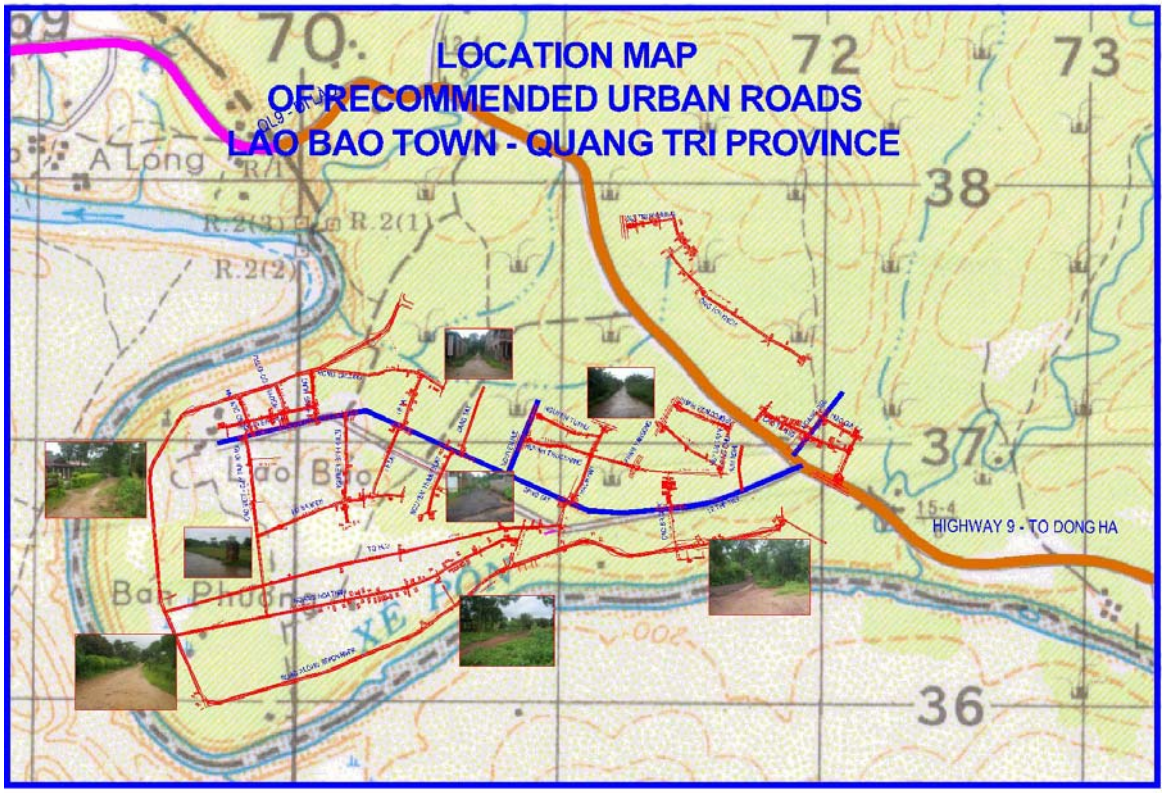
ii. Lao Bao Urban Area

3) Road along Se Pon River is 4.5 km with a road base width of 15.5 m, and made of cement concrete.

4) Duy Tan - Cao Viet – Tan Kim road is 1.5 km with a road base is 22.0 m and made of ashphalt concrete

5) Roads in flooded area of 8.4 m with a road base width of 11.5 m wide that is made with cement concrete.

Figure 9. Location of urban road network in Lao Bao



b. Hung Vuong road:

124. Road is located in the Khe Sanh in densely populated areas. The pavement only exists for about 1 km. The upgrades are needed to meet the travel needs of people as well as transportation of agricultural commodities, implementation of the general planning of economic development zone Lao Bao Special Trade to promote investment activities investment, trade and tourism, and economic development. Additionally, the upgrades are essential to improve the image of the district improve the urban infrastructure of the town.

c. Route of Doan Khue-Truong Cong Kinh

125. Route of Doan Khue-Truong Cong Kinh in Khe Sanh is currently a dirt path with the width of (3.0 - 4.0) m. Road is mud in the rainy season and dusty in the dry season which makes the travelling difficult, and badly affects the residential environment on both sides. Therefore, the investment in construction of Doan Khue-Truong Cong Dinh route is vital to create a smooth communication system and a clean spacious urban aream, creating favorable conditions for the travel of people in the region.

d. Route along Sepon river

126. Route along Se Pon River is the arterial road of Lao Bao town extending through the province. The route passes through residential and production areas of western of Lao Bao. The upgraded and rebuilt road the will promote the production and marketing of products, reduce production costs as well as transportation costs, improve labor productivity and people's income, play an important role in the regional economic-social development. The upgraded road will ensure smooth traffic in the town of Lao Bao in particular and the transport system of Quang Tri province in general.

e. Route in flooded areas

127. These routes are currently degraded seriously. The route in flooded areas (Duy Tan - Cao Viet - An Ha – Dong Chin - Vinh Hoa - Xuan Phuoc) and other urban routes are important roads, linking the residential areas of Lao Bao Town. The road connects residential areas, facilitating cross-cultural, social and economic exchange. The construction project will (i) contribute to completing the system of infrastructures of Lao Bao Town in particular and Huong Hoa district in general, (ii) restructure, stabilize population, expand the town space, promote economic-social development, and (iii) promote economic and cultural exchanges, improve social security for people and tourism in the region.

4. Subproject components

128. The upgrades to the five different routes will occur along different distances as follows. Table 4 summarizes the range of key specifications of for the five routes.

1) Hung Vuong Route: 5.2 km.
2) Doan Khue - Truong Cong Kinh route: 1.7 km.
3) Road along the Sepon River: 4.5 km.
4) Road in Duy Tân - Cao Viet - Tan Kim: 1.5 km.
5) Road in flooded areas: 8.5 km.

Table 4. Range of key specifications of upgrades to roads in Lao Bao

Standard	Unit	Specifications
Road grading		Secondary main urban road / internal
Design speed	km/h	30 - 60
Minimum horizon curve radius	m	30 - 125
Roadbed width	m	11.5 – 30.0
Pavement width	m	5.5 - 16
Sidewalk width (treed)	m	3.0 – 6.0

Standard	Unit	Specifications
Separating strip width	m	0 - 2
Design load	mt	10 - 12

5. Moc Bai

a. Existing Situation

129. The road upgrades traverse 18.96 km of Loi Thuan commune and are divided into 6 different routes (Figure 10). Similar to Lao Bao major portions of the urban road network in Moc Bai are in bad condition, experience regular flooding, and overall could not support future economic development in the area. A summary of the six route segments selected for upgrading is below.

Road D.N1A:

130. The route is 3.0 km starting at the border gate (inner Dia Xu bridge) and ending at the internal road D.D11 (on DDT786, about 100m from Dia Xu bridge). Road Đ.N1A has not been established. The area where the road goes through along Dia Xu canal was upgraded from K0+0,00 to K2+2712,04. The section from K2+2712,04 is the rice field. The route cuts across the canal or ditch or water guide canal excavated by local residents in cajuput garden. These drainage ditches are used to drain the water to Dia Xu canal.

131. This is the main urban road located at the North of Moc Bai border gate economic zone along Dia Xu canal. This route will help to connect the industrial zone No.2 to the centre of Moc Bai border gate economic zone.

Road D.N1B:

132. This segment is of 2.2 km starting at internal road D.D11, about 100 m from Dia Xu bridge, to end at the road to the port. Route D.N1B has not been established. The area where the road goes through is along Dia Xu canal. At present, the new route is traverses rice fields, melaleuca garden, eucalyptus garden and some orchards. The route cut across the canal or ditch or water guide canal excavated by local residents in melaleuca garden. These drainage ditches are used to drain the water to Dia Xu canal.

133. The road is located north of Moc Bai border gate economic zone along Dia Xu canal. This route will, help connect the industrial zone No.1 to the centre of Moc Bai border gate economic zone. When the other regional roads are formed the road D.N1B will link residential area in the east to the railway and the border gate economic zone and from the border gate economic zone to the river port.

Road D.D10:

134. This segment is 2.2 km starting at the end of internal road D.N12 and at the intersection with internal road D.N1. Road D.D10 has not been established. Apart from two sections- from Km0+020 to Km0+100 and from Km1+417 to Km1+483, the new road goes across the residential area. The remaining section of the route traverses rice fields, short term crops of sugarcane, peanuts or eucalyptus. The route cuts through drainage channel as per

the plan at the Km0 +960. The route collects water from other areas and discharge to Dia Xu canal.

135. This route will create a core road for the residential area north of Moc Bai border gate economic zone. This main street supports service facilities, restaurants, shopping centers that serve the urban residential areas at north of Moc Bai border gate economic zone.

Figure 10. Location of road segments to be upgraded in Moc Bai

Road D.D11:

136. This segment is 2.2 km long starting at the middle of internal road D, and ending at intersection with internal road D.N1. Road D.D11 passes through residential areas, passing through rice field or cajuput, eucalyptus lowland. Route cuts through drainage channels at the km0 +708. This route collects water from other areas and then discharged to Dia Xu canal.

Therefore, it is necessary attend to the drainage solution during the construction especially in rainy season. This route will create the core road for the residential area at the north of Moc Bai border gate economic zone.

Road DN 51:

137. Road 51 is 2.9 km long starting at the intersection with D.D7 and the ending at junction with road DD 23 in Moc Bai town. Road 51 passes through flat terrain of cajuput gardens, and alum field with grasses. The route cuts through the canal at Km0 = 400 (Right branch). This route collects water from other areas and then discharged to Dia Xu canal. In addition, the route cuts across the canal or ditch or water guide canal excavated by local residents in cajuput garden.

138. The road will create a core road for the residential area at east of Moc Bai border gate economic zone. This main street supports service facilities, restaurants, shopping centers to serve the urban residential areas north of Moc Bai border gate economic zone.

Road DN 65:

139. This road 2.2 km long beginning the intersection with Road 14, and ending at junction with road DD 23 in the Moc Bai town. Road 65 passes through the cajuput gardens, alum field with grasses. The terrain is relatively flat and is favorable for construction works. It will create a core road for the residential area east of Moc Bai border gate economic zone. This main street, where the service facilities, restaurants, shopping centers are located serve the urban residential areas at the North of Moc Bai border gate economic zone.

b. Components of Road Upgrades

Road No. 1A

- Across gradient of road pavement: 2.0%; sidewalks: 1.0%
- Embankment: excavating: 1/1; filling: 1/1.50; compacted soil: C3; K ≥ 0.95.
- Sidewalks: curbing, planting trees
- Scale: Bn = 7.5 +15.0 +7.5 = 30.0 m
- 2 reinforced concrete culverts of 1000 cm and 1500 cm to escape to Dia Xu canal shall be arranged.

Road No. 1B

- Across gradient of road pavement: 3.0%; road edge: 4.0 %
- Embankment: excavating: 1/1; filling: 1/1.50; compacted soil: C3; K ≥ 0.95.
- Scale: Bn = 7.5 +15.0 +7.5 = 30.0 m
- 2 reinforced concrete culverts of 1000cm to escape to Dia Xu canal shall be arranged.

Road D10

- Across gradient of road pavement: 2.0%; road edge: 2.0 %
- Embankment: excavating: 1/1; filling: 1/1.50; compacted soil: C3; K ≥ 0.95.
- Scale: Bn = 5.0 +7.5 +2.0 +5.0 = 17.5 m
- 2 reinforced concrete culverts of 1000cm và 1500cm to escape to Dia Xu canal shall be arranged.

Road D11

- Across gradient of road pavement: 2.0%; road edge: 2.0 %
- Embankment: excavating: 1/1; filling: 1/1.50; compacted soil: C3; K ≥ 0.95.
- Scale: Bn = 5.0 +7.5 +5.0 = 17.5 m

- 2 reinforced concrete culverts of 1000cm to 1500cm to escape to Dia Xu canal shall be arranged.

Road 51

- Across gradient of road pavement: 2.0%; road edge: 2.0 %
- Embankment: excavating: 1/1; filling: 1/1.50; compacted soil: C3; K ≥ 0.95.
  Scale: Bn = 5.0 +10.5 +5.0 = 20.5 m
- 2 reinforced concrete culverts of 1000cm to 1500cm to escape to Dia Xu canal shall be arranged.

Road 65

- Across gradient of road pavement: 2.0%; sidewalks: 1.0%
- Embankment: excavating: 1/1; filling: 1/1.50; compacted soil: C3; K ≥ 0.95.
- Sidewalks: curbing, planting trees
- Scale: Bn = 5.0 +10.5 +3.0 +10.5 +5.0 = 34.0 m.
- 2 reinforced concrete culverts of 1000cm to 1500cm to escape to Dia Xu canal shall be arranged.

H. Materials Recovery Facilities – Dong Ha & Moc Bai

1. Dong Ha

a. Existing Situation

140. The main waste sources in Dong Ha include households, hotels, guesthouses, markets, commercial establishments, institutions and street sweepings. As of 2012, waste generation is estimated at 56 tons per day (tpd). This is projected to increase to 89 tpd by 2020 and reach 160 tpd by 2030.

141. Mixed waste collection is undertaken by a government agency known as Urban Environment Company (URENCO) at an estimated rate of 43 tpd as of 20112 which is expected to progressively increase to 89 tpd in 2020 and 160 tpd in 2030. The collected waste is disposed at a newly completed sanitary landfill located about three (3) kilometers west of the town center.

142. The uncollected waste is usually disposed along streets and vacant lots. Some waste is reportedly buried or buried by the local residents. Composting is not practiced in Dong Ha. Segregation of recyclables for reuse and sale to junkshops takes place at sources, bins and at the existing sanitary landfill. Segregation at bins and at the sanitary landfill is undertaken by the informal sector under unsanitary conditions which are usually exposed to heat of the sun or rains.

143. A significant percentage of recyclables are informally recovered at source defined by unsanitary picking of mixed waste at 1) bins; 2) at waste collection trucks; and 3) at the existing open dump by the informal sector. This practice exposes people to obvious health and safety hazards aside from providing a negative aesthetic image of the district and province.

144. The MRF together is needed to more effectively support with the directives of the Law on Environment (2005) on segregation of recyclables at source. The passage of the necessary declarations on segregated waste collection and IEC on SWM will provide a sanitary and efficient system and facility for the recovery of the recyclables than that currently

being done at bins, waste trucks and dumpsite.

b. Components of MRF in Dong Ha

Table 5 summarizes the features of the proposed MRF in Moc Bai. Figure 11 outlines the plan of the facility.

Table 5. Features of proposed MRF in Dong Ha

Location	:	Dong Ha, Quang Tri Province, Vietnam
Objective	:	Recovery of recyclable materials from municipal solid waste generated at Dong Ha; improvement of the solid waste management system
Technology	:	Fully manual sorting aided by payloader for movement of waste and recyclables and by a baler for compaction of the recovered materials
Capacity	:	The MRF will have a capacity of processing a maximum of 60 m^3 or eight (8) tons of dry, source segregated and non-biodegradable waste on a daily 8-hour shift using eight (8) l sorters[4]. Depending on the amount of recovered recyclables, 2 to 4 personnel could be added to handle the storage of the valuable materials. The facility will be operated six (6) days a week. Sorting operations will be fully manual and will target the recovery of recyclable materials such plastic bottles, tin cans, metal containers, carton and white paper. The facility can also process the recyclables recovered by the waste collection crew and those purchased from the different waste generators. It has a capacity of storing at least 100 tons of recyclables.
Operating Schedule	:	The facility shall operate from 7:30 AM to 4:30 PM from Monday to Saturday.
Target Inputs	:	1. The primary inputs correspond to dry, source segregated non-biodegradable waste from households and commercial establishments. 2. Secondary inputs correspond to segregated recyclables to be purchased directly from bin pickers, households and other establishments
Target outputs	:	Recyclable materials which include plastic bottles, tin cans, metal containers, carton and white paper, metal
Design	:	MRF corresponds to a 800 m^2 fully enclosed building with paved flooring

[4] A sorter can process at least 1 m^3 of dry source segregated non-biodegradable waste per hour.

Features		and designated areas for receiving and sorting of waste, storage areas for recyclable materials and residual materials, office, area for equipment and toilet and wash areas for pickers and facility supervisor/staff. The facility will be equipped with a payloader, baler, weighing scales, bins and a small power generating set. It shall have a main front door and 2 side doors and will be enclosed by a perimeter fence with a brick lower base and an upper chain link section.
General Process Flow	:	Waste will be inspected then unloaded into the receiving/sorting area. Recyclables will be segregated from the waste pile and stored in designated temporary storage areas. Biodegradable and residual materials will be moved by the payloader into the nearby sanitary landfill cell. Recovered recyclable materials will be weighed, baled or packed and/or sold to large junkshops or recycling facilities.
Management and Operational Arrangements	:	1. The facility will be managed by URENCO 2. A technical supervisor and one (1) staff shall oversee the day to day operations of the facility. At least eight (8) waste pickers shall undertake the segregation of the recyclable components. The pickers shall be compensated in accordance with the amount of valuable materials recovered. Aside from assisting the facility supervisor, the MRF staff shall also operate the baler and payloader. 3. Recovered recyclables shall be sold to recyclable trading centers in Hue or Da Nang
Key project stakeholders	:	Waste pickers at Dong Ha SLF, waste collection crew, URENCO, Dong Ha, junkshop operators
Requirements for sustained operation	:	1. Implementation of the 2005 environmental law which requires waste segregation at source 2. Passage and implementation of a declaration requiring segregated waste collection. Non-segregated or mixed waste shall not be collected. 3. Passage and implementation of a declaration which provides the MRF operator priority in the purchase of segregated dry non-biodegradables from locators, factories, and establishments within the current and future special economic zones 4. Capacity building for MRF supervisor and staff
Implementation Schedule	:	1. Detailed Engineering Design – 3 months 2. Bidding and Award of Construction Contract – 4 months 3. Construction – 4 months

c. Location

145. The proposed Dong Ha Materials Recovery Facility (MRF) will be located within a flat, 16-hectare lot that has been developed into a 4-cell sanitary landfill. The site is about three (3) road kilometers southwest of the center of the city (Figure 12).

Figure 11. Floor plan of MRF in Dong Ha

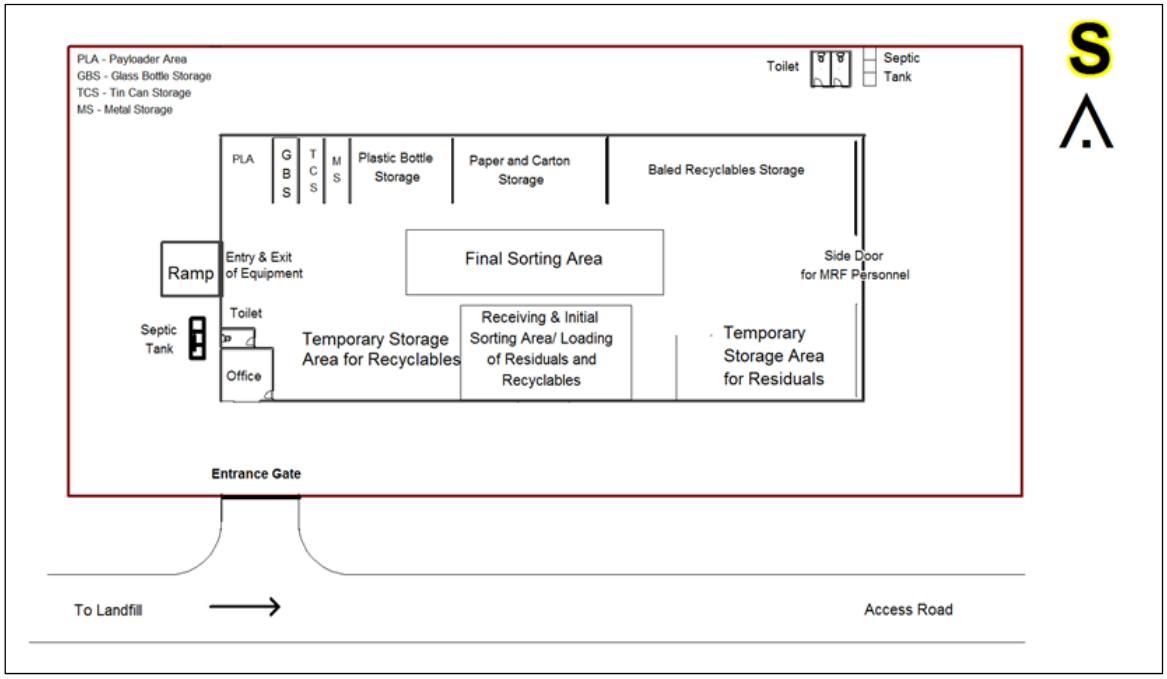
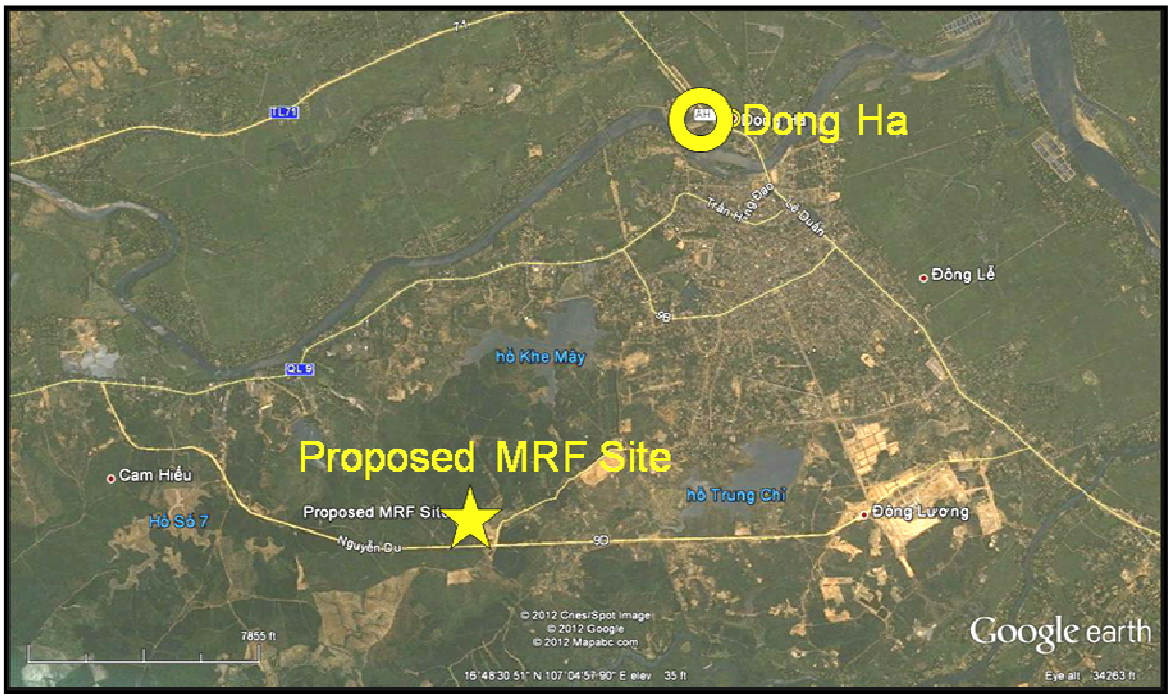


Figure 12. Proposed location of MRF in Dong Ha



2. Boc Mai

a. Existing Situation

146. Solid waste management collection in Moc Bai is undertaken by Tien Len Company (TLC) and the Urban Environmental Company (URENCO). The TLC collects mixed waste from households, one market, offices, commercial center and supermarket and disposes them to an open dump located near the town center. Average daily collection is about 2 to 3 tons.

147. URENCO collects the street sweepings, office waste and waste from the bus terminals of Moc Bai. It also collects waste from the households of the Tay Ninh province. The collective daily mixed collection is 90 tons all of which is disposed to a dumpsite in Tan Hung.

148. Collection of segregated recyclables and household waste of the workers of the different locators in the industrial zones of Tay Ninh province is undertaken by Green Environment Corporation. The recyclables are sorted in a large warehouse in Tay Ninh town while the household waste is incinerated in the same compound.

149. Waste generators include households, market, commercial establishments and institutions. Recovery of the recyclable materials for reuse and recycling is done at varying levels at the waste generation level. Unsanitary picking of waste is done at the bins, waste collection trucks and the Moc Bai dumpsite. A significant percentage of recyclables are informally recovered at source defined by unsanitary picking of mixed waste at 1) bins; 2) at waste collection trucks; and 3) at the existing open dump by the informal sector. This practice exposes people to obvious health and safety hazards aside from providing a negative aesthetic image of the district and province.

150. The MRF together is needed to more effectively support with the directives of the Law on Environment (2005) on segregation of recyclables at source. The passage of the necessary declarations on segregated waste collection and IEC on SWM will provide a sanitary and efficient system and facility for the recovery of the recyclables than that currently being done at bins, waste trucks and dumpsite.

b. Components of MRF in Moc Bai

151. Table 6 summarizes the features of the proposed MRF in Moc Bai. Figure 13 outlines the plan of the facility.

Table 6. Profile of features of MRF in Moc Bai

Location	:	Go Dau District, Tay Ninh Province, Vietnam
Objective	:	Recovery of recyclable materials from municipal solid waste generated at Moc Bai town and urban centers south of Tay Ninh Tow; improvement of the solid waste management system
Technology	:	Fully manual sorting aided by payloader for movement of waste and recyclables and by a baler for compaction of the recovered materials
Capacity	:	The MRF will have a capacity of processing a maximum of 60 m^3 or eight (8) tons of dry, source segregated and non-biodegradable waste on a daily 8-hour shift using eight (8) l sorters[5]. Depending on the amount of recovered recyclables, 2 to 4 personnel could be added to handle the storage of the valuable materials. The facility will be operated six (6) days a week. Sorting operations will be fully manual and will target the recovery of recyclable materials such plastic bottles, tin cans, metal containers, carton and white paper. The facility can also process the recyclables recovered by the waste collection crew and those purchased from the different waste generators. It has a capacity of storing at least 100 tons of recyclables.
Operating Schedule	:	The facility shall operate from 7:30 AM to 4:30 PM from Monday to Saturday.
Target Inputs	:	3. The primary inputs correspond to dry, source segregated non-biodegradable waste from households and locators of Moc Bai and the southern districts of Tay Ninh province and truck sorted recyclable materials. 4. Secondary inputs correspond to segregated recyclables to be purchased directly from households and other establishments
Target outputs	:	Recyclable materials which include plastic bottles, tin cans, metal containers, carton and white paper, metal
Design Features	:	MRF corresponds to a 800 m^2 fully enclosed building with paved flooring and designated areas for receiving and sorting of waste, storage areas for recyclable materials and residual materials, office, area for equipment and toilet and wash areas for pickers and facility supervisor/staff. The facility will be equipped with a payloader, baler, weighing scales, bins and a small power generating set. It shall have a main front door and 2 side doors and will be enclosed by a perimeter fence with a brick lower base and an upper chain link section.

[5] A sorter can process at least 1 m^3 of dry source segregated non-biodegradable waste per hour.

General Process Flow	:	Waste will be inspected then unloaded into the receiving/sorting area. Recyclables will be segregated from the waste pile and stored in designated temporary storage areas. Biodegradable and residual materials will be moved by the payloader into the nearby sanitary landfill cell. Recovered recyclable materials will be weighed, baled or packed and/or sold to large junkshops or recycling facilities.
Management and Operational Arrangements	:	4. The facility will be managed under a public – private partnership. Tay Ninh District will engage the Green Environment company to operate the MRF 5. A technical supervisor and one (1) staff shall oversee the day to day operations of the facility. At least eight (8) waste pickers shall undertake the segregation of the recyclable components. The pickers shall be compensated in accordance with the amount of valuable materials recovered. Aside from assisting the facility supervisor, the MRF staff shall also operate the baler and payloader. 6. Recovered recyclables shall be sold to recyclable trading centers in Tay Ninh or Ho Chi Minh City.
Key project stakeholders	:	Waste pickers at dumpsite and urban sector of Moc Bai and southern districts of Tay Ninh province, waste collection crew, private waste collection company, Moc Bai District, Tay Ninh province, junkshop operators
Requirements for sustained operation	:	5. Implementation of the 2005 environmental law which requires waste segregation at source 6. Passage and implementation of a declaration requiring segregated waste collection. Non-segregated or mixed waste shall not be collected. 7. Passage and implementation of a declaration which provides the MRF operator priority in the purchase of segregated dry non-biodegradables from locators, factories, and establishments within the current and future special economic zones 8. Capacity building for MRF supervisor and staff
Implementation Schedule	:	4. Detailed Engineering Design – 3 months 5. Bidding and Award of Construction Contract – 4 months 6. Construction – 4 months

c. Location

152. The proposed Moc Bai – Tay Ninh Materials Recovery Facility (MRF) will be located within a flat, 17-hectare government lot in Hiep Thanh, Go Dau District whose land use rights have been given to the Green Environment Company (GEC) for a 50-year period which started in 2010. The 800 m2 MRF for Moc Bai and southern urban areas of Tay Ninh province will be located within 7.5 hectares currently being developed by GEC into a sanitary landfill and composting plant. The site is about 25 road km north of Moc Bai (Figure 14).

Figure 13. Floor plan of Moc Bai MRF

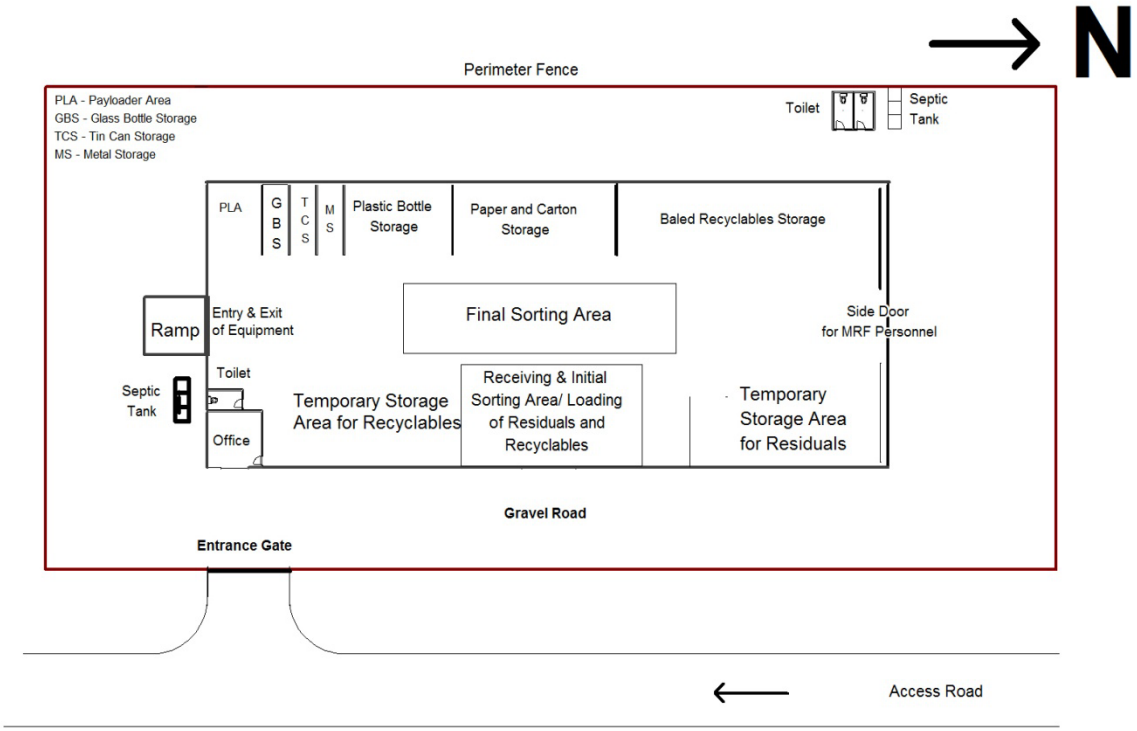
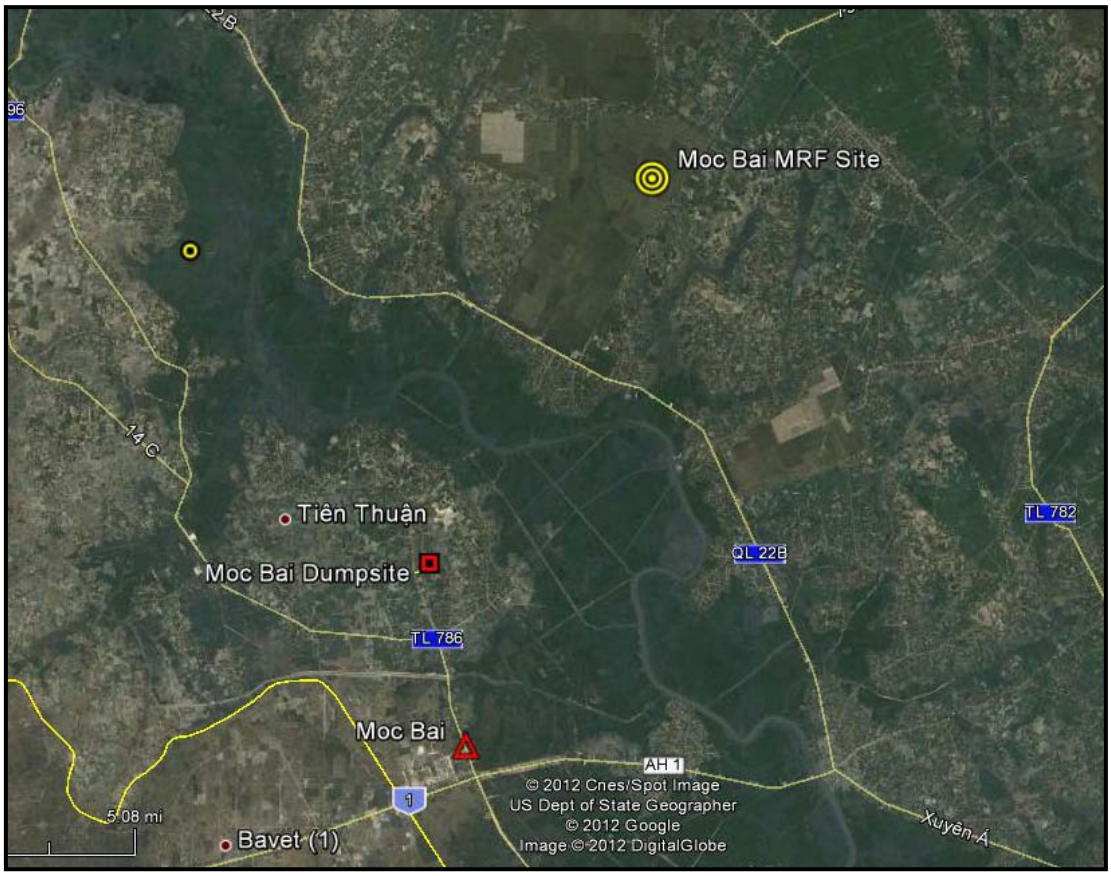


Figure 14. Proposed location of MRF in Moc Bai.



V. DESCRIPTION OF ENVIRONMENT

A. Dong Ha, and Lao Bao

1. Physical Environment

153. Quang Tri Province is located in the north central region of Viet Nam ($16^0$18'N - $17^0$10' north and from $106^0$24' - $107^0$24' east) bordering with Quang Binh province in the north, Thua Thien Hue province and the south, south China s to the east, and Lao PDR to the west. Quang Tri province has 75 km of coastline and a total land area of 4746.99 km^2 consisting of 141 commune / ward / towns in eight districts. The population of Quang Tri is 599.221.

a. Climate

154. Climate of Quang Tri has a tropical monsoon climate. However, due to geographical and topographical features climate in Quang Tri is complex which affects agriculture and forestry.

155. The average annual temperature is between 23-25^0C with the highest in from June to July of about 35-40^0C. Average lowest temperatures of about about 18^0C, dropping to sometimes 8 - 9^0C occur in December-January..

156. Average annual humidity is 85%, categorized into two distinct seasons: dry season lasts four months, from May to August with average humidity between 70 - 80% and reached minimum in July: 65 - 70%. Humidity increased quickly when the rainy season come and maintained at high levels, with the average humidity from 85 to 90%.

157. The rainy season is from September to February with peak rainfall in October and November. From March to July rainfall lowest. The total average annual rainfall is from 2,300 to 2,700 mm in the mountains and from 1,800 to 2,000 mm in the plains.

.

158. Quang Tri is affected by two main monsoons. southwest monsoon (Laos monsoon) usually occurs from May to August with a frequency of 50 to 60%. The northeast monsoon occurs from September to February next year, with a frequency between 40 - 50%.

159. Annual typhoon season usually begins in September and ends in late November. Due to geographical location adjacent to the sea, storms often occur with great intensity, accompany with high tides, and cause large Lakeage to agriculture and forestry development and people's lives.

b. Air quality and noise

160. Data from Hue University (Table 7) indicates that the microclimate parameters (moisture, temperature, wind speed) from 2006 – 2010 in Dong Ha are normal. For air quality dust, and other parameters (i.e., Pb, CO, NO_2, SO_2 and NH_3) at most monitoring locations from 2006 to 2010 met the national technical regulations currently QCVN 05:2009/BTNMT- National technical regulations on ambient air quality and QCVN 06:2009/BTNMT- National Technical Regulation on some hazardous substances in ambient air quality.

161. Lead (Pb) was only detected in some monitoring locations at very small concentrations, < 0,1 μg/m^3 (standards for maximum levels of 1.5 μg/m^3). The concentration of the parameters Pb , NO_2 , SO_2 and dust decreased from 2006 to 2010.

Table 7. Summary of air quality in urban areas of Dong Ha

Parameters	Unit	2006[a]	2007 – 2008[b]	2009[c]	2010[d]	QCVN 05:2009/BTNMT[e]
		TB ± S (Min - Max)[*]	TB ± S (Min - Max)	TB ± S (Min - Max)	TB ± S (Min - Max)	
Temperature	^{0}C	-	-	30 ± 4 (23 - 38)	30 ± 4 (23 - 37)	-
Humidity	%	64 ± 6 (52 - 73)	60 ± 11 (40 - 84)	70 ± 10 (46 - 89)	71 ± 9 (57 - 82)	-
Wind Speed	m/s	-	1,4 ± 0,8 (0,2 – 3,8)	1,8 ± 0,7 (0,8 – 3,8)	1,2 ± 0,4 (0,5 – 2,1)	-
Suspended dust	μg/m^3	493 ± 135 (250 - 750)	233 ± 117 (17 - 642)	112 ± 72 (15 - 317)	147 ± 51 (63 - 235)	300
Noise	dBA	63 ± 8 (50 - 85)	61 ± 7 (46 - 79)	66 ± 6 (51 - 79)	70 ± 4 (63 - 76)	60[f]
Pb	μg/m^3	-	-	(<0,03 – 0,09)	<0,03	1,5
CO	μg/m^3	1750 ± 765 (1150 - 3450)	2700 ± 1302 (370 - 5900)	1481 ± 991 (282 - 8071)	1893 ± 634 (1353 - 3976)	30,000
NO_2	μg/m^3	65 ± 18 (50 - 125)	39 ± 36 (5 - 300)	32 ± 20 (6 - 89)	35 ± 21 (10 - 92)	200
SO_2	μg/m^3	-	110 ± 94 (5 - 550)	64 ± 34 (15 - 152)	38 ± 17 (18 - 91)	350
NH_3	μg/m^3	21,7 ± 42,2 (0 - 100)	29,7 ± 11,8 (5 - 70)	-	-	200[g]

[*] TB: Average value, S: standard deviation; Min: minimum value; Max: maximum value

[a] – Source: Quang Tri Department of Natural Resources and Environment; values in the table are calculated from measurements at 23 points across Quang Tri province *(n=23)*

[b] - Source: Institute of resoueces, environment and biotechnology- Hue; n = 79 with suspended dust*, Noise n = 75 with CO and NO2; n = 74 with SO_2; n = 76 with NH_3; n = 45 with humidity and wind speed*

[c] - Source: Center for Monitoring andeinvironmental technology; n = 60 for SO_2, n = 64 with the remaining parameters

[d] - Source: Center for Monitoring andeinvironmental technology; n = 17 for all parameters

[e] QCVN 05:2009/BTNMT: National technical regulations on ambient air quality (average of 1 hour , particularly for Pb is the average 24 hours)

[f] TCVN 5949:1998: Noise in public and residental areas Maximum permited noise level (from 6h to 18h)

*[g] QCVN 06:2009/BTNMT: National Technical Regulation on some hazardous substances in ambient air quality. (*average of 1 hour*)*

162. Noise levels increased from 2006 to 2010, however the increase is very small. The reason the noise level tends to rise may be due to the increasing number of transport and production activities. Compared with TCVN 5949:1998, noise in public and residential areas exceed maximum permitted levels from 6 to 18h. Clearly, there should be measures to reduce noise in order to protect the health of communities.

163. Air quality within Lao Bao and Khe Sanh town is influenced by the predominantly rural nature of land use. Major air pollutants include dust and particulate matter generated by agricultural activities and land clearing, particularly during the dry season. Industrial development in these Huong Hoa Districts is relatively low and, as such, industrial activities do not influence air quality in the project area. Air quality is influenced by the more developed nature of the land use. Air pollutants include dust and particulate matter, vehicle emissions and emissions from low-scale industry and manufacturing. Dust in Khe Sanh town is 180 $\pm$ 69 $\mu g/m^3$/hour.

164. Noise levels are generally considered to be low, due to the predominantly rural nature of land use. Local sources of noise generation include agricultural activities and transport related noise in proximity of major transport corridors. Noise sources include transport, low-scale industrial and manufacturing activities and general urban noise sources. Noise level in Khe Sanh town is 72.5 $\pm$ 1,1 dB/hr.

c. Topography and Soils

165. The terrain of Quang Tri slopes from from west to east and is lowest in southeast. The topography has generated differences in social and economic characteristic of the regions. The hilly terrain in the west and occupies nearly 78% of the province. The distribution of hilly terrain in the mountains forms two sub-regions defined below.

i. Truong Son mountain terrain:

166. This area is concentrated along the Truong Son Mountains (Huong Hoa district and west-southwest of Dakrong district). The general features of the sub-regions are steep slopes divided by rivers and narrow valleys. Lao Bao is in this sub-region.

ii. Hilly and low mountains (sub-region Midlands):

167. The sub-region occupies a large area and stretches from north to south between the high regions and the coastal plain. The topography consists of hills bowl (of schist, sandstone slabs) and the ranges of gently hill (the land of basalt and alluvium) with a height of 20-700 m, the slope varies from 8-300.

iii. Coastal lowlands and islands:

168. The coastal plains is divided into: 1) the alluvial plains; and 2) sand dunes and sandy grasslands. These forms are distributed at riversides and located between the western hills and sand dune areas. The narrow fields with generally unequal height are formed by the consolidation of the river systems and the convergence slope strip that are mined and reformed for a long time. The sand dunes generally form parallel strip to the coast, absolute height from 4-20 m.

169. Khe Sanh town belongs to the region of hills and mountains divided by natural streams; and characterized by the altitude of 390m ÷550m from the sea level, combined with artificial and natural lakes creating favorable conditions for the development of service and tourism sectors.

170. Lao Bao belongs to mountainous terrain transiting from the West to the East of Truong Son range. The terrain is characterized by relatively high slope and divided by small and medium flows to Se Pon River.

d. Surface waters

171. The Cam Lo river (Hieu river) river originates from the eastern slopes of the Truong Son range with height above 1,000 m. It flows from the northwest to southeast through Huong Hoa district into Dong Ha city and becomes the Hieu river to eventually intersect with Thach Han River. The Cam Lo basin is 465 km^2 with the average river width of 150 ÷ 200m. At the coast the river is tidal. Cam Lo River is a source of alluvium consolidating for the land along the riverside, provide fresh water for production and living, and also the place to regulate heat-moisture regime for the region, especially in summer.

172. The Vinh Phuoc river originates from the high hills 300 - 400m in Cam Nghia commune (Cam Lo district), flows through the southern of Dong Ha city to then discharge into in Thach Han river. The basin is 183 km^2 with the average annual river flow of 9.56 m^3/s, and dry season flow of 1.79 m^3/s.

173. The Sepon river drains the area of Lao Bao. The river originates in Laos in the Phou Ke Lo and Phou Ke Day at about 500m above sea level. The upstream river is in the administrative areas defined by Savannakhet and Saravan provinces of Lao before it flows west through Laos to discharge into the Mekong river. Average flow is 50 m^3/s.
Lao Bao lake is located in the central area of in Lao Bao near highway 9. The lake is believed to influence the microclimate of the area.

174. Other smaller rivers in area of Lao Bao are Se Pang Hieng, and Rao Quan. There is also a system of ponds and lakes, and hundreds of streams in the area. Other lakes in Quang Tri. Include Tram lake and Tich Tuong lake are located about 8 km southeast of Quang Tri town.

e. Water Quality

Tables 8-11 summarize the water quality in major rivers in Quang Tri for the period 2006 – 2010. The water quality data indicate that with the exception of total suspended solids (TSS), and iron (Fe), most of the other parameters meet water use type A2 defined QCVN 08:2008/BTNMT – National Technical Regulation on surface water quality. Concentrations of these parameters did not fluctuate significantly during the period 2006-2010.

f. Groundwater

175. In Quang Tri, Quaternary unconsolidated sediments are found in the river basin, in the plains and the coastal sand dunes. Hydraulic gradients of the aquifers is generally very small (from 0.008 to 0.012). Depth of groundwater at the center of the basin is typically only about 1.0 to 2.0 m. On the dunes and the plains before the mountains, alluvial cone is deeper water (2.0 to 5.0 m).

176. The aquifer thickness is quite large (10-30m) and in places reach 35m. Composition of coarse-grained sediments (sand , pebbles , gravel) dominate over fine-grained sediments (clay slurry) on the section. The results of monitoring of groundwater in the aquifer shows that

movement of groundwater varies with seasonal fluctuations in aquifer water level, and not much on fluctuations in rainfall and surface flow.

177. The groundwater reserves in Quang Tri province are estimated to be 1,656,800,000 m^3. Potential exploitation varies regionally. In general, groundwater resources in Quang Tri, are rich with good quality of large reserves that can be exploited in service and manufacturing activities.

Table 8. Thach Han River water quality from 2006 – 2010

Parameter	Unit	2005[a]	2006[b]	2007[c]	2009[d]	2010[e]	QCVN 08:2008/BT
		TB ± S (n = 45)	TB ± S (n = 7)	TB ± S (n = 4)	TB ± S (n = 18)	TB ± S (n = 5)	A1
pH	-	7.5 ± 0.5	6.8 ± 0.2	7.9 ± 0.5	6.9 ± 0.6	7.3 ± 0.2	6-8.5
Temperature	^oC	27.7 ± 4.6	28.7 ± 0.5	29.7 ± 0.9	25.6 ± 1.8	24.2 ± 0.8	-
Total suspended solids (TSS)	mg/l	9 ± 12	47 ± 24	5 ± 2	42 ± 38	30 ± 13	20
Dissolved oxygen (DO)	mg/l	6.4 ± 0.6	6.8 ± 0.4	6.9 ± 0.5	7.0 ± 0.6	7.3 ± 0.4	≥ 6
Biochemical oxygen demand (BOD_5)	mg/l	0.5 ± 0.3	-	0.6 ± 0.3	0.6 ± 0.2	1.4 ± 1.0	4
Chemical oxygen demand (COD)	mg/l	6.3 ± 2.6	-	3.7 ± 2.0	3.8 ± 3.4	2.6 ± 1.4	10
NO_3^--N	mg/l	0.08 ± 0.09	-	< 0.05	1.0 ± 1.1	0.88 ± 0.75	2
NH_4^+-N	mg/l	0.06 ± 0.04	0.13 ± 0.04	< 0.05	0.08 ± 0.06	0.05 ± 0.06	0,1
PO_4^{3-}-P	mg/l	-	0.13 ± 0.06	0.01	0.08 ± 0.05	0.03 ± 0.02	0,1
$Fe^{II,III}$	mg/l	-	0.15 ± 0.05	0.20 ± 0.09	0.51 ± 0.55	0.21 ± 0.12	0,5
Cu^{II}	mg/l	-	-	-	0.02 ± 0.01	< MDL	0.1
Zn^{II}	mg/l	-	-	-	0.02 ± 0.01	< MDL	0.5
Coliform	MPN/100ml	812 ± 779	-	1482 ±1626	222 ± 191	69 ± 79	2500

[a] TB: average value, S: standard deviation;
[b] source: WQI (analysis results in five river sections in 9 batch from 3 – 11/2005)
[c] source: Quang Tri Department of Natural Resources and Environment
[d] source: Planning for building a network of environmental monitoring in Quang Tri province (analysis results in 10/ 2007 in four sections or river)
[d,e] source: Center for Monitoring and environmental technology (Quarter I, II, III, IV in 2009 and quarter I in 2010)
[f] QCVN 08:2008/BTNMT - National Technical Regulation on surface water quality:
- A1: Good use for domestic water supply purposes and other purposes , such as type A2 , B1 and B2
- A2: Used for domestic water supply but must apply appropriate processing technology; conservation of aquatic animals and plants or intended use requires lower water quality (such as type B1 and B2).

Table 9. Hieu River water quality 2006 – 2010

Parameter	Unit	2005[a]	2006[b]	2007[c]	2009[d]	2010[e]	QCVN 08:2008/BT
		TB ± S (n = 27)	TB ± S (n = 2)	TB ± S (n = 3)	TB ± S (n = 10)	TB ± S (n = 3)	A1
pH	-	7.5 ± 0.5	6.8	7.6 ± 0.5	6.7 ± 0.6	7.0 ± 0.3	6-8,5
Temperature	^oC	27.9 ± 4.2	29.0	29.6 ± 0.4	26.6 ± 3.0	24.0 ± 0.1	-
Total suspended solids (TSS)	mg/l	4 ± 3	27	5 ± 2	32 ± 21	29 ± 16	20
Dissolved oxygen (DO)	mg/l	6.9 ± 0.9	7.0	7.7 ± 1.2	7.3 ± 0.5	7.1 ± 0.4	≥ 6
Biochemical oxygen demand (BOD_5)	mg/l	0.5 ± 0.4	-	1.1 ± 0.8	0.6 ± 0.3	1.3 ± 0.5	4
Chemical oxygen demand (COD)	mg/l	6.7 ± 2.7	11	9.3 ± 5.3	3.0 ± 2.0	2.6 ± 1.4	10
NO_3^--N	mg/l	0.08 ± 0.07	-	< 0.05	0.82 ± 0.87	0.64 ± 0.79	2
NH_4^+-N	mg/l	0.07 ± 0.07	0.15	< 0.05	0.06 ± 0.04	0.04 ± 0.02	0,1
PO_4^{3-}-P	mg/l	-	0.14	0.01	0.02 ± 0.01	0.03 ± 0.02	0,1
$Fe^{II,III}$	mg/l	-	0.16	0.18 ± 0.06	0.41 ± 0.36	0.14 ± 0.02	0,5
Cu^{II}	mg/l	-	-	-	< 0.001	< 0.001	0.1
Zn^{II}	mg/l	-	-	-	0.02	< 0.001	0.5
Coliform	MPN/100ml	823 ± 922	-	24 ± 15	112 ± 141	56 ± 59	2500

[a] TB: average value, S: standard deviation

[a] source: WQI (analysis results in three sections river in 9 batch from 3 – 11/2005)

[b] source: Quang Tri Department of Natural Resources and Environment

[c] source: Planning for building a network of environmental monitoring in Quang Tri province (analysis results in 10/ 2007 in three section the river)

[d,e] source: Center for Monitoring andeinvironmental technology (Quarter I, II, III, IV in 2009 and quarter I in 2010)

[] QCVN 08:2008/BTNMT - National Technical Regulation on surface water quality:

- A1: Good use for domestic water supply purposes and other purposes , such as type A2 , B1 and B2

A2: Used for domestic water supply but must apply appropriate processing technology; conservation of aquatic animals and plants or ntended use requires lower water quality (such as type B1 and B2).

Table 10. Vinh Phuoc river water quality 2009 – 2010

No.	Parameter	Unit	2009[(a)] Vinh Phuoc River	2010[(b)] Vinh Phuoc River	QCVN 08:2008/BTNMT[(c)]	
			TB ± S (n = 6)	TB ± S (n = 3)	A1	A2
1	pH	-	6.8 ± 0.5	7.2 ± 0.2	6-8,5	6-8,5
2	Temperature	^{o}C	26.9 ± 1.7	24.5 ± 0.7	-	-
3	Total suspended solids (TSS)	mg/l	38 ± 41	9 ± 2	20	30
4	Dissolved oxygen (DO)	mg/l	6.8 ± 0.6	7.1 ± 0.4	≥ 6	≥ 5
5	Biochemical oxygen demand (BOD_5)	mg/l	0.7 ± 0.5	1.1 ± 0.6	4	6
6	Chemical oxygen demand (COD)	mg/l	3.7 ± 4.0	2.3 ± 1.5	10	15
7	NO_3^--N	mg/l	0.66 ± 0.44	0.33 ± 0.20	2	5
8	NH_4^+-N	mg/l	0.08 ± 0.06	0.08 ± 0.07	0,1	0,2
9	PO_4^{3-}-P	mg/l	0.08 ± 0.09	0.02 ± 0	0,1	0,2
10	$Fe^{II,III}$	mg/l	0.58 ± 0.42	0.24 ± 0.02	0,5	1
11	Cu^{II}	mg/l	< 0.001	< 0.001	0.1	0.2
12	Zn^{II}	mg/l	< 0.001	< 0.001	0.5	1
13	Coliform	MPN/100ml	92 ± 50	13 ± 3	2500	5000

[)]TB: average value, S: standard deviation

[a,b)] source: Center for Monitoring andeinvironmental technology (Quarter I, II, III, IV in 2009 and quarter I in 2010)

[c)] QCVN 08:2008/BTNMT - National Technical Regulation on surface water quality:

- A1: Good use for domestic water supply purposes and other purposes , such as type A2 , B1 and B2

A2: Used for domestic water supply but must apply appropriate processing technology; conservation of aquatic animals and plants or ntended use requires lower water quality (such as type B1 and B2).

Table 11. Se Pon river water quality 2009 – 2010

No.	Parameter	Unit	2009[a] Se Pon River	2010[b] Se Pon River	QCVN 08:2008/BTNMT[c]	
			TB ± S (n = 10)	TB ± S (n = 2)	A1	A2
1	pH	-	6.8 ± 0.2	6.8	6-8,5	6-8,5
2	Temperature	^{o}C	26.4 ± 2.2	24.0	-	-
3	Total suspended solids (TSS)	mg/l	40 ± 28	19	20	30
4	Dissolved oxygen (DO)	mg/l	7.0 ± 0.5	7.2	≥ 6	≥ 5
5	Biochemical oxygen demand (BOD_5)	mg/l	0.4 ± 0.1	1.2	4	6
6	Chemical oxygen demand (COD)	mg/l	3.1 ± 2.6	2.1	10	15
7	NO_3^--N	mg/l	0.77 ± 0.61	1.42	2	5
8	NH_4^+-N	mg/l	0.08 ± 0.05	0.06	0,1	0,2
9	PO_4^{3-}-P	mg/l	0.05 ± 0.02	0.19	0,1	0,2
10	$Fe^{II,III}$	mg/l	1.27 ± 1.78	0.09	0,5	1
11	Cu^{II}	mg/l	< 0.001	< 0.001	0.1	0.2
12	Zn^{II}	mg/l	0.01	< 0.001	0.5	1
13	Coliform	MPN/100ml	200 ± 457	7	2500	5000

[(*)] TB: average value, S: standard deviation

[(a,b)] source: Center for Monitoring andeinvironmental technology (Quarter I, II, III, IV in 2009 and quarter I in 2010)

[(e)] QCVN 08:2008/BTNMT - National Technical Regulation on surface water quality:

- A1: Good use for domestic water supply purposes and other purposes , such as type A2 , B1 and B2

- A2: Used for domestic water supply but must apply appropriate processing technology; conservation of aquatic animals and plants o intended use requires lower water quality (such as type B1 and B2).

178. At the coastal plain region along the total exploitation flow can reach up to 10,000 m^3/day. At Gio Linh survey results show that groundwater can be exploited with constant flow of 15,000 m^3/day Dong Ha township area and Quang Tri town can design the exploitation of underground water with a total capacity reached to 19,000 m^3/day. West of Dong Ha township also can be exploited to achieve flow 2800 m^3/day.

179. In the majority of the provincial area for example in Cam Lo groundwater can be exploited with a constant flow of 1,500 m^3/day. Many areas with the same carbonate sediments as found in Cam Lo such as Da Ban mountains, west of Sa Rieng Cave area) can also exploit the at the same capacity.

1. Resources

a. Land:

180. The total area of the city is 7,296 ha, including agricultural land (about 4,000 ha, accounting for 54.85%), non-agricultural land (approximately 2.492ha, accounting for 34.2%) and other unused land (approximately 748ha, accounting for 10.9%).

b. Water:

181. As indicated above Dong Ha city has abundant surface water provided by Hieu river, Thach Han river and Vinh Phuoc river.

c. Forest:

182. Quang Tri's total forest area in 2010 was 390,248 ha, of which some 88 percent was nature forest and the rest was planted forest. Forest cover rate of the Province was 50 percent. In the same year, Dong Ha City had a forest cover rate of 25 percent, almost entirely contributed by planted forests. Dong Ha town has a forest area of 2,255 ha, in which entire land is planted forest. Natural forest destroyed by war and human.

d. Mineral:

183. Mineral resources are generally poor being dominated by clay reserves, only include clay, limited reserve.

2. Ecological environment

184. In general, the biological resources of the area of Dong Ha are minimal and have been influenced past human activities. Aquatic ecosystems of the rivers have also suffered the effects of urban and industrial development (pollution). Ecosystems in Dong Ha area lack the pristine nature of natural ecosystems.

185. The subproject area is not located near protected areas such as the DaKrong Nature Reserve. Little information on rare or endangered species or critical habitat in the area was obtained.

3. Socio-Economic & Cultural Setting

186. In 2005 Dong Ha was upgraded to a Grade III town and was made the provincial capital and further upgraded to city status in 2009. The city is made up of five wards and four communes and is the political, cultural and economic centre of development in Quang Tri and the leading trade centre along the EWEC (Figure 15).

187. The population of Dong Ha in 2010 was 83,321 with an average population density of 2,227 people/km^2. Ward 1 (with 7,705 people/km^2) is the most densely populated area of the city while Ward 3 and Dong Luong commune are the least dense (355 and 459 people/km^2 respectively). The growth rate of the city has averaged 1.4% per annum

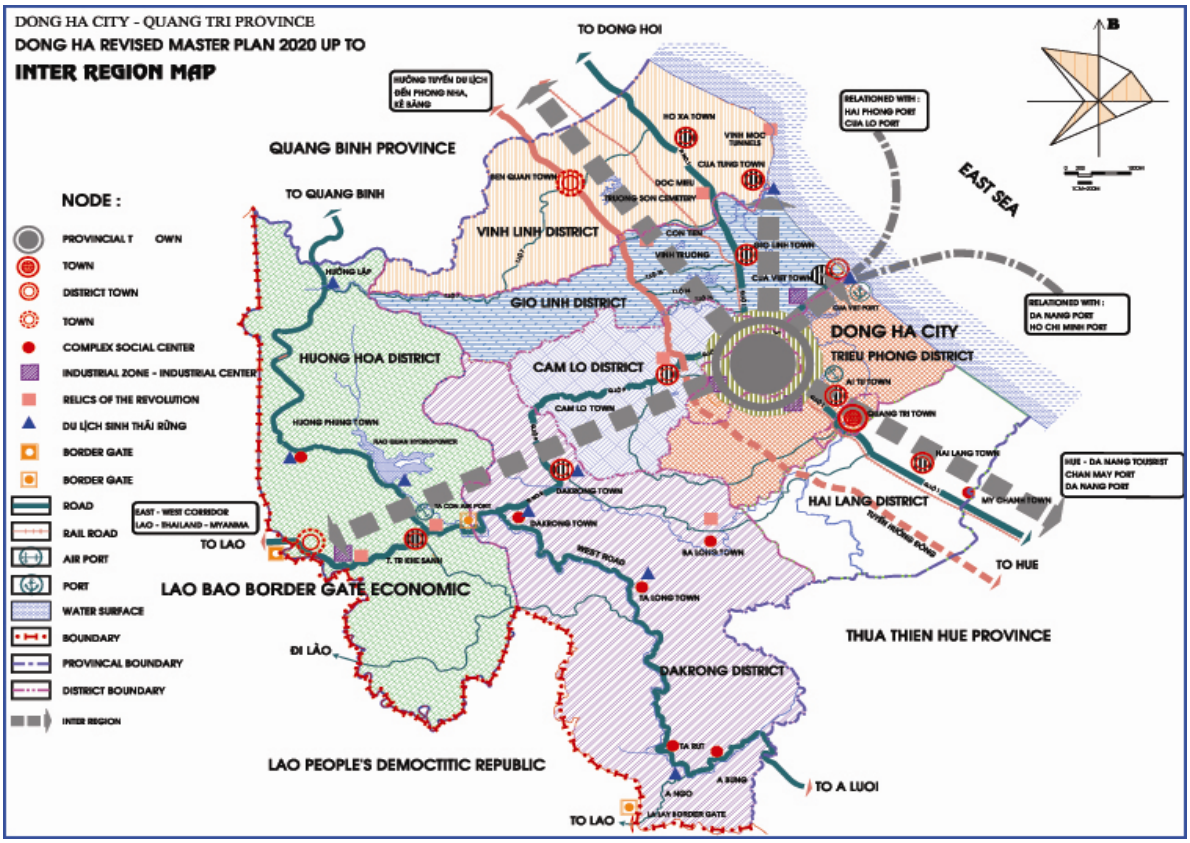
Table 12. Population of Dong Ha

Ward/commune	Population (2010)	Population density (per/km2)	Population projections	
			2020	2030
Ward 1	19,997	7,705	32,405	38,410
Ward 2	4,491	2,225	7,278	8,626
Ward 3	6,807	355	11,031	13,075
Ward 4	4,474	877	7,250	8,594
Ward 5	21,815	5,998	35,351	41,886
Dong Thanh	3,874	800	6,278	7,441
Dong Giang	5,100	815	8,265	9,796
Dong Le	7,607	810	12,327	14,611
Dong Luong	9,156	459	14,816	17,561
Total	83,321	2,227	135,000	160,000

Source: SLEDP (August 2011)

during the past five years. The population projections anticipate the population reaching 135,000 by 2020 and 160,000 by 2030.

Figure 15. Dong Ha City



188. More than a third (35%) of households is headed by a woman. Two-thirds (69%) of heads of household are aged between 31 and 60 years old; with 30% being aged between 31 and 45 years old and 39% aged between 46 and 60 years. A small proportion (4%) of households heads are relatively young household heads (20 to 30 years old), 19% are aged between 61 and 75, and 8% are elderly, being older than 76 years or older.

189. Education levels in the city are high, over half of heads of household (53%) have attained at least some secondary level education (42%) and 11% has attained a tertiary level education. Some 17% of heads of household have completed primary school and 21% have at least some education, while a small proportion (2%) stated they have no education.

190. There are three main ethnic groups in the city; Kinh (98%), Van Kieu (1%) and Pako (0.3%), there are also some non Vietnamese households including Chinese and Lao (0.3% and only in Ward 5). The beneficiary households are 100% Kinh in Dong Thanh and Ward 3, in Ward 5 3.5% are Van Kieu and 1.2% are other ethnic groups (Chinese and Lao), while in Ward 1.3% of households are Pako.

191. The age and sex composition of households indicates an even distribution with similar numbers of males and females relative to their overall number (there are more females than males). As shown in Graph 2 two age cohorts stand out; the 16 to 64 year age group which comprises a larger proportion of males (67%) compared with females (64%) and the 76 years

and older age cohort which comprises a significantly larger proportion of females (5%) than males (2.5%).

192. The current livelihood systems of the beneficiary households involve (a) agriculture including (i) rice and vegetable cultivation; (ii) cash crop production; and, (iii) livestock and poultry raising; (b) engaging in seasonal or casual livelihood activities such as daily labor to farming households during the planting or harvesting season, street vending, or waste picking; (c) employment for regular wages or salary; and, (d) other cash generating activities such as market trading or operating small household business or enterprise.

193. Many households have multiple income streams, however regular or waged income is earned by a quarter of households. More than half (59%) of households earn income from casual or daily labor (48% in Dong Thanh and 78% in Ward 5). Sale of goods produced by the household contributes to income; 39% of households earning income from sale of crops or livestock and 26% of households deriving income from sale of other goods. The largest proportion of households earning income from selling agricultural goods is Dong Thanh, the ore rural location of those in the sample. Income from non-wage sources such as remittances, pensions or rent represents a small proportion of household income and is earned by 5% of households overall and ranging from 1% of households in Dong Thanh to 8% of households in Ward.

194. The city offers a range of infrastructure along with various social and economic services and facilities, and households have connected to a number of utilities (Table 13). Connections to national grid electricity is universal in two wards and accounts for 96% or more in the other two locations, connection to the town water supply ranges from 52% of households in Ward 5 to 83% of households in Ward 4 and 69% overall but access to private wells is available for only 44% of households (ranging from 19% in Ward 5 to 83% in Dong Thanh), households with a flush/pour toilet account for 86% of households overall and from 78% of households in ward 4 to 94% of households in Dong Thanh, less than half of households overall (48%) are covered by regular solid waste collection but this service is available to nearly two-thirds of households in Wards 4 and 5.

Table 13. Access and connection to utilities

Location	Connections/access to services and utilities (%)							
	Elec.	Municipal water supply	Private well	Hot water system	Flush/pour toilet	Sanitation	Telephone	Regular solid waste collects
Dong Thanh	98.8	73.3	82.6	4.7	94.2	53.5	65.1	30.2
Ward 3	100.0	70.4	40.8	1.4	78.9	64.8	53.5	29.6
Ward 4	96.3	82.5	32.5	10.0	77.5	45.0	81.3	65.0
Ward 5	100.0	51.8	18.8	14.1	90.6	80.0	83.5	63.5
Total	98.8	69.3	44.1	7.8	85.7	60.9	71.4	47.5

Source: PSA household survey (September/October 2011)

B. Moc Bai

195. Tay Ninh province is in southeast Viet Nam ($10^0$57'08" – $11^0$46'36" N) $105^0$48'43" - $106^0$22'48" E). The province is bounded in the west and northwest by Cambodia, by provinces of Binh Duong and Binh Phuoc in the east, with Ho Chi Minh City and Long An provinces to the south and southeast. The total area of the province is 4,035 km^2. The province has 9 administrative units, including 1 town and 8 districts, and 95 communes (townships 08, 05 wards, 82 communes). Tay Ninh acts as the bridge between Ho Chi Minh City and Phnom Penh, Cambodia.

1. Physical Resources

a. Climate

196. Tay Ninh has a tropical monsoon climate (Table 14) that is dry, hot, and windy. The average annual air temperature is 26.5ºC. The rainy extends from September to December which accounts for 75-80 percent of total annual rainfall. The prevailing wind directions are northeast during the dry season, and southwest during the rainy season.

Table 14. Climate data of Tay Ninh province

Indicators	Annual Average
Temperature	26 - 27 ^oC
Amount of sunny hours	2,700 - 2,800 hrs
Rainfall	750 – 800 mm
Relative humidity	80-82 %
Evaporation	1,000 - 1,200 mm

Report on State of Environment of Tay Ninh Province, 2010, DONRE

b. Air Quality and Noise

197. Data on air quality levels in Tay Ninh Province is not available. However, it is assumed that dust levels in Tay Ninh exceed VN QCVN standards for air quality. The only available data on noise level in Tay Ninh are those in Moc Bai (64 dBA).

c. Topography and Soils

198. There are eight main soil groups in Tay Ninh Thuan province. The soil groups found in the mountains and hill areas summarized as follows:

- Grey soil of light mechanical composition and low humus content found in the Districts of Ben Cau appropriate to short-term industrial trees;
- Yellow red soil of light mechanical composition and is acidic about found in about 15,000 ha of land, appropriate to fruit trees, short-term industrial trees and livestock grass;
- Yellow-red humus, found in Ninh Son District most of which are forest lands;

- gravelly (stony) eroded soil not appropriate for agriculture concentrated in areas with sloping terrain, low rainfall and low vegetation cover; and

- Alluvial soil concentrated in river valleys making up only about 0.9 percent of the Province.

199. Soil groups in coastal areas include sandy soil & alkaline soil concentrated in low plains and estuaries which is appropriate for salt beds and aquaculture, and alluvial soil.

200. Moc Bai border gate economic zone is located on flat land with relatively low (approximately 0-4 m) altitude and slope from northwest to southeast. The highest area around the border gate on average, is 3 m. The lowest region to the southeast are submerged grass fields ranging from 1 m to - 0.3 m.

201. The regional topography is divided into some main areas as follows. The northwest to provincial highway 786 and Cambodia border the terrain is high and low hill and low rice fields. In the northeast to Vam Co river and Ben Cau town the terrain is high to the centre of Ben Cau town. Rice fields and marsh are located on both sides of provincial highway 786 and Vam Co Dong river lowlands. South to Highway 22 the terrain is low with mainly rice fields. South from Highway 22 to the end of the boundary is high at the middle and gradually low to the east and the west.

d. Hydrology

202. There are many rivers, canals and ditches in the area as exemplified by the Dia Xu canal extending from the north to the east-west from Vam Co Dong River to the border, the Vam Co Dong river in the east, and numerous small canals & ditches in the South.

203. The Vam Co Dong River starts from the high hills in Cambodia flowing from the northwest to the southeast with a total length of 220 km. Approximately 39 km flows through the Moc Bai border gate economic zone. Vam Co Dong River flows to Bau Quy (Can Duoc, Long An) to meet with the Vam Co Tay River before the south china sea.

204. The basin is 8.500 km^2 with average water flow of 96 m/s. Vam Co Dong river is the water supply source for domestic use for the Moc Bai border gate economic zone in the future. However, the Vam Co Dong River is infected with heavy alum, so it is necessary to study the de-alum technology.

2. Natural Resources

a. Land:

205. The total area of the city is 7,295 ha, including agricultural land of about 4,000 ha, non-agricultural land of 2,492 ha, and other unused land of 748 ha.

b. Water:

206. As introduced above the area is supported by the Hieu River, Thach Han River, and Vinh Phuoc River. Average annual rainfall is approximately 2,700mm which acts as a significant input to surface water resources in the town. Groundwater in the downtown area and below adjacent hilly lands is really poor.

c. Forest:

207. Ben Cau district has a forest area of 2,255 ha which is entirely second growth.

d. Mineral:

208. In general mineral resources in the area are poor, limited to clay reserves.

e. Ecological resources

209. The Lo Go Sa Mat National Park will not be affected by the subproject investments in Moc Bai. Little information on rare or endangered species or critical habitat in the area was obtained.

f. Health:

210. In 2010, there were 2,603 recorded cases of malnutrition (under 5 years old) in Moc Bai. During the same year, cases of dengue fever reached 630; while new cases of tuberculosis numbered 350.

g. Sanitation:

211. About 77 percent of the survey respondents have septic tanks, 20 percent uses latrines; while 3 percent have temporary or no toilets. About 90 percent wash their hands after using the toilet and 100 percent boil water for drinking.
Solid Waste Management:

212. About 47 percent of the households have access to solid waste collection services. The remaining households dispose of their generated solid wastes by burning, burying or indiscriminately dumping them on open grounds.

VI. PUBLIC CONSULTATION

A. Stakeholder Consultation Process

213. The consultation and participation process during the preparation of the three subprojects in Dong Ha, Lao Bao, and Moc Bai involved the following activities:

1. Reconnaissance Surveys

214. Reconnaissance surveys of subprojects sites were held almost every month between July and October 2011. The survey was done by a composite group of members of the Project Preparation Team (PPT) and provincial and town representatives. On-site discussions with provincial and relevant town officials provided the PPT with information on the physical and environmental resources, opportunities and constraints relevant to the proposed subprojects.

2. Socioeconomic Survey

215. A socioeconomic survey (SES) was conducted in October 2011 to establish the socioeconomic profile of subproject towns. The survey, at township level, included such usual indicators as population, income and poverty levels, health, education, migration patterns, residential status, among others, as well as access to water supply and sanitation facilities. In terms of participatory-based consultations with stakeholder groups, there was considerable information sharing with a range of public sector officials and informal consultations with a range of local community members including poorer and vulnerable groups.

3. Stakeholder Workshop

216. A stakeholder workshop was held in Quang Tri on October 2011. Participants included representatives from the Quang Tri DoNRE, DoH, DoT, and DARD, relevant town and city officials, and such organization as the Women's Union. The objectives of the workshop were:

1. present the subproject and the subcomponents, designs and locations; and

2. present the PPTA team's perceived outstanding social and environmental issues and concerns and to solicit from them their perception of the same.

217. Future public consultations will be held during detailed engineering design, construction, and operation stages following the general guidelines. All stakeholders should be invited and encouraged to participate in the consultation workshops. Suggestions from the general public may be sought through the mass media, when necessary.

218. The PMUs and People's Committees of all relevant levels should be open to contact by the public on matters concerning the progress of the subprojects, adverse impacts and mitigation measures and environmental monitoring.

B. Information Disclosed To Date

219. Information disclosed to stakeholders to date includes:

- Subprojects' objectives;
- Subprojects' locations, designs and cost estimates;
- Government of Viet Nam and ADB environmental policies and procedures;
- Project's environmental category per ADB and Government of Viet Nam policies;
- Environmental issues per subproject locations and designs;
- Proposed mitigation measures, and;
- Forms of possible institutional set up for environmental monitoring.

C. Summary Stakeholder Concerns

1. Hieu River Embankment Protection in Dong Ha

220. For the Hieu River embankment protection and flood control component the primary stakeholders are the households and commercial enterprises (including evening market stall holders) along the riverbank and pedestrians and tourists who will benefit from a larger area along the riverbank and improved services and facilities and formalization of the river-side area. Secondary beneficiaries are the wider town population who will benefit from improved riverbank protection (reduced risk of erosion or flooding/over-topping in certain areas). Table 15 summarizes the views of the stakeholders of the Hieu riverbank protection investment with negative views highlighted in **bold**.

Table 15. Summary of stakeholder views of Hieu River embankment protection

Stakeholder	Primary	Secondary	Stakeholder Views of Hieu River Embankment Protection
Households in beneficiary area	X		Reduced flooding of houses and commercial establishments along the river; Improved safety along the riverbank; Potential for improved income generation during construction (selling goods); Larger area for providing food and drink stalls and encouraging tourism; Open space along the riverbank for local recreation and exercise; Opportunities to participate in construction as workers; **Any loss of livelihoods from reduced sand mining, fishing or collection of aquatic resources need to be compensated**
Private Contractors	X		Can bid for construction package
Small business operators (stall holders)	X		Larger area, can expand businesses or new businesses can establish; Improved conditions and access to utilities; More formalized parking area makes area safer and more attractive; **Require compensation for loss of income during construction and until businesses can be re-established**
Wider community		X	Reduced flooding and increased riverbank stability; Improved riverbank area for recreation, festivals and events and aesthetics; Improved public image of a key attraction in the town

2. River Port Rehabilitation in Dong Ha

221. The river port rehabilitation will be beneficial for the company or agency running the port, people who can become workers at the port, shippers, and the municipality. Table 16 summarizes the views of the stakeholders of the Hieu riverbank protection investment. No negative concerns were identified.

Table 16. Summary of stakeholder views of Dong Ha river port rehabilitation

Stakeholder	Primary	Secondary	Stakeholder Views of River Port Rehabilitation
Shippers	X		Additional port, reduced congestion at existing ports and reduced cost associated with delays at existing ports
Municipality	X		Major infrastructure which can generate revenues for city

			development
Private Contractors	X		Can bid for construction package
Wider community		X	Reduced heavy vehicle traffic using roads in the city; Employment opportunities provided at the port for existing stevedores and others

3. Solid Waste Management and Sanitary Landfill in Lao Bao

222. For the solid waste management investment the primary stakeholders are the households and commercial enterprises (including market stall holders) who will benefit from regular and reliable solid waste collection and improvement in their immediate urban environment. Private contractors may benefit from offering collection services in an improved solid waste management system. Secondary beneficiaries are the wider town population who will benefit in less direct but no less tangible ways, for example health benefits and an improved urban environment (reduced litter, reduced waste build-up, reduced potential for flies and disease vectors). Table 17 summarizes the views of the stakeholders of improvements to solid waste management in Lao Bao. No negative concerns were identified.

Table 17. Summary stakeholder views of solid waste management in Lao Bao

Stakeholder	Primary	Secondary	Stakeholder Views of Solid Waste Management
Households in beneficiary area	X		Improved and regular waste collection and management reduces localized pollution from informal and illegal rubbish dumping; Improved public health status and living conditions in immediate area; Improved environment and reduced nuisance (smell and flies) for households currently adjacent to, close proximity of, existing dump-site; Opportunities to earn additional income from 'recyclables'; Opportunities to participate in recycling, environmental health and hygiene awareness raising campaign
Private contractors	X		Increased business opportunities in offering regular and reliable waste collection services
People trading in waste products; Waste pickers	X		MRF can formalize recycling and trade in waste; Provides opportunity for income generation through sale of waste collected from town or sorted at landfill; Opportunities to participate in recycling, environmental health and hygiene awareness raising campaign
Wider community		X	Improved public health status and living conditions (reduced nuisance - smell and flies); Opportunities to earn additional income from 'recyclables'; Opportunities to participate in recycling, environmental health and hygiene awareness raising campaign

4. Wastewater Treatment in Moc Bai

223. For the WWTP and sewerage component the primary stakeholders are the households and commercial enterprises (including market stall holders) who currently live along the roads and areas with open channels that convey combined wastewater and run-off

and who will benefit from improvement in health (reduced WBIs and missed work and school days) and their immediate urban environment.

224. This subproject component will also contribute to addressing flooding issues along with the road improvement subproject. Secondary beneficiaries are the wider town population who will benefit in similar ways, for example health benefits and an improved urban environment (reduced odor, potential for flies and disease vectors). Table 18 summarizes the views of the stakeholders of improvements to wastewater treatment in Moc Bai. No negative concerns were identified.

Table 18. Summary stakeholder views of WWTP and sewerage in Moc Bai

Stakeholder	Primary	Secondary	Stakeholder Views of WWTP and Sewerage
Households in beneficiary area	X		Improved and regular wastewater collection and treatment reduces localized pollution; Improved public health status and living conditions in immediate area (adjacent to existing open channels and sewers); Improved environment and reduced nuisance (smell and flies) for households; Potential increase in land values as result of foregoing; Opportunities to participate in environmental health and hygiene awareness raising campaign; Opportunities to participate in construction as workers
Private investors and business operators		X	Induced business opportunities from incremental improvements in urban environment and improved services and infrastructure; Do not have to install individual WWTPs or sewerage connections
Small business operators	X		Removal of barriers to trade from bad smells putting off customers and improvements to livelihoods; Improved income generation during construction;
Municipality	X		As major stakeholder in infrastructure and service provision; Potential to levy higher fees/taxes with improved services; Can encourage additional investors to area as services expanded to cover wider area and meet basic requirements for infrastructure and service provision
Wider community		X	Improved public health status and living conditions (reduced flooding, reduced nuisance - smell and flies); Opportunities to participate in environmental health and hygiene awareness raising campaign

5. Water Supply Development in Moc Bai

225. For the water supply investment the primary stakeholders are the households and commercial enterprises (including market stall holders) who currently have insufficient or poor quality supply form the municipal system as well as non-connected households that have to rely on alternative water sources (mostly unimproved and lined wells) and who will benefit from a more reliable and safe water supply and improvement in health (reduced WBIs and missed work and school days). Women will be primary beneficiaries as they are responsible for collecting water in non-connected households and in connected households treating the water from the town supply as the quality is not adequate to drink without treatment.

226. Secondary beneficiaries are the wider town population who will benefit in similar ways from an expanded and upgraded water supply, for example health benefits. Table 19 summarizes the views of the stakeholders of water supply development in Moc Bai. No negative concerns were identified.

Table 19. Summary of stakeholder views of water supply development in Boc Mai

Stakeholder	Primary	Secondary	Stakeholder Views of Water Supply Development
Households in beneficiary area	X		Improved public health status due to reduction in number of WBIs associated with poor quality water; Reduction in missed work days and school days; Savings from reduced expenditure on treatment for WBIs; Opportunities to participate in environmental health and hygiene awareness raising campaign; Opportunities to participate in construction as workers
Women	X		Reduced exposure to WBIs (women and girls are more susceptible and treatment is more expensive); Reduced time allocated to collection and treatment of water can be transferred to other livelihood activities;
Municipality	X		As major stakeholder in infrastructure and service provision; Potential to levy higher fees/taxes with improved services; Schools and health centres provided with more reliable and safe water supply; Can encourage additional investors to area as services expanded to cover wider area and meet basic requirements for infrastructure and service provision
Private investors and business operators		X	Induced business opportunities from incremental improvements in urban environment and improved services and infrastructure; Do not have to install individual water supply systems and pumps
Wider community		X	Improved public health status and living conditions; Benefits accruing from schools and health centres being provided with more reliable and safe water supply; Opportunities to participate in water supply, sanitation, environmental health and hygiene awareness raising campaign

6. Urban Road Improvements in Dong Ha, Lao Bao, and Moc Bai

227. For the urban roads and drainage improvement investments the primary stakeholders are the people living along the roads, road users, as well as the wider population catchment that rely on the roads for access to facilities and services. The benefits determined during the focus group discussions (FGD) were considered to include participation in construction and opportunities for local contractors, increased selling opportunities for street vendors, local cafés and food sellers during construction, and following construction the improved roads would benefit most people, with specific benefits identified for enterprises and those engaged in marketing with it being easier to carry goods and traffic volumes increasing.

228. Transport operators (passenger transport services and cargo/freight cartage) are another primary beneficiary who can respond to improved access and increased demand for services. Secondary beneficiaries are those who will benefit in less direct ways, for example health workers and teachers will enjoy greater mobility, and street vendors, marketers and merchants could potentially have more customers. Table 20 summarizes the views of the

stakeholders in all three subproject towns of the urban road & drainage upgrade investments. No negative concerns were identified.

Table 20. Stakeholder views of road upgrades in Dong Ha, Lao Bao, and Moc Bai

Stakeholder	Primary	Secondary	Stakeholder Views of Urban Road Upgrades
Road users, members of households in vicinity of the roads	X		Improved access to markets, key social services (health and education services) and urban employment opportunities; Reduced local flooding from improved drainage (household and public health); Increased incentives to produce higher value agricultural products as transport to markets improve; Increased incomes from produce and cash crop marketing will allow families to invest in better housing and healthcare which will improve wellbeing and living standards; Small household retail businesses will become more profitable as traffic volumes and local incomes rise; Increased access to vocational education, training and employment opportunities among youth
Transport operators	X		Business opportunities to carry passengers and goods on a regular basis on upgraded roads; New services/routes can open up; School bus services will improve
Street vendors and markets along the roads	X		Improved access and increased traffic and passenger flow can increase volume of sales; Access and mobility improved (convenience, comfort and ease of travel)
Health and Education personnel		X	Services in schools and the health centre disrupted during rainy season flooding can resume without interruption; There will be easier access to the clinics for mobile health teams from District hospital and for patients travelling to town clinics/ District hospital; Reduced road accidents and injury
Police/traffic police		X	Improved security (including street lighting) deterrent for petty and local criminals; Civil defence capability of local area improved; Involved in delivery of road safety campaign
Agricultural product processors and exporters		X	Assuming other constraints to the sector/industry are overcome, production in the area will increase, diversify and modernize as it becomes easier to get products to market.
Merchants in town markets		X	Improved access and increased traffic and passenger flow can increase volume of sales to small businesses and households

D. Project Response to Stakeholder Concerns

229. The overall response of the consulted stakeholders to the subprojects in Dong Ha, Lao Bao, and Moc Bai was positive as summarized in Tables 15-20. The only negative view was of potential lost livelihoods due to sand mining, and disturbed aquatic resources during construction phase of the Hieu riverbank protection component in Dong Ha, and that compensation that is required for lost income is adequate (Table 15).

230. Even though the concern of lost livelihoods and adequate compensation will be addressed by the RAP, the environmental management plan (EMP) for the Hieu riverbank protection investment will provide a specific subplan to minimize disturbance to the aquatic environment of the Hieu river during construction phase the shoreline works.

VII. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

231. The assessment of potential impacts of the CTDP in Viet Nam is structured by the different types of infrastructure investments that will occur at the three subproject towns defined as follows:

1) Hieu River Embankment Protection - Dong Ha
2) Dong Ha River Port Rehabilitation - Dong Ha
3) Improved Solid Waste Management - Lao Bao
4) Improved Wastewater Treatment - Moc Bai
5) Waters Supply System - Moc Bai
6) Upgrade Urban Road Network & Drainage - Dong Ha, Lao Bao, Moc Bai
7) Materials Recovery Facility - Dong Ha, Moc Bai

A. Overview of Benefits of Subprojects

232. The benefits of the completed subprojects will be registered at two spatial and temporal scales. As indicated in the Introduction the planned impact of the project will be regional socioeconomic development in the vicinity of each subproject town, and cumulatively along the southeast economic corridor of the GMS (Figure 1). Socioeconomic development along the SEC will stem from the transition of the SEC from a transportation corridor between Viet Nam and Thailand to an economic corridor.

233. The smaller scale benefits will be the direct effects (outcomes) of the subprojects on quality of life within Dong Ha, Lao Bao and Moc Bai. Urban transportation will be significantly improved in all three towns, while community sanitation access to potable water will increase in Moc Bai. The investment in the river port and Heu river embankment in Dong Ha will increase local trade while also significantly increasing the beauty of the city, and access to the waterfront areas by residents and visitors. The investments in all subproject towns will improve and develop livelihoods.

234. The specific benefits of the individual subproject investments on which the direct outcomes of the subprojects above are based are highlighted in the summaries of existing conditions for each subproject component in the Project Description. The remedial measures required by each subproject component indicate the specific urban issues that will be addressed.

235. Providing relevance to the benefits defined by the subproject designs are the most significant benefits of the subproject components that were articulated by the community stakeholders who were consulted during the IEEs (Tables 15 – 20).

B. Subproject Impacts and Mitigations

236. The assessment of potential negative impacts of the subproject investments is structured chronologically according to subproject implementation starting with the pre-construction-preparation phase, followed by the construction phase, and ending with the post-construction operation phase of the commissioned infrastructure developments. Provided below is a description of potential impacts and general mitigations. The detailed mitigations for potential impacts are provided in the three environmental management plans (EMP) that are prepared for the three subprojects. This impact assessment by the three phases of subproject implementation is carried forward and shapes the structure of the EMPs.

1. Pre-construction Phase

237. Negative impacts associated with the pre-construction phase of the infrastructure developments focus on land acquisition and resettlement. At the feasibility design stage resettlement and/or compensation for loss of land or structures is anticipated for the following investments:

- Hieu river embankment protection in Dong Ha;
- Solid waste management improvements in Lao Bao;
- Wastewater treatment improvements in Moc Bai;
- Urban road upgrades in all three subproject towns.

238. The greatest level of resettlement or compensation will arise from the urban road upgrades. A draft resettlement plan (RP) has been prepared for each subproject component which is found under separate cover.

239. Impact mitigation focus areas of the pre-construction phase of all three subprojects are:

1) Completion & initiation of the resettlement and compensation plans (RP) for the affected subproject investments;
2) Completion of detailed designs of the three subprojects in Dong Ha, Lao Bao, and Moc Bai; and
3) Updating and initiation the three subproject EMPs.

240. The EMPs will need to be reviewed and updated where necessary during pre-construction phase to meet the detailed designs of the subproject components to ensure that additional or changes to impacts arising from detailed designs are addressed by the EMPs.

a. Transition to New Sanitary Landfill

241. The new sanitary landfill will be located between the towns of Khe Sanh and Lao Bao which therefore means it will be located between the two existing dumpsites which are located at each of the towns according the FS report. The existing landfills are not scheduled to be closed as part of the subproject, and are not considered *associated facilities* of the new landfill (SPS, 2009).

242. During the pre-construction phase the potential influence of the existing dumpsites on the proposed site for the new sanitary landfill, and ultimately on the design and operation of

the new sanitary landfill needs to be reviewed. The possible link between an old dumpsite and site for new landfill is through groundwater or possibly by overland runoff during the rainy season. The possible contamination of groundwater at the new site from one or both of the existing dumpsites should be ascertained. The design of the cells and liner, and leachate collection and treatment system of the new sanitary landfill will require understanding the influence if any of the existing dump sites.

243. Updating the three EMPs during the pre-construction, detailed design stage will involve finalization of sub-plans of the EMPs to manage potential impact areas such erosion, sedimentation of surface waters, noise, dust & air quality, spoil disposal, traffic, and worker and public safety at the project sites. Similarly, a subplan to clarify the influence of the old dumpsites on the site for the new sanitary landfill, and ultimately the design and operation of the new landfill will be prepared.

2. Construction Phase

a. Common potential impacts of infrastructure investments

244. The potential environmental impacts of the subprojects in Dong Ha, Lao Bao, and Moc Bai are dominated by the disturbances created by construction phase of the individual subproject components. Common potential impacts arising from civil and earthworks will consist of for example, reduced and/or blocked public access to the affected areas, disrupted business and recreation, noise, dust and air pollution from NOx, SOx, & CO caused by increased truck traffic and heavy equipment use, soil and surface water pollution caused by equipment operation and maintenance, public and worker accidents, increased traffic accidents, land erosion and surface water sedimentation, drainage and flooding problems, solid waste and domestic pollution from worker camps, social disease and community problems caused by migrant workers.

245. These short-term construction impacts will occur at different levels of magnitude depending on the construction activities and the proximity of sensitive environments and the community. The urban road upgrades will cause the greatest disturbance to the community because the construction activities will occur adjacent to the homes, businesses, stores, and other public use areas that are adjacent to the roadways. Similarly, the embankment protection works and the port rehabilitation in Dong Ha will cause extensive sedimentation, and degrade water quality and potentially impair uses of the Hieu river at, and downriver of the sites. The shoreline works will disrupt navigation along the affected shorelines, and will significantly disturb aquatic habitat at both shorelines

i. Common mitigation measures

246. Management measures to mitigate potential common impacts associated with the construction phase of the infrastructure developments are exemplified below. Standard construction norms and practices of Viet Nam and international community should be followed. The mitigation measures are detailed further in the EMPs.

1) All subproject sites were exposed to the Viet Nam-American war with specific reference to Lao Bao. Extreme attention must be taken to ensure that sites for all earthworks (e.g., excavations, trenches) that could have unexploded ordnance be surveyed and cleared by the military prior to the onset of construction activities.

2) Open excavations should be fenced, and trenches covered where public walkways or vehicles must cross.
3) A chance find management plan must be in place for cultural artifacts and property.
4) Regular use of wetting agents should be employed at construction sites to minimize dust.
5) All construction vehicles and equipment should be maintained in proper working order, and not operated at night if possible to minimize noise.
6) Speed limits should be posted and adhered to by all construction vehicles.
7) Where possible construction vehicles should use different roads or dedicated lanes of roads shared by the public.
8) Trees and other vegetation at all construction sites, along urban road corridors, along Hieu river shoreline in Dong Ha, adjacent to WTP and WWTP sites including pipeline & distribution corridors in Moc Bai, at site for sanitary landfill in Lao Bao, and the MRFs in Dong Ha and Moc Bai must be protected.
9) Present and past land use should be reviewed to assess whether soil to be excavated is contaminated. Contaminated spoil should be disposed at a landfill or a location approved by DoNRE.
10) Berms and/or silt curtains should be constructed around all excavation/trench sites and along all surface waters to prevent soil erosion and surface water sedimentation. In particular is protection of the Hieu river from the civil works to be conducted for the embankment protection, and wharf reconstruction at the river port.
11) Local workers should be used as much as possible to prevent or minimize influx of migrant workers, and incidence of social disease and community unrest.
12) Worker camps must have adequate domestic waste collection facilities and sufficient pit latrines that are located away from public areas and surface waters.
13) Dedicated fuel storage areas must be established away from public areas and marked clearly.
14) To supplement missing or incomplete national directives for protecting the public and workers from construction activities the World Bank Environment, Health, and Safety Guidelines (2007) that govern the safe and orderly operation of civil works should be followed.
15) Aggregates (e.g., sand, gravel, rock) that are transported by truck should be covered.
16) Prolonged use of temporary storage piles of file should be avoided, or covered, or wetted regularly to prevent dust and erosion.
17) Aggregate mining (e.g., sand) in Hieu river, and in all other surface waters should be minimized, and conducted at approved areas only.
18) Storage of bulk fuel should be on covered concrete pads away from the public and worker camp. Fuel storage areas and tanks must be clearly marked, protected and lighted. Contractors should be required to have an emergency plan to handle fuel and oil spillage.

b. Infrastructure-specific Construction Impacts & Mitigations

247. Potential construction impacts of individual subproject investments or specific elements of a subproject investment are identified below. The potential impacts and mitigations elaborate some common impacts identified above.

i. Hieu River Embankment Protection & River Port Rehabilitation in Dong Ha

Water quality

248. The civil and earthworks (e.g., dredging, footings/foundations, sheet piling, concreting) that will occur to fortify the embankment of the Hieu river, and to replace the wharf and shoreline stabilization work the Dong Ha port will cause extensive siltation & sedimentation of the river which will degrade water quality, and negatively affect aquatic biota, and downstream human use of the river. Significant pollution from solid and liquid construction wastes being discharged into the river could also occur. Proper silt curtains with anchors along the lower edge, and floatation along the upper edge should be installed in the river parallel to the shoreline construction areas at both sites. The curtain should extend upstream and downstream of the entire construction areas, and should separate all shoreline earthworks from the rivers. Where possible onshore berms should be constructed to contain, and minimize soil erosion to the river.

249. Over and above the containment and isolation of the construction areas from the river, the overriding mitigation is to minimize and localize the in-river civil works as much as possible. Ideally the embankment protection works, and rehabilitation of the port wharf occurs during the dry season, thereby, disturbing less river at low flow.

Aquatic Biota

250. The Hieu river supports a finfish and shellfish community which will be affected by the construction works along the riverbank. Some aquatic habitat at the shoreline will be lost as a result of embankment protection, and wharf replacement. Fishing and other uses of the river and resident biota will be negatively affected. During the construction phase resident fish will be repelled from the area negatively affecting local fishing. The aquatic resources and human uses of the Hieu river at, and below the sites for embankment rehabilitation, and port wharf replacement were not identified in the original IEEs, and will need to be documented as part of the finalization of the EMPs at detailed design stage.

River navigation

251. The civil and earthworks plus likely construction barge traffic to/from the construction areas will potentially disrupt public and commercial use of the river. Contractors should minimize blockage of the river, and clearly post signage warning of any construction boat traffic along the shore. A well marked construction boat/barge lane should be installed to keep construction vessel traffic separate from other traffic during the construction phase.

ii. Sanitation Landfill in Lao Bao

Groundwater

252. The FS report has selected the landfill site based on many selection criteria and also pursuant to the national regulations for solid waste management. Criteria include soil permeability and existence of groundwater well in the area. The upper layer of soil is considered impermeable, and there are no wells near the site with the nearest house located

over 4 km away. Nonetheless, a liner for the landfill is proposed in order to meet national regulations.

253. The depth of groundwater does not appear to have been documented. Required excavations for the new sanitary landfill site could penetrate or become too close to the local water table. The sensitivity of the groundwater to the construction and ultimate operation of the new sanitary landfill should be confirmed before construction begins. This assessment should be done in conjunction with the clarification of the influence of the existing dump sites on the selected site of the new landfill.

iii. Water Supply Improvements in Moc Bai

254. The general potential construction impacts and required mitigations defined above apply to the water supply investment in Moc Bai.

iv. WWTPs

Groundwater

255. Similar to the new sanitary landfill, any excavations that will be required for the receiving, settling, oxidation or sludge tanks of WWTP Option 1 from the FS report needs to consider the sensitivity of local groundwater. A review of the depth of the water table, soil permeability, and subsurface flow of local aquifer should be conducted during the pre-construction phase. This study should be coordinated with the same study required for the sanitary landfill.

256. The detailed designs of the WWTP and raw sewage conduits need to confirm whether local groundwater, and land & surface waters are vulnerable to possible leakage or rupture from the various treatment tanks or raw water pipelines. The effects of possible leaks from the pressurized stage of raw sewage transport should be assessed.

v. Urban road upgrades in Dong Ha, Lao Bao, & Moc Bai

257. The potential impacts and required mitigations for the urban road upgrades in all three subproject towns are addressed by the general impacts and required mitigations associated with standard civil construction activities defined above. The composite impact to be mitigated is disturbance of local community, worker and public safety, and traffic safety with completed road upgrades.

vi. Material Recovery Facilities in Dong Ha & Moc Bai

258. No specific construction impacts/mitigations need to be identified. Increased traffic to/from MRFs to be addressed as with increased traffic from upgraded urban roads..

vii. All infrastructure components

Terrestrial & Aquatic Resources, and Cultural Property & Values

259. The original IEEs did not report on existing ecological resources at the sites of all subproject investments. The presence or absence or rare or endangered species, or critical habitat[6] was not declared in original IEEs. This information will need to be obtained during the detailed design phase when the EMPs are updated. The subproject investment sites are not near protected areas (i.e., DaKrong nature reserve, Lo Go Sa Mat national park or cultural/historic sites or property).

260. However, because the final locations of some facilities & components of the infrastructure developments will only be determined at the detailed design phase of the subprojects, the potential exists for rare or endangered species, critical habitat, or cultural property to be negatively affected. Thus, as part of the detailed design stage when investment siting is finalized, and when the EMPs are updated, a review of the proximity and sensitivity of all valued eco-cultural resources of the subproject areas to finalized infrastructure investments should be undertaken.

3. Operation Phase

a. Rehabilitated Dong Ha River Port

i. Hieu River

261. The rehabilitated [& re-opened] port in Dong Ha will increase boat traffic on the Hieu river, which will increase the risk of boat collisions, increase pollution from oils & gas, and solid waste & liquid waste discharged from boats, and from hazardous boat cargo that is dumped or falls into the river. The potential increase in pollution will negatively affect the aquatic biota of the river. The increase in boat traffic will potentially constrain other ongoing uses of the river such as fishing, and tourism.

262. The composite mitigation for the potential impacts summarized above is a management plan for boat operations in/out of port. The plan should adhere closely to existing regulations for operating river ports. The plan should specify how waste is to be managed on boats, and how cargo is to be managed on boats in/out of the port. Specifically liquid and solid waste should not be allowed to be discharged from boats entering or exiting the port. The GoV QCVN standards for coastal water quality should be included in the plan. Enforced speed limits for all boats in the vicinity of the port should be clearly marked along the river with dedicated shoreline lane for port boat traffic.

ii. Onshore

263. The shoreline facilities of the port include septic tank treatment for domestic waste with ultimate discharge to the river, and a separator for oil and port process waste. However, there is a risk of spills of hazardous materials in cargo storage areas. There is also risk of employee injury from port operations, and the port-induced traffic congestion and traffic accidents that will be created from the new truck and vehicle traffic to/from the port.

264. Similar to offshore operations a management plan for the shoreline operations should be developed. The plan would adhere to national regulations for operations of a port, specify handling and storage of hazardous materials, and solid waste management practices. The

[6] SR1, Appendix 1, SPS 2009

plan would include national (MoLISA) guidelines for worker and public safety. Enforced speed limits near port property should be posted.

b. New Sanitary Landfill

Contamination of groundwater, surface waters, and land

265. The feasibility design and siting of the sanitary landfill in Lao Bao incorporates technology and management protocols to prevent pollution of groundwater, local surface waters, and land. However, the potential for groundwater, land and surface water pollution caused by the new landfill exists, and should be further reviewed at the detailed design stage. In particular, the leachate collection and treatment system, and expected quality and disposal protocol of treated leachate should be reviewed.

266. Similar to existing dumpsite in Khe Sanh, the proposed site for new landfill is an upper basin - headwater location. This means that runoff from the landfill could directly affect permanent or ephemeral (seasonal) streams/rivers lower in the basin. This situation is particular important during the heavy rain season. The sensitivity of local surface waters to the finalized landfill site and leachate treatment facility during the rainy and dry season conditions needs to be reviewed. In particular is the design of the landfill system of runoff diversion channels. A groundwater and surface water quality monitoring program will be included in EMP for subproject.

Negative Aesthetics & Community Health

The feasibility design of landfill in indicates new landfill will be located at least 4 km from nearest house. This means issues of noise, odour, vermin, habitat for disease vectors, and public safety should not become a problem with local community. At detailed design stage these potential aesthetic and health impacts should be reviewed to ensure they do not occur. Example mitigations for potential community impacts are as follows:

1. Confirm landfill is far away from residential and urban areas;

2. Install a tall perimeter fence that ideally is also treed around entire landfill property;

3. Install sufficient signage along perimeter warning the public to stay away from landfill;

4. Post a fulltime guard at landfill who monitors the perimeter by vehicle;

5. Grade and cover solid waste with appropriate thickness of soil/aggregate to minimize exposure of waste to open air, disease vectors, and vermin; and

5. All loaded solid waste trucks on route to landfill must be covered, and solid waste trucks should be rinsed and kept clean daily.

Traffic disruption and road accidents

267. Speed limits along road to landfill should be clearly posted and enforced. Roads should be well lighted at night. Signage for road conditions should be well placed.

Increased air pollution

268. As much as possible all vehicles and trucks that travel to and from the landfill must be kept in good working order, and inspected regularly by authorities.

c. Water Treatment Supply

269. The potential environmental issues associated with the operation of the WTP in Moc Bai are 1) the sustainability of the required quality and quantity of the raw groundwater source; 2) the resultant sustainability of treated water quality; 3) disposal of treatment sludge; 4) the ability of existing wastewater management of the community to accommodate the increased wastewater that will be produced by the water supply system; and 4) risk of spills of hazardous chemicals such as chlorine. The issues need to be reviewed at detailed design phase to ensure the overall sustainability of the WTP according to specifications. Of particular importance is sustainability of raw groundwater supply, and the assimilative capacity for increased wastewater.

d. WWTPs

Contamination of environment & community impact

270. The waste treatment system in Moc Bai will collect and treat wastewater that is currently discharged untreated diffusely throughout the area. The treated wastewater will be discharged to canals ultimately to the Vam Co river. At feasibility stage the quality of the treated effluent that will be discharged from the aerobic treatment ponds was set to meet GoV (7957-2008) Category B discharge standard as follows:

pH: 5.5 to 9.0
BOD_5 : ≤50 mg/l
COD: ≤100 mg/l
SS: ≤100 mg/l
Total nitrogen content: ≤60 mg/l
Total phosphorus content: ≤6 mg/l
Coliform (MNP/100ml): ≤10,000

271. The obvious risk is contamination of the proposed receiving environments from the WWTP effluents. This could occur if the effluent is not treated to specification, or the receiving environment cannot assimilate (i.e., dilution & bioaccumulation) the concentrated effluent thereby creating a pollution problem. Therefore, sensitivity of the affected reaches of Vam Co river to the effluent from the WWTP needs to be reviewed during the detailed design phase.

Negative Aesthetics & Contamination of Groundwater

272. A potential risk is the operation of the WWTPs will negatively affect the community, and contaminate groundwater from the proposed treatment tanks/ponds. The feasibility design of the WWTP includes a treed perimeter with fencing to isolate the WWTP operations from the community. Potential environmental impacts of the operation of the WWTPs are summarized below.

1. Change to the community landscape of the nearby homesteads due to noise, odour, and overall negative aesthetics of the WWTP;

2. Increased traffic in area, and traffic accidents caused by staff and plant operations;

3. Increased air pollution and noise from increased vehicle traffic;

4. Contamination of shallow groundwater from aerated treatment ponds;

5. Pollution of land, local surface waters, or groundwater from discharged treated effluent that does not meet original effluent quality designs, or GoV effluent quality standards;

6. Pollution of Vam Co river leading to impairment of downstream uses of the river;

7. Contamination of land surface water, or groundwater from spills or uncontrolled discharge of untreated and treated wastewater due to pipeline or equipment failure;

8. Increased incidence of vector carried disease arising from standing water; and

9. Increased injury people in nearby community from exposure to WWTP or pipeline operations.

i. Mitigations

273. Most of the required mitigations for the potential impacts listed above will be addressed directly by the detailed engineering design specifications for the siting, operation, and management of the WWTP and pipelines.

274. However, at the time of writing the detailed designs of the WWTPs and pipelines were not completed. In particular, not finalized are:

1) specifications for the treated effluent quality other than the declaration that effluents meet (7957-2008) Category B discharge standard;
2) final locations of the effluent discharge sites; and
3) design & operation specifications for treatment system including management of waste sludge to ensure soil, groundwater and surface waters are not negatively affected.

275. Clarification of depth and sensitivity of local water tables and aquifers to WWTP and sludge management is required. The detailed engineering designs of the WWTPs needed to be completed to be able to specify the engineering process-mitigations to manage the impacts above identified.

276. Additionally the water quality of the Vam Co river that will receive the treated effluent via the wastewater canals needs to be determined. The update to the environmental baseline will be done during the pre-construction phase along with the updates to the EMPs.

277. The composite impact mitigation for the wastewater treatment systems consists of:

a) sustained safe collection and transport wastewater to the WWTP;
b) consistent treatment of wastewater to effluent quality design specifications;

c) the ability of the receiving environments to assimilate the treated effluent at all times of year;

d) the ability of the WWTP to manage and dispose safely treatment byproducts such as sludge; and

e) the ability of the WWTP to not intrude into normal community life through negative aesthetics.

278. Specific mitigations for the potential impacts of the operation of the WWTP and pipeline networks are provided below. The mitigations are detailed in the EMPs.

1. Confirmation of placement of a treed perimeter berm built around WWTP facility including the treatment lagoons to isolate the WWTP facility from the nearby community to reduce noise odour and overall negative aesthetics of the WWTP;

2. Enforced well marked speed limits will be posted on roads used by WWTP staff, with WWTP vehicles kept in good working order;

3. A carefully designed system of treatment lagoons that does not contaminate groundwater and land;

4. A regular effluent and sludge quality testing protocol;

5. All equipment and processes maintained in good working order with back-up equipment and processes in place in critical areas;

6. Engineering and management systems in place to prevent and address emergency spill and discharge situations;

7. All staff properly trained with regular refresher courses;

8. Adequate domestic waste management procedures; and

9. All standing water and wastewater covered as much as possible;

e. Urban roads in Dong Ha, Lao Bao, and Moc Bai

Increased traffic accidents

279. Speed limits should be clearly posted and enforced. Roads should be well lighted at night. Signage for road conditions should be well placed.

Increased air pollution

280. As much as possible all vehicles must be kept in good working order, and inspected regularly by authorities.

4. Induced and Cumulative Impacts

281. Complementing the planned impact of the CTDP of socioeconomic development at each subproject town and along the EWEC and the SEC are the potential negative impacts of

increased urban development which would occur at different spatial scales. An immediate potential impact of urban development is increased traffic-related accidents, and air pollution.

282. At the town level the new and upgraded infrastructure will create immigration to the towns. Potential induced impacts will be increased land development and pressure on existing infrastructure not developed by the CTDP. New zones for housing and commercial development could follow to support and be supported by the expanding populations of the towns.

283. Socioeconomic development from the CTDP could cause increased consumption of natural resources, and pollution along and adjacent to the EWEC and SEC. Regional economic development commonly is linked to environmental degradation and natural resource consumption. Socioeconomic development of a region is normally manifest by population growth and the increase in living standards which lead directly to increased individual and family consumption leading directly and indirectly to increased natural resource consumption, and waste production, and environmental pollution.

VIII. ANALYSIS OF ALTERNATIVES

A. Dong Ha

1. Urban Road Upgrades

284. The selection of the urban roads and drainages to be upgraded was according to the Masterplan for the development of Dong Ha.

2. Hieu River Embankment Protection

285. The Hieu River embankment was built in accordance with the urban landscape in the north area. This considers the Hieu river as the center axis for development of new urban areas in accordance with the plan to develop the services along Hieu river of Dong Ha city 2020.

286. However, based on the hydrological condition and the river bed two options for riverbank protection were considered as follows:

Option 1.

287. The plan is for a coastal downriver route, which would strongly interfere with present river contour. The protruding bank would be trimmed and chopped to make it straight. Concaved sections would be filled.

Option 2.

288. Maintain existing bank contour with some sections trimmed as necessary.

289. Both options were technically equivalent but option 2 was cheaper. Option 2 also maintained the natural geometry of the riverbank as much as possible.

3. Dong Ha River Port Rehabilitation

290. The selection of the Dong Ha river port Sub-project was according to the Masterplan for the development of Dong Ha. The use of either poured concrete or steel piling for construction of the wharf was assessed for technical reasons and for cost. The implications to the environmental impact of whether steel or concrete is used do not differ. Steel piling was selected because it is cheaper.

B. Lao Bao

1. Urban Road Upgrades

291. The selection of the Road Sub-project was according to the Masterplan for the development of Lao Bao border town.

2. Solid Waste Treatment Technology

After the solid waste was classified the different methods to treat the solid waste were reviewed.

a. Combustion:

Combustion is a chemical reaction in which carbon, hydrogen, and other elements in the waste mixed with oxygen to form a complete oxidation products and generate heat.

i. Advantages:

- Reduces the volume of waste to be buried
- A safety solution to remove hazardous substances Recovery of energy from steam and electricity production
- Reduces environmental impact: reduction of waste water and gas generated compared to disposal process

ii. Disadvantages

- Investment and maintenance costs are very high compared with other treatment methods
- Operation: waste requires high heat, specialized labor and harsh environment around incinerators.
- Secondary impacts to the environment due to air emissions and ash handling after combustion.
- Can cope with difficulties due to the change of the waste composition and change of legal provisions.

b. Sanitary Landfill Disposal

292. Burying of waste is the most usual waste disposal method being used in the area. Old dumpsites are unhygienic, and do not have bottom liners, no collecting and treating system for waste gas and waste water. Although the cost for disposal is low, it occupies a bigger space and lot area making the land cost higher and would eventually cause environmental

hazards and therefore will need waste treatment too in the future. The impact on the environment and public health can be serious and long-term.

293. The present popular disposal method is sanitary landfill disposal. This is a method to control the decomposition of of buried waste in the soil by compaction and placing a cover layer on top. With this method, garbage is collected from the pit or dug holes and reinforced by the technical standards to prevent and reduce pollution caused by the phenomenon of infiltration of leakage water to the surrounding environment. In this holes, rubbish are placed by thick layers <0.6 m and then sprayed with EM microorganism mixed in water to control the smell H2S, SO2 and kill the pathogenic insects such as flies, mosquitoes and, further burying the next layers of wastes.

294. When the landfill reaches the required height, wastes are covered with soil of 80 to 100 cm to finish the disposal cell and can be moved to other cells. The landfills are arranged with gas exhaust piping, leakage water pipe net system, rain water collection system when the landfill area is not yet full. These systems are generally connected to the network pipe to regulate tank and wastes are pumped out to the treatment area.

i. Advantages:

- Simple technological process, low operating management costs
- Initial investment cost is minimum
- Limit the air pollution due to bio disintegration and discharge to natural environment.
- Control of water from waste decomposition and reduction of the majority of germs in the garbage

ii. Disadvantages:

- One major disadvantage of the disposal method is land occupation. In addition, to the operation of the landfill, the restriction of rain water impacting the waste is quite difficult.. There is still a large amount of irrecoverable waste water seeping into the groundwater causing pollution to the surroundings. On the other hand, decomposing time is very long, especially to the inorganic substances such as plastics, glass, fabric etc.
- Decomposing organic wastes produce gas that is a mixture of light gas that always tend to find a way out. The gas contains 55% methane (CH_4) and 45% CO_2 and water vapor. The amount of gas leaking generates extremely unpleasant odor. Along with air pollution, the production of gas within the landfill creates a risk of explosion hazard.

c. Composting

295. Making compost is to make the process of aerobic biodegradation of organic compounds to produce products like stable humus which can be used to increase nutrients for the soil and prevent erosion.

296. Advantages are restricted land use compared to disposal methods and is low in investment cost, simpler in operation compared to combustion. However, this method failed in Vietnam because it requires wastes to be classified and pre-sorted correctly before putting it into compost pits, which the people can not comply. It also generates wastes and emissions, particularly odor during anaerobic processes. The effectiveness of waste compost as fertilizer is not yet popular unlike the effectiveness of the chemical fertilizers. In this regard, it is not preferred by the market and hence organic could hardly be sold.

C. Moc Bai

1. Urban Road Upgrades

297. The selection of the Road Sub-project was according to the Masterplan for the development of Tay Ninh province.

2. Wastewater Treatment

298. The selection of the Waste Water Treatment Sub-project was according to the Masterplan for the development of Tay Ninh province.

3. Water Supply Development

299. The selection of the Moc Bai Water supply system Sub-project was according to the Masterplan for the development of Tay Ninh province. The selection of groundwater versus surface water as the raw water source was based on sustainability, quality, the distance (cost) of the source. Groundwater was chosen as the raw water source because it provided more optimal conditions for the three criteria.

IX. INFORMATION DISCLOSURE AND GRIEVANCE REDRESS MECHANISM

300. As part of the information disclosure requirements of the subproject[7] all safeguard documents will be made available to the stakeholders who were consulted during the first round of consultations, as well as other affected persons. The IEE and upgraded EMP will be available for review at the beginning of the detailed design stage on ADB's web site and at commune offices for public access. Public comment on the EMP should be included in the update and finalization of the EMP at detailed design stage.

301. A grievance redress mechanism is included here because it forms part of the stakeholder consultation process that will be continued throughout the construction and operation phases of the subprojects. Grievances related to any aspect of the water supply systems will be handled through negotiation aimed at reaching consensus. Complaints and grievances will pass through three stages before they can be elevated to a court of law as last resort. The three EAs through the PMU will shoulder all administrative and legal fees that might be incurred in the resolution of such grievances and complaints. This mechanism will be integrated with that which will be used to settle grievances related to resettlement and compensation.

302. The first stage venue for raising and resolving complaints and grievances is at the Commune People's Councils (CPC). An aggrieved party may bring its complaint or petition

[7] ADB 2009. Safeguard policy Statement.

before any member of the council in writing or verbally. Grievances may also be raised during scheduled subproject consultations with local residents. The council first investigates the complaint and, if warranting project management action, notifies the PMU. The PMU will then meet with the complainant. The PMU will have 15 days after the lodging of the complaint to resolve the grievance, say, for example by requiring contractors to remedy the complaint or submit a plan of action. The PMU may get assistance from the DoNRE in evaluating the technical basis of complaints related to environment-related impacts (e.g., vehicle emissions, dust, noise, vibration). The council will be responsible for documenting and keeping a record of all complaints that are lodged with the local committees.

303. The aim is for community grievances to be resolved at the first level. However, if not resolved at that level, the second venue for grievances is the City or District People's Committee (DPC). That is, if after 15 days the aggrieved party or complainant does not hear from the PMU, or if the complainant is not satisfied with the decision taken on the complaint, the affected party may bring the case, either in writing or verbally, to any member of the DPC. The DPC in turn will have 15 days following the lodging of the complaint to resolve the case. The DPC secretariat is responsible for documenting and keeping a record of all complaints that are lodged with the district committee.

304. The third stage is the Provincial People's Committee (PPC). If after 15 days the aggrieved affected party does not hear from the District People's Committee, or if the complainant is not satisfied with the decision taken with regard to the complaint, the case may then be brought, either in writing or verbally, to any member of the PPC. The PPC has 15 days within which to resolve the complaint to the satisfaction of the concerned parties. The PPC secretariat is responsible for documenting and keeping a record of all complaints lodged with the committee.

305. In the event that the grievance remains unresolved even after being raised at the level of the Provincial People's Committee, the final resort is a court of law. Specifically, if after 15 days following the lodging of the complaint with the PPC, the aggrieved party does not get a response, or if the complainant is not satisfied with the decision taken on the complaint, the case may then be brought to a court of law for adjudication.

306. In support of the grievance redress mechanism the PMUs/contractors need to establish a telephone HOTLINE to provide easy and instant contact with the CPC by the public. A clearly marked phone number for a responsive PMU/CPC officer office should be placed at all construction sites of all subproject components (see Mitigation Plan). The purpose of the HOTLINE is to enable affected persons to convey to PMU/CPC at any time their concerns or issues of the project during the construction and operation phases with the construction phase being most important.

X. ENVIRONMENTAL MANAGEMENT PLANS

307. Environmental management plans for each subproject in Dong Ha, Lao Bao, and Moc Bai have been developed, and are found under separate cover.

XI. CONCLUSIONS AND RECOMMENDATIONS

308. The examination of the three subproject investments in Dong Ha, Lao Bao, and Moc Bai indicates that potential environmental impacts are mostly construction-related, and can be

mitigated with standard construction practices for the protection of the environment and local community.

309. Potential impacts of the new WWTP and sanitary landfill concern the operation of the two facilities. The sensitivity of groundwater and overland runoff to the operation of the landfill, and the sensitivity of groundwater, and the assimilative capacity of the drainage canals and Vam Co river to the treated effluent from the WWTP need to be clarified at detailed design.

310. The limited data or information clarifying presence or absence critical habitat or rare or endangered species at the investment sites will need to be addressed at detailed design phase. In particular are the aquatic resources of the Hieu and Vam Co rivers. It is recommended that as part of the update of the EMPs at the detailed design stage that supplementary data/information be obtained.

311. The IEE concludes that the feasibility designs of the project combined with available information on the affected environments are sufficient to understand the scope of potential environmental impacts of the subprojects. Providing that significant changes do not occur to the design of one or more of the subproject investments, and that the supplementary sensitive receptor data, and final design information identified above is provided, that further detailed environmental impact assessment (EIA) of the subprojects is not required.

312. The separate EMPs developed for the subprojects provide impacts mitigation plans, environmental monitoring plans, and specify the institutional responsibilities and capacity needs for the environmental management of the subprojects. The IEE recommends that the EMPs be reviewed and updated at the detailed design phase to ensure that EMPs address fully the final subproject designs.

XII. REFERENCES

ADB, 2009. Safeguard Policy Statement, ADB Policy Paper.

ADB, 2003, Environmental Assessment Guidelines of the Asian Development Bank.

World Bank Group, 2007. Environmental, Health, and Safety Guidelines. Washington DC., 96 pgs.

QT DoNRE, Environmental protection plan of Quang Tri province for the period 2005-2010, vision to 20205-2010, climate & weather data.

QT DoNRE, 2010. Report of Environmental Quality Monitoring in Quang Tri in 2010.

PPTA Consultant, 2006. Social Survey Methodology and Findings Report, March 2006

TN DoNRE, 2010. Report on State of Environment of Tay Ninh Province, 2010, DONRE