NINH THUAN PROVINCIAL PEOPLE'S COMMITTEE

COASTAL CITIES SUSTAINABLE ENVIRONMENT PROJECT

ENVIRONMENTAL AND SOCIAL IMPACTS ASSESSMENT

(Final Report)

PHAN RANG - THAP CHAM CITY SUB-PROJECT

FINAL REPORT

PHAN RANG, November 2016

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PROJECT INVESTOR

CONSULTANTS

PHAN RANG, November 2016

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AH	Affected Household
AP	Affected Person
CCESP	Coastal Cities Environmental Sanitation Project
CCSEP	Coastal Cities Sustainable Environment Project
CSC	Construction Supervision Consultant
CSO	Combined Sewer Overflow
DN	Nominal Diameter
DARD	Provincial Department of Rural Development
DOC	Provincial Department of Construction
DONRE	Provincial Department of Natural Resources and Environment
ECOPs	Environmental Code Practices
ESIA	Environmental and Social Impacts Assessment
ESMP	Environmental and Social Management Plan
FS	Feasibility Study
HH	Household
HTLO	Hai Thuong Lan Ong road
IDA	International Development Association
IEMC	Independent Environmental Monitoring Consultant
cmd	Cubic meter per day
MONRE	Vietnam Ministry of Natural Resources and Environment
NEPA	National Environmental Protection Agency
O&M	Operation and Maintenance
ODA	Official Development Assistance
PAPs/APs	Project's Affected Persons/Affected Persons
PDO	Project Detail Outline
PMU	Project Management Unit
PPC	Provincial People's Committee
PR-TC	Phan Rang – Thap Cham
QCVN/TCVN	Vietnam National Technical Regulations/Standards
RP/RAP	Resettlement Plan
SA	Social Assessment
TOR	Terms of Reference
URENCO	Urban Environment Company
USD	United States Dollar
VND	Vietnam Dong
WB	The World Bank
WWTP	Wastewater Treatment Plant

INTRODUCTION

1. PROJECT ORIGIN

The World Bank funded Coastal Cities Environmental and Sanitation Project (CCESP)" was successfully implemented from 2007 to 2014 in three cities including Nha Trang (Khanh Hoa province), Quy Nhon (Binh Dinh province) and Dong Hoi (Quang Binh province). With the main objectives of addressing flood issues and improve environmental conditions in three cities, CCESP provided investments to develop drainage and sewer systems, lakes and canals, solid waste collection and treatment facilities.

In order to maintain and to promote the efficiency of CCESP investments and to strengthen the institutional arrangements of environmental sanitation sector, the Government of Vietnam and the World Bank have agreed to finance a new project named "Coastal Cities Sustainable Environment Project (CCSEP). The Project will be implemented in four coastal cities, including Dong Hoi, Quy Nhon, Nha Trang and Phan Rang–Thap Cham (Ninh Thuan province) – a new city brought into this project. Total budget of CCSEP is USD 236 millions; of which the estimated budget for Phan Rang Thap Cham Sub-project is USD 74.85 million.

The location of Phan Rang – Thap Cham city is shown in Figure 0.1.

Figure 0.1. Location Map of Phan Rang Thap Cham City.

2. RELATED PROJECTS

Phan Rang – Thap Chap City Wastewater Collection, Treatment and Reuse System

Estimated budget is USD 21 million, financed by the Government of Netherland (hereafter ORIO Netherlands Project). Implementation is scheduled from 2015 to 2019.

Scope of investment:

- Drainage: Address flooding issue for Phu Ha Ward by the construction of storm water drainage DN800, L = 866m from the Provincial Children's House in 21/8 street and connect to D800 existing culvert in Hung Vuong street.
- Sewerage: collect household wastewater and sewage from small production facilities in Do Vinh, Bao An, Phuoc My, Dai Son, Phu Ha, Van Hai, and My Binh wards. The serviced areas of the existing water treatment plant (Q = 5.000m³ / day) in Phan Rang-Thap Cham city are not included in this Project.
- Main sewers: pipeline along 21/8 street and run to the city center, Nguyen Van Cu street-Tran Phu street to intersection Phu Ha, from Thap Cham downward and Phan Rang upward, connecting together at Le Quy Don Street into the treatment plant, build a new wastewater treatment plant capacity of 10,000m^3/day in Pham Ngu Lao Street, one pumping station capacity 3,000m^3/day and one wastewater reuse pumping station capacity 10,000m^3/day, D355-uPVC drain 0.7km long. The length of HDPE pipe D280 - D560 is 13.8km; an uPVC pipe DN150 - DN200 is 88km. Households connection is 14,200 households.

3. LEGAL AND TECHNICAL BASIS FOR ESIA PREPARATION

3.1. Vietnamese Environmental Legislations

- Law on Environmental Protection No. 55/2014/QH13 dated 23 June 2014.

  Administrative framework on Environmental Assessment

  The Law on Environmental Protection (No.55/2014/QH13) dated June 23, 2014 and Decree on Environmental Protection Planning, Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Plans (No. 18/2015/ND-CP) dated February 14, 2015 are key legal frameworks for environmental management in Vietnam. Law on Environmental Protection (LEP) provides statutory provisions on environmental protection activities; measures and resources used for the purpose of environmental protection; rights, powers, duties and obligations of regulatory bodies, agencies, organizations, households and individuals who are tasked with the environmental protection task. LEP is applicable to regulatory bodies, public agencies, organizations, family households and individuals within the territory of the Socialist Republic of Vietnam, including mainland, islands, territorial waters and airspace. LEP is on regulating strategic environmental assessment, environmental impact assessment and environmental protection commitment.
- Furthermore, the law also indicated to consultation on, inspection and approval of the planning for environmental protection (Article 11, chapter II) as well as the list of entities subject to strategic environmental assessment in appendix I and II of the Decree No. 18/2015/ND-CP dated February 14, 2015 of the Government.
- The Article 13 of the Decree (No. 18/2015/ND-CP) explains the requirement of the pertaining ESIA agencies. Clause 1: the project owner or the advisory organization

conducting ESIA must meet all requirements – (a) there are staff members in charge of ESIA meeting requirements prescribed in Clause 2 of this Article; (b) there is specialist staff members related to the project obtaining at least Bachelor's degrees; and (c) there are laboratories, inspection and calibration devices eligible for performing measurement, sampling, processing and analysis of environmental samples serving the ESIA of the project; if there is not any laboratory with decent equipment for inspection and calibration, it is required to have a contract with a unit capable of carrying out inspection and calibration. Clause 2: the staff members in charge of ESIA must obtain at least Bachelor's degrees and Certificate in ESIA consultancy and Clause 3: the Ministry of Natural Resources and Environment shall manage the training and issuance of Certificates in consultancy of ESIA.

- The project does not involve wetlands and natural protected areas, neither does it relate to emission of persistent organic pollutants or international trade in endangered species of wild fauna and flora. Therefore, no relevant international environmental agreements to which Vietnam is a party would apply.
- Law of Land No. 45/2013/QH13dated 29 November 2013.
- Law on Occupational Safety and Hygiene No. 84/2015/QH13 dated 25June 2015.
- Law of Investment No. 67/2014/QH13 dated 26 November 2014.
- Law of Construction No. 50/2014/QH13 dated 18 June 2014.
- Law of Water Resources No. 17/2012/QH13 dated 21 June 2012.
- Law of Labor No. 10/2012/QH13 dated 18 June 2012.
- Law on Fire Prevention and Fighting No. 45/2013/QH13 dated 22 November 2013.
- Law on Technical Standards and Regulations No. 68/2006/QH11 dated 29 June 2006.
- Decree No. 18/2015/ND-CP dated 14 February 2015 by the Government providing environmental protection planning, strategic environment assessment, environmental impact assessment and environmental protection plan.
- Decree No. 19/2015/ND-CP dated 14February 2015 by Prime Minister detailing implementation of some articles of the Law on Environmental Protection.
- Decree No. 38/2015/ND-CP dated 24 April 2015 by the Government on management of wastes and scraps.
- Decree No. 03/2015/ND-CP dated 06 January 2015 stipulating determination of damages to the environment.
- Decree No. 179/2013/ND-CP dated 14 November 2013 by the Government on handling legal violations in the field of environmental protection.
- Decree No. 25/2013/ND-CP dated 29 March 2013 by the Government on environmental protection charges for wastewater.
- Decree No. 80/2014/ND-CP dated 06 August 2014 regulating drainage and wastewater treatment.
- Decree No. 59/2007/ND-CP dated 9April 2007 by the Government on management of solid wastes.
- Decree No. 201/2013/NĐ-CP dated 27 November 2013 by the Government detailing implementation of some articles of Law of Water Resources.

- Decree No. 127/2007/NĐ-CP dated 01 August 2007 by the Government regulating implementation of some articles of Law on Technical Standards and Regulations.
- Decree No. 79/2014/ND-CP dated 31 July 2014 detailing implementation of some articles of Law on Fire Prevention and Fighting and Law on amendments and additions to some articles of the Law on Fire Prevention and Fighting.
- Decree No. 43/2014/ND-CP dated 15 May 2014 by the Government detailing the implementation of some articles of the Law on Land.
- Decree No. 44/2014/ND-CP dated 15 May 2014 by the Government stipulating land price.
- Decree No. 45/2014/ND-CP dated 15 May 2014 by the Government providing collection of land use charges.
- Decree No. 46/2014/ND-CP dated 15 May 2014 by the Government providing collection of land and water surface rents.
- Decree No. 47/2014/ ND-CP dated 15 May 2014 by the Government regulating compensation, support and resettlement when the Government recovers land.
- Decree No. 84/2013/ND-CP by the Government on management of housing development and resettlement.
- Decree No.59/2015/NĐ-CP dated 18 June 2015 by the Governmenton management of construction investment projects.
- Decree No. 38/2013/ND-CP dated 23 April 2013 by the Government on management and use of official development assistance (ODA) and preferential loans from donors.
- Decree 108/ND-CP dated 22 September 2006 by the Government detailing implementation guidance of some articles of the Law on Investment.
- Circular 27/2015/TT-BTNMT dated 29 May 2015 by the Ministry of Natural Resources and Environment on strategic environment assessment, environmental impact assessment and environmental protection plan.
- Circular No. 36/2015/TT-BTNMT dated 30 June 2015 by the Ministry of Natural Resources and Environment regulations on hazardous waste management.
- Circular No. 36/2014/TT-BTNMT dated 30 June 2014 detailing the method of land valuation; development and adjustment of land price list; specific land valuation and consultancy in land valuation.
- Circular No. 37/2014/TT-BTNMT dated 30 June 2014 detailing compensation, support and resettlement when the Government recovers land.
- Decision No. 63/2015 / QD-TTg dated 10 December 2015 by Prime Minister stipulating policies to support vocational training and resolution of jobs for people with land acquisition.
- Decision No 1956/2009/QD-TTg by the Prime Minister dated 17 November 2009 approving the project of "Vocational training for rural workers until 2020".
- Circular No. 02/2009/TT-BTNMT dated 19 March 2009 of MONRE guiding on assessment of wastewater receiving ability of water sources.

Applicable Environmental Technical Standards and Regulations

- QCVN 05:2013/BTNMT: National technical regulation on ambient air quality;

- QCVN 50:2013/BTNMT : National technical regulation on hazardous thresholds for sludge from water treatment process;
- QCVN 06:2009/BTNMT: Ambient air quality. Maximum allowable concentration of hazardous substances in ambient air;
- QCVN 26:2010/BTNMT: Acoustics – Noise in public areas and residential areas – Permissible noise levels.
- QCVN 08-MT:2015/BTNMT - National technical regulation on surface water quality.
- QCVN 09-MT:2015/BTNMT - National technical regulation on ground water quality.
- QCVN 03-MT:2015/BTNMT - National technical regulation on the allowable limits of heavy metals in the soils.
- QCVN 07:2009/BTNMT- National technical regulation on hazardous waste threshold;
- QCVN 14:2008/BTNMT- National technical regulation on domestic wastewater.

3.2. Environmental and Social Safeguards Policies of WB

The environmental and social screening shows that the WB policies on Environmental Assessment (OP/BP 4.01)[1], Physical Cultural Resources (OP/BP 4.11); and Involuntary Resettlement (OP/BP 4.12)[2] are triggered for this subproject. The subproject is also required to comply with the WB's requirements on public consultation and information disclosure.

World Bank-financed projects should also take into account the World Bank Group Environmental, Health, and Safety Guidelines[3] (known as the "EHS Guidelines"). The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group and are generally considered to be achievable in new facilities at reasonable costs by existing technology.

3.3. Legal Documents Related to the Project

- Documents No. 2338/UBND-QHXD dated on 8 June 2015 of Ninh Thuan PPC on the project execution.
- Documents No. 2339/UBND-QHXD dated on 2015 of Ninh Thuan PPC sent to Ministry of Planning and Investment on registering TP Phan Rang- Thap Cham city into the list of WB funded project in period 2015-2017 for the CCSEP.

3.4. Data and Materials Established by Project Owner

- Feasibility Study (FS) report and Basic Design of the project;
- Social Assessment (SA) report of the project;

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

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

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

- Resettlement Plan (RP) report of the project.

4. METHODS APPLIED DURING ESIA PREPARATION

The ESIA of CCSEP –Phan Rang Thap Cham City Sub-project was prepared in parallel with its feasibility study to identify and assess impacts and propose plans to prevent, mitigate and control potential negative environmental and social impacts possibly occurring during project implementation. Environment-friendly solutions towards sustainable development are also considered during the preparation and implementation of the Project. ESIA was developed in compliance with the ESIA policies of the WB and current related policies of Vietnam.

a). Rapid assessment method

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

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

b). Impact matrix method

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

c). Comparison method

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

d). Impact identification method

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

e). Listing method

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

f). Method of Public Consultation and Disclosure of Information

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

agencies to discuss all aspects of the proposed subproject. The feedbacks from consultation will be incorporated into the subproject ESIA and design.

Those affected by the subproject include those resettled and those in the nearby communities affected by subproject impacts, intended beneficiaries of the subproject, key interest groups – depends upon the project, local NGOs/Mass organizations, including women's unions, local, state and central governments, other donor and development agencies, and other stakeholders.

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

Other Methods

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

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

b). Field survey method

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

c). Consensus method

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

d). Sampling and analyzing methods in laboratory

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

e). Social survey and assessment method

Social survey and assessment method: From the list of households living in the study area selected and the list of affected households by each investment item, socio-economic survey was carried out in 3 weeks from 17 February to 4 March 2016 with 2,276 households in 12 wards/communes in PR-TC City. Answers from the sociological survey using questionnaires were processed by SPSS software (Statistical Package for Social Sciences).

In-depth interviews were carried out with 196 key informants: leaders of the Province/City/Ward People's Committee; officers of provincial department of economy/construction planning/land use planning; officers of City Infrastructure Department, leaders/deputy leaders of village/street groups at ward/commune level, households in project area (including affected households and beneficiary households)

Twelve group discussions were conducted for 105 affected households in Bao An, Phước Mỹ, Mỹ Bình, Đông Hải, Tấn Tài, Thanh Sơn wards/commune with from 6 to 10 persons for each discussion group.

- Monitoring method: is applied to collect and analyze water samples (wastewater, surface water, groundwater); air, noise, vibration, and mud/soil samples. Environmental monitoring processes are carried out according to Vietnamese regulations to assess the current status of the environment of the project area.
- Comparison method: is used to assess impacts and current status of environment by comparing environmental monitoring data and collected data with Vietnamese standards and regulations, comparing options.

CHAPTER 1. PROJECT DESCRIPTION

1.1. PROJECT INFORMATION

1.1.1. General Information

Project Name: Coastal Cities Sustainable Environment Project (CCESP) –Phan Rang Thap Cham City Sub-project (hereinafter referred to as "the Project").

Project Owner: Ninth Thuan Provincial People's Committee (PPC).

- Address: No. 450 Thong Nhat street, My Huong ward, Phan Rang Thap Cham city, Ninh Thuan province, Vietnam.
- Telephone number: +84.68 382 2683 Fax: +84.68 382 3937

Representative of Project Owner: Implementation Unit for Capacity Development and ODA Water Resources Projects in Ninh Thuan province

- Address: No.450 Thong Nhat Road, My Huong Ward, Phan Rang Thap Cham City, Ninh Thuan Province, Vietnam.
- Telephone number: +84.68 382 6984 Fax: +84.68 383 2925
- E-mail: pr.pmu.ccesp2@gmail.com

Project's objectives

General objectives:

- To sustain the efficiency of environment investment and strengthen the utility reform agenda concerning sanitation sector in the project cities

Specific objectives

- Improvement of the drainage capability and reduce number of flooded places.
- Enhancement of wastewater collection and treatment capability, aiming to improve the water, soil and air environment.
- Enhancement of capacity and efficiency of waste collection.
- Improvement of school and public sanitary conditions.
- Improvement of inner urban transport and drainage, sewerage infrastructure.
- Improvement of the management, operation for the PMU, provincial departments, sector, public work institutions and project stakeholders.
- Aiming to sustainability about technical and financial conditions of the project.
- Mitigation of project impacts to the affected people, improvement and enhancement of the living conditions for the local residents and tourists.

1.1.2. Project Location

The Project will be implemented in 15 wards and 1 commune of Phan Rang – Thap Cham city, including: Bao An, Dai Son, Dao Long, Do Vinh, Dong Hai, Kinh Dinh, My Binh, My Dong, My Hai, My Huong, Phu Ha, Phuoc My, Tan Tai, Van Hai, Thanh Son wards and Thanh Hai commune. Project layout is shown in Figure 1.1.

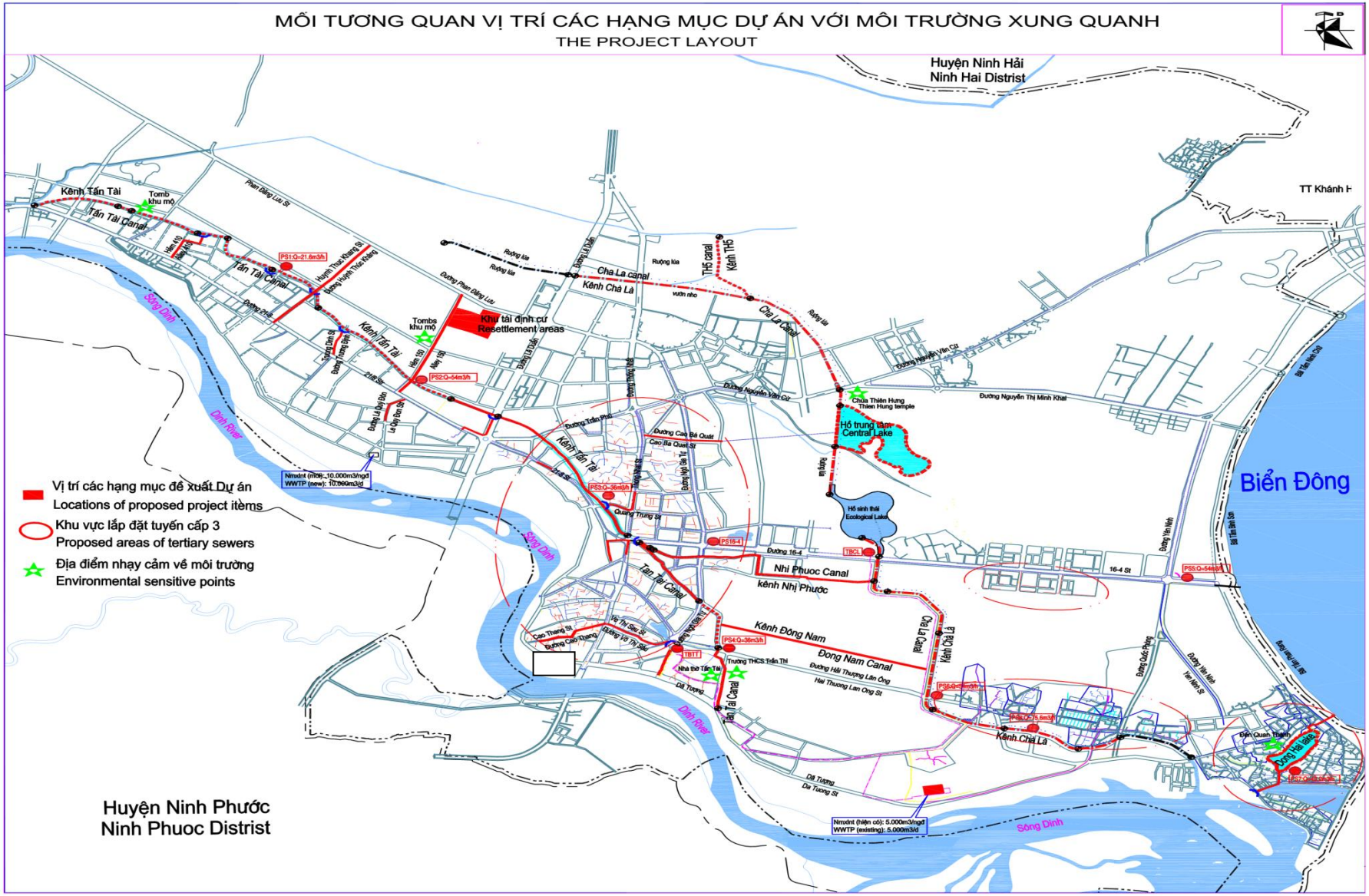


Figure 1.1. Project layout.

1.2. SCOPE OF WORKS

The proposed Coastal Cities Sustainable Environment Project (CCESP) –Phan Rang Thap Cham comprises of four Components, including:

Component 1: Sanitation Infrastructure

Component 1 will address or prevent flooding issues, create green corridors along the new or improved canals and lakes. Component 1 will also cover wastewater collection and treatment, construction of toilets at some schools and public areas. Solid waste collection capacity will be improved.

Component 2: Urban Connectivity

This component covers the expansion and lengthening of the Alley 150 in 21/8 road and Huynh Thuc Khang road including the construction of road enclosed infrastructures such as drainage, sewers, trees, sidewalks, lighting etc.

Component 3: Resettlement and Site Clearance

A 6.7 ha new resettlement area with be fully invested technical and social infrastructures will be constructed to serve 250 households affected with residential land acquisition.

Component 4: Technical Assistance and Institutional Reform

This component covers construction supervision, technical assistance to reform the institutional settings of sanitation sector of the province.

Details about scope of investments in each Component are described below.

1.2.1. Component 1: Sanitation Infrastructure

Investment contents of Component 1 include three groups of major works, including drainage, sewerage collection and treatment, and school/public toilets construction as described below:

- *Drainage:* Rehabilitate 6,946m of Tan Tai canal,expand1,379m of Dong Nam canal 3,739m of Cha La canal (total length is 7,567m) and1,709m of Nhi Phuoc and 662m of TH5 canals; Construct the Central Lake with water surface of 17.7 ha; Rehabilitate the Dong Hai lake with water surface of 3.4ha; and construct 3,667 m of secondary drainage. DN 500-1500
- *Wastewater collection and treatment:* Construct about 41.2km of tertiary sewers, 28 Combined Sewer Overflows (CSO); eight new pumping stations (PS). Rehabilitate four existing PSs and upgrade the existing wastewater treatment plant (WWTP) from 5,000 cmd to 7500 cmd.
- *School and public toilets:* Construct four public toilets in the city center and parks and construct toilets in three schools.

Details about proposed investment on each item are described below,

1.2.1.1. Drainage

Rehabilitation of the Tan Tai Canal

The Project proposed to dredge and lower the canal bottom for improving drainage capacity. Where space is adequate (e.g. Sections TT1 and TT5), the project will rehabilitate the existing open canal, build canal-side management roads together with basic technical infrastructures including trees planting. At sections where space is limited, box culverts will be built on the

existing canal section in order to minimize land acquisition. The Tan Tai canal is divided into 6 sections based on existing conditions and hydraulic analysis as described in Figure 1.2 and Table 1.1.

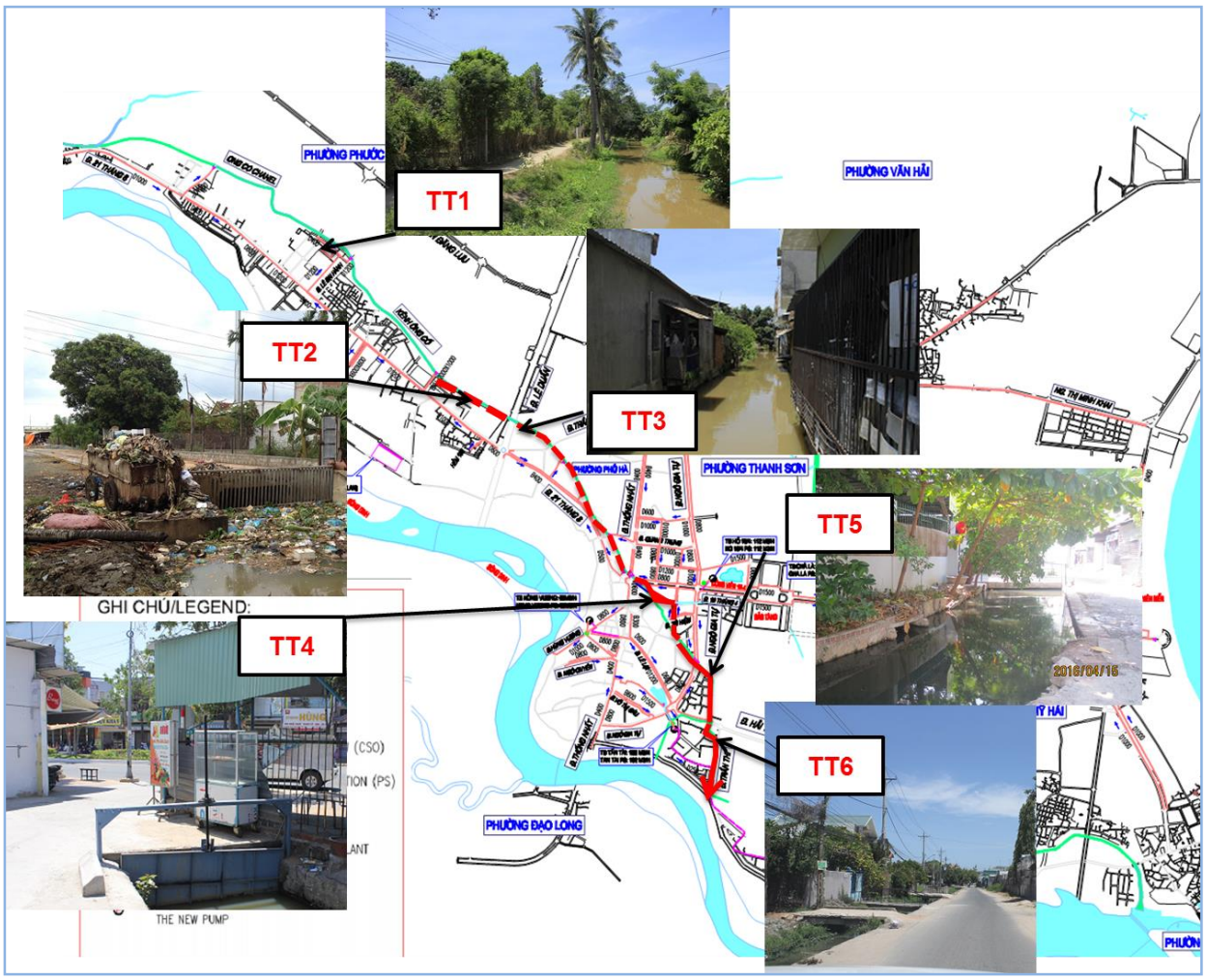
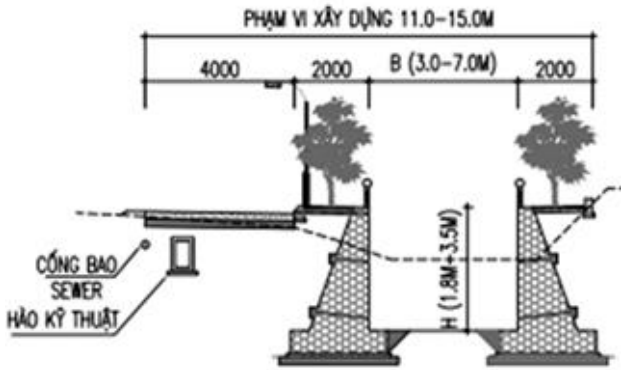
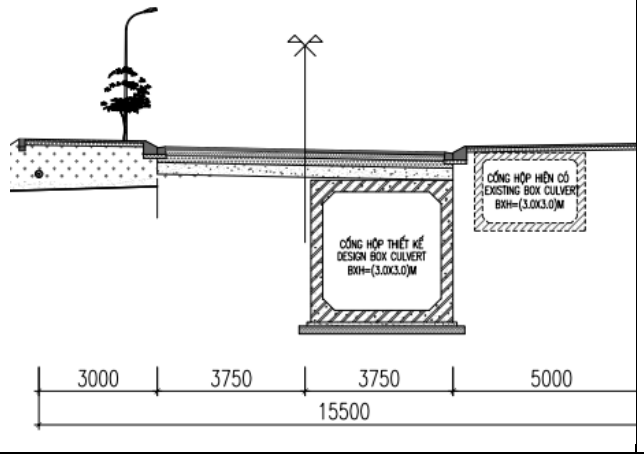
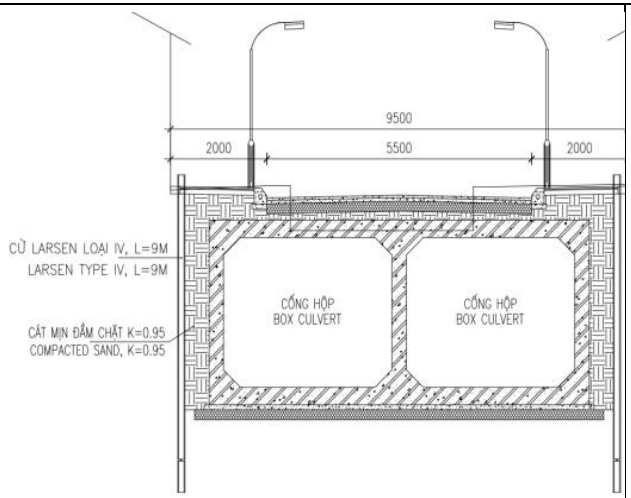
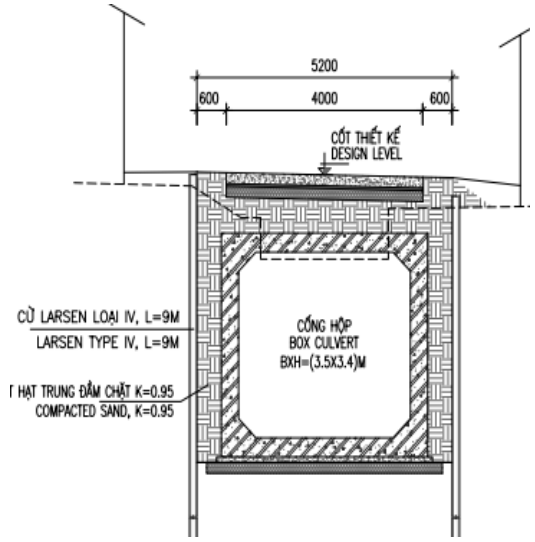
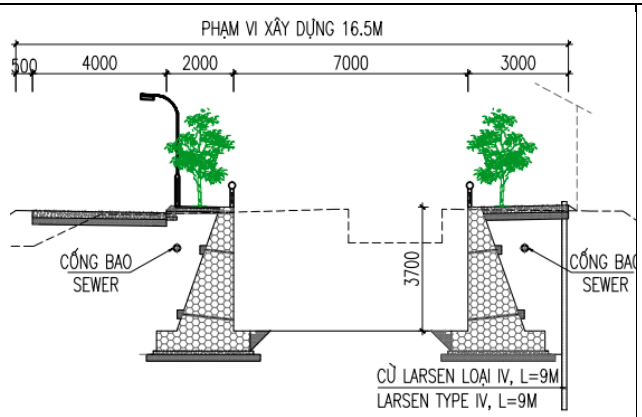
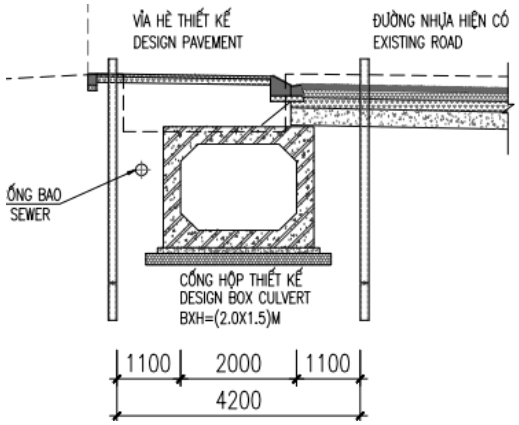


Figure 1.2. Map of Tan Tai canal.

Table 1.1. Proposed Investments by Sections of Tan Tai canal

	Start point	End point	Existing status	Proposed technical design	Proposed Investment
Section 1	Behind Son Long Thuan petrol station	Existing boxed drain (332m from Le Duan road	Open canal L= 3,435 m; B = 6 to10m.	 Stone wall	Dredge and excavate the existing canal following designed cross sections, line the embankments with stones. This section is divided into 7 sub-sections with different designed dimensions, BxH=(3.0-7.0)x(2.3-4.0), cross section of construction area is 11.0-15.0m wide. Construct management road on the left side B=4m, pavement B=2x2m, CSOs , drainage and sewers, technical drain, lighting, canal crossing bridge and staircases. Rebuild seven irrigation sluice gates and one water level controlling gate.
Section 2	From the end-point of section 1	Le Duan road	Box culvert, L= 332 m. BxH= 2.4x1.6m		Remain the existing box drain BxH=2.4x1.6m; Construct another new parallel box drain BxH=3.5x3.0m. Reinstate road surface after construction; Reconstruct one irrigation sluice gate

Section 3	The existing concrete sewer at downstream (on Le Duan road)	Nuoc Da bridge (on Thong Nhat road)	Open canal, L=1,481m; B = 4m. The end section is small culvert		Build two paralel drains dimensions 2xBxH=2x3.5x3.0m to replace the canal. Total construction corridor is 9.5m wide. Replace the exsiting drain at the end of this section (Thong Nhat to 16/4 road). Build management road on the top B=5.5m, , footpath, CSO, drainage, sewers, technical drain, lighting, manholes and maintenance staircases. Build/rebuild 6 outlets DN600 including CSO and flap valve to avoid the canal water entering combined sewer.
Section 4	Road 16/4	Ngo Gia Tu	Open canal, L=722m; B = 2.5m.		Build a new box drain dimension BxH=3.5x3.4m. Total construction corridor is 9.5m wide. Build enclosed infrastructures including management road on the top B=4.2m, wastewater interceptor, footpaths for both sides, four sewer connections D400-800, drainage, technical drain, lighting, manholes and maintenance staircases

Section 5	Ngo Gia Tu road	Hai Thuong Lan Ong road	Open canal, L=415m; B = 2.5m.	 Stone wall	Construct embankments of vertical stone walls dimensions BxH=4.7x3.9m with L=271m, and BxH=3.5x3.9m with L=144m. Total construction corridor is 10.7m Build enclosed infrastructures including management road B=5.2m, CSOs, drainage, sewers, lighting and maintenance staircases. Construct enclosed infrastructures including management road on the top B=5.2m, wastewater interceptor, pavement B=2.25 for both sides, rainwater runoff collection, technical drain, lighting, manholes and maintenance steps. Construct an outlet BxH=2.0x1.8m including CSO and flap valve in HTLO street.
Section 6	HTLO road	Dinh River dike	Open canal, L=561m; B = 2.5m.	 Box culvert	Build a new box drain dimension BxH=1.5x1.8m. Total construction corridor is 4.2 m. For segment from HTLO road to Tran Thi road, a new road will be constructed on the top of box drain. For segment along Tran Thi road, the box drain will be a new pavement. Enclosed infrastructure includes pavement, wastewater interceptor, drainage. Rebuild three irrigation gates and add a stop log at the end of Tran Thi road.
				Total length is 6,946m	

Construction of the Dong Nam Canal

Figure 1.3. Proposed Route of Dong Nam Canal.

Dong Nam canal is located in the Dong Nam urban area, connecting Cho Tan Tai canal and Cha La canal. The canal is running parallelly with Hai Thuong Lan Ong road, currently is a small irrigation canal with B=0.8-1.5m.

The proposed new construction will be widening the canal with sizes of BxH=10.0x2.7m; stone embankment for both sides; a sidewalk on the left side B=2.0m; a macadam road B=4.0m, lighting and tree planting on the right side. Reinstate agricultural irrigation works.

Rehabilitation of the Cha La Canal

There are two existing roads along the Cha La canal, one is 6m wide, mostly concrete-built, and the other is 2m wide earthern road. General proposals for rehabilitation of Cha La canal are as follows,

- Maintain open canal and water surface for the city.
- Rehabilitate the canal sections from Nguyen Van Cu road to the Sinh Thai lake and from 16/4 road to Da Bac bridge (CL2 and CL3): line the embankment; improve management road with B = 4.0m. Auxiliary items such as 1.0m wide kerb and 2.0m wide sidewalk for each side, wastewater interceptors, lighting system, trees and handrail are included.

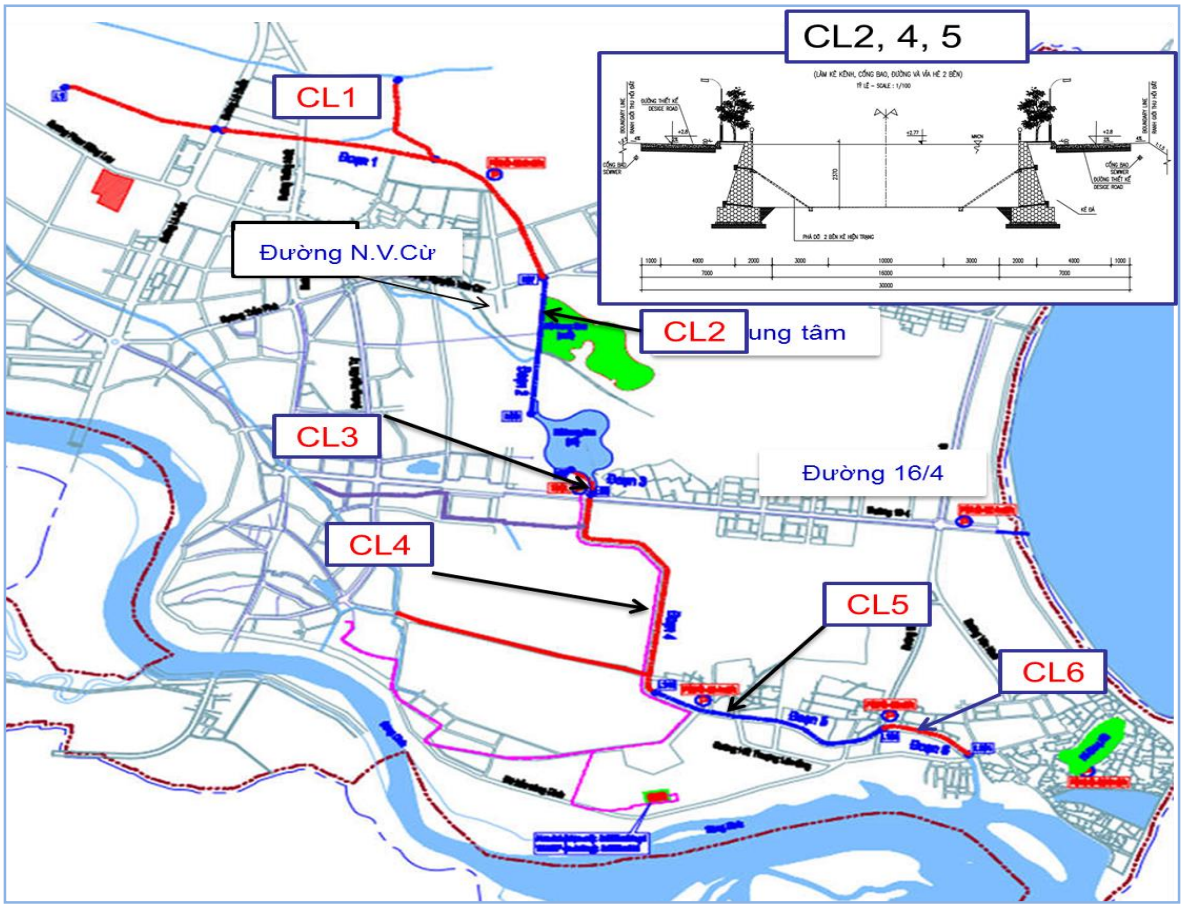


Figure 1.4: **Cha La canal route map and the proposed cross section.**

Summary of the proposed work items for Cha La canal is shown in Table 1.2.

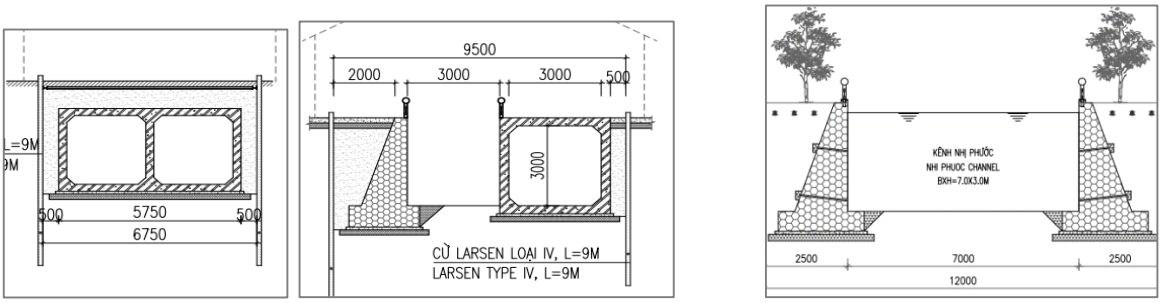
Table 1.2: List of Proposed Investments for Cha La Canal

No.	Name of Section	First point	End point	Existing condition			Proposal			Length (m)
				Canal	Left alignment	Right alignment	Canal	Left alignment	Right alignment	
1	Section CL1	Truong Dinh road	Nguyen Van Cu road	Concrete embankment	Earthen road, 2.0m wide	Concrete road, 6.0m wide	Maintain the existing condition	Maintain the existing condition	Maintain the existing condition	3,056
2	Section CL2	Nguyen Van Cu road	Sinh Thai lake	Earthen canal	Earthen road, 2.0m wide	Earthen road, 6.0m wide	Embank with stone walls BxH =12.2x(2.8-3.5)m	Construct 4m wide concrete road and the auxiliary items	Construct 4m wide concrete road and the auxiliary items	935
3	Section CL3	Sinh Thai lake	Road 16/4	Concrete embankment	Earthen road, 6.0m wide	Earthen road, 3.0m wide	Dredging canal bottom 0.2-0.3m	Maintain the existing condition.	Maintain the existing condition	258
4	Section CL4	Road 16/4	HTLO 1	Concrete embankment	Earthen road, 2.0m wide	Earthen road, 6.0m wide	Embank with stone walls BxH =(14.3-16)x2.8m	Construct 4m wide concrete road, and the auxiliary items	Construct 4m wide asphalt road and the auxiliary items	1,459
5	Section CL5	HTLO 1	Vo Nguyen Giap road	Earthen canal	Earthen road, 4.0-6.0m wide	Earthen road, 3.0-5.0m wide	Embank with stone walls BxH =16x(2.7-3.7)m	Construct 4m wide concrete road and the auxiliary items	Widen the existing road, construct 4m wide concrete road and the auxiliary items	1,345
6	Section CL6	Vo Nguyen Giap road	End point (at Da Bac Bridge, HTLO)	Concrete embankment	Concrete road, 4.0-6.0m wide	Earthen road, 3.0-4.0m wide	Dredging canal bottom 0.7-1.0m	Maintain the existing condition	Maintain the existing condition	514
									Total length	**7,567**

Rehabilitation of Nhi Phuoc Canal

Nhi Phuoc canal is 1,660m long, starts at 16/4 road and ends at the connection to Cha La canal. The existing canal is about 2.5m wide. The proposed works for Nhi Phuoc canal are as follows,

- **Section NP1 (L=93m)**: from 16/4 road to the Center for Social Education. The existing canal is about 7.3-7.7m wide, and the concrete road on the right is about 4.8-5.2m. It is proposed to construct two parallel box culverts 2xBXH=2x2.5x2.5m.
- **Section NP2 (708m) & NP3 (475m)**: from the NP1's ending point to behind the museum. The project proposes to maintain open canal and construct a box culvert BxH=3x3 in parallel for improvement of drainage capability in case heavy rains. The water flow through the box culvert is regulated by a sluice gate system for independently operation. Management road is constructed on the right side.
- **NP4 (384m):** from the ending point of NP3 to Cha La canal. The project proposes to construct an open canal BxH=7.0x3.0m embanked with stone vertical walls on both sides. Two 2.5m-wide macadam roads will be constructed along both sides.



Section NP1. Sections NP2 & NP3. Section NP4.

Figure 1.5: Proposed cross sections of Nhi Phuoc canal.

Rehabilitation of TH5 Canal

The TH5 canal has a total length of 662m connecting the Tan Hoi and the Cha La canals. The canal is about 2-3m-wide. The project proposes to build new cross section and embankments with dimensions of B1xB2xH=0.6x1.4x1.58m and construct a 3m-wide earth road on the left side and a 1m-wide earth road on the right side, repair/rehabilitate 5 sluice gates along the canal.

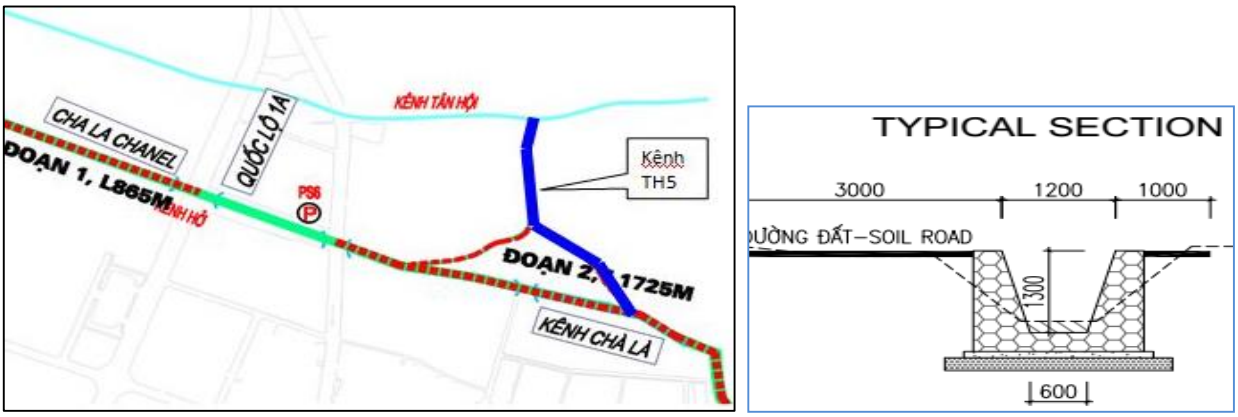


Figure 1.6: Map of TH5 canal route and designed cross section.

Construction of the Central Lake

The proposed new Central Lake is proposed on an existing agricultural lands with a total land use area of 22.69 hectares.

The lake is located in Van Hai ward, it will be connected with the Cha La canal with the main function is to store water for improving city's microclimate and to improve the water quality of Cha La canal.

Proposed scope work includes construction of 17.7ha new lake, 3.5 m deep, construction of lakeside road with L = 2,172m, B= 7m, lighting and trees.

Figure 1.7: **Layout of the central lake.**

Rehabilitation of Dong Hai Lake

Dong Hai lake has an area of about 4.32ha, located in a populated area subjected to flooding by tide and heavy rain. The project will rehabilitate the Dong Hai lake in order to address flooding issue in Dong Hai ward and improve the landscape in the area.

Scope of investment includes rehabilitation of the lake with water surface at 3.4ha, 2.1 m deep. Build embankment, construction of lakeside road with L =2,220m, and B =5.22m interceptors and wastewater pumping station; lighting system, tree planting. The stone embankment has a slope of 1:2, and 5 m wide maintenance steps.

Rehabilitation of the existing 100 m long canal connecting Dong Hai lake with the nearby sea lagoon and build a sluice gate for tide control.

Construction of a combined sewer and drainage D800 (L=704m), wastewater interceptors D800 (L=346m), CSOs, a drain D1200 (L=271m) and enclosed sluice gate from Dong Hai lake to the inlet of Dinh River.

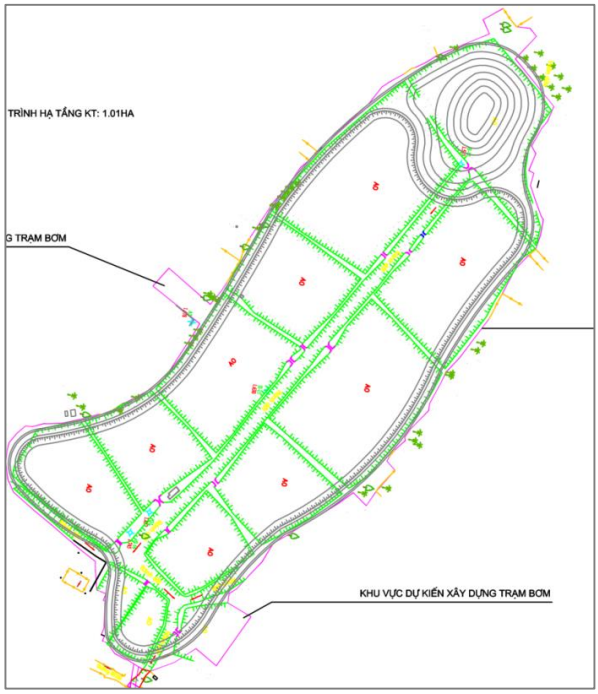


Figure 1.8: Proposed design layout of Dong Hai lake.

Rehabilitation of Secondary Drainage

The proposed secondary drainage are listed in Table 1.3 and Figure 1.9 below.

Table 1.3: Proposed investment in secondary sewers for flood control

No	Flooded road/area	Proposed solution	Length (m)
1	D1 route: Alley 410 of 21/8 road discharged to Tan Tai canal	Construct a drain route DN600; bottom depth of 1.3-2.53 m	500
2	D2 route: in Truong Dinh road discharged to Tan Tai canal	Construct a drain route DN1200; bottom depth of 2.0-2.76 m	220
3	D3 route: from 21/8 road to Le Quy Don road connected to D1000 drain in 21/8 road	Construct a drain route DN1200; bottom depth of 1.33-1.46 m	222
4	D5 route: from 21/8 to the Children Cultural Center discharged to Tan Tai canal	Construct a drain route DN600; bottom depth of 1.3-2.38 m	122
5	D6 route: from Thong Nhat road to Quang Trung road discharged to Tan Tai canal	Construct a drain route DN1000; bottom depth of 1.7-3.25 m	339
6	D7route: in Le Hong Phong, Yersin and Thong Nhat roads discharged to Tan Tai canal	Construct a drain route DN800; bottom depth of 1.51-2.47 m	326
7	D8 route: in front of PPC office in Thong Nhat road discharged to Tan Tai canal	Construct a drain route DN600; bottom depth of 1.34-1.96 m	130
8	D9 route: Cao Thang road	Construct a drain route DN800; bottom depth of 1.32-2.55 m	450
9	D10 route: in Vo Thi Sau road discharged to Tan Tai canal	Construct a drain route DN1500; bottom depth of 1.28-2.71 m Construct a box culvert BxH= 2000x1800	506 357
10	D11route - Cao Ba Quat road connecting to K1 urban area	Construct a drain route DN1000; bottom depth of 1.73-2.98 m Construct a box culvert BxH= 1500x1500	285 210
	TOTAL		3,667

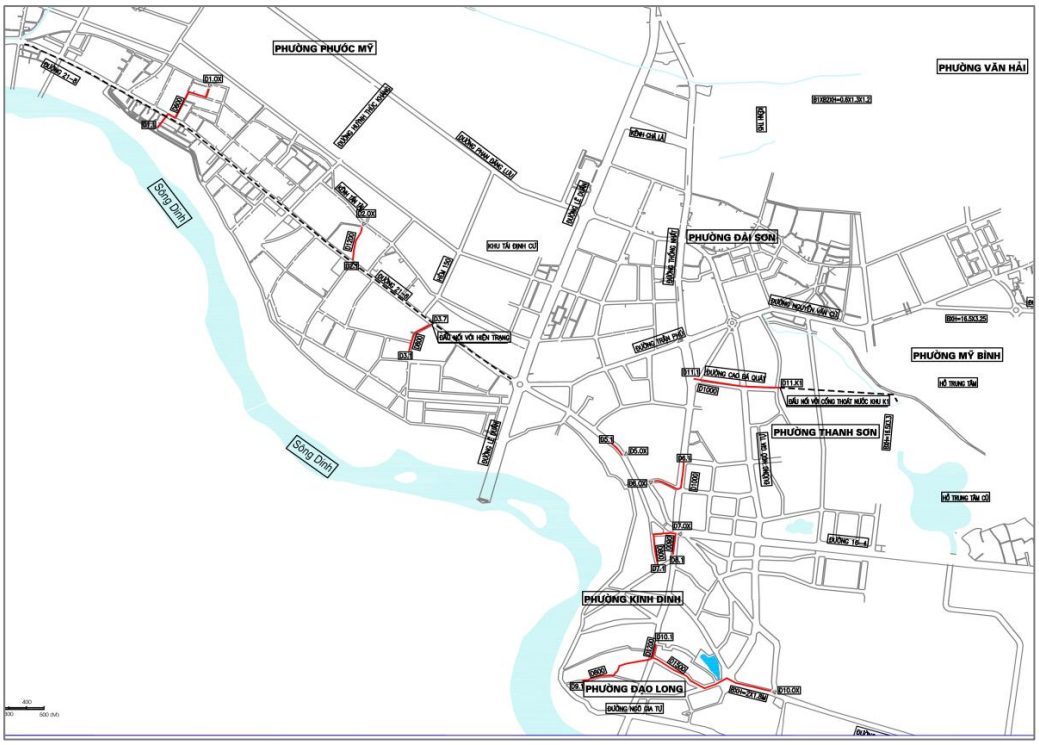


Figure 1.9: Proposed drainage improvement.

1.2.1.2. Wastewater Collection and Treatment System

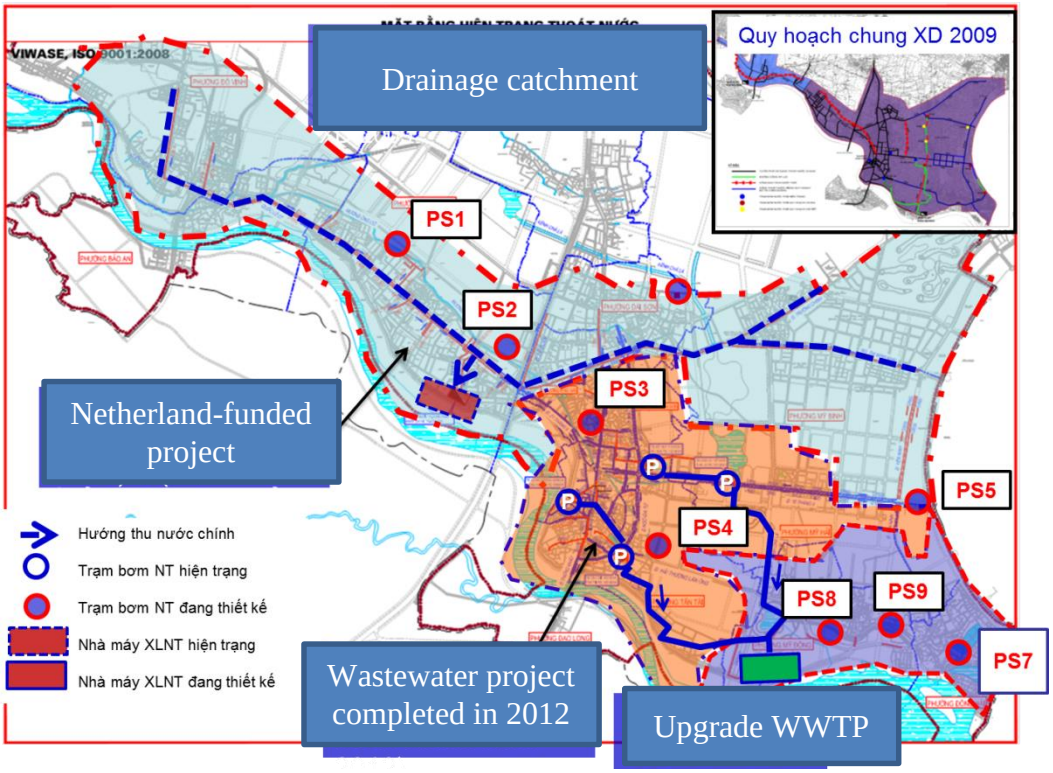


Figure 1.10: Map of wastewater collection network to the WWTP.

The Project proposes to construct and install 41.2 km of tertiary sewers, 28 CSOs, 8 wastewater pumping stations (WPS) and upgrade the exsiting Wastewater Treatment Plant (WWTP) with treatment capacity from 5,000 cmd to 7,500 cmd.

The 41.2 km of brick drains B400, B500 or uPVC pipes were proposed for Dong Hai ward and the areas surrounding 16/4 road as summarised in Table 1.4 below.

Table 1.4: Proposed Tertiary Sewers

No	Area	Dimension	Unit	Quantity
1	Dong Hai ward	Drain B400-B500	m	8,954
2	North of 16/4 road	Drain B400	m	2,565
		Sewer uPVC D160	m	5,413
		Sewer HDPE D200-D315	m	2,742
3	Southern 16/4 street area, exception from Dong Hai ward	Drain B400-B500	m	12,819
		Sewer uPVC D160	m	7,014
		Sewer HDPE D200	m	1,724
		Total	m	**41,231**

Source: FS report of the project.

The project proposes to construct 28 CSOs including: along Tan Tai canal (18 CSOs), Cha La canal (5 CSOs), Nhi Phuoc canal (4 CSOs), and Binh Son Park (1 CSO).

Eight new wastewater pumping stations (PS) were proposed are shown in Table 1.5 below.

Table 1.5: Locations and Designed Parameters of the WWPSs

No.	PS	Location	Capacity (m^3/h)	Site area (length. width. depth)	Pressure pipeline
1	PS1	Luong Van Can road intersects with Tan Tai Canal	12.2	L= 11.4m; W= 8.2m; D= 6.56m	HDPE D125 L= 50m
2	PS2	Alley 150 intersects with Tan Tai Canal	31.38	L= 11.4m; W= 8.2m; D= 6.56m	HDPE D160 L= 180m
3	PS3	Quang Trung road intersects with Tan Tai Canal	19.02	L= 11.4m; W= 8.2m; D= 6.56m	HDPE D125 L= 320m
4	PS4	HTLO intersects with Tan Tai Canal	21.26	L= 11.4m; W= 8.2m; D= 6.56m	HDPE D125 L= 320m
5	PS5	Road 16/4, Binh Son Park	29.6	L= 11.4m; W= 8.2m; D= 6.56m	HDPE D160 L= 1555m
6	PS7	Dong Hai lake	39.3	L= 11.4m; W= 8.2m; D= 6.56m	HDPE D160 L= 520m
7	PS8	Cha La Canal and Ngo Duc Ke	200.1	L= 13m; W= 9.4m; D= 6.93m	HDPE D280 L= 1370m
8	PS6	Cha La Canal and HTLO road	107.6	L= 13m; W= 9.4m; D= 6.93m	HDPE D250 L= 1400m

Source: FS report of the project.

Equipment replacement and small civil works were also proposed for 4 existing WPSs. Particularly, fence and warning signs will be added to protect one WPS is located within the boundary of Hung Vuong secondary school.

Total construction length of newly proposed pressure pipeline is 6,370m, of which HDPE pipe D125, 160, 222, 250 and 280mm in turn will be 660m, 2380m, 560m, 1400m and 1400m.

Upgrading the Existing Wastewater Treatment Plan (WWTP#1)

The existing WWTP#1 has originally a designed treatment capacity of 5,000 m^3/day using, aerated biological lagoon treatment technology. The designed treated wastewater meets QCVN 14:2008/BTNMT- column B as shown below.

Table 1.6: Designed parameters of the WWTP#1

Parameters	Unit	Before being upgraded			After being upgraded		
		Input wastewater	Output wastewater quality	Treatment efficiency	Input wastewater	Output wastewater	Treatment efficiency
Average flow	m3/day m3/h m3/s	5000 208 3.47			7,500 312.5 0.087		
BOD5	mg/L kg/day g/m3	300 1,500 300	50	83%	150 1,125 150	40	73%
COD	mg/L	441	100	77%	221	90	60%
BOD/COD		0.68			0.68		
TSS	mg/L	350	100	71%	300	90	70%
Total N	mg/L	21.6	20	7%	30	20	33%
$N\text{-}NH_4^+$	mg/L				20	8	60%
Total P	mg/L	8.12	10		8.12	5	

Source: FS Report.

The project proposes to upgrade the capacity of the WWTP to 7,500 m^3/day by increasing the areas/volumes of the aerobic and sedimentation tanks so as supplement mud can be added for recirculation, or to separate the aerobic lagoons for treatment of wastewater following the batch-based treatment principles. The key proposed civil works for WWTP#1 are summarised in Table 1.7.

Table 1.7: Key Proposed Civil Works for WWTP#1

Facilities	Existing Issues	Proposed Investment
Aerobic lagoon	HDPE cover has been deformed at the bottom and sides	Consolidate the lake beds and replace HDPE cover
Settling tanks	1 settling tank is not working.	Demolish the existing canal and building a replacement. Installing one more V notch weir for the two settling tanks
Disinfection tank	Working well	Upgrade
Outfall	There has been some erosion at the embankment of the Dinh River where the outfall is located. As there are no flap valves, river water backflown into the	Repair and upgrade the outfall. Install flap valve and sluice gate

Facilities	Existing Issues	Proposed Investment
	disinfection tank when the water level in the river is high,	
Electrical and control system	Some equipment has been broken or degraded. There is no equipment for continuously monitoring influent and effluent quality.	Replace broken equipment Provide and install continuous water quality monitoring system
Administrative house	Main panels of the plan are hot; fans have been used for cooling which is not safe. The area is small. Rooms are being used as resting areas for workers	Install more ventilators for the panel room. Some masonry works for the administrative room 68m2. Providing office equipment
Stores, parking areas and security house	Good operation	Providing repairing tools and cabinets Paint the gates, fence and security house.
Other tasks	N/A	Install cameras at the receiving areas, aerobic tank, security gate and outlets discharging water to rivers. Rebuild outlet. Install new sluice gate for electrical motors at the outlet of the plant. Install information boards at the gate including buffer areas

1.2.1.3. School and Public Toilets

The project proposes to build four public toilets in the city center and 3 school toilets. All toilets will be built with stone or reinforced concrete, brick wall, steel purlins, heat insulation metal roof, ceramic tile floor, aluminium glazing frame door, decorated with glazing ceramic tiling, painted in light yellow or green. The locations and key parameters are shown in Table 1.8 below.

Table 1.8: Proposed Toilets

No.	Location	Dimensions (m)			Proposed Location
		L	B	H	
Public Toilets					
1	16/4 Park, east side;	13.4	7.6	3.9	
	16/4 Park: near the main gate	12.1	7.1	3.0	
2	Binh Son Park: sea side;	14.15	5.6	4.0	
	Binh Son Park: at the center.	10.3	9.8	3.7	

No.	Location		Dimensions (m)			Proposed Location
			L	B	H	
School Toilets						
Phu Tho Primary School		For pupils	11.8	6.9	4.4	At the existing toilet.
		For teachers	5.3	3.2	3.6	New, on the right of students' toilet.
Do Vinh 2 Primary School		For pupils	9.4	4.2	4.0	Northwest, toward the main entrance.
		For teachers	5.3	3.2	3.6	Northeast, toward main entrance.
Nguyen Van Troi secondary School		For pupils	11.8	9.5	4.4	Southwest toward the main entrance.

1.2.2. Component 2: Urban Connectivity

1.2.2.1. Alley 150 of 21/8 Road

The existing alley 150 in 21/8 road is 979.46 m-long, about 5m-wide without footpath. It starts at the junction with 21/8 road which is about 600m from the national highway 1A (NH1A) and ends at the junction with Phan Dang Luu road, about 600m from NH1A. The Project proposed to upgrade the alley to 27m-wide road with design speed of 50 km/h, four lanes 4x3.5 m= 14.0 m,2x2m= 4.0 m kerbs;2x4.5m= 9.0 m sidewalks.

The proposal also includes supporting facilities such as sewers and drainage, technical canal, trees along the sidewalks (average every 10m) in accordance with the city's approved plans.

Figure1.11: Locations of Alley 150 and Huynh Thuc Khang road on the detailed 1/2000 plan.

1.2.2.2. Huynh Thuc Khang Road

The existing Huynh Thuc Khang road is 420m-long, 7m-wide, starts from the junction with 21/8 road which is about 1.7km from NH-1A and ends at the junction with Phan Dang Luu road which is about 1.3km from NH1A . The project propose to prolong and widen this road to 920m-long, 20m-wide with design speed of 50 km/h, two lanes 2x3.5 m=7.0m, 2x2m=4.0 m kerbs, 2x4.5m =9.0m sidewalk.

The proposal also includes supporting facilities similar to Alley 150 described above.

1.2.3. Component 3: Construction of Resettlement Area

2. The proposed resettlement site is located in Phan Dang Luu road of Phuoc My ward with total land area of 6.7 ha. The site will be divided to 250 land slots serving the resettlement demand of the Project. The Project will cover the site clearance and levelling, construction of basic infrastructure including roads and traffic safety facilities, drainage, water and power supply, underground technical channel, park and green areas, lighting system.

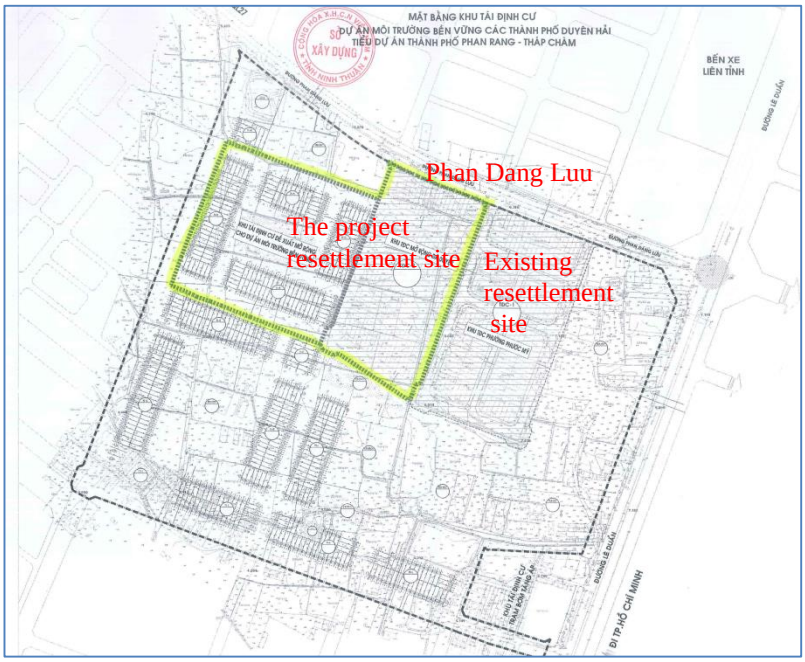


Figure 1.12: Layout of the proposed resettlement area.

The quantity of key proposed investments at the Resettlement site are summarised in Table 1.9 below

Table 1.9: Scope of works of Component 3

No.	Work items	Unit	Quantity
1	Total area of site levelling	ha	4.41
2	Road foundation	m	1,693
3	Tree planting	tree	164
4	Drainage construction	m	2,000
5	Sewer construction	m	3,033
6	Water supply pipeline - pipe HDPE D75-110 mm	m	2,700
7	Total number of transformer station 22/0.4kV-250kVA	station	4

1.2.4. Total Excavated and Leveling Volumes of the Project

The total volumes of earth works are presented in the Table below

Table 1.10: Summary of excavated and filled volumes and balance of levelling materials for the project's investment items (unit: m^3)

No	Item	Topsoil/ dredged	Excavated soil		Filling demand	Balance of materials	
			Excavated	Reused		Disposed off	Transported to the sites
	COMPONENT 1	**58,631**	**1,095,798**	**362,973**	**478,513**	**791,456**	**123,658**
1	Tan Tai canal	0	362,427	90,607	139,631	271,820	49,000
2	Dong Nam canal	1,288	41,607	0	20,878	42,895	20,878
3	Cha La canal	42,538	240,838	155,725	155,725	127,651	0
4	Nhi Phuoc canal	0	62,105	0	24,124	62,105	24,100
5	TH5canal	178	3210	0	4,894	3,388	4,900
6	Central lake	11,538	256,382	57,405	57,405	210,515	8,160
7	Dong Hai lake	3,089	59,658	15,877	32,497	46,870	16,620
8	Secondary drainage	0	23,050	18,203	18,203	4,847	0
9	Tertiary sewers in Kinh Dinh& Phuoc My	0	14,250	11,663	11,663	2,587	0
10	Tertiary sewers in Phu Ha &Tan Tai wards	0	32,189	13,426	13,426	18,763	0
11	Public/school toilets	0	82	67	67	15	0
	COMPONENT 2	**19,379**	**17,653**	**0**	**41,689**	**37,032**	**41,600**
12	Huynh Thuc Khang	7,772	9,362	0	17,242	17,134	17,200
13	Alley 150 of 21/8 road	11,607	8,291	0	24,447	19,898	24,400
	COMPONENT 3	**36,487**	**924**	**0**	**173,000**	**37,411**	**173,000**
14	Resettlement area	36,487	924	0	173,000	37,411	173,000
TOTAL		**114,497**	**1,114,375**	**362,973**	**693,202**	**865,899**	**338,258**

1.2.5. Construction Methods and Technologies

Rehabilitation of Tan Tai Canal

The Tan Tai canal will be accessible through the existing roads/streets in Phuoc My, Phu Ha, Tan Tai, Long Binh and Kinh Dinh wards, including: Luong Van Can, Le Dai Hanh, Huynh Thuc Khang, Truong Dinh Hieu, Nguyen Trai and Tran Thi. Materials will be transported through 21/8, 16/4 and Hai Thuong Lan Ong roads/streets. Small steel boats may be used for waste/materials transportation at sections where there is no existing roads along the canal.

Dredging, embankment lining and construction of box culverts requires to be implemented in dry canals. Rolling method will be applied, 200m-500m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry and also to ensure the continuous water flow in the canal during construction period.

Construction method

Section	Construction solution
Section 1	The embankment will be constructed with block stone, covered with cement mortar and lean concrete, 100mm thick 200mm crushed stone. Excavation the embankment with slope 1:1, use the proposed management road as access to the construction site. Build at each side by side, divert flow or pump water for drainage/ irrigation.
Sections 2 to 6	RC box culver will be built in-situ. Construction will be carried out for each segment of 15m or shorter. Use Larsen or steel sheet piles for slope protection, the site is accessible through the top of culverts

Construction of Dong Nam Canal

The Dong Nam canal will be accessible through the existing HTLO road parallely with the canal. Six existing branch roads perpendicularly cutting through HTLO road could access directly to the canal. And the existing earthen road along the canal could also be used to access to the construction sites.

Construction method: Build coffer dam to block both ends of the canal to prevent water coming into the canal; applying open digging method. Construction method is of open canal with training methods. Using pumps and hoses to supply water for agricultural irrigation from Tan Tai and Cha La canals during the construction phase

Rehabilitation of Cha La Canal

The Cha La canal will be accessed through Truong Dinh road which is an existing management road along the canal. The embankments will be constructed with block stones, covered with cement mortar, concrete and crushed stones. Eexcavate with slope 1:1, use the proposed management road to access the site. Rolling method will be applied, 200m-500m each segment.

Rehabilitation of Nhi Phuoc Canal

Nhi Phuoc canal will be accessible through the existing road along this canal. Materials are transported to the site from management road of Cha La canal and 16/4 road.

RC box culvert will be built onsite. For NP1 Section of box culvert 2xBxH = 2x2.5x2.5m which is laid on the road, use Larsen sheet piles with top bracing for trench upholding and minimizing the road area to be reinstated. The box culvert shall be cast in-situ concrete for each segment, in length of 15.0m or shorter; joints shall be designed for load bearing and water proofing. Structure of the open canal shall be the vertical retaining walls by rock revetment masonry mortar M100. After the construction of box culvert, the existing road will be reinstated and combined as the operational road for section from Road 16/4 to the museum. Interceptors will be constructed on the right of NP1 Section and on both sides from the Social Education Center to the Museum area.

Rehabilitation of TH5 Canal

The site is accessible through existing urban roads and Thong Nhat road. The structure of the open canal shall be rock revetment masonry grade M100, lean concrete grade M100, in thickness of 100mm, gravel bedding 1x2cm of 200mm thick. Apply the open excavation method with slope of 1:0.5.

Construction of the Central Lake

The main access to the construction site is Nguyen Van Cu, Nguyen Thi Minh Khai and 270 roads, and the on-bank management roads along Cha La canal. Slope of the lake embankment shall be 1:2, constructed with block stone and riveted with cement mortar M100, lean concrete M 100, thickness of 100mm. The wall foot is strengthened with the wooden piles in density of 25 piles/1m^2.Maintenance steps will be constructed for the purpose of inspection and cleaning. The block stone masonry steps in a width of 0.3m cement mortar M100 plastering shall be 5m wide, two sides of 0.4m wide, cement mortar finishing and roughness trimming.

Rehabilitation of Dong Hai Lake

For Dong Hai lake construction site, the main access routes are Alley 62 and Alley 80 of Bach Dang road, Hai Thuong Lan Ong road, and Yen Ninh road. Slope of the lake embankment shall be 1:2, constructed with block stone and riveted with cement mortar M100, lean concrete M 100, thickness of 100mm. The wall foot is strengthened with the wooden piles in density of 25 piles/1m^2. Maintenance steps will be constructed for the purpose of inspection and cleaning. The block stone masonry steps in a width of 0.3m cement mortar M100 plastering shall be 5m wide, two sides of 0.4m wide, cement mortar finishing and roughness trimming. All lake bed and embankment will be lined with HDPE geotextile or waterproof membrane to avoid contaminated water seeping into the lake and from the lake into the ground during the dry season. That liner shall be laid up to elevation of 1.0 meaning the elevation higher than the max. water level in the lake.

Construction and Rehabilitation of Secondary Drainage

All kinds of reinforced concrete culverts are prefabricated by means of vibration or centrifugal casting from the factories. The box culvert type is constructed directly onsite or assembled, depending on the actual terrain and abilities of contractors. On the route facilities such as manholes, CSOs... shall be constructed onsite. Installation of culverts is implemented by opened digging method using piles of Larsen sheet to prevent land slides.

Construction of Wastewater Pumping Stations

Wastewater pumping stations shall be constructed by onsite concrete casting method. The excavated pit of the pump stations shall be reinforced using steel sheet piles or steel sheet anti-stayed system.

Construction of Roads

The main access roads to the construction sites of Huynh Thuc Khang road and Lane 150 are the existing Huynh Thuc Khang road and the lane 150. The main material transport route is 21/8 road.

Remove top soil. Fill foundation with selected natural soil with minimum base of 30 cm and compaction density K≥ 0.95.

Road wearing structure:

- *Alley 150 of 21/8 road*

The structure of road wearing course with the top-down layer thickness is below: i) Fine-grain sized asphalt concrete 12.5 cm, in 7cm thickness; ii) Cohesive bituminous spraying, standard volume of 1.0 kg/m²; iii) Macadam type I Dmax=25mm, upgrade, thickness of 25cm, E=3,000daN/cm²; and iv) Macadam type II Dmax=37.5mm, subgrade, thickness of 30cm, E=2,500daN/cm².

- *Huynh Thuc Khang road*

The structure of road wearing course with the top-down layer thickness is below:

- Structure Type 1: New road surface construction: i) Fine-grain sized asphalt concrete 15 cm, in 3cm thickness; ii)Medium-grain sized asphalt concrete 19, in 4 cm thickness; iii)Cohesive bituminous spraying, standard volume of 1.0 kg/m²; iv) Macadam type I thickness of 25cm; and Macadam type II, subgrade, thickness of 30cm.
- Structure Type 2: Strengthened structure on existing road surface: i) Fine-grain sized aspahlt concrete 15 cm, 3cm in thickness; ii) Medium-grain sized aspahlt concrete 19, in 4 cm thickness; iii) Cohesive bituminous spraying, standard volume of 0.5 kg/m²; iv) Compensation layer of Medium-grain sized aspahlt concrete 19, 5 cm thick; and v) Cohesive bituminous spraying, standard volume of 0.5 kg/m².

1.2.6. Proposed List of Plants, Equipment and Human Resources

At each main construction site such as canal rehabilitation, lake construction, road and drainage construction, resettlement site construction, an estimated average number of workers mobilized daily during construction phase would be about 50-70 persons, during peak times would be 100-120 persons. Estimated average total number of workers daily working at all project's construction sites would be about 300-400 persons, at peak times about 500-600 persons.

The expected equipment, machines necessarily for construction activities of the project's investment items are listed in the following table.

Table 1.11: List of Equipment and Machines

No	Equipment, machine	No	Equipment, machine
1	Cement concrete mixing vehicle	9	Excavating machine 1.25m3
2	Truck 16 tons	10	Concrete pumping vehicle 50m3/h
3	Plate rammer 1Kw	11	Hydraulic pressing machine 130T
4	Toad rammer	12	Welding machine 23 KW
5	Rod rammer 1.5 KW	13	Bulldozer 108CV
6	Steel cutting machine 5KW	14	Concrete mixing machine 250l
7	Crane vehicle 25T	15	Concrete mixing machine 80l
8	Excavating machine 1.6m3	16	Rammer vehicle 18T

Source: FS report of the project.

1.2.7. Proposed Sources of Construction Materials

1.2.7.1. Construction Materials Demand

In addition to the filling materials for ground levelling listed in Table 1.12 of Section 1.2.4, total demands of other construction materials are listed in the following table.

Table 1.12. Quantity of Construction Materials

No	Item	Stone (ton)	Compacted soil (ton)	Sand (ton)	Steel (ton)	Cement (ton)
	COMPONENT 1					

1	Tan Tai canal	208,820	-	107,760	4,333	21,385
2	Dong Nam canal	21.949		7.343		1.407
3	Cha La canal	4,657	-	2,200	7,381	1,429
4	Nhi Phuoc canal	32,248	-	32,000	1,032	5,258
5	TH5canal	3,593	-	8,000	-	258
6	Central lake	17,421	10,600	5,131	-	1,100
7	Dong Hai lake	20,923	21,600	6,159	-	1,324
8	Secondary sewers	1,225	-	11,733	40	307
9	Tertiary sewers in Dong Hai ward	12,561	-	4,267	492	1,901
10	Tertiary sewers in Kinh Dinh& Phuoc My wards	3,599	-	10,286	141	546
11	Tertiary sewers in Phu Ha &Tan Tai wards	17,982	-	15,123	707	2,727
12	Public and school toilets	154	-	190	18	19
	COMPONENT 2					
13	Huynh Thuc Khang road	16,508	16,418	7,695	911	835
14	Alley 150 of 21/8 road	17,584	17,489	8,197	971	890
	COMPONENT 3					
15	Resettlement area	629	117,000	46,910	924	769
TOTAL		**379,853**	**183,107**	**272,994**	**16,950**	**40,155**

1.2.7.2. Sources of Materials

According to the recommendations of Ninh Thuan provincial Department of Natural Resources and Environment (DONRE), the borrow pits and quarries listed in Table 1.13 were considered meeting all legal requirements, material quality and reserve, and complying with environmental and labour safety regulations.

Table 1.13. Proposed Borrow Pits and Quarries[4]

No	Name of mine's owner	Exploited location/Transport routes	Brief information of mine
I. QUARRY			
1	Ninh Thuan Construction JS Company	Hon Giai mountain, Nhon Son commune, Ninh Son district. Located in the west of the city;18km from the city, travel through National Highway 27	Permission No: 12/ GP-UBND dated on 20 April 2015; Expire date: 20 April 2030. Square are: 14.8ha Reserve: 2,348,375 m^3 Exploiting capacity: 200,000 m^3/year
II. SAND MINE			

[4]Recommended by Ninh Thuan DONRE

No	Name of mine's owner	Exploited location/Transport routes	Brief information of mine
2	Ninh Thuan Lien Minh Company Ltd.	Nha Ho 3 sand mine in Nhon Son commune, Ninh Son district. Located in the west of PR-TC city; with a distance of ~15km, travel through National Highway 27	Permission No: 47GP/UBND 30/06/2014 Starting date: October 2014 Square are: 4.56 ha Reserve: 69,549 m3 Exploiting capacity: 10,000 m^3/year
III. BORROW PIT			
3	Van Phu Loc Company Ltd.	Soil mine at the west of Cha Bang mountain, Phuoc Dinh commune, Thuan Nam district. Located in the south of PR-TC city; with a distance of ~20km, travel through NH-1A	Permission No: 25/ GP-UBND 31/05/2015 Expire date: 31/05/2025 Square are: 239,690m2 Reserve: 1,691,280 m3 Exploiting capacity: 200,000 m^3/year

The locations of the borrow pits and quarries is shown in Figure 1.13. Environmental and safety due diligence compliance of the proposed borrow pits and quarries are presented in Appendix 5.

Note: (1) is quarries; (2) is sand pit; (3) is borrow pit.

Figure 1.13: Location Map of the Proposed Borrow Pits and Quarries.

1.2.8. Proposed Disposal Sites

Regarding the places for disposal of waste materials during the construction phase of the project, the ESIA team has consulted with Ninh Thuan DONRE and was recommended some disposal sites as shown in Table 1.14.

Table 1.14. Proposed Disposal Sites[5]

No	Type of waste	Characteristics of waste	Disposal place
1	Excavated and dredged materials	Can be used for levelling in urban areas	Some planned new urban areas in the city
2	Excavated material from Dong Hai lake and the Section CL5 of Cha La canal	Saline	Onsite disposal/ Nam Thanh sanitary landfill
3	Construction and domestic solid wastes	Non-hazardous wastes	Nam Thanh waste treatment complex

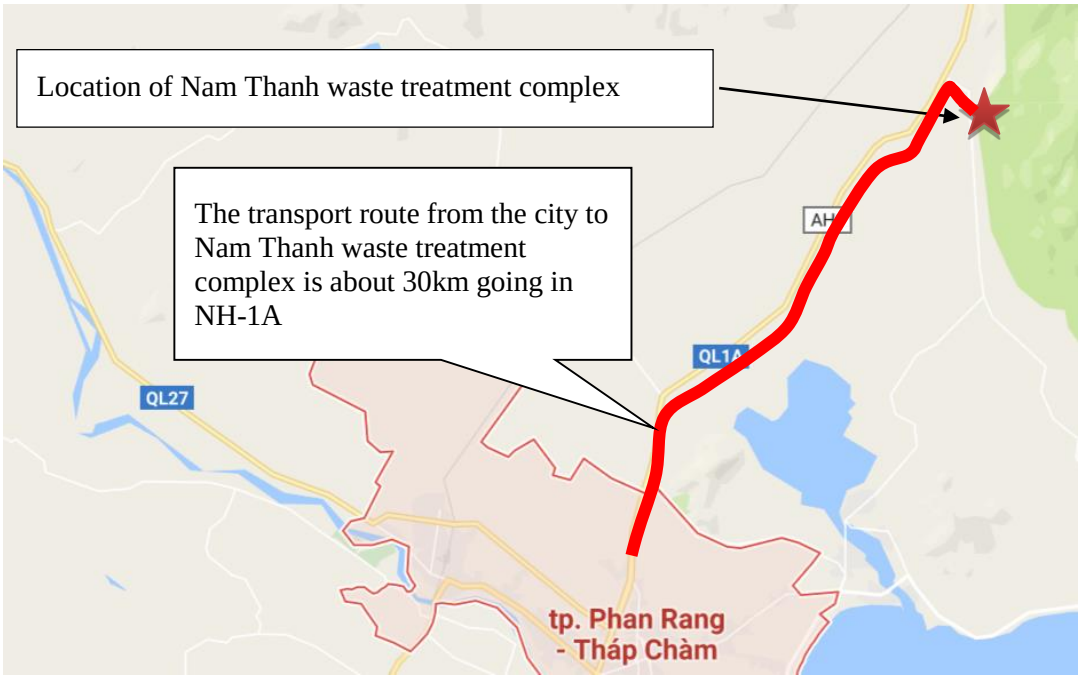


Figure 1.14. Route map to Nam Thanh Waste Treatment Complex .

[5] (recommendedby Ninh Thuan DONRE at the official letter No. 1479/STMNT – MT dated 29 April 2016)

1.2.9. Proposed Implementation Schedule

Table 1.15: Implementation Schedule

TT	Investment items	No. of months	Phase 1 (30% of total construction volume)								Phase 2 (70% of total construction volume)												Balance
			Year 2017				Year 2018				Year 2019				Year 2020				Year 2021				Year 2022		
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
1	Component 1–Sanitation infrastructure	60																							
1.1	Rehabilitation of Cha La and TH5 canals	18																							
1.2	Construction of Nhi Phuoc canal	18																							
1.3	Construction of Dong Nam canal	15																							
1.4	Construction of secondary drains/sewers (in Thong Nhat, Ngo Gia Tu and Hai Thuong Lan Ong streets)	42																							
1.5	Construction of school and public toilets	42																							
1.6	Construction of the project's resettlement area	6																							
1.7	Rehabilitation of Tan Tai canal	42																							
1.8	Construction of the central regulation lake	39																							
1.9	Construction of Dong Hai lake & sewers in the area	39																							
1.10	Construction of secondary & tertiary sewers in Kinh Dinh & Phuoc My wards	42																							
1.11	Construction of secondary & tertiary sewers in Phu Ha and Tan Tai wards	42																							
1.12	Upgrading the existing WWTP	24																							
1.13	Procurement and installation of mechanic equipment for WWTP and pump stations	24																							
1.14	Procurement and installation of mechanic equipment for WWTP and pump stations and scada	24																							
2	Component 2 – Urban Connectivity	42																							
2.1	Extension and widening the Alley 150	51																							
2.2	Extension and widening Huynh Thuc Khang road	18																							
3	Component 3 –Site clearance and resettlement	18																							
4	Component 4 - Technical assistance and institutional reform	63																							

Source: FS report of the project.

CHAPTER 2. NATURAL ENVIRONMENT AND SOCIO-ECONOMIC CONDITIONS

2.1. ENVIRONMENTAL CONDITIONS

2.1.1. Geographical Location

Ninh Thuan is a south central coastal province of Vietnam. Phan Rang – Thap Cham city is the province's administrative, economic, political and cultural centre of Ninh Thuan. The city is located 340km north of Ho Chi Minh City, 1,380km south of Hanoi capital; 100km from Nha Trang city. The city is bordered with Bac Ai and Ninh Hai districts to the north, with Ninh Son district to the west, with Ninh Phuoc district to the south, and with the East Sea to the east.

The Coastal Cities Sustainable Environment Project – Phan Rang Thap Cham City Sub-project will be implemented in all 15 wards and 1 communes of the city, including: Bao An, Dai Son, Dao Long, Do Vinh, Dong Hai, Kinh Dinh, My Binh, My Dong, My Hai, My Huong, Phu Ha, Phuoc My, Tan Tai, Van Hai and Thanh Son wards, and Thanh Hai commune. The Project location is shown in Figure 0.1 and the project areas are shown in Figure 2.1.

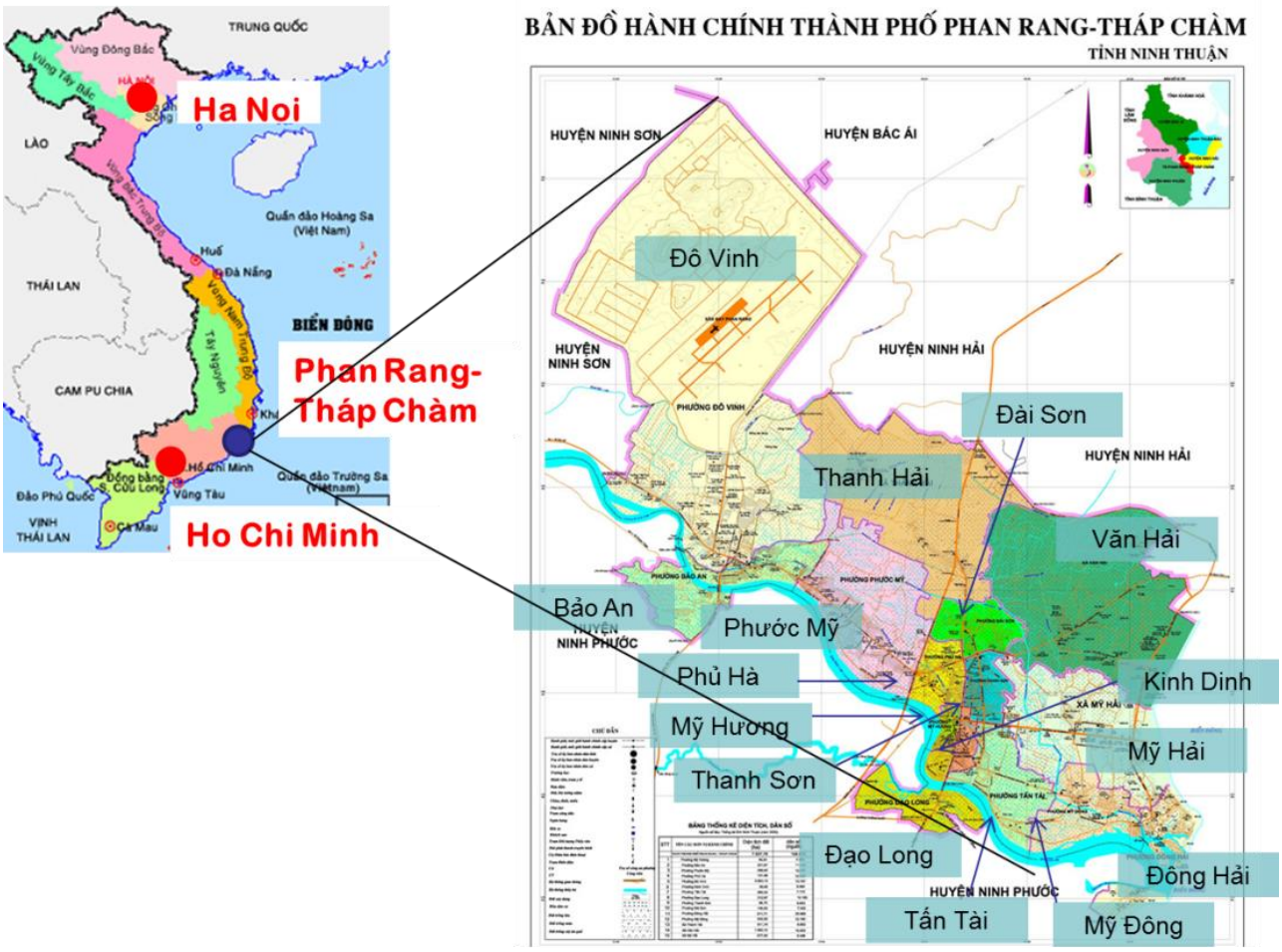


Figure 2.1. Map of the Project Areas.

2.1.2. Topography

The city is located on low hill terrain, lowered from Northwest to Southeast. The urban areas are mainly located on the North bank of the Dinh River and surrounded by 10km dyke with the top height of 6.2m. In the inner city, the natural ground elevation is less than 20m, the construction elevation ranged from 3.5m to 7.0 m. There are paddy fields in the Northwest, is low, ground elevation from 2.5m to 7.5m interspersed with sand strips. The highest areas are the low hills near Thap Cham. The Southern area of Dinh River has not been urbanised because there are no dykes, ground elevation is from 1.5m to 3.5m, being functioned as flood discharge area of the city.

2.1.3. Geology

The geological stratum of the city is relatively uniform, mainly composed of sandy silt, sandy clay, sand and sandy clay, the thickness varies between regions. The main geological formation in the project area is alluvial from the Dinh River. Specific geological characteristics in this area are as follows:

- Layer 1: 0 to 1.0-1.5m deep. Composed of gray or gold gray sandy clay, which is endurable soft.
- Layer 2: 1.0-1.5 to 5.0-5.6m deep. Medium and bigger grained sand and gold gray, dark gray clay silt, which is porous and saturated.
- Layer 3: 5.0-5.6m to 6m deep. Composed of mud, dark gray mud clay, which is loose soft.
- Layer 4: 6.0-8.0m to>12m. Composed of brown gray and green gray sandstones, which is packed and hard.

In general the geological conditions are favorable for construction, with load strength from 1.5kg/cm^2. The low laying paddy field has weak topsoil and mud, lower layers consist of sandy silt, sandy clay, the load strength of 1.0 kg/cm^2 ÷ 1.5 kg/cm^2. The mountainous areas are composed of clayish gravel, rocks, weathered rocks mixed with fine grains and sandy silt, the load strength of those soil strata is good.

According to the forecast of the Geophysics Institute, Phan Rang – Thap Cham city is located in the area of possible earthquake level 5. This risk should be taken into account in engineering design and construction of important structures.

2.1.4. Hydrogeology

Underground water level is influenced by surface water from surrounding irrigation ditches, with an average depth of one meter.

The groundwater level in Phan Rang Thap Cham city varies seasonally. In rainy seasons, groundwater level in some regions are equal to the surface water level, water is yellowish in colour and brackish as being influenced by sea water. Groundwater in Phan Rang located mainly in 02 aquifers: Holocene and Pleistocene.

- Holocene layer (Qh): The aquifer ingredients are diverse, mainly composed of sand, shell dust and pieces, vegetable humus, fine sand, fine clay, gravel clay, pebbles, gravel. The aquifer has medium thickness and relatively stable; the average static water level is 2.47m; fresh water has relative good quality and meet drinking water standard. However, in some areas, the concentrations of nitrate, sulphate, phenol and arsenic exceed the allowable limit.
- Pleistocene layer (Qp): Main ingredients are sand, dust, fine sand, silt clay, gravel sand limestone, coral limestone, and the bottom is composed of medium quartz sand, coarse

quartz sand and gravel. Aquifer thickness is medium and unstable; the average static water level is 1.5m. The water at Qp layer in the area is mostly saline.

Estimated groundwater volume exploitable from the aquifers in Phan Rang Thap Cham is 338,543m^3/day. In particular, the exploit table volume in Holocene aquifer (Qh) is 186,437 m^3/day; and in Pleistocene aquifer (Qp) is 152,106 m^3/day[6].

2.1.5. Hydrology

The Dinh River serves as the life blood one of Ninh Thuan province. Phan Rang Thap Cham city is located on the northern bank of the river. The river has been playing very important roles in irrigation, serving domestic, tourism and economic activities. The river is also important for drainage and flow control. Dinh River (also other names as Phan Rang Cai River or To Hap River) is about 120 km long, originates from the E Lam Thong Mountains in the border with Lam Dong province, and emptied into the sea at Dong Hai ward. The total basin area of Dinh River is about 2050 km². The average flow is approximately 39m³/s; and the lowest flow is about 3.35 – 8.0m³/s. The Dinh river section passing through Phan Rang Thap Cham city is about 16km long.

There are two weirs named as Nha Trinh and Lam Cam on the mainstream of the Dinh river. These were built to raise water level so as water can be taken to canals for irrigation. The Nha Trinh weir is 500m long, located 25km from the river mouth. Lam Cam weir is 7.4m high, 150m long and is located at 15km from the river mouth. There is a sluice gate between the Lam Cam weir and the Tan Tai canal.

Part of the water flow separated by the weir flow diversion structure runs into the city through Tan Tai and Cha La canals The river's lowest flow at Lam Cam weir in dry season is estimated at 2.0-3.5m^3/s.

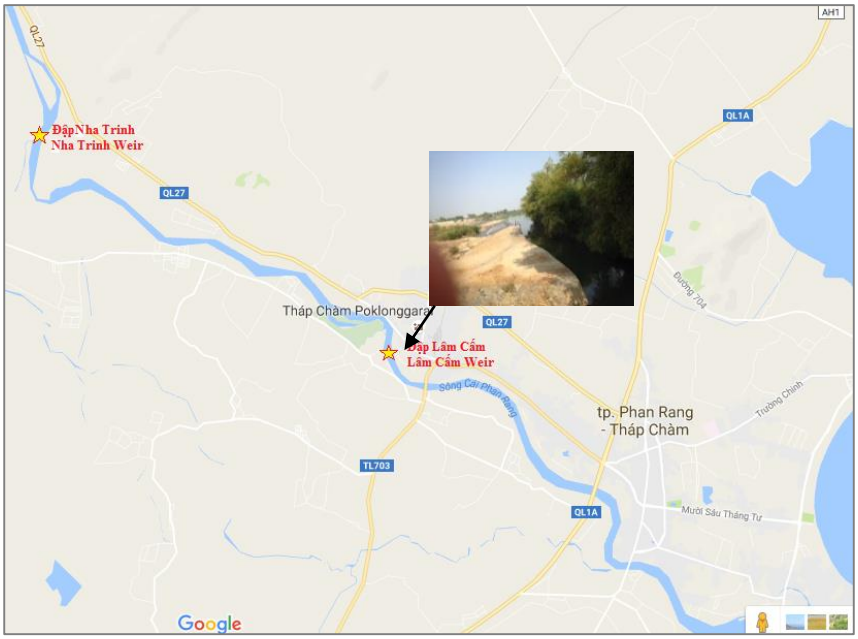


Figure 2.2. Dinh river route map.

The downstream section of the Dinh River in PR-TC city is influenced by tide. The highest water level in Dinh River is 6.05m (much higher than ground level of low laying areas of the city), 5.48m, 5.18m, 4.79m, 4.07m and 2.05m, respectively corresponding to the flood frequency of 1%, 5%, 10%, 20%, 50% and 100%.

[6]FS Report.

The flood period usually lasts about 4 months, from September to December. Due to steep river bed, floods come and go in short time with only one flood peak. Floods with frequency of less than 10% are often with big flood. The alarming flood levels I, II and III in Dinh River are 1.03, 0.4 and 0.1 m respectively.

The main canals important for irrigation and drainage in the city include: Tan Tai, Cha La, Nhi Phuoc and TH5. These canals are part of the proposed investment items of the project.

2.1.6. Marine Conditions

According the information from Ninh Thuan DONRE[7], the tidal regime in Ninh Thuan is irregularly semi-diurnal tide. In each month, there are 22 to 28 days of diurnal tide and the remaining days of semi-diurnal tide. Diurnal tide in the northern part occurs more often than in the southern part. Neap-tides are usually semi-diurnal tide. The semi-diurnal tides may occur in the north during the transition from flood-tide to neap-tide and vice versa. Tidal amplitude at the southern coast is greater than that at the northern coast. Large tidal amplitudes often occur in January, June, July and December; Small tidal amplitudes often occur in March, April and September. In a month, there are often 2-3 flood tides and about 2 neap tides. Flood tides usually occur at the beginning, middle and end of each lunar month. Meanwhile neap tides occur from 6th to 8th and 21st to 23rd of the lunar month.

Table 2.1: Flood tides in Dong Hai sea area recorded in 2014

Tidal high peak		Tidal low peak	
Water level	**Time**	**Water level**	**Time**
2.64	12h/2/1	0.99	6h/2/1
2.47	21h/15/1	1.14	6h/17/1
2.58	21h/30/1	1.07	5h/30/1
2.37	21h/13/2	1.24	5h/14/2
2.46	20h/27/2	1.21	4h/28/2
2.37	14h/23/3	1.31	1h/26/3
2.34	12h/4/4	1.34	20h/4/4
2.45	13h/20/4	1.17	20h/19/4
2.43	11h/2/5	1.19	19h/2/5
2.54	11h/18/5	1.04	19h/17/5
2.50	10h/30/5	1.11	18h/30/5
2.60	11h/15/6	0.99	19h/15/6
2.51	10h/28/6	1.09	18h/28/6
2.61	10h/13/7	1.01	18h/13/7
2.45	9h/26/7	1.16	17h/26/7
2.54	9h/10/8	1.11	17h/10/8
2.33	8h/23/8	1.28	16h/23/8
2.42	9h/8/9	1.25	16h/7/9
2.37	1h/1/10	1.31	10h/1/10
2.38	0h/13/10	1.27	7h/12/10
2.46	0h/29/10	1.16	8h/28/10

[7]Ninh Thuan DONRE, http://sotnmt.ninhthuan.gov.vn/News/?ID=2156&CatID=55. 10/7/2016.

Tidal high peak		Tidal low peak	
Water level	**Time**	**Water level**	**Time**
2.47	23h/9/11	1.14	7h/10/11
2.55	23h/25/11	1.05	7h/25/11
2.53	22h/7/12	1.08	6h/7/12
2.60	22h/23/12	1.01	7h/24/12

Source: Ninh Thuan DONRE, 2016.

2.1.7. Climate and Meteorology

The project area has a high and stable temperature. The average temperature is 27ºC, tends to decrease from east to west. The difference of temperature between the hottest month and the coldest month is about 5 to 6ºC. The temperature is usually highest from May to June and lowest in December and January. The monthly average temperature is shown in Table 2.2 below.

Table 2.2: Monthly Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	25.3	26.3	27.1	28.6	29.8	29.3	28.4	28.5	28.5	26.7	25.9	25.1
2011	24.5	25.1	25.8	27.1	28.5	28.7	28.2	28.4	28.2	27	26.7	25.1
2012	25.3	25.8	26.9	27.8	28.6	29	28.6	29	26.6	27	27.2	26.6
2013	25.1	25.5	26	26.4	26.4	26.5	27.5	27.9	27.6	26.6	26.2	24.7
2014	23.6	24.2	26.2	27.8	29.4	29.5	28.9	28.3	27.8	27.5	27	25.6
Ave.	24.8	25.4	26.4	27.5	28.5	28.6	28.3	28.4	27.7	27	26.6	25.4

Source: Statistical Year Book of Ninh Thuan province in 2014.

Due to the prevailing wind direction is from the sea, humidity in PR-TC city is relatively high all year around, at 77%. Humidity is higher during the night time and peaks in the early morning. The lowest humidity is usually in early afternoon.

Table 2.3: Monthly Average Humidity

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	75	77	74	77	76	78	79	78	78	83	82	75
2011	70	72	72	73	77	78	76	78	75	82	77	73
2012	75	74	74	81	77	74	75	71	88	79	80	74
2013	70	68	69	71	71	74	83	83	80	80	79	78
2014	68	72	75	80	75	72	73	77	82	77	76	75
Ave.	71.6	72.6	72.8	76.4	75.2	75.2	77.2	77.4	80.6	80.2	78.8	75

Source: Statistical Year Book of Ninh Thuan province in 2014.

Ninh Thuan province is the driest province with lowest annual rainfall in Vietnam. Average annual rainfall in Phan Rang is lowest in the province, at 763 mm. Rainy season usually lasts from September to December (04 months) with a rainfall accounts for 65-75% of the annual rainfall. The average number of annual rainy days is about 75 days.

Table 2.4: Monthly Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	83	-	1.5	22.5	18.7	71.2	168	33.9	58.6	561.1	5181	113
2011	20.6	-	25.8	10.3	112.1	49.1	78.9	7.3	116.2	412.7	38.5	22.6
2012	26.4	14.9	29.5	160.2	45.4	117.4	99.8	24.5	332.7	81.1	118	34.3
2013	29	2	2.3	4.9	154.6	137.9	69	70.2	141.8	106	330.9	0.7
2014	-	-	6.5	5	4.7	63.7	76.6	56.2	83	17.1	104.3	95.8
Ave.	31.8	3.4	13.1	40.6	67.1	87.9	98.5	38.4	146.5	235.6	1154.5	53.3

Source: Statistical Year Book of Ninh Thuan province in 2014.

Table 2.5: Highest Daily Rainfall recorded in Many Years

Station	Phan Rang	Nha Ho	Tan My	Ba Thap
Rainfall (mm)	235,5	232,2	236,2	288,1
Date	02/02/1986	18/11/1979	16/11/2000	13/03/1991

Source: Ninh Thuan Provincial Meteo-hydrology Forecasting Center.

Total annual evaporation potentials in the area reaches 1700-1800 mm. Daily evaporation potential ranges from 4.6 to 6.4 mm in dry seasonand from 2.5 to 5.1 mm in rainy season.

Table 2.6: Average Monthly Evaporation

Monitoring station	Month												Year
	1	2	3	4	5	6	7	8	9	10	11	12	
Phan Rang	190.2	183.6	175.8	154	142.4	145	151.8	152.6	115.3	104.8	137.2	156.2	1816.1
Nha Ho	155.5	151.1	178.9	159.1	143.3	136.5	160.9	176.2	103.3	79	91.4	134.6	1.670

Source: Ninh Thuan Provincial Meteo-hydrology Forecasting Center.

Total annual radiation is from 150 to 170 kCal/cm^2/year. Average lighting time is about 12 hours a day.The average total annual sunshine hours in the city is about 2,516- 2,918 hours per year. Period having higher sunshine time is from January to August with an average of more than 200 sunshine hours per month.

The project area has monsoon climate with two main prevailing wind directions. Northeasterly wind prevails in rainy season (October to April) with average velocity of about 3 m/s. Southwesterly wind prevails from May to October with average velocity of 1.8 m/s. In May and June, southeasterly wind blows from the sea to onshore.

Table 2.7: **Average Monthly Wind Speed**

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
Average wind speed (m/s)	3.5	3.4	2.5	2.0	1.5	1.7	2.0	2.1	1.6	1.7	2.9	4.0	2.4
Average wind speed only accounted for the main wind directions (m/s)	NE	NE	NE	SE	SE	SW	SW	SW	SW	NE	NE	NE	
	4.5	5.1	4.3	4.2	4.3	3.3	3.5	3.6	3.5	4.1	4.3	5.5	4.18

Source: Ninh Thuan Provincial Meteo-hydrology Forecasting Center.

Hurricanes occur around September to December, mostly in October and November. On average one storm hits Ninh Thuan every 4 to 5-year. Due to topographic characteristics of Ninh Thuan province, the effect of hurricanes in PR_TC city is usually not as severe as in other central

provinces in Vietnam. However, storms may cause heavy rains in the upstream areas of Dinh River causing floods for some areas located along the river's banks, especially the sections without dikes.

2.1.8. Environmental Quality

2.1.8.1. Air Quality

Air quality monitoring data from 2011 to June 2015 presented in Table 2.8 shows that the air quality at the local key sampling locations in particular and in Phan Rang city is good, not polluted. Most of parameters are within allowable standards. Except at the Phan Rang Market, Total Suspended Particulates (TSP) in 2015 exceeded standards but not significantly. According to DONRE[8], the major sources emissions in the city are from transportation, construction, domestic activities and wastes treatment.

Noise level and ambient air quality tested during ESIA preparation presented in Table 2.9 shows that all parameters including TSP, SO2, NO2 and CO were within allowable limits set in QCVN 05:2013/BTNMT – National technical standards for ambient air quality.

[8]Ninh Thuan Environmental Status Report in 5 years (2011-2015). DONRE Ninh Thuan.2015.306 pages.

Table 2.8: Air **Quality Monitoring results in Phan Rang- Thap Cham** from 2012-2015 (implemented by DONRE)

No	Area	Label	Noise (dBA)	TSP (ug/m3)				NO2 (LOQ=10ug/m3)				SO2 (ug/m3))				CO (ug/m3)				CnHm (LOD= 40ug/m3)	H2S (LOQ= 7ug/m3)	NH3 (LOQ= 7ug/m3)
			2014	2012	2013	2014	2015	2012	2013	2014	2015	2012	2013	2014	2015	2012	2013	2014	2015	2014	2014	2014
1	Dong Hai Fish port	KK-HT08	54	230	96	113	129	62	64	11	4	37,1	18,3	20	20	7250	2324	3666	5485	KPH	-	-
2	Phan Rang market	KK-HT26	67	280	220	160	**342**	71,5	57,3	19	6	20	22,3	21	20	11500	3212	3918	6448	KPH	-	-
3	Dong Hai ward	KK-HT27	61	-	-	79	-	-	-	15	-	-	-	KPH	-	-	-	2929	-	KPH	KPH	KPH
QCVN 05:2013* QCVN 27:2010** QCVN 06:2009***			70**	300*				200*				350*				30.000*				5000***	42***	200***

Notes: KPH- Not detectable.

No	Sampling location	Coordinate		Sample label
		X	Y	
1	Dong Hai Fishing port	1253393	548942	KK-HT08
2	Phan Rang Market	1278280	580471	KK-HT26
3	Dong Hai Ward Urban Area	1277282	566161	KK-HT27

Source: Ninh Thuan Environmental Status Report from 2011 – 2015. DONRE. 12/2015.

Table 2.9: Results of Air Quality Monitoring at the Project Areas

Parameter	Unit	Analytical results											QCVN 05:2013
		KK-MTVN01	**KK-MTVN02**	**KK-MTVN03**	**KK-MTVN04**	**KK-MTVN05**	**KK-MTVN06**	**KK-MTVN07**	**KK-MTVN08**	**KK-MTVN09**	**KK-MTVN10**	**KK-MTVN11**	
Temperature	^oC	29.7	28.7	31.2	26.7	28.1	27.7	33.2	30.4	26.6	26.7	27.0	-
Humidity	%	60.4	62.5	56.8	66.2	65.8	63.8	54.7	62.7	69.7	65.1	69.0	-
Wind	-	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-
Wind speed	m/s	1.7-2.1	1.2-2.1	5.1-5.3	3.1-3.4	1.4-.16	1.7-1.9	1.3-1.7	2.6-2.8	2.1-2.4	6.8-7.2	6.9-7.2	-
Noise	dBA	61	61	55	55	54	57	67	65	57	54	68	70[(b)]
TSP	$\mu g/m^3$	80	154	74	27	74	73	7	101	86	54	86	300
NO_2	$\mu g/m^3$	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	200
SO_2	$\mu g/m^3$	KPH	KPH	KPH	KPH	KPH	31	29	KPH	KPH	42	KPH	350
CO	$\mu g/m^3$	14,790	8,136	7,238	15,095	7,055	7,265	13,252	7,904	8,640	11,417	10,240	30,000

Notes: KPH- Not detectable.

Label	Location	Coordinate(VN 2000)	Label	Location	Coordinate(VN 2000)
KK-MTVN01	At Thuy Nguyen restaurant gate in Huynh Thuc Khang road	x=1281421, y=0582713	KK-MTVN07	Point at Tan Tai canal in thong Nhat road	x=1279227, y=0580602
KK-MTVN02	At the first intersection in Alley 150 of 21/8 road	x=1280646, y=0579241	KK-MTVN08	In Nguyen Thi Minh Khai road, near the proposed Central lake	x=1280543, y=0582713
KK-MTVN03	At Ninh Thuan Museum, near to the joint of Cha La and Tan Tai canals	x=1278860, y=0581680	KK-MTVN09	At the proposed PS8, near the proposed Central lake	x=1279310, y=0579241
KK-MTVN04	Nearby the proposed pumping station PS6, near Cha La canal	x=1277684, y=0582504	KK-MTVN10	Nearby Binh Son park	x=1279743, y=0584206
KK-MTVN05	At the gate of WWTP	x=1276855, y=0582378	KK-MTVN11	In Phan Dang Luu road, the proposed resettlement area	x=1281215, y=0579861
KK-MTVN06	At gate of Quan Thanh temple	x=1277343, y=064671			

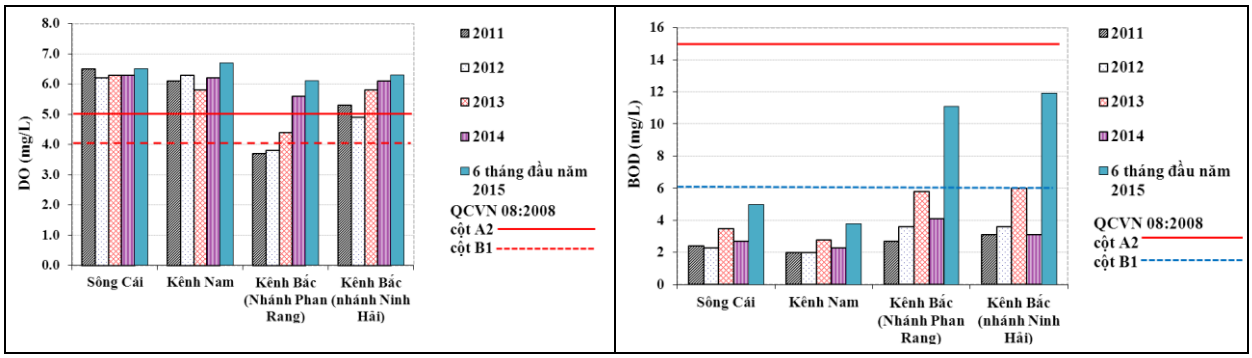
Source: Project ESIA Team. March 2016.

2.1.8.2. Water Quality

a. Surface Water Quality

Surface water quality monitoring conducted by DONRE from 2011 to 2015 in Dinh river shows that the river water quality (pH, DO, Fe, NH4 +, NO2, NO3, BOD5, COD and Coliforms) is still relatively good and not contaminated. Meanwhile water in the North (Bac) Canal and South (Nam) Canals have signs of organic contamination.

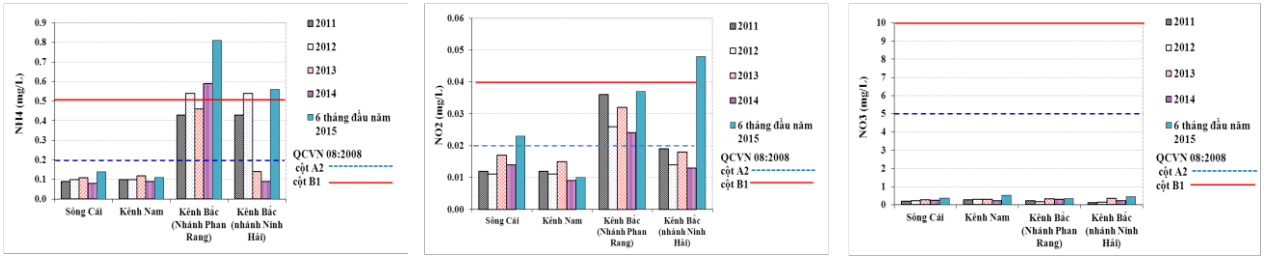
In the period of 2012 - 2014, surface water quality seemed to be stable, and most parameters met applicable standards. However, in 2015, the level of organic matters and nutrients has significantly increased and exceeded the standards, especially in the Phan Rang and Ninh Hai branches of Bac canal. Surface water in some places has signs of organic pollution with low DO and high BOD5. DO in surface water of the Bac canal of Phan Rang was low in 2011 and 2012. Although BOD5 concentrations did not exceed standards but seems increased over the years.



(Source: DONRE, 2015)

Figure 2.3. DO and BOD5 in surface water from 2011 to 2015.

Nutrient levels are demonstrated through $N\text{-}NH_4^+$, NO_2^- and NO_3^-. Many monitoring locations in the Bac canal of Phan Rang and the Nam canal of Ninh Hai had $N\text{-}NH_4^+$ exceeded allowable standards – Column B1, especially in Muong Co (Tan Tai canal) of the Bac canal of Phan Rang branch.



(Source: DONRE, 2015).

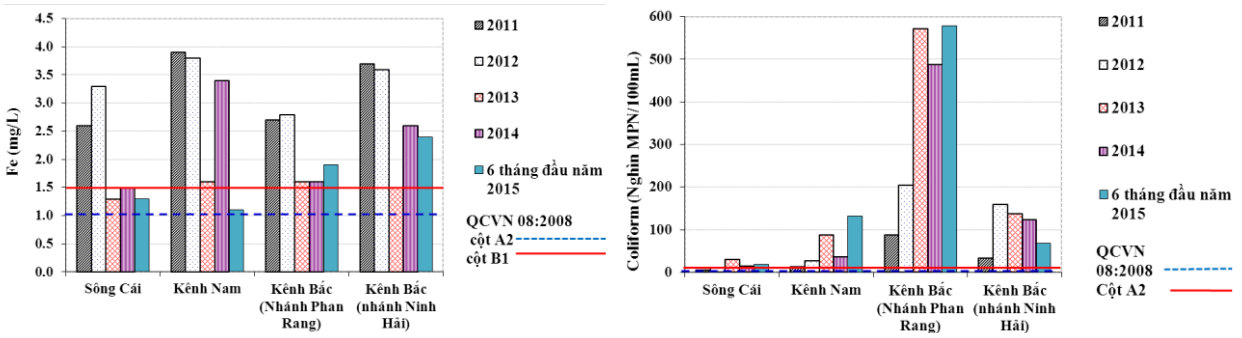
Figure 2.4. NH_4^+, NO_2^-, NO_3^- concentration in surface water from 2011 to 2015.

Surface water was contaminated with Fe, most monitored values exceeded QCVN 08: 2008/BTNMT[9]. Especially in the Nam canal from irrigation station (Phuoc Dan) to sewer no. 26 (An Hai), iron concentration is up to 3.9 mg/L.

Coliforms concentration was significant in surface water, fluctuated from $12x10^3$ to $5.7x10^5$ MPN/100mL, which exceeded from 1.6 to 77 times the limit set in QCVN 08:2008/BTNMT. The highest level was in the Bac canal of Phan Rang branch. The causes are supposed to be wastewater

[9]QCVN 08: 2008/BTNMT: National Technical Regulation on surface water quality, Column A2

discharged from industrial and agricultural production as well as domestic activities along the river.



(Source: DONRE, 2015)

Figure 2.5. Fe and Coliforms concentration in surface water, 2011 to 2015.

Surface water quality tested during ESIA preparation is shown in Table 2.10, and map of sampling points is shown in Appendix 1. The analysis results show that some parameters exceeded standard. Particularly, surface water in Tan Tai (Ong Co) canal had Coliforms concentration exceeded allowable limits from 61.3 times in the upstream to 613 times in the downstream. N-NH4+ and BOD5 met standards in the upstream but exceeded allowable limits at downstream. In Cha La canal, Coliforms concentration exceeded standard 3.1 times in the upstream and 5.7 times in the midstream. TSS and N-NH4+ concentration in the midstream and downstream surpassed the standards 1.3 times and 1.6 times respectively. Coliforms concentration at the beginning of TH5 canal exceeded 32 times. In Dong Hai regulation lake, BOD5 and CL concentration outreached the standards 1.2 times and 51.9 times respectively. It was noticeable that salinity in surface water of Dong Hai Lake was very high, at 24.7$^{o}/_{oo}$. Surface water in the Dinh River at the outlet of the wastewater treatment plant was saline with salinity at 10 o/oo. Cl- and Coliforms concentration exceed the standards 32.1 and 1.2 times respectively. TSS, N-NH4+, Cl- and Coliforms parameters at the Sinh Thai Lake exceed the standards 2.0, 1.4, 8.2and 10 times respectively.

Table 2.10: Surface Water Quality in the Project Area

Parameter	Unit	Analytical results											QCVN 08-MT:2015
		NM-MTVN01	NM-MTVN02	NM-MTVN03	NM-MTVN04	NM-MTVN05	NM-MTVN06	NM-MTVN07	NM-MTVN08	NM-MTVN09	NM-MTVN10	NM-MTVN11	
pH	-	8.1	6.7	9.0	9.2	7.2	6.7	7.1	8.0	7.6	7.9	7.0	5.5-9
Temp	^oC	27.2	28.3	29.5	29.0	28.4	29.4	28.2	28.5	28.2	28.3	28.7	-
Salinity	‰	0.1	0.1	0.09	0.29	0.14	0.09	0.11	24.7	10.4	10.5	0.44	-
TSS	mg/L	12.1	6.7	13.0	63.3	5.8	39.8	5.6	56.3	19.0	51.8	99.5	50
BOD_5	mg/L	1.5	16.0	3.0	6.8	2.3	5.1	4.9	18.2	5.4	4.8	5.0	15
$N\text{-}NH_4^+$	mg/L	0.11	3.9	0.39	0.39	3.24	0.15	0.05	0.48	0.34	0.57	1.24	0.9
Cl^-	mg/L	38	50	22	110	26	8	64	18.160	11.240	8.840	2.858	350
Total N	mg/L	KPH	6.3	KPH	3.9	5.0	KPH	KPH	6.3	KPH	KPH	6.9	-
Total P	mg/L	0.17	0.93	0.50	1.15	0.68	0.33	0.26	1.98	0.13	0.15	1.38	-
Mn	mg/L	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	0.5
Fe	mg/L	0.23	0.91	0.90	1.51	1.09	1.05	KPH	KPH	KPH	0.64	1.36	1.5
As	mg/L	0.0031	0.0028	0.0077	0.0110	0.0003	0.0016	0.0002	0.0084	0.0012	0.0055	0.0110	0.05
Oils & Greases	mg/L	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	1
Coliforms	MPN/100mL	460,000	4,600,000	23,000	23,000	43,000	240,000	23	4,600	9,300	2,400	75,000	7500

Notes: KPH- Not detectable.

Sample code	Sampling point	Co-ordinate (VN 2000)	Sample code	Sampling point	Co-ordinate (VN 2000)
NM-MTVN01	Beginning point of Tan Tai canal	x=1282198, y=0576919	NM-MTVN07	Cho Tan Tai canal- beginning point	x=1278394, y=0580836
NM-MTVN02	Downstream of Tan Tai canal (at joint of Da Tuong and Tran Thi roads)	x = 1277697, y = 0581152	NM-MTVN08	Dong Hai lake	x=1277315, y=0584695
NM-MTVN03	Beginning of Cha La canal	x=1281857, y=0579465	NM-MTVN09	Dinh River- WWTP discharge point	x=1277685, y=0581152
NM-MTVN04	Cha La canal- Ending point of Section CL3 in My Dong ward	x=1277559, y=0582719	NM-MTVN10	Dinh River- 150m downstream from WWTP discharge point	x=1276775, y=0582572
NM-MTVN05	Nhi Phuoc canal- near Cha La canal	x=1278404, y=0582508	NM-MTVN11	Sinh Thai lake	x=1279220, y=0582073
NM-MTVN06	TH5 canal- beginning point	x=1281909, y=0581169			

Source: Project team. March 2016.

b. Groundwater Quality

Groundwater tested by DONRE during 2011-2015 indicated that most of the tested parameters (pH, hardness, NH4+, Cl-, Fe and As) met QCVN 09:2008/BTNMT10. However, Cl- concentration in locations close to the sea surpassed the allowable levels. Particularly, groundwater sample NN-HT05 taken from Dong Hai ward had Hardness, NH4+ and Cl- surpassed allowable standards.

The groundwater quality tested during ESIA preparation is shown in Table 2.11. The data shows that Coliforms concentration in all samples exceeded allowable limits of QCVN 09-MT:2015/BTNMT from 14.3 times to 367 times, Chloride exceeded the allowable limits from 2.3 times to 44.3 times. Especially the sample from My Dong village had N-NH4+ concentration doubled the allowable limits and KMnO4-values are 1.6 times higher than allowable limits. Most samples in the Project areas show that water was saline.

Table 2.11: Ground Water quality in the Project Area

Parameter	Unit	Analytical result					QCVN09-MT:2015
		NDĐ-MTVN01	**NDĐ-MTVN02**	**NDĐ-MTVN03**	**NDĐ-MTVN04**	**NDĐ-MTVN05**	
pH	-	7.5	7.0	7.6	7.6	7.7	5.5 – 8.5
$N\text{-}NH_4^+$	mg/L	0.74	0.26	**2.01**	0.17	0.12	1
Fe	mg/L	0.5	KPH	0.56	KPH	KPH	5
Hardness	mg/L-$CaCO_3$	103.2	428.4	234.0	**613.6**	393.0	500
KMnO4 value	mg/L	3.20	2.56	**6.24**	2.14	0.85	4
Cl^-	mg/L	**11,080**	**1,350**	**2,030**	**850**	**580**	250
SO_4^{2-}	mg/L	88.3	135.4	55.2	140.0	84.6	400
Mn	mg/L	0.4	KPH	0.3	KPH	KPH	0.5
As	mg/L	0.0290	0.0047	0.0048	0.0140	0.0220	0.05
Coliforms	MPN/100mL	**43**	**1,100,000**	**2,300**	**93**	**240,000**	3

Notes: KPH- Not detectable;

Sample code	Sampling point	Co-ordinate (VN 2000)
NDĐ-MTVN01	Well at Thanh Khuong auto garage in Phan Dang Luu road, Phu Ha ward	x = 1281209, y = 0579801
NDĐ-MTVN02	Well of Mr Nguyen Ngoc Hung's family in My Binh ward	x = 1280130, y = 0581933
NDĐ-MTVN03	Well of Mr Bui Hon's family in Cluster 3, My Dong ward. A distance of 5m from the wall of WWTP	x = 1276930, y = 0582729
NDĐ-MTVN04	Well of Mr Xuan's family in No 73/43 Hai Thuong Lan Ong road, in Dong Hai ward	x = 1277348, y = 0584648
NDĐ-MTVN05	Well of Mrs Nguyen Thi Quyen's family in 106/4 Nguyen Thi Minh Khai road, Van Hai ward	x = 1280291, y = 0583892

Source: ESIA team. March 2016.

c. Wastewater Quality

Wastewater quality tested during ESIA preparation is in Table 2.12.

[10]QCVN 09-MT:2015/BTNMT: National regulations on ground water quality.

Table 2.12. Wastewater Quality in the Project Areas (Tested in March 2016)

Parameter	Unit	Analytical result						QCVN 14:2008/ BTNMT
		NT-MTVN01	NT-MTVN02	NT-MTVN03	NT-MTVN04	NT-MTVN05	NT-MTVN06	
pH	-	7.6	7.0	6.9	6.9	7.9	7.3	5 - 9
TSS	mg/L	80.0	158.7	9.2	273.6	313.0	25.7	100
BOD_5	mg/L	70.2	66.0	10.5	66.6	94.2	72.0	50
COD	mg/L	184.3	116.7	33.8	122.9	264.2	95.5	-
$N\text{-}NH_4^+$	mg/L	KPH	7.56	21.28	6.16	26.88	16.80	10
Total N(	mg/L	8.8	9.1	44.8	10.1	31.4	17.1	-
Total P	mg/L	1.85	0.56	3.46	1.77	3.69	1.82	-
Fe	mg/L	KPH	1.7	0.22	0.29	0.72	0.22	-
As	mg/L	0.0031	0.0002	0.0002	0.0150	0.0084	0.0064	-
Cu	mg/L	KPH	KPH	KPH	KPH	KPH	KPH	-
Pb	mg/L	KPH	0.0076	KPH	0.0995	0.0107	KPH	-
Cr	mg/L	0.0025	0.0074	0.0085	0.0308	0.0178	0.0074	-
Zn	mg/L	KPH	0.07	KPH	0.05	KPH	KPH	-
Oil & grease	mg/L	17.1	19.8	4.3	17.2	20.0	3.7	20
Total Coliforms	MPN/100mL	430	11,000,000	43,000	2,400,000	930,000	4,600,000	5,000

Notes: KPH- Not detectable.

Sample code	Sampling point	Co-ordinate(VN 2000)	Sample code	Sampling point	Co-ordinate(VN 2000)
NT-MTVN01	Treated wastewater at the WWTP discharge	x=1276897, y=0582441	NT-MTVN04	Domestic wastewater at Hai Chu bridge in Dong Hai ward	x=1277101, y=0584658
NT-MTVN02	A sewer in Thong Nhat road, near Tan Tai canal	x=1279226, y=0580589	NT-MTVN05	Manhole at the gate of Hong Duc hotel, nearby Binh Son park	x=1279767, y=0584123
NT-MTVN03	Treated wastewater at Ninh Thuan Provincial General Hospital	x=1280782, y=0581933	NT-MTVN06	Input raw wastewater at the city WWTP.	x=1276979, y=0582717

Source: ESIA team. March 2016.

It is noticeable that the TSS in the treated wastewater of the WWTP is higher than the untreated wastewater taken from the intake. BOD5 of both samples exceed standards. Although only one sample was tested, the data indicate that: i) the quality of untreated wastewater is unstable; ii) there could be some problems with the treatment of the WWTP. This issue will be examined in other chapters of the report.

Comments about wastewater quality:

The test results of 6 wastewater samples show that:

- Exception from BOD5 concentration exceeded the standards 1.4 times higher, the quality of wastewater taken at the WWTP outlet to the Dinh river (NT-MTVN01) had pH, TSS, $N\text{-}NH_4^+$, Biological oils/greases and Coliforms meeting the standards.
- The domestic wastewater in the sewer nearby Nuoc Da bridge in Thong Nhat road discharged to Tan Tai canal (NT-MTVN02) had pH, $N\text{-}NH_4^+$ and Biological oils/greases parameters meeting the standards. Meanwhile, TSS, BOD5 and Coliforms concentrations exceeded the standards from 1.6 to 2,200 times higher respectively.
- The treated wastewater at the outlet discharge of Ninh Thuan provincial hospital (NT-MTVN03) had pH, TSS, BOD5 and Biological oils/greases in ranges of the allowable limits. Meanwhile $N\text{-}NH_4^+$ and Coliforms concentrations exceeded the standards respectively 2.1 and 8.6 times.
- The wastewater taken at Hai Chu Bridge in Dong Hai ward (NT-MTVN04) had pH, $N\text{-}NH_4^+$, Biological oil/greases meeting the standards. While TSS, BOD5 and Coliforms concentrations exceeded the standards respectively 2.7, 1.3 and 480 times higher.
- The wastewater taken in a sewer in front of Hong Duc near to Binh Son Park in Yen Ninh road (NT-MTVN05) had pH and Biological oil/greases parameters meeting the standards. TSS, BOD_5, $N\text{-}NH_4^+$ and Coliforms exceeded the standards 3.1, 1.9, 2.7 and 186 times respectively.

  The input raw wastewater of the WWTP (NT-MTVN06) had pH value, TSS and Biological oil/greases concentration meeting the standards. While BOD_5, $N\text{-}NH_4^+$ and Coliforms concentrations exceeded the standards respectively 1.4, 1.7 and 920 times

d. Quality of Coastal Sea Water

In the period of 2011 – 2015, DONRE conducted monitoring activities of coastal water twice a year in every April and September with the main focus on 4 fish ports of Ninh Thuan province which are Na Ca fish port, Dong Hai fish port (PR – TC city), My Tan fish port and Ninh Chu fish port

The coastal water quality at fish ports serving sea transport purpose was compared to Column B2 of QCVN 08:2008/BTNMT.

Coastal sea water in Ninh Thuan province during 5 years from 2011 to 2015 has stable pH value from 7.5 to 8.2 which is within allowable limits. DO concentration fluctuate from 4.0 to 6.1 mg/L, meeting the standards (≥ 2). NH4+ concentration fluctuated from 0.09 to 0.78 mg/l, meeting the standards. Nitrite (N02-) concentrations fluctuated from 0.007 to 0.051mg/L, meeting the standards at almost fish ports; Exception from the observed concentrations at Ca Na fish port in 2012 was slightly exceeding the standards. Nitrate (NO_3^+) concentrations fluctuated from 0.03 to 0.30 mg/L, much lower than the standard limits. TSS concentrations fluctuated from 8.5 to 49.2 mg/L, meeting the standards. TSS concentration at Dong Hai fish port increased faster than that at the other ports over the years. TSS concentrations at Ca Na, Ninh Chu and My Tan fish ports tended to gradually increase over the period of time. PO_4^{3-} concentration fluctuated from 0.02 to 0.3 mg/L, meeting the standards. BOD5 concentration fluctuated from 1.7 to 8.9 mg/L, meeting the standards. COD concentration fluctuated from 6.1 to 34.7 mg/L, meeting the standards. Coliforms concentration at Dong Hai and Ca Na fish ports exceeded the standards, fluctuated from 2,729 – 106,680 MPN/100mL.

2.1.8.3. Sediment/Soil Quality

Surveyed results of the sediment/soil quality in the Project areas implemented during ESIA process were shown in Table 2.13. According to the analytical results, almost all the sediment/soil samples taken in the project's areas are meeting the allowable standards for agricultural and residential soils in accordance with QCVN 03-MT:2015/BTNMT. Only 3 out of 14 samples including one sample in Tan Tai (Ong Co) canal and two others from organic topsoil in the Central lake area had As concentration slightly exceeding the allowable limits for agricultural soil from 1.1 to 1.2 times higher.

Table 2.13: Sediment/Soil Quality in the Project Area

Parameter	Unit	Analytical result														QCVN03-MT:2015/ BTNMT
		BUN-01	BUN-02	BUN-03	BUN-04	BUN-05	BUN-06	BUN-07	BUN-08	BUN-09	BUN-10	BUN-11	BUN-12	DAT-01	DAT-02	
pH	-	7.0	6.8	6.9	7.0	7.5	7.1	7.0	6.8	6.8	7.1	6.6	6.9	6.1	6.2	-
Hg	mg/kg	0.2	0.1	0.3	0.2	0.2	0.1	0.5	0.1	0.1	0.7	0.2	0.2	0.4	0.3	-
As	mg/kg	**17.7**	8.75	6.44	2.21	0.92	11.5	7.74	13.3	**17.2**	**18.5**	11.9	14.6	2.31	1.33	15
Cd	mg/kg	0.08	0.12	0.18	0.05	0.06	0.11	0.13	0.09	0.09	0.06	0.1	0.22	0.11	0.11	1,5
Cu	mg/kg	28.7	23.6	26.4	5.6	6.2	21.8	22.6	20.7	22.7	6.0	24.4	34.9	1.2	5.7	100
Pb	mg/kg	28.6	29.2	26.8	6.4	6.6	27.7	10.5	21.6	25.9	5.6	32.8	30.6	14.6	17.2	70
Zn	mg/kg	119	76	77	26	20	58	101	61	65	22	64	107	12	47	200
Cr	mg/kg	23.5	31.0	34.2	6.7	5.8	32.4	19.7	16.7	32.4	4.6	31.6	36.6	2.8	8.7	150
Cl^-	mg/kg	-	-	-	3,986		65.7	-	-	-	-	-	-	-	-	-

Notes:

Sample code	Sampling point	Co-ordinate(VN 2000)	Sample code	Sampling point	Co-ordinate(VN 2000)
BUN-01	Beginning point of Tan Tai canal	x=1282193, y=0576947	BUN-08	Topsoil at northern part of the proposed Central lake	x=1280145, y=0582184
BUN-02	Tan Tai canal	x=1278217, y=0580861	BUN-09	Below topsoil layer at northern part of the proposed Central lake	x=1280145, y=0280184
BUN-03	Sediment in WWTP's lagoon	x=1276908, y=0582442	BUN-10	Topsoil at southern part of the proposed Central lake	x=1280389, y=0581955
BUN-04	South part of Dong Hai lake	x=1277304, y=0584688	BUN-11	Below topsoil layer at southern part of the proposed Central lake	x=1280389, y=0581955
BUN-05	North part of Dong Hai lake	x= 277367, y=0584812	BUN-12	TH5canal – point near to Cha La canal	x=1281763, y=0581171
BUN-06	Cha La canal –20m from Hai Thuong Lan Ong road	x=1277963, y=0582477	DAT-01	In the area of Nam Thanh waste treatment complex	x=1293234, y=0588557
BUN-07	Nhi Phuoc canal – near Cha La canal	x=1278381, y=0582520	DAT-02	In the proposed resettlement area	x=1281131, y=0584688

Source: Project ESIA team. March 2016.

To determine the salinity in sludge at some canal sections and Dong Hai lake where are in doubt of saline intrusion, the following points have been sampled for analysis of the chloride concentration,

Table 2.14: **Sampling points and analytical results of salinity in sludge/soils**

No	Sampling location	Co-ordinate (VN 2000)	Code	Chloride (mg/kg)
1	Dong Hai lake	x = 1277304, y = 0584688	BUN-MTVN01	3,986
2	Downstream section (CL6) of the Cha La canal – point at 30m upstream of Dong Ba bridge in My Dong wards	x = 1278217, y = 0580861	BUN-MTVN02	2,500
3	Cha La canal – point at the connection to the regulation lake	x = 1280274, y = 0581910	BUN-MTVN03	65.7

Result discussion:

Although the saline level in soils/sludge is not regulated by any national standards, the chloride concentrations observed sludge samples taken at the Dong Hai lake and the Section CL6 of Cha La canal are relatively high which need to be managed the proposal site properly in order to control the dispersion of salinity causing impacts on surround areas.

2.1.9. Biological Resources

2.1.9.1. Natural Protected Areas in Ninh Thuan Province

There are two National Natural Protected Areas in Ninh Thuan province, namely Phuoc Binh and Nui Chua National Parks. These areas have high biodiversity values.

Phuoc Binh National Park (a distance of about 62km from PR-TC city)

Phuoc Binh National Park is located in Phuoc Binh commune, Bac Ai district, Ninh Thuan province, about 62 km west from Phan Rang – Thap Cham city. Total square area of the park is 19,814 ha, of which strictly protected zone covers 10,486 ha, 9,144 ha for rehabilitation zone, 18 ha for administration and service areas and 11,082 ha for buffer zone.

Floral system of Phuoc Binh National Park can be divided into two types, including evergreen subtropical forest with broad leave trees and secondary evergreen subtropical forest.

- Evergreen subtropical forest with broad leave treeshas an area of 1,858.94ha distributed at the elevation of 1000m above the sea level in the west, north-west and north of the park. This forest type has been rarely affected, basically retained its primitive features. Plant species are very diverse.
- Secondary evergreen subtropical forest with an area of 721.1ha is located near old upland fields at the elevation of1000-1300m above the sea level. This forest type has been formulated directly from the evergreen subtropical forest as a result of human's activities.

According to the surveyed data up to now, there are 1,322 discovered floral species (1 species of May Cat Phuoc Binh has been newly added), belonging to 584 branches, 156 families of 7 different floral phylum in Phuoc Binh national park. Among the number of floral species recorded, up to 75 species are considered as rare, valuable and threatened at both National and International level, accounting for 6.1% of discovered species in the park. Of the 75 species, there are36 species (3% total discovered species) listed in the flora chapter of Vietnam's (1996), and 58 species (4.7% total species) recorded in the IUCN Red List.

Phuoc Binh National Park has many valuable plant species, such as: 2-leaf pine, Fokienia, blue cypress, yellow pine, Da Lat 5-leaf pine, chestnut, dalbergia oliveri, etc. The primitive forest areas have many rare and valuable plants distributing over approximately 2,000ha in the park, with 513 species of vascular plants belong to 116 families.

The terrestrial vertebrates in Phuoc Binh National Park have been recorded with 69 species of animals under27 families, 10 phylums; 206 birds species which belong to 50 families, 14 phylums; 34 species of reptiles (1 lizard specie in Phuoc Binh has just been added) belong to 12 families, 3 phylums; and 18 species of amphibians belong to 5 families, 1 phylum. In total there are 326 terrestrial vertebrates, including 50 species listed in the Vietnam's Red Data Book and 29 species listed in the IUCN Red List.

Nui Chua National Park(a distance of about 40km from PR-TC city)

Nui Chua National Park is located at about 40 km to the north of Phan Rang – Thap Cham city, has a total area of 29,865ha; of which the onland area is 22,513ha and the sea area is 7,352 hectare. The park areas are belonging to 8 communes of 2 districts named Ninh Hai and Thuan Bac of Ninh Thuan province.

Belonging to the total square area of 22,513ha, 13,360.6ha is considered as the strict protected area, 6,693.9ha is the ecological restoring area, and the remaining are buffer zone, administrative and service areas.

According to Ninh Thuan DONRE[11], generally the remained rich forest area in Nui Chua National Park is very limited (only about 0.065% of the total natural area), mostly the park is secondary forest types, especially the secondary broad leaf forest, which often grows green after exploitation (31.31%) distributes in most area of the park. Typically, this secondary forest type is rich forest and had been extremely exploited so that the forest structure changed. Another abundant secondary forest type is secondary forests recovering on large forest-loss land (accounting for 22.96%), this is the type of secondary forest derived from long -time uninhibited cultivation land or restored after forests had been depleted.

The sea area of Nui Chua National Park includes the coastal area of Vinh Hai commune, running from south of Chong rock to Vach rocky headlands, it is nearly 25 km long, and 4.5 km wide. This area has rich and diverse marine resources.

Flora and fauna in the park are quite diverse[12]. Specific records are as follows:

- Recorded 330 species of terrestrial vertebrates, with 84 species of mammals, 163 species of birds and 83 species of reptiles - amphibians. Among them are 46 species of rare and endangered species listed in the Vietnam's Red Data Book, The IUCN Red List and the index of Decree 32/2006 / ND-CP.
- Recorded 1,504 species of vascular plants which belong to five different plant branches in which 30 rare species are listed in the IUCN Red List.
- Recorded 350 species of coral in which 307 species of hard coral reef of 59 varieties, 15 families; especially 46 species of coral are recognized as new classifications in Vietnam.
- Nui Chua National Park is also recognized as an area for the population of sea turtles to give birth, they are 3 species *Eret- mochelys imbricata, Chelonia mydas, Lepidochelys olivace*.

2.1.9.2. Ecosystems in the Project Area

Terrestrial Flora and Fauna

So far there has been no study in specific quantity of plant and animal species in the city. However the results of a field survey and according to information provided by local residents, the characteristics of terrestrial flora and fauna in the city is as follows:

- Generally ecosystem in the project area is poor due to the city only has urban ecosystem, garden and agricultural land ecosystems. Terrestrial flora and fauna are simply pets and cultivated plants of households or amusement park.
- The vegetation in the city is mainly agricultural crops (rice, corn, potatoes, grapes, etc.), home garden crops (fruit trees, ornamental plants, etc.), park trees, and shrub. Animals in the area are mostly livestock animals and poultry, such as chickens, ducks, dogs, cats, pigs, goats, sheep, cows, etc.
- There is no area with high biodiversity value which needs to be conserved in the city; no species found belonging to rare species, no genes needed to be protected and no species listed in the Vietnam's Red Data Book.
- The city has no area playing important roles as food or breeding area for rare/ endangered/protected animals.

[11]DONRE. 2015. Report on Environmental Status of Ninh Thuan for 5 years (2011-2015). 306 pages.

[12]http://www.vqgnuichua.vn/thongtinchitiet.aspx?id=43

Aquatic Flora and Fauna

As discussed, the area of Phan Rang is the driest city of Vietnam. Water sources in the project area are limited. The canals and Dong Hai lake are small-scale artificially works built for agricultural irrigation and drainage. The Dong Hai Lake has been polluted seriously with domestic waste and wastewater, particularly in dry season. Thus the water bodies disturbed by the Project have no value in terms of biodiversity.

The fishes found in the canals are local popular species; they are adaptable and fast-growing species, without value in terms of biodiversity. Particularly, in Dong Hai Lake at the moment, there is no valuable fish or aquatic species because of water and sediment contamination and shallow water level.

Only two remarkable water sources in the project area are Dinh River and the coastal area in Dong Hai ward.

***/ Characteristics of Dinh River's Aquatic Ecosystem**

Up to now there has been no study in aquatic flora and fauna or ecosystem of Dinh River. Interviews with people living in the local region showed that no public record of rare endangered or valuable aquatic species in the Dinh River.

Because there are two weirs constructed on the main river's route including Nha Trinh and Lam Cam weirs, the river's flow has been divided into several segments. Therefore, the status of aquatic ecosystem of Dinh River is predicted to be relatively similar to the ecosystem of other large water reservoirs. Species of fish living in Dinh River would probably be locally common species; they live there and do not migrate.

***/ Characteristics of the Coastal Aquatic Ecosystem**

According to the information from DONRE, at present, there is no study or full statistics about marine biodiversity conducted in Ninh Thuan province in general and Phan Rang – Thap Cham city in particular. The latest data available is a Brief survey in biodiversity - Nui Chua National Park in 2009 conducted by the Nui Chua National Park. According to this report, in the coastal area of Vinh Hai commune, running from the South to Vach rocky headland is nearly 25 km in length, and 4.5 km in width at its widest with plentiful and diverse marine resources, the result of the survey in marine life is stated as follows:

- Coral: 197 species have been identified which belong to 49 genera distribute from Vinh Hy to My Tan village of Nhon Hai commune, the average coverage rate is 42.6% in which 14 species of coral were identified as new species in Vietnam which are: *Acropora tutuilensis, Acropora wallaceae, Montipora delicatula, Cantharellus noumeae, Barabattoia laddi, Favites paraflexuosa, Platygyra acuta, Platygyra contorta, Echinopora pacificus, Alveopora minuta, Porites negrosensis, Porites horizontalata, Acanthastrea brevis* and *Goniopora burgosi.*
- Reef Fish: There are 147 species belong to 81 genera, 32 families, the density is 361-1984 fishes/500m^2, at the average 739-564 fishes/500m^2;
- Mollusca: There are 45 species, including large size species such as: *Trochus, Strombidac* and *Tridacna*;
- Polychaete worm: There are 22 species; Crustacean: 24 species; Echinoderms: 13 species;
- Seaweed: There are 03 species, including *Enhalus acoroides, Thalassia hemprichu* and

- Sea turtles: There are 03 species in the coastal area of Nui Chua National Park which are *Eret- mochelys imbricata, Chelonia mydas, Lepidochelys Olivacea.*

a) Results of Aquatic Ecological Sampling and Analysis in the Project Area

During EIA study, the Project team has performed the sampling and analysis of several aquatic ecological samples in the project area. The results of the ecological analysis are presented in Table 2.15.

The analytical results of aquatic ecological samples taken in Cha La canal and Dinh River show that:

- There were not any phytoplankton and benthos species observed among the analyzed samples.
- There are only 3 species of zooplankton among the collected samples in Cha La and Dinh river canals.

Table 2.15: **Sampling Results of Aquatic organisms**

Factor	Analytical method	Unit	Analytical results								
			TS-MTVN01				TS-MTVN02				
Zoo-plankton (a)	Counting	Species	Copepoda		Larvae	Total	Rotatoria	Copepoda		Larvae	Total
			Mesocyclops leuckarti	*Hermocyclops hyalinus*	*Nauplius*		*Tintinnopsis sp*	*Thermocyclops sp*	*Mesocyclops leuckarti*	*Nauplius*	
		Individual/ sample	3	2	11	16	+	+	6	11	17
		Density (MNP/m3)	300	200	1,100	1,600	+	+	600	1,100	1,700
Benthos (a)	Counting	Scientific name	KPH				KPH				
		Number									
Phyto-plankton	Counting	Scientific name	KPH				KPH				

Notes: KPH- Not detected

Sample code	Sampling location	Co-ordinate (VN 2000)
TS-MTVN01	Cha La canal, point at before connected to Sinh Thai lake	x = 1279668, y = 0581862
TS-MTVN02	Dinh river, point near to the WWTP's discharge point	x = 1276729, y = 0582475

Source: Project team. 3/2016.

2.2. SOCIO-ECONOMIC CONDITIONS

2.2.1. Land Use

The area for different types of land use in the period of 2011-2015 is as follows,

Table 2.15: Land Use, 2011-2015

No	Type of land use	Year 2011		Year 2015	
		Square area (ha)	Rate %	Square area (ha)	Rate %
A	Total land area (1+2+3)	7,917.08	25.73	7,917.08	25.28
1	Agriculture	3,452.46	11.22	2,768.92	8.84
1.1	Paddy field	1,393.88	4.53	1,214.42	3.88
1.2	perennial crops	913.12	2.97	711.26	2.27
1.3	Aquaculture	86.82	0.28	64.86	0.21
1.4	Salt production	2.91	0.01	-	
1.5	Other agricultural lands	1,058.64	3.44	778.38	2.49
2	Non-agricultural land	4,328.55	14.07	5,061.18	16.16
2.1	Institutions	26.60	0.09	36.22	0.12
2.2	Land for national defence	2,129.36	6.92	2,137.16	6.82
2.3	Land for security	10.04	0.03	19.31	0.06
2.4	industrial zones	78.60	0.26	97.56	0.31
2.5	business & production	125.57	0.41	177.60	0.57
2.6	building material production	1.82	0.01	1.82	0.01
2.7	Heritage land	10.45	0.03	10.45	0.03
2.8	Land for waste treatment	5.11	0.02	5.11	0.02
2.9	Land for religious purposes	29.11	0.09	29.11	0.09
2.10	Cemetery	135.45	0.44	107.36	0.34
2.11	surface water bodies	35.51	0.12	32.80	0.10
2.12	infrastructure	812.59	2.64	1,170.45	3.74
2.13	urban dwelling	620.87	2.02	953.26	3.04
2.14	Remaining of non-agricultural land	307.47	1.00	282.97	0.90
3	Unused land (remaining)	136.07	0.44	86.98	0.28
B	Urban	7,005.34	22.77	7,500.00	23.95
C	Tourism	75.00	0.24	104.69	0.33
D	Rural residential land	73.58	0.24	52.58	0.17

Source: FS report of the project.

Urban lands occupy 23.95% of the total land area of the city and to be the highest land use type. In near future, the city has planned to develop some new urban areas, such as: Tay-Tay Bac residential area, Dong Bac residential area, Bac Tran Phu residential area, Dong Van Son Eco-urban area…

2.2.2. Population, Labor and Income

Phan Rang – Thap Cham city has a total population of 170,720people, of which 94.53% are living in the inner city and the remaining 5.47% are living in suburb areas. The population distribution in the 3 consecutive years from 2012 to 2014 is presented as follows[13].

Table 2.16: Population distribution in Phan Rang – Thap Cham City

No.	Administrative units	Area (ha)	Population (person)			Resident density in 2014 (person/km^2)
			Year 2012	Year 2013	Year 2014	
1	Thanh Hai Commune	9.12	8,950	8,960	9,330	1,023
2	Dao Long Ward	2.13	10,288	10,313	9,603	4,508
3	Dong Hai Ward	2.12	20,824	20,904	21,674	10,224
4	Do Vinh Ward	30.43	13,094	13,150	13,577	446
5	Dai Son Ward	1.47	7,230	7,310	7,489	5,095
6	Van Hai Ward	9.27	14,935	14,960	15,662	1,690
7	Tan Tai Ward	2.68	9,196	9,693	9,470	3,534
8	Thanh Son Ward	0.99	9,497	9,649	9,845	9,944
9	Phu Ha Ward	1.31	10,904	10,973	11,375	8,683
10	Phuoc My Ward	5.99	14,881	15,039	15,517	2,590
11	My Dong Ward	2.4	11,590	11,686	11,974	4,989
12	My Hai Ward	2.75	4,929	4,979	5,130	1,865
13	My Huong Ward	0.47	4,066	4,224	4,143	8,815
14	My Binh Ward	4.44	8,081	8,118	8,441	1,901
15	Kinh Dinh Ward	0.38	6,951	7,042	7,203	18,955
16	Bao An Ward	3.22	9,895	10,007	10,287	3,195
The city		79,17	165.311	167,007	170,720	2,156

Source: Statistical Year Book of Phan Rang – Thap Cham city, 2015.

The average population density of the city in 2014 was 2,156 persons/km^2, in which the Kinh Dinh Ward is most populous with density at 18,955 persons/km2 (around 5.0-8.5 times higher than the average density of the city) and the population density in Do Vinh Ward is the lowest, only 446 persons/km2. The population density in wards/communes in Phan Rang – Thap Cham City in 2014 is shown in the Figure 2.6.

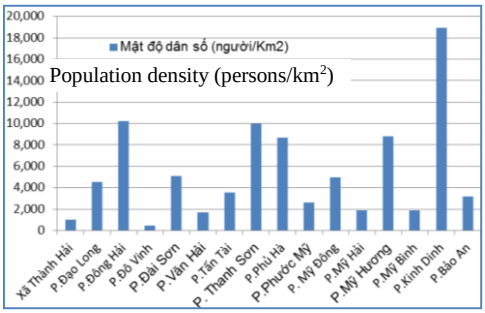


Figure 2.6: Population density in Phan Rang – Thap Cham City in 2014.

[13]According to the data from the statistical year book of the city 2015.

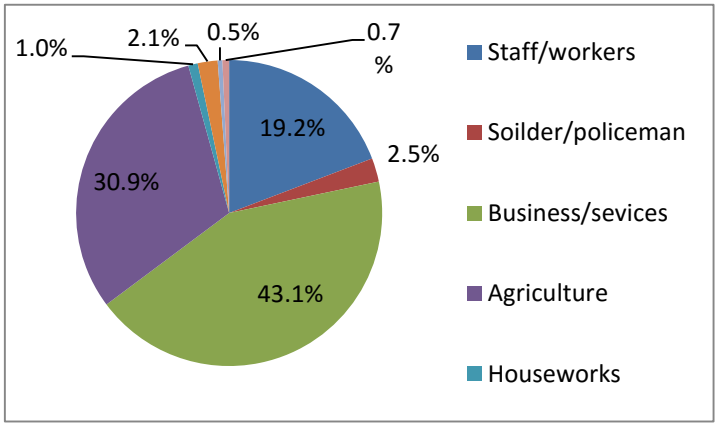
The total number of people in working age in 2014 was 121,941 persons. Among these, 61,336 people are male workers, accounts for 50.3%, and 60,605 are female workers, accounts for 49.7%. 115,234 workers have been working in urban areas; accounts for 94.5% and 6,707 are working in rural areas, accounts for 5.5%.

The existing employment rate is at 94.3%, mainly in non-public sectors with85, 050 persons, accounts for 96.4%. 2,918 persons working in public sectors, accounts for 3.3% and 289 persons in the foreign investment organizations, accounts for 0.3%. The unemployment rate accounts for 5.7% with 3.48% in the urban area and 2.22% in the rural area.

Social survey carried out in 12 wards/commune covering 2,276 households (1800 are beneficiaries and 476 are affected households of the project) were conducted in parallel with ESIA preparation. The survey shows that the average size of the households is 4.2 persons/household, mostly nuclear are families. 99.5% of interviewed persons were in the Kinh ethnic group, 0.5% was in the Hoa ethnic group. Although the Hoa ethnic people are not abundant, they live scatterly, intermingled with the Kinh ethnic people. Due to a long-standing with the Kinh people, the Hoa people's customs and living habits in the project areas are the same as of the Kinh people. They all know how to read and write Vietnamese language. Most of the interviewees have completed secondary school, high school or higher levels.

Occupation of householders

The survey show that the rate of householders working in business/services sector accounted for the highest, at43.1%; followed by the householders working as farmers accounted for 30.9%; the householders working as staff/worker and employees accounted for 19.2%; and the householders working in other industries were remaining with a small percentage. The proportions of respondents' occupation in the project areas are shown in the below figure.



(Source: SA report of the project)

Figure 2.7: Householders' occupation.

Family assets

According to the survey, motorcycles, televisions and multi media facilities are widely used in the majority of households in the ward / commune, this ratio reached respectively 60.9% and 60.4%. For motorcycles, in the past if any household had motorbike was considered prosperous/rich, but now when this item becomes very popular and diverse with many designs and at reasonable prices. They not only use it as a means of transportation but also a means of income generation, many families have more than 01 motorcycle but mainly in better-off households.

The number of households owning a mobile phone accounts for 49.7%, this is the canal of communication between family members and in the transaction. 49.3% families have been using household refrigerators. Only 2.8% of households own expensive assets such as cars. These are wealthy households.

With all sources of income considered, poor households accounted for 32.6% (741 households), middle-income households accounted for 54.3% (1,236 households) and better-off households are 13.1% (299 households). The number of poor households living in the surveyed localities is mostly living on agriculture, forestry households lacking of arable land, on fisheries but lacks of financial

resources for upgrading fishing tools, purchasing fishing nets; underemployed, life is hard, living in simple houses.

Source of Incomes, expenses and income Level

Household economic model is often mixed economy (agriculture combined with some other activities), so sources of incomes are also diverse. Income from casual employment is unstable but account for a significant portion of total income of households. The Table below shows the sources income by household living standard.

Table 2.17: Sources of Incomes by Living Standard

No.	Sources of Income	Poor HH		Medium HH		Better-off HH		Total	Rate (%)
		Frequency	Rate (%)	Frequency	Rate (%)	Frequency	Rate (%)		
1	Cultivation	149	20.1	193	15.6	36	12.0	378	16.6
2	Animal raising (included aquaculture)	70	9.4	17	1.4	15	5.0	102	4.5
3	Employment	251	33.9	262	21.2	54	18.1	567	24.9
4	Salaries/pensions	139	18.8	608	49.2	74	24.7	822	36.1
5	Trading/services	128	17.3	281	22.8	89	29.8	498	21.9
6	Saving	0	0.0	18	1.5	27	9.1	46	2
7	Given by children or relative	9	1.2	120	9.7	64	21.4	193	8.5
8	Others	0	0.0	85	6.9	85	28.5	171	7.5

Source: SA report of the project.

Structure of expenses and income as well as savings are differences between groups as detailed in Table 2.18.

Table 2.18: Monthly Average Income, Expenses and Savings

No.	Average income, expenses and savings		Average	Amount (VND)		
				Poor group	Middle group	Better-off group
1	Income	Household/month	5,680,000	2,970,000	6,040,000	10,910,000
		Person/month	1,350,000	780,000	1,410,000	2,370,000
2	Expenses	Household/month	4,390,000	2,750,000	4,630,000	7,490,000
		Person/month	1,050,000	720,000	1,080,000	1,630,000
3	Saving	Household/month	1,290,000	220,000	1,410,000	3,430,000

(Source: SA report of the project)

Total expenditure per household is VND 4,390,000 million household/month. The level of spending increases with higher living standards, particularly: VND 2,750,000 per month for poor households; VND 4,630,000 millions per month for medium group; and better-off group with VND 7,490,000 millions per month. In other words, the spending of poor household is only equal to about 37% of better-off households and 59% of average households in the same month.

Table 2.19: Households Monthly Average Income, Expenses and Savings

Household expenses	Average		Poor group		Medium group		Better-off group	
	% of total income	Amount	% of total income	Amount	% of total income	Amount	% of total income	Amount
Food	28.0	1,588,400	30.3	901,000	37.7	2,279,100	19.7	2,146,800
Education	11.0	626,700	17.3	514,900	13.0	784,900	11.0	1,199,300
Health care	3.2	181,300	6.5	194,300	3.2	193,900	3.2	347,900
Electric	3.1	173,400	7.9	234,700	3.4	208,100	2.6	288,700
Water	0.4	23,600	0.4	12,600	0.5	28,400	0.3	29,600
Sewage, waste fee	0.5	26,700	0.7	21,000	0.5	33,200	0.2	23,300
Production	3.9	220,700	5.6	166,600	4.8	288,400	4.3	473,800
Travel	5.7	323,200	5.8	171,600	6.0	364,100	6.1	666,300
Helping relatives	3.3	185,300	0.0	0	2.9	175,000	2.9	318,300
Others	18.3	1,041,300	18.0	533,400	4.6	274,900	18.3	1,996,000
Average	77.3	4,390,000	92.6	2,750,000	76.7	4,630,000	68.7	7,490,000

(Source: SA report of the project)

The survey shows that monthly expenditure accounts for 92.6% of total monthly income of poor households. Expenses on food accounts for a high proportion (30.3%), followed by others such as family business, account for 18%. Meanwhile, with the medium households, average expenditures account for 76.7% of total incomes, for better-off households, that rate is only at 68.7%. The Table 2.19 above also shows that the expenses for food accounted for the largest proportion of household's total income.

When asked "The income source of your family is stable or not? 43.2% of households said that their income is not stable; most of the respondent were medium households. According to the households, their income were unstable mainly due to agriculture is heavily dependent on weather; being sick; employment is irregular and business is small.

Vulnerable households

Vulnerable groups identified in the Project include the poor, ethnic minority, female-headed households, and households with old or disabled people. The rate of disadvantage groups identified in the survey is shown in the Table 2.20 below.

Table 2.20: Households'conditions

Group	Poor (%)	Medium (%)	Better-off (%)	Overall rate (%)
Poor[14]	27.9	0.0	0.0	9.1
Ethnic minority	0.0	0.4	2.3	0.5
Female-headed household	18.6	27.7	11.0	22.5
Family with disable and aged people	7.0	5.9	7.7	6.5
Not in the above mentioned groups	46.4	65.9	81.3	61.4
Total	100	100	100	100

[14] Old poor classification standard and confirmed by local authority

The survey shows that 61.9% of households are not in disadvantageous/vulnerable groups. Among the vulnerable group, female-headed households accounted for the most, at 22.5%, followed by poor households accounted for 9.1%, poor households with elderly and disabled persons accounted for 6.5%, families of ethnic minorities (Hoa) is with just 0.5%.

By economic status, there are no ethnic minority HHs in the poor group, 0.4% in the medium group and 2.3% in better-off group. This is because the ethnic groups, particularly ethnic Hoa, have lived for a long time with the Kinh, so their habits and traditions are just the same as the Kinh. Even they can use Vietnamese language fluently. In their daily life, they immerse in the Vietnamese community, do not encounter any barriers whatsoever. Thus they do not have any difficulties due to ethnic when doing business.

For the poor group, the rate of female-headed household is 18.6%, 27.9% are poor households and 7.0% are with elderly and disabled people. It can be said that the proportion of households in vulnerable/disadvantaged group is relatively high.

2.2.3. Existing Infrastructures and Services

2.2.3.1. Housing

In the central areas of the city, the construction density is relatively high, mostly residential houses; some wards in the suburb, construction density is lower. Total number of households in the inner city is 42,164. Total number of households owning house is 40,071, accounts for 95.04%.

For planning and development of new urban and residential areas, until now the city has formed five new urban areas, including Binh Son sea tourism urban area, Dong Bac new urban area (zone K1), Binh Son - Ninh Chu new urban area (area K2), the south of 16/4 road new urban area (axis D2 - D7) and Dong Nam new urban area.

2.2.3.2. Education and Training

There are 45 schools/1,040 classrooms in the city, including 6 high schools/190 classrooms. There are 29 kindergartens/ 242 classrooms in the city.

Socialization in education is receiving increasing concern, especially for early childhood education. There are nearly 100 kindergartens in the area with over 8,000 children. There are 19 schools meeting national standards which account for 47.5%. Currently 16/16 wards and communes have achieved universal primary education at the right age.

2.2.3.3. Health Care

Phan Rang-Thap Chap city has Provincial General Hospital of Ninh Thuan with 600 beds, Hospital for treatment and functional restoration with 60 beds, Social Disease Prevention Center (20 beds), Traditional Medicine Hospital (50 beds), General Clinic of Phan Rang – Thap Cham area (30 beds), General Clinic of Thap Cham area (30 beds), city health care centers, health care stations at wards/communes… The system of health care foundations are being increased and improved both in quality and quantity to meet the requirement of health diagnostics and treatment of people in the city as well as in the whole province.

2.2.3.4. Urban Lighting and Park

National electrical grid has covered 100% of the city area. The power supply meets the demand for production and daily actives for the city residents as well as investors. There are about 106 km of urban streets with streetlights which means nearly 100% of urban roads have streetlights. The lighting system in alleys reaches 60%.

There are 5 parks in the city. These are Binh Son, 14/6, Old Bus Station, Le Hong Phong and Hung Vuong parks.

2.2.3.5. Cultural and Historical Structures

There are no cultural structures located within the project's construction limits. However, there are some cultural structures located near the proposed project area as listed below.

1) Thien Hung Pagoda

The pagoda was constructed in 1927, is a small Buddhism pagoda located in Van Son village, Van Hai ward.The pagoda is about 100m from the north from the proposed construction site of the proposed Central lake.

Annually festive days of Thien Hung pagoda are on 01/01, 19/2, 8/4 and 15/7 (lunar calendar).

2) Quan Thanh Temple

Quan Thanh temple locates in Alley 68, Bach Dang road, Dong Hai ward. The temple is, about 50m to the north-west of the proposed construction site of Dong Hai lake.

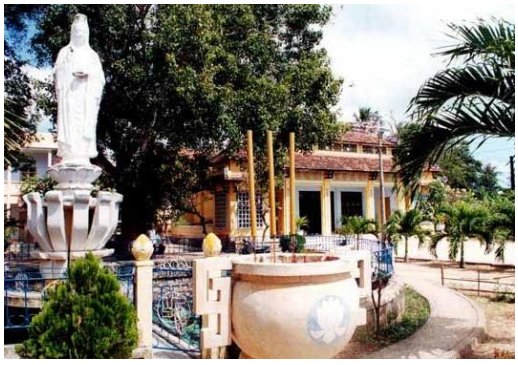
Quan Thanh temple is a small temple constructed in Duy Tan King period (about the first half of 19 century). The temple worships Sir Bui Huy Tan, a mandarin under Nguyen Kings.

Annually festive days are on 20/7 and 16/1 (lunar calendar).

3) Phan Rang Provincial Pagoda

Phan Rang Provincial pagoda (other name Sung An pagoda) is located at No. 56, in 21/8 road, Phu Ha ward, PR-TC city, about 50m to the south from the proposed Section TT3 construction site of Tan Tai canal.

The pagoda was constructed in 1947 with a total square area of 10,756m2. Annual festive days are on 16/01, 14-15/4, 12/5 and 8/12 (lunar calendar).



4) Tan Tai Parish Church

The church locates in Tran Thi road, Tan Tai ward, PR-TC city, about 50m to the west from the proposed construction site of Tan Tai canal.

Local people go to the Church on Sunday mornings, and during Christmast times

2.2.4. Socio-economic Conditions

Phan Rang – Thap Cham City is Urban City Class II in accordance with Decision 252/QD-TTg date 26/2/2015. The total state budget income in the city is about VND 1,328 billion the average income per capita is VND 40.3 million. The main economic sectors are trading-service (60%), construction (35%) and agriculture and fishery (5%).

The total state budget income in the city is about VND 1,328 billion, accounting for 73% of the total province (Economic Condition Report, 2015); the average income per capita is VND 40.3 million, higher than the one of Ninh Thuan Province (VND 28.8 million). The average growth rate is 13.5%. According the socio-economic development plant of the city, the growth rate shall be remained in around 13-14%, focusing on trading-service (60%), construction (35%) and agriculture and fishery (5%).

Agriculture and Fisheries: The new rural construction program has brought some positive changes with many effective production models having been expanded. The model of agricultural production associated with building a new countryside funded by KOICA organization from Korea has achieved some initial results and has being expanded to create more resources for the program implementation. The aquaculture production: Investment in building boats is effectively carried out. Together with continuous investment in building boats, fishing nets and tools with high capacity modern equipment, offshore fishing along with maritime cooperation pattern is enhanced and improved effectively.

Trade – Service: With the advantage of a centre of economy, politics, culture of the province, the urban technical infrastructure is more and completed and effective policies to attract investment are being implemented. Hence, supermarkets and markets have been developed widely in the province, creating good condition for production and business. The passenger transport services continue to develop with new investment in vehicles and meet the transport needs for commodities and passengers.

Tourism: The number of facilities increases continuously in both quantity and quality, promoting the connecting role with tourist attractions in the province, especially with key tourist areas such as Vinh Hy - Binh Tien Bay (Ninh Hai), Bau Truc pottery village and My Nghiep weaving village (Ninh Phuoc), etc. and gradually meeting demand of travellers. The city has carried out programs to promote and attract tourists to the city in the year the service quality is improved thanks to the investment and development of restaurants and hotels. The environmental sanitary and urban order has been better and the number of tours increases. Now there are more than 50 hotels and guest houses in the province and the number of tourists to 2015 is estimated at 1.2 million passengers, increasing 20% in comparison with 2014, in which the domestic tourists account for the major share (97.2%). The number of the foreign passengers for sight-seeing and resorts reduces 7.4%; the total social income from tourism reaches VND 510 billion, increasing 27.5% (Socio-economic report, 2015).

Industry: Currently, besides two industrial clusters in the province with many operating factories, some industrial projects have been put into operation such as Sai Gon – Ninh Thuan Brewery Factory, Tan Dinh Packaging Factory, Thong Thuan Fishery Processing Factory, Tien Thuan Garment Company, Yen Viet Company. The production value of the industry – construction is estimated at VND 3,460 billion, equivalent to the plan of the year, increasing 15.2% in comparison with 2014. In which, the value of the industry is estimated at VND 1,996 billion.

Agriculture - Fishery: The total production value of agriculture-fishery was estimated at VND 469 billion in 2015. The value of agricultural products reached VND 180 million/ha. Regarding agricultural production, it is directed to archive high quality crops and high economic value in line with the process of urban development; the prevention of diseases in plants and animals is always strictly controlled; dredging canals and water regulation are implemented to ensure water for

irrigation. The total planting area is 4,521 ha. Total seafood output is estimated at 15,312 tones increasing 16.24%; the production value is estimated at 194.2 billion, or 92.8% of the plan.

2.3. EXISTING TECHNICAL INFRASTRUCTURES

2.3.1. Transport Systems

Road Transport

External transport system includes Highway 1A (Le Duan), Highway 27 (21/8 road), Phan Dang Luu road.

- National Highway 1A section running through the city centre has a length of 6.7km, 20m wide asphalt concrete road surface. This is the main traffic route of the city connecting with the provinces in the region and the economic centres of the country.
- National Highway 27 was constructed before 1975. The section running through the city is 7.2 km. The asphalt concrete carriageway is 10 meter wide and roadbed is 12 m wide.
- National Highway 1A and National Highway 27 are the main routes connecting North-South routes and connecting with Highland area. The roads have high traffic density. Now, the people are living full in the area along National Highway 27, increasing the traffic density of the route.
- Phan Dang Luu Road is constructed to reduce the traffic load for National Highway 27 but there are no connection roads. Therefore, the function of the road is not fully utilized.

Currently, there are 131 roads in Phan Rang – Thap Cham City with a total length of 115.9 km having been constructed 100% of asphalt concrete. Roads in the center areas have high transport density. The northwest area along National road 27 is mostly unique way. Provincial roads including 702, 703 and 704 connect externally the city with other districts. Connected with the national and provincial roads are inner city existing main roads and planned roads. The main road network in the inner city are Hai Thuong Lan Ong, 16/4, Tran Phu, Nguyen Van Cu, Nguyen Thi Minh Khai and 21/8 Roads.

Waterway Transport

There is Dong Hai Fish port, which locates at Dinh river mouth is a small fish port in the city.

Railway Transport

The section passing through the city of Vietnam North – South railway route has a length of about 8.6km. The railway running through the city creates favourable conditions for travelling and transporting from the province to other whole country from the north to the south of Vietnam.

Airway

The province has no civilian airport. However, the Cam Ranh airport (in Khanh Hoa province) is only about 60km from the PR-TC city to the north. Nowadays, Government has planned to construct a highway route for going from the city to Cam Ranh airport.

2.3.2. Water Supply Conditions

Currently the city is using the surface water source of Dinh River to supply for the domestic and other productive water demands. The PR-TC clean water supply system has a total capacity of

52,000 m^3/day, including raw water intake works, water treatment factory and clean water pump stations.

The city has total 428.3km long water pipelines installed along the existing roads. On average, every each person in the inner city areas has been supplying with an amount of 132 litres clean water per day. And a percentage of about 90% of the urban population are using tap water. In general, the water supply system of the city is relatively enough for the water use demands for the socio-economic development.

Figure 2.8: a picture of the Phan Rang - Thap Cham water supply factory.

The social survey results showed that households mainly use one water source, accounting for 81% of surveyed households. The number of households using two water sources accounted for 17.6% and 1.4% is the percentage of households using water from more than three sources. The water is being used in the province included: Tap-water, well-water, rainwater and purchased water bottles.

Table 2.21: Number of water sources being Used by HHs

No. Water sources	Poor group		Medium group		Better-off group		Frequency	Rate (%)
	Frequency	Rate (%)	Frequency	Rate (%)	Frequency	Rate (%)		
1 source	523	70.6	1057	85.5	264	88.3	1844	81.0
2 sources	215	29.0	158	12.7	28	9.4	401	17.6
More than 2 sources	3	0.4	22	1.8	7	2.3	32	1.4
Total	741	100	1236	100	299	100	2276	100

(Source: SA report of the project)

Water consumption for basic demands such as eating, drinking, bathing, washing of household is relatively quantified and calculated, summarized in the table below. It was found that, average water consumption is 103 liters/person/day (equivalent to 430 liters/household/person).

Table 2.22: Daily Water Consumption of HHs

Daily living purposes	Overall average (L/person/day)	Poor (L/person/day)	Medium (L/person/day)	Better-off (L/person/day)
Eating, drinking	2.405	2.405	2.275	2.99
Cooking	20.28	19.045	19.89	22.295

Bathing, washing	80.08	62.855	85.085	74.1
Total	102.765	84.305	107.25	99.385

(Source: SA report of the project)

The percentage of households invests in water treatment by household size very small, only 4.1% of the surveyed households. The investment in water treatment facilities by household size is mainly made by better-off/rich households and some households have average living standards. Poverty households are less interested in investing furthermore water treatment facilities.

According to the survey results of current state, the percentage of the households surveyed were connected to the household water supply with city clean water system is 72.5%. The remaining 27.5% of households where answers are not connected, they provide a lot of reasons for not connecting but almost concentrated in: the cost is too high; household has water wells and ensure sufficient current living...

Table 2.23: Rate of Connection to Clean Water Supply

Actuality connection	Poor group		Medium group		Better-off group		Overall average	
	Frequency	Rate (%)	Frequency	Rate (%)	Frequency	Rate (%)	Frequency	Rate (%)
Connected	475	64.1	878	71.0	297	99.3	1.650	72.5
Not yet connected	266	35.9	358	29.0	2	0.7	626	27.5
Total	741	100.0	1236	100.0	299	100.0	2.276	100.0

(Source: SA report of the project)

2.3.3. Sanitation Conditions

2.3.3.1. Drainage Basins

The existing drainage system of Phan Rang-Thap Cham city is combined sewer system, including a network of sewers sized D400 - D1,000mm and ditches, box culverts sized B300 - B800. The drainage network focuses mainly in the city centre and along the main roads to serve the basin area of about 1,000 hectares. However, coverage of drainage network is still low. Exception from some proportion of self-infiltrated into the soil, rain water flows on the surface on follows drainage network to be discharged into the drainage canals and finally discharged to Dinh River. On the other hand the existing size of sewers has not been calculated for the basin square area; the slope laying the sewers are totally follows the slope of roads, thus the drainage capability is quite limited, leading to flooding in many areas.

In addition, the encroachment of existing drainage works, reduction of surface areas during the urban and economic development affect the current state of the drainage system. Along with that, the conditions of management and operation of the drainage system such as equipment, personnel, organizational, legal and financial conditions are still not meeting the drainage requirements.

The rate of wastewater collection in the whole city is currently reaching about 15%.

The urban areas mainly locate at the north of Dinh River and are surrounded by over 10km dyke with the top elevation of 6.2m. In the inner urban area, the construction elevation varies from 3.5m to 7.0m. The paddy field at the northern west is a lowed area, with elevation from 1.5m to 3.5m. The southern and southern east areas have evaluation from 2.5m to 7.5m with scattered sand bar. The highest area is the hill near Thap Cham. The southern area of Dinh River is the undeveloped

urban area because there is no dyke, elevation varying from 1.5m to 3.5m and normally the area for flooding drainage of the city.

The whole city has three main basins, including:

Basin 1 includes the old urban along the northern side of Dinh River to National Road 27B, discharging to Tan Tai canal and the lake of Park 16/4, then to Dinh River at the east of the city. Existing sewers are developed following the road projects in different periods, and then the quality is deteriorated and not comprehensive. Tan Tai canal was constructed from hundred years ago, with its initial function of irrigation for the agricultural land in the northern west and the eastern areas of the city. Currently, that canal is still serving for agricultural irrigation and drainage of the city. The elevation of the canal bed is high, therefore many sewers from roads in the city centre such as Thong Nhat road, Hung Vuong road, Le Loi road, 16/4 Road, Le Hong Phong road, Tran Hung Dao road and Road 21/8 cannot utilize their function. The combined sewerage system was constructed with dimension of sewers, culverts from BxH=400x600; D500-D1000 mm, however, compared to the existing road network of the city, number of sewers, culverts, canal is not satisfactory to the city demand. Many areas are seepage and runoff to the lower areas when raining and causing local flood.

Basin 2 is for the areas where are presently the paddy rice fields, decentralized population areas from Thap Cham area to the sand bars along Ninh Chu sea, main drainage direction is to Cha La canal, Tan Hoi canal, then to Dinh river at the southern east.

Basin 3 is for Ca Na, Ninh Chu and sand hills along the seashore, with gravity drainage to the sea. The main sewers have mainly installed in the main roads in the downtown area, with a total length of 42.9 km, which is 8.8 km of the drainpipe, the remaining 34.1 km of the box culverts. The tertiary drainpipe is only 22.3 km covering 52% of total sewer line of the city. Therefore, capability of wastewater collection and rainwater is very limited. Investment demand for water drainage systems are crucial for PR-TC City.

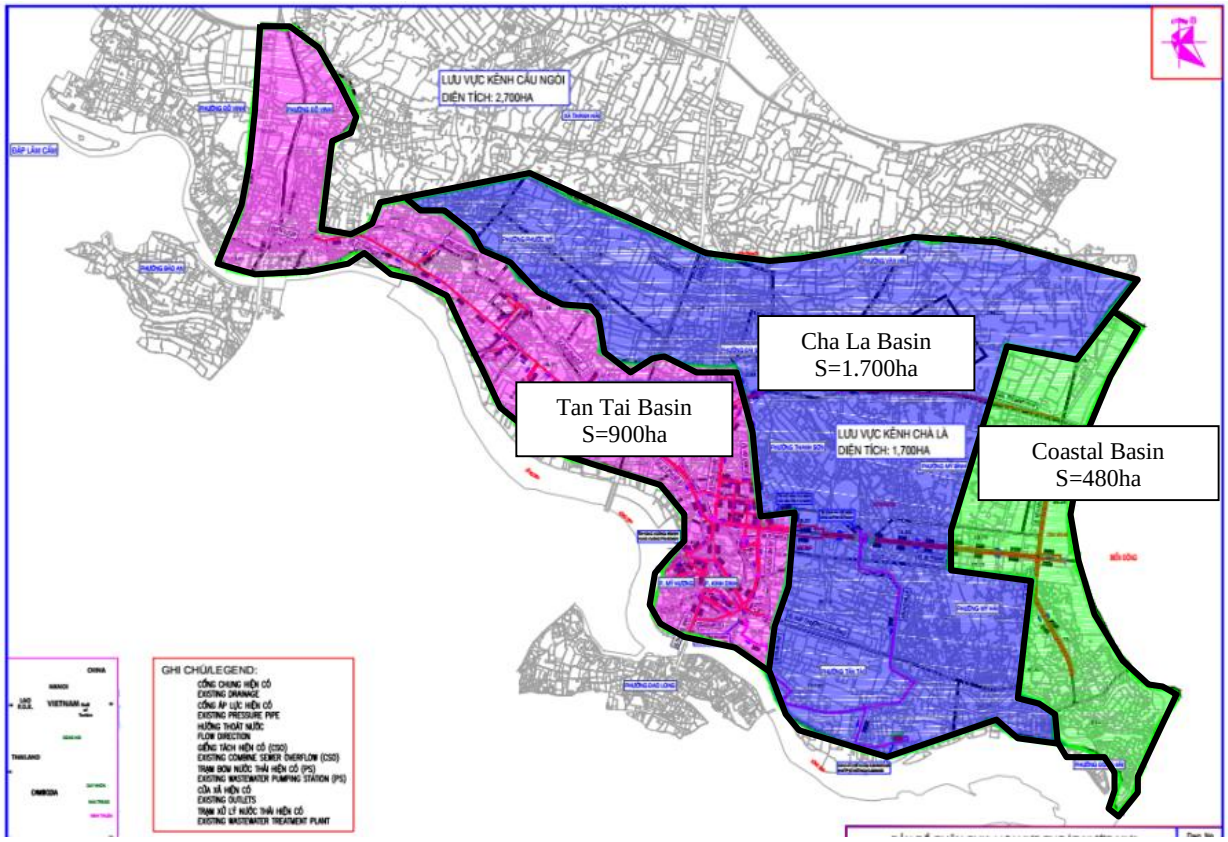


Figure 2.9: The wastewater basins of PR-TC city.

Results of the social survey shows that 95.0% surveyed households have their owned toilets.In which, septic toilets account for highest rate (94.8%); semi-septic toilets account for 3.9%; only 0.2% of the households using bucket toilets and 1.1% of households use unsettled toilet. That is why most of toilets of the people in the city are septic so 90.5% of comments responded that their current sanitation work is clean and hygienic.

2.3.3.2. Regulation Lakes and Main Drainage Canals

Main drainage system of the City includes Tan Tai canal, Cha La canal and Cho Tan Tai canal, in combination with regulation lakes such as the 16/4 park lake, Kinh Dinh lake and the Sinh Thai lake. Kinh Dinh lake located in Tan Tai ward has an area of 0.74 ha, a regulating capacity of about 18,000 m^3 for Phan Rang market and adjacent areas in Kinh Dinh, Dao Long and My Huong wards. The Sinh Thai lake has an area of 10 ha, a regulating capacity of 100,000m^3. The Sinh Thai lake is connected to Cha La canal for storm water drainage to Dinh River. The 16/4 lake locates in the city centre, functions as landscaping and storm water drainage for the city centre.

a) Tan Tai Canal

Start point of Tan Tai canal is at the coordinate of 11°35'36.5"N 108°57'25.8"E; and end point of the canal is at coordinate of 11°33'09.7"N 108°59'45.3"E.

The gate near the Lam Cam weir

Starti n canal and a gate next to the Lam Cam weir on the Dinh river, Tan Tai canal runs through PR-TC city with a total length of nearly 7 km, In Bao An ward the canal is divided into two branches namely Tan Hoi canal and Tan Tai canal.

Water from this open canal irrigates of 567ha of agricultural. The canal also functions as the main drainage channel for the city. Currently many sections of the canal have been filled up with sediments, and polluted by solid wastes and wastewaters. Since the main function of the canal is agricultural irrigation, the elevation of the bottom bed is rather high; the width at the downstream is narrower than upstream. The canal always maintains water level for irrigation, therefore the drainage capability of the canal is rather limited. The canal can be divided into 6 sections as follows.

Section TT1: This section is 332 m long, 6-10 m wide, starting from the Ba Hong Sluice Gate (behind the Thap Cham Petrol Station to the area behind the stadium. This section is an earthen

canal; the flow has been obstructed and polluted with the wastes discharged from local households. The canal has been sedimented with a layer of around 0.7m thick of deposits, mud and wastes the flow.

On 21/8 road side, section 1of the canal has been often invaded with residential houses. Local residents living near the canal often dispose wastes and wastewater into the canal. The other side of the canal has on-bank management road..

It is needed to be noted that there is a cemetery with about 30 graves located at a distance of about 6m far from north bank of the canal in section flowing through Phuoc My ward (at point with coordinate of 11°35'21.1"N 108°58'07.7"E).

Figure 2.10: Typical examples of Section TT1 – Tan Tai canal.

SectionTT2: running along the road behind the stadium continuously from the endpoint of Section TT1 to Le Duan road with a length of 332m. This canal section was culvertilzed with dimension of BxH=2.4x1.6m. The culvert surface has been used as internal traffic route for the local residential area. Due to the canal cross section of this section is quite narrow, garbages disposed from the canal riparian areas are causing the stuck flow and locally floods and environmental pollutions.

Figure 2.11: Typical examples of Section TT2- Tan Tai canal.

Figure 2.12: Existing conditions along the Section TT2 of Tan Tai canal.

Section TT3: starting from Le Duan road and ending at Thong Nhat road, 1,384m long and 4 m wide. This canal section has a sediment layer of 0.8 m thick. The canal cross section has been narrowed down by residential house invasion. There is no management roads, only houses and fence facing water surface. There are some trees, green space and bridges crossing the canal at some locations. Section TT3 is divided into two sub-sections including:

- First sub-section from Le Duan road to Tran Phu road is a soil canal with an average width of 4m, without management road along the banks.
- Second sub-section from Tran Phu road to Nuoc Da bridge in Thong Nhat road is an existing canal with dimension of BxH=4.0x0.8m; canal's bottom has been settled with a sediment layer of about 0.8m.

Figure 2.13: Typical examples of Section TT3- Tan Tai canal.

The canal is polluted; water is very turbid and hardly moving at some locations. In other locations, there are some floating plants on the water surface. As mentioned in the section 2.2.3.5 above, Phan Rang Provincial Pagoda is located in the middle of this section.

Figure 2.14: Existing conditions along the Section TT3 of Tan Tai canal.

ScetionTT4: From 16/4 road to Ngo Gia Tu road, 749m long, about 4m wide. Sediment layer is about 0.8m thick. The canal cross section has been narrowed down by residential house invasion. Drainage capability is very low, water overflow riverbanks under normal operational condition. Section TT4 is divided into four sub-sections including,

- First sub-section from 16/4 to Anh Sang Kindergarten: there is no management road, local houses encroached both the banks.
- Second sub-section from Anh Sang Kindergarten to To Hieu road: there are houses on the left bank and a 3m-wide concrete road on the right bank.
- Third sub-section from To Hieu road to Nguyen Trai road, 180m long. There are houses on the left bank and anearthen road on the right bank. Only part from the Cham Cultural House (located about 30m far from the construction site along the management road) to Nguyen Trai road has no management road, but households on both canal sides.
- The remaining sub-section is from Nguyen Tra road to Ngo Gia Tu road, 170m long. Along the part from Nguyen Trai road to PR-TC city clinic, there arehouses on the right bank and an existing 2.5m-wide concrete road on the left bank. The remaining part has houses are located along both banks andwithout management roads.

Figure 2.15: Typical examples of Section TT4- Tan Tai canal.

Figure 2.16: Existing conditions along the Section TT4 of Tan Tai canal

SectionTT5: From Ngo Gia Tu road to Hai Thuong Lan Ong road, 427m long. The canal has cross section of dimentions BxH=2.3x0.8m and stone embankments. This canal has been sedimented with a layer of 0.75m; Along the first 140m, there are 3-3.5m-wide management road on both sides; the remaining part towards Hai Thuong Lan Ong road, there is 2.5m-wide earthen road on the right bank, the left bankis covered with thick vegetation and there is no road. Drainage capacityis quite weak, water usually overflowing the bankment.There are power lines and poles running along the left bank.

Figure 2.17: Typical examples of Section TT5- Tan Tai canal.

Figure 2.18: Existing Conditions along TT5 Section of Tan Tai canal.

SectionTT6: from Hai Thuong Lan Ong road to the Dinh river dike road, 587m long. There is a sediment layer of 0.75m thick. Embankment is stone on one side and earthen on the other side. The endpoint of the canal is on rice field, there is no connection with the Dinh river thus drainage capacity has been limited.

The canal in this section is narrow, there are access to canal-side houses. Along the first one third of the canal section, there are residential houses but without management road. The sensitive receptors along the canal route are the Tan Tai Parish Church which is located 50m from the right of construction site, theTran Thi Primary School located on the left of the construction site in Tran Thi road;.

Figure 2.19: Typical Landscape of TT6 Section - Tan Tai canal.

Figure 2.20: Existing conditions along the Section TT6 of Tan Tai canal.

b) Dong Nam Canal

The existing Dong Nam canal is a small irrigation canal B=0.8-1.5m, L=1,379m, connecting Tan Tai and Cha La canals, running parallely with Hai Thuong Lan Ong road. Both sides along the canal are mostly existing paddy fields and gardens. However, in the ending part towards Cha La canal, there are also some houses located along the canal-side earthern road.

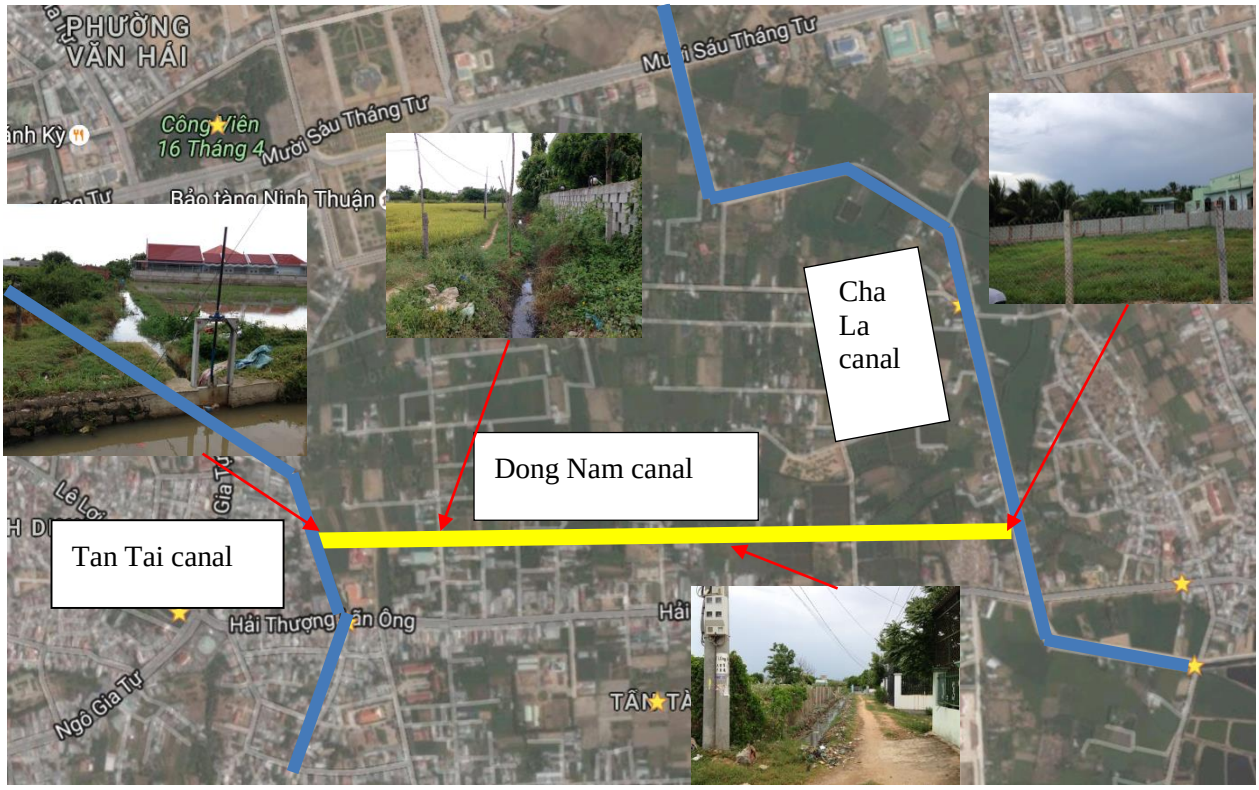


Figure 2.21: **Existing conditions along the Dong Nam canal.**

c) Cha La Canal

The Cha La canal is about 7.6km long, starts in Truong Dinh road and ends at Da Bac Bridge in Hai Thuong Lan Ong road. The canal has trapezoid shape, BxH=(2-10)x 1.2-2.7 m). The canal was constructed in 2005to irrigate about 1,555ha of agricultural land and to function as drainage for designed floe rat rate at 1.63-8.44m3/s. Currently, the embankments along 5.48 km of the canal has been lined, and the remaining 2.23km still has earthen embankments.

Along the canal, the concrete roads were constructed on both sides in 3.6 km and the remaining side is the earthen road in 4.1km. It is mainly agricultural land along the both banks and will be converted as the urban land according to the plan to year 2025, which was approved in 2009.

Similar to the Tan Tai canal, Cha La canal also receives water from Dinh River through TH5, (which is connected to the Tan Hoi canal) and from the low laying areas at the upstream. At the downstream, the canal has been directly affected by tide of Dinh River, approximate 1.0 km from the tidal control gate at the downstream.

Upstream of the Cha La canal is mainly agricultural land, few residents living along the banks. There is a gate for salinity intrusion control. Some sections have beautiful landscape with trees and flowers.

Figure 2.22: Typical examples of Cha La canal.

Many parts at downstream of Cha La canal has been seriously polluted by domestic waste . Canal cross sections at some locations have been reduced when road were built. Some sections have management road on one side only due to encroachment of the canal water surface. There are only few houses along the canal, rice fields and fruit gardens are the main land use along the Cha La canal.

Figure 2.23: Existing Condition at Downstream Sections of Cha La canal.

The canal can be divided into 6 sections, including:

Section CL1: from beginning point in Truong Dinh road to Nguyen Van Cu road with alength of about 3.1 km was constructed with concrete embankment on both sides. The existing canal dimension is B1xB2xH=(2-4)x(5.6-7.6)x1.2m and the sediment layer is about 0.2-0.3m. There is a 6m wide concrete road constructed on the right, and a 2m wide earthen road on the left side of the canal. The canal runs along mostly agricultural land, except from km 2.5, there are some houses along the road on the right side of the canal. The canal is dry at some sections at the time visited, vegetation grow within the canal bed. While there are bridges to connect the two sides of the canal, local people placed some timber pieces for accessing the other side of the canal.

Figure 2.24: Typical examples of Section CL1- Cha La canal.

Figure 2.25: Existing conditions along Section CL1 of Cha La canal.

Section CL2: from Nguyen Van Cu road to the Sinh Thai lake with a length about 0.94 km has not yet constructed embankment. There are management earthen roads on both sides, 6m-wide road on the right bank and 2m-wide road on the left bank. There are some houses along the road on the right handside; the left handside is mostly agricultural land.

Figure 2.26: Typical examples of Section CL2- Cha La canal.

Section CL3: from the Sinh Thai lake to 16/4 Road with a length of about 0.26km has been constructed concrete embankment on both sides sizedB1xB2xH=8x11.6x1.2m. There are a 6m-wide management earthen road on the right bank and a 3m-wide earthen road on the left bank. Floating vegetation is observed. There is a small concrete bridge for crossing the canal.

Figure 2.27: A typical example of Section CL3- Cha La canal.

Section CL4: from 16/4 road to Hai Thuong Lan Ong road with a length of about 1.65km has been constructed concrete embankment on both sides. The existing dimension of the canal is B1xB2xH=(8-10)x(11.6-16.6)x(1.2-2.2) m. There are 6m-wide and 2m-wide management earthen roads respectively on the right and the left banks. A power line constructed along the left side if the canal. Natural floating vegetation (water hyacinth) is observed in some parts of this section.

Figure 2.28: Typical examples of Section CL4- Cha La canal.

Figure 2.29: Existing conditions along Section CL4 of Cha La canal.

Section CL5: from Hai Thuong Lan Ong street to Vo Nguyen Giap road (the route going to An Dong bridge), 1.29km long, the embankments have not been lined. Trapezoied cross section has dimension B1xB2xH=10x17x2.3m. There are 6m-wide and 3m-widemanagement earth roads on the right and the left banks, respectively. A lot of garbage floating in the canal was observed. The first 1/3 is passing through paddy fields and along south of the proposed Central lake item. There are houses and aquaculture ponds located along both sides of the middle part. And the 1/3 ending part has high dense houses on the left sides.

Figure 2.30: Typical examples of Section CL5- Cha La canal.

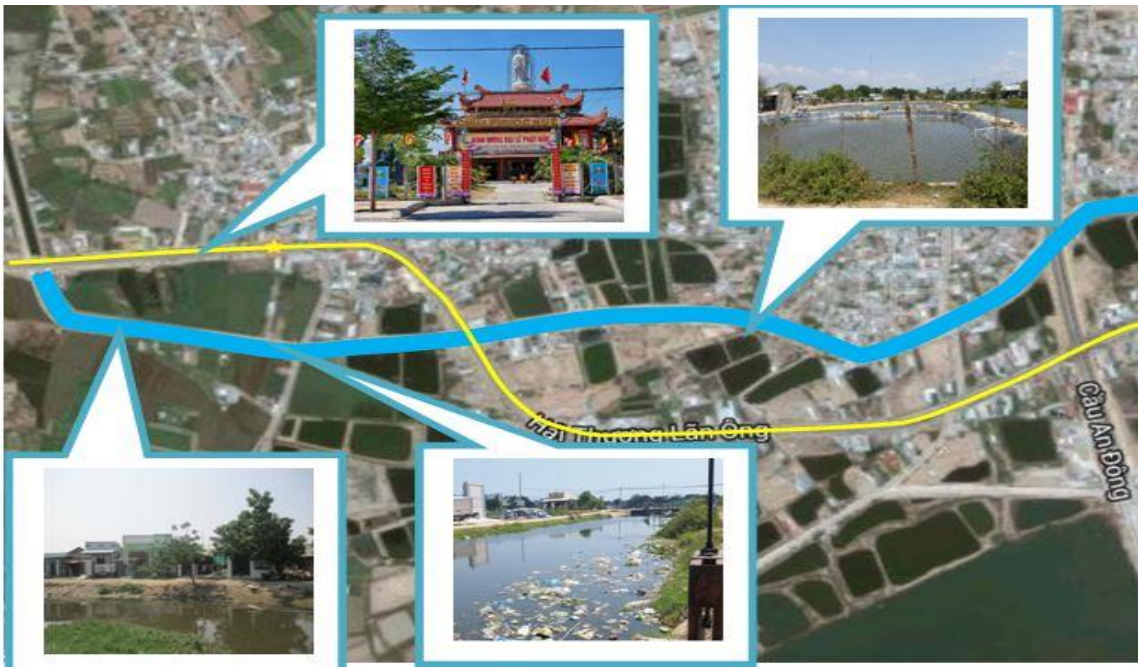


Figure 2.31: Existing conditions along Section CL5 of Cha La canal.

Section CL6: from Vo Nguyen Giap road to Hai Thuong Lan Ong 3 road, 0.5 km long. The canal has concrete embankment on the left side only. Cross section has dimension B1xB2xH=10x(20-21)x(3.3-3.7)m. Sediment layer is about 0.7-1.0m thick. There are a 3.0-4.0m wide earthen road on the right and a 4.0-6.0m wide concrete road on the left. A power line is running along the left side and houses are along both sides. Garbage is observed floating in the canal.

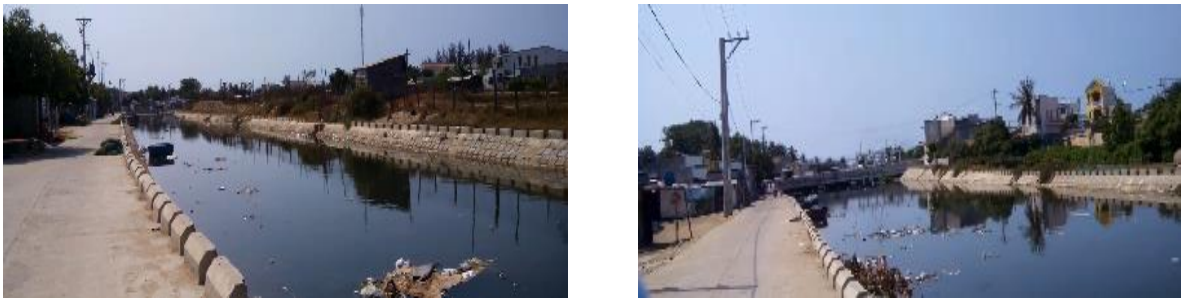


Figure 2.32: Typical examples of Section CL6- Cha La canal.

d) Nhi Phuoc Canal

Nhi Phuoc Canal is 1,660m long, located in the city center, connecting Tan Tai canal with Cha La canal. Beginning point is on 16/4 road and endpoint is on Cha La canal. The canal was constructed in 2000 with the designed flow at 3.0 m/s. The canal has stone embankments and cross section dimensions BxH=2.5x1.17m.

From 16/4 road to Museum area, the canal runs along concrete roads and residential houses at both sides. The canal bottom has been sedimented with a thick layer of mud and garbage; therefore in normal condition water in the canal is almost full.

Figure 2.33: Typical examples of Nhi Phuoc canal.

Figure 2.34: Existing Land use Along Nhi Phuoc Canal

e) TH5 Canal

TH5canal is 662m long, conveying water from Tan Hoi to Cha La canals. Along the canal, there are 7 residential grade 4 houses with some animal cages and gardens. There is no existing road along some sections while in some parts there are 2m-wide earth roads along the canal.

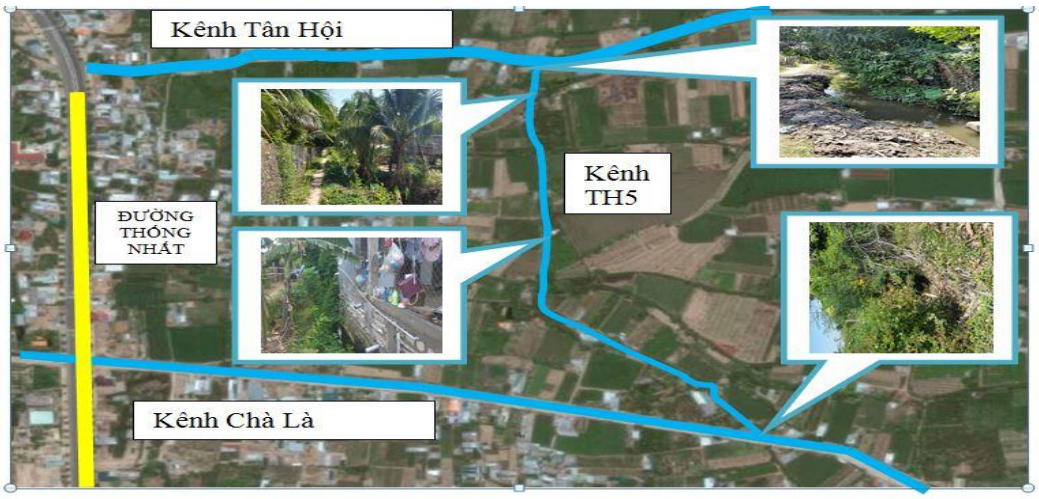


Figure 2.35: **Existing conditions along TH5 canal.**

f) Flooding Situation

The locations often subjected to flooding after rains includes Road 21/8, the Stadium, Le Quy Don road, Ha Huy Tap road, Pham Ngu Lao road (near the Television Broadcast), Dong Dan sluice gate, Pham Ngu Lao, Ngo Thi Nham, Nguyen Du, Bao An commune, Minh Mang-Tu Duc, the Kid Cultural House, Yersin- Thong Nhat, area at the booster pumping station on Tran Phu road, Phu Ha-Tran Phu, Phan Rang market and Nguyen Thi Minh Khai road. Flooding time is subject to each location, normally from 20-30 minutes to 2-3 hours. In which, the flooding area at the Provincial Children Cultural House in Phu Ha ward is the most serious (in October 2010) with the flooding depth of 40-60cm in the period of 90-120 minutes. The flooding water mixed with dirty water and waste from residential areas and sewers on the road causes unsanitary, obstructing traffic, effects on people's lives and a negative sensation among the people.

The flooded places occur due to the lack of drainage system, incomplete connections, and rarely dredged sewage system, catch pits are far distance. Next to that, the bottom elevation of Ong Co canal is high and narrowed downstream, reducing the drainage capacity. Outside the dyke, the high tide along with water level increasing in Dinh River by flood discharge at the upstream also reduce the drainage capacity from the city to the sea.

Điểm	Diện tích (m2)	Chiều sâu (m)	Thời gian ngập (phút)
F1	1,045	0.2-0.3	40-45
F2	1,470	0.1-0.2	20-30
F3	1,814	0.2-0.3	30-45
F4	**2,860**	**0.4-0.6**	**90-120**
F5	1,220	0.2-0.3	20-30
F6	3,906	0.2-0.3	30-45
F7	3,945	0.3-0.4	30-45
F8	3,119	0.2-0.3	20-30
F9	11,000	0.2-0.3	20-30

Figure 2.36: Map of flooded Locations on 21/8 road in 2010.

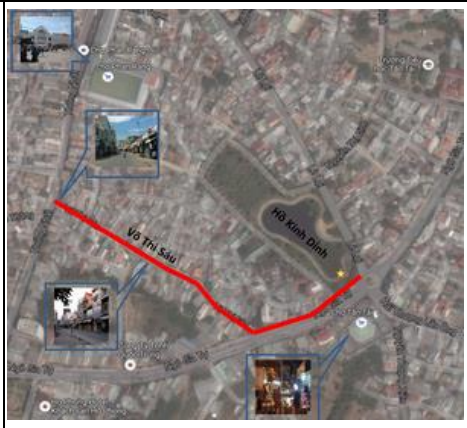
g) Existing Conditions in Proposed Secondary Drainages

Table 2.22: Site-Specific Characteristics along Drainage Alignment

No	Secondary drains	Description	Existing Conditions
1	D1 route: Alley 410 of 21/8 road discharged to Tan Tai canal. L=500m	Existing is 6m-wide asphalt road, no sidewalks; high density of houses located along both roadsides. Frequently flooded in heavy rains. 	

No	Secondary drains	Description	Existing Conditions
2	D2 route: in Truong Dinh road discharged to Tan Tai canal. L=220m	Existing is 7m-wide asphalt road, narrow sidewalks; high density of houses located along both roadsides. Many business households along the route Intersection between Truong Dinh Street and 21/8 Street always flooded in the rainy season 	
3	D3 route: from 21/8 road to Le Quy Don road connected to D1000 drain in 21/8 road. L=222m	Existing is 7m-wide asphalt road, no sidewalks; high density of houses located along both roadsides. Intersection between Le Quy Don Street and 21/8 Street prone to flooding during rains. Business households along the route. 	
4	D5 route: from 21/8 to the Children Cultural Center discharged to Tan Tai canal. L=122m	Existing is 6m-wide asphalt road, narrow sidewalks; high density houses located along both roadsides; relative heavy traffic on 21/8 Street. Frequently flooded in the rainy season. 	

No	Secondary drains	Description	Existing Conditions
5	D6 route: from Thong Nhat road to Quang Trung road discharged to Tan Tai canal. L=339m	Existing is 6m-wide asphalt road, narrow sidewalks; densely-populated areas along with many high buildings and a lot of business establishments. 	
6	D7route: in Le Hong Phong, Yersin and Thong Nhat roads discharged to Tan Tai canal. L=326m	Existing is 7m-wide asphalt road, large sidewalks; no existing drainage sewers. Along the new sewer line: area with many administrative agencies of Ninh Thuan Province (provincial People's Committee, provincial Department of Internal Affairs, provincial Department of Education & Training) 	
7	D8 route: in front of PPC office in Thong Nhat road discharged to Tan Tai canal. L=130m	Existing is 7m-wide asphalt road, large sidewalks. One side has provincial administrative offices, while the other side is residential houses. Sewer line to be installed in front of the provincial People's Committee and Phan Rang Parish Church. 	

No	Secondary drains	Description	Existing Conditions
8	D9 route: Duong Cao Thang road. L=450m	Existing is 6m-wide asphalt road, no sidewalks; power lines along the route. Densely-populate areas along the line; no existing sensitive location 	
9	D10 route: in Vo Thi Sau road discharged to Tan Tai canal. L=863m	Existing is 6m-wide asphalt road, narrow sidewalks; power lines along the route; Existing DN1200 sewer line, but now pressed down under present residential houses, with water unable to be discharged into Kinh Dinh lake resulting in flooding in the areas of Phan Rang market; existing B500 sewers on Thong Nhat not effective; Busy market areas; Mainly small businesses and residential houses along Vo Thi Sau Street. 	
10	D11route - Cao Ba Quat road connecting to K1 urban area. L=495m	Existing is 8m-wide asphalt road, large sidewalks. Phat An pagoda located at 5m from the road edge. 	

No	Secondary drains	Description	Existing Conditions
			

h) Existing Conditions at the Proposed Central Lake Site

The area proposed for construction of the central lake is limited by the following points:

- Point1: the joint of Nguyen Tri Phuong and Nguyen Van Cu roads
- Point2: the joint of Nguyen Van Cu and Nguyen Thi Minh Khai roads
- Point 3:the joint of Nguyen Thi Minh Khai and Phan Boi Chau roads
- Points 4&5: the joint of the provincial road 270 and Nguyen Tri Phuong road and Phan Boi Chau road.

The proposed site area is about 30.3ha, currently is a rice field. 205 households have been cultivating on this land. There are also 102 concrete graves and 160 earth graves at this location. There is no existing structures within the proposed site area, however there are some few temporal houses/camps built illegally in the area.

As mentioned in the section 2.2.3.5 above, Thien Hung pagoda is located about 50m to the north of the proposed central lake construction site.

Figure 2.37: Existing conditions at the proposed central lake.

Notes: Remarkable points on the map

1	Thien Hung pagoda
2	Existing rice fields
3	Illegally temporal houses/camps

i) Existing Conditions in Dong Hai Lake Area

Dong Hai lake has a square area of about 4.32ha. In the past, thesea water from a nearby sea lagoon was collected into the lake via an inlet canal for shrimp cultivation purpose. However, the lake has been left fallow for many years and pollutted by dosmestic wastewater and garbage disposed from the surrounding residents. Nowaday, the lake is quite shallow settled with polluted organic mud. The area is polluted by smell from the lake and floods.

The lake is located within a high density residential area. The area is usually flooded during flood tides and heavy rains. Rain water and domestic wastewater are freely over flowing on the road surface.

Dong Hai 2 Primary School, Quan Thanh Temple and Dong Giang market are located from 50m to >200m from the construction site. There are two houses at the number 44A of HTLO road, located on the access route for transportation of materials to construction site. These houses will have to be relocated for transporting materials during the lake construction.

Figure 2.38: Existing Conditions in Dong Hai Lake area.

Notes: The numbered points on the map are

1	Quan Thanh Temple, a distance of about 50m far to the north-west from the proposed construction site of Dong Hai lake,
2	A free land area with some trees proposed to be used as a construction material pilling area during construction phase.
3	A residential house which would have to be relocated for access route to the construction site.
4	Existing lake
5	Connection canal from the lake to the sea lagoon (the docks)
6	Starting point of the connection canal.

2.3.4. Existing Wastewater Collection and Treatment

2.3.4.1. Tertiary Sewer Network

Currently, there is no wastewater collection system for Phan Rang-Thap Cham City. Only in urban areas (in Phu Ha, Thanh Son, My Huong, Kinh Dinh and Tan Tai Canal), the system was built in principle of separating wastewater from the sewer system of the area. The wastewater collection and treatment system of Phan Rang-Thap Cham city was invested for constructed under the Project for Rehabilitation of city drainage system with a capacity of 5,000m^3/day.

According to the results surveys implemented in February 2016 with 2,276 households in Phan Rang-Thap Cham city, it is revealed that if there are programs to upgrade infrastructure in the locality, 78% of households want to connect with the wastewater system and they are willing to pay the connecting fee from their house to the common sewers. 22% households disagree because most of them want to use the domestic wastewater for watering thanks to the gravity flowing into the garden or some households have connected with the sewerage system of the city or they do not have money or do not understand well about the project.

2.3.4.2. Wastewater Collection

In general, wastewater in many areas has not been collected and treated, mainly discharged into canals and low elevated areas and then flowing into the sea throughTan Tai and Cha La canals. Therefore most of the wastewater collection system has not met the required demand.

Wastewater in the city center is collected into the combined sewer system via 4 CSOs and then transported to 4 existing pumping stations (PS) namely Hung Vuong, Tan Tai, Cha La and 16/4 PSs. The wastewater is transported to the WWTP with a capacity of 5,000 m^3/day.

2.3.4.3. Wastewater Treatment Plant

Phan Rang - Thap Cham wastewater treatment plants (WWTP) has an existing designed capacity of 5,000 m3/day, the designed standards of treated wastewater output are meeting the QCVN 14:2008/BNTMT (Column B). The WWTP was completed construction in 2011, but only formally brought into operation in 2013. The WWTP consists of two parallel treatment lines; each line consists of a treatment lagoon chain including: aerobic lagoon, facultative lagoon and final treatment lagoon.

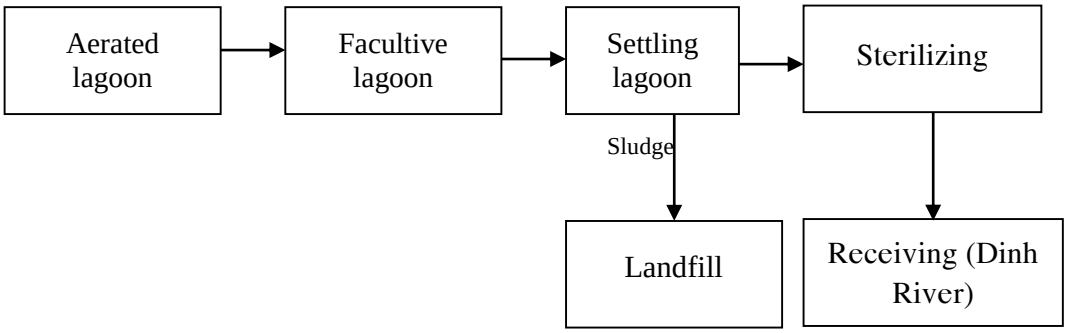


Figure 2.39: **Wastewater Treatment Technological Process of the WWTP.**

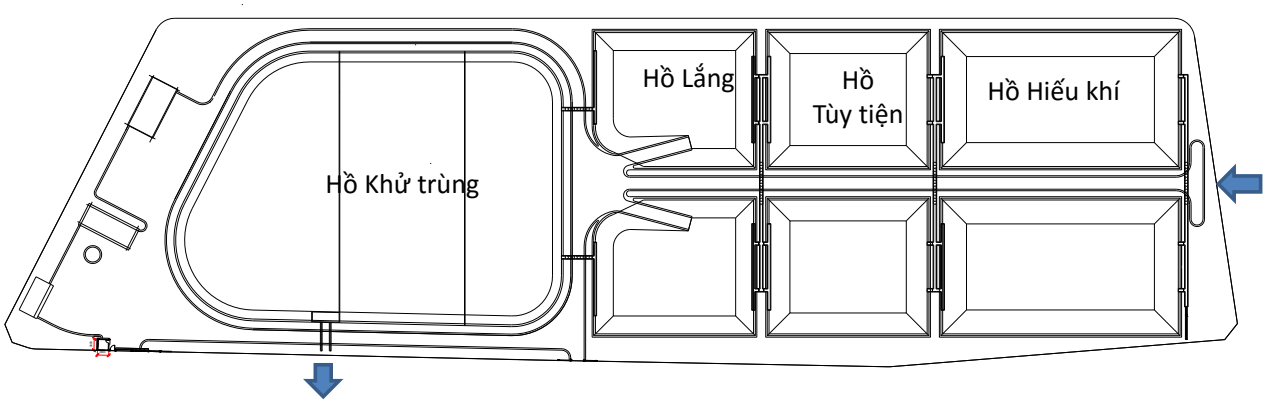


Figure 2.40: General layout of the existing WWTP.

Review of Phan Rang WWTP operation

The Hieu Thao Trading and Construction Company Limited have been contracted by the Phan Rang – Thap Cham to operate and manage the wastewater treatment plant since October 2012. The scope of service included: (i) manage the WWTP with total land area of 4.36 ha, operate 4 pumping stations, maintain the 6,700 m2 of green space including grass/vegetation cover and trees. The plant has been operated automatically; however, sometimes the inflow is too low to activate automated operation. To date some of the equipment has been broken or not working. An inventory on the existing conditions of the wastewater treatment plant and related facilities were conducted at the end of 2015 and summarised below:

Table 2.23: Existing Conditions of WWTP and Related Facilities

No	Equipment	Quantity	Conditions
1	Aerobic lagoon	2	HDPE membrane broken
2	Aerator	14	3 machines not working
3	Air blower	14	Good
4	BOD reading	5	3 readers not working
5	Sedimentation tank	2	Not working
6	Control panel	1	Frequency converter and Scada failed
7	Flow meter	1	Not working
8	Tan Tai pumping station (PS)	4	One submersible pump not working
9	Hung Vuong PS	3	Starter broken, being replaced
10	PS in 16/4 Park	3	In good condition, not being operated due to there is no wastewater
11	Chà Là PS	4	In good condition, not being operated due to there is no wastewater
12	Outfall	1	Eroded
			

 The buffer zone has been maintained relative well however recently there were two houses built in front	 Grass cover and trees within the WWTP has been maintained	 Some equipment or treatment units either broken or not working properly. The outlet on the Dinh river has been eroded seriously

Seven staff has been appointed to manage the wastewater system including one technician who is also in charge of environmental issues, one electrician, three guards and two workers to maintain the green space.

In general, the WWTP has not been working properly with many parts being broken.

2.3.5. Solid Waste Management

According to the master plan of solid wastes management in Ninh Thuan province towards 2025, the whole PR-TC city has been served with solid waste collecting services with the collection rate of 100%.Total generated amount of municipal solid wastes of the city is about 150 ton/day; in which the domestic solid waste is about 107 ton/day and market waste is about 13 ton/day.

Solid wastes from small alleys are collected by the environmental sanitation groups established by the wards. After collection and gathering, SLW is transferred to the main roads. Nam Thanh Company has been providing solid waste collection and treatment services for Phan Rang City. Nam Thanh Company has 08 garbage compacting vehicles (loading capacity from 5 to 11 tons).

Industrial SLW in the city is not much, mainly generated from Thap Cham and Thanh Hai industrial zones. Industrial production sectors in IZs are mostly agricultural product processing, construction material production, textile, minerals, cigarette, sea food processing, beer, beverage, etc. These industrial sectors have not much industrial wastes, especially seemly no hazardous wastes. Therefore, the industrial wastes are currently collected together with domestic wastes and transport to the Nam Thanh waste treatment complex for final treatment.

Medical wastes are classified from sources. Non hazardous wastes are transported and treated together with the municipal solid waste. Medial hazardous waste is treated by burning method installed at Provincial General Hospital, Lung Disease Hospital, Social Disease Center, and PR-TC Healthcare Center.

The Project proposed to use Nam Thanh

Nam Thanh Solid Waste Treatment Complex, the Dong Bac and Dong Nam for disposal of the wastes generated during the construction phase of CCSEP Solid waste collection and management in Phan Rang city has been provided by the Nam Thanh Construction-Trading and Production Co Limited. The Nam Thanh solid waste treatment plant was put into operation from January 2003. The main service provided includes solid waste collection, composting and recycling. The Nam Thanh solid waste treatment complex is located in Loi Hai commune, Thuan Bac district, 30 km from Phan Rang-Thap Cham City. The complex is 20 ha, has a design treatment capacity of 150 – 250 T of solid waste/day with three main units.	 

Composting factory:300 ton/day; Waste recycling (plastic) factory: 100 ton/day; Sanitary landfill: take about 10% of the total waste volume. The company has 330 workers, among these 164 are female. The average income of the worker is 6 millions VND/person/month in 2014; the company paid 2.38 billions VND for tax, approximately 5 billions for retirement fund and health insurances for the workers. 130 millions VNS was also been contributed for charity Source: Site visit and http://ninhthuan.made-in-vietnam.com/san-pham/phoi-nhua-819dd89c	Composting plant  Recycling products: granular plastic, and plastic sheets for floor lining

Description about proposed disposal place (excavated materials)

Dong Bac and Dong Nam new urban areas in the city center

Dong Bac new urban area is located in the city center, just behind Statue Square in 16/4 road. The land area is 60ha, borders with Regulation lake and a 100ha green tree park to the east; with Ngo Gia Tu street to the west; with Nguyen Van Cu street to the north; and with 16/4 street to the south. Currently, site clearance has been completed partially, 1st phase construction of technical infrastructures has been started. Site clearance for the second phase has been planned.

Dong Nam new urban area is also located at the south of 16/4 road in the city center. The area has a total area of 43.8ha, is limited by from D2 to D7 axis roads.

The site is agricultural lands with low ground elevation. Therefore, the areas will require a large amount of filled materials for ground levelling.

First phase construction has been started; Site clearance for the second phase will be started soon. Therefore, this urban area can receive the excavated materials in 24 to 30 months.

The dredged and excavated materials from CCSEP phase two (2019-2022) will be dumped as levelling materials at Dong Nam new urban area.


Existing conditions of Dong Bac and Dong Nam new urban areas.

Most of the materials generated during dredging/ excavation for rehabilitation of Dong Hai lake will be kept onsite for filling up to construct a small landscaping park at the northern part of the lake.

There would be about 46,000 m3 of saline excavated materials from this site need to be disposed off during the construction of Dong Hai lake. In addition, an estimated amount of 14,000 m3 saline dredged material would also be generated from rehabilitation of Section CL5 of the Cha La.

Two options recommended to DONRE for treatment of total 61,000 m3 of saline materials:

+ disposed off in Dong Hai lake area if possible

+ disposed off in Nam Thanh landfill site.

2.3.6. Public and School Toilets

2.3.6.1. Public Toilets

Phan Rang – Thap Cham city has totally 7 parks, and two additional parks are under construction. Only the Le Hong Phong Park and 16/4 Park have public toilets. However, these toilets are not working properly or degraded and not in service for a long time.

2.3.6.2. School Toilets

There are some good models of school toilets built in Phan Rang City, for example the one in Binh Quy School financed by the Belgium Government

Toilet in Binh Quy School: good landscaping, make use of natural light, safe for the children, included posters about hygen behaviour and water saving practices

Figure 2.41: A good example of school toilet in Phan Rang.

The CCSEP will build some school toilets at some schools. The existing conditions of the toilets at these schools are described below.

****/ Do Vinh II Primary School***

The school was built in 2000. There are 15 teachers (one male and 14 female) and 161 pupils (78 male and 83 female). The existingtoilets of the school were constructed separately for male and female areas; each area with 2 chambers. These toilets have been degraded seriously.

The project proposes to build new toilets for teachers and pupils nearby the existing toilets. Total land area is about 50m^2.

Nguyen Van Troi Secondary School:

The school was constructed in 2005. There are 88 teachers, including 24 male and 64 female teachers and 1,600 pupils including824 male pupils and 786 female pupils. The existingtoilets of the school were constructed separately for male and female areas. However, the toilets have been degraded seriously.

The project proposes to construct new toilets for teachers and pupils at the north of the school's area. Square area of site is about 100m^2.

/ Phu Tho Primary School

The school was constructed in 2001. There are 24 teachers, including 8 male and 16 female teachers and 308 pupils including155 male pupils and 153 female pupils. The existing toilets of the school were constructed separately for male and female areas. However, the toilets have been degraded seriously.The project proposes to construct new toilets for teachers and pupils at the same location of the existing toilets. Square area of site is about 40m^2.

2.3.7. Huynh Thuc Khang Road

The existing Huynh Thuc Khang road is a 420m-long, 7m-wide asphalt concrete road, starting from 21/8 and ending at Thuy Nguyen restaurant near Tan Tai canal. The proposed project will extend the road with a new section from Thuy Nguyen restaurant to Phan Dang Luu road. The section 100 m long starting from the junction with 21/8 passing populated residential areas. The remaining parts the alignment cut through most agricultural or barren. Along the existing road there are about 50 residential houses; most of them are fourth class houses. Some households have small business shops. Most trees along the road are still small trees newly planted. The road cut through some existing paths.

Figure 2.42: Route map of Huynh Thuc Khang road.

2.3.8. Alley 150 of 21/8 Road

The existing Alley 150 of 21/8 road is a 980m-long, 5m-wide earth road in Phuoc My ward, connecting 21/8 road and Phan Dang Luu road. There are about 42 residential houses concentrated mostly in the beginning section and agricultural lands with grape and rice fields located mostly in the ending section, and also about 35 graves along the alley would be affected by land acquisition for the alley widening and extending construction.

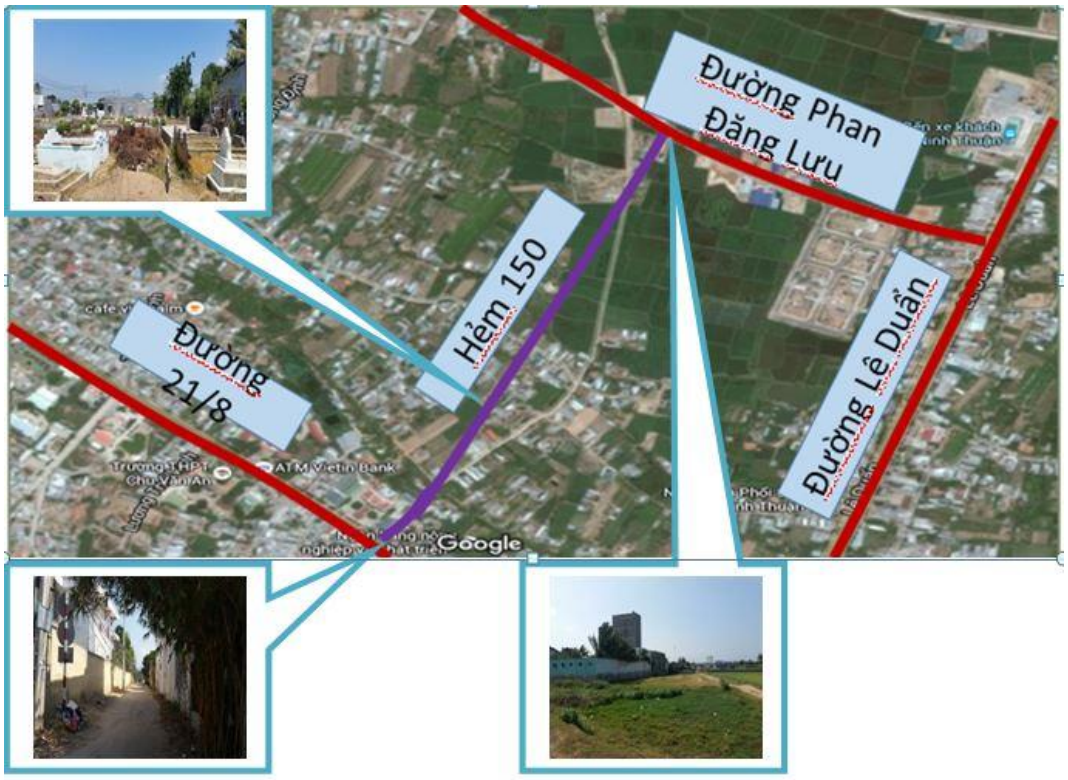


Figure 2.43: Route map of Alley 150 of 21/8 road.

2.3.9. Proposed Resettlement Sites

The proposed resettlement site is located in Phuoc My ward, has a total land area of 6.7 ha. The site is bordered with Phan Dang Luu road and agricultural lands to the north, with an existing residential area to the east, with agricultural lands of Phuoc My ward to the south, and with Alley 150 of 21/8 road and agricultural lands to the west.

The existing area proposed for construction of the project's resettlement area is agricultural lands with low elevation.

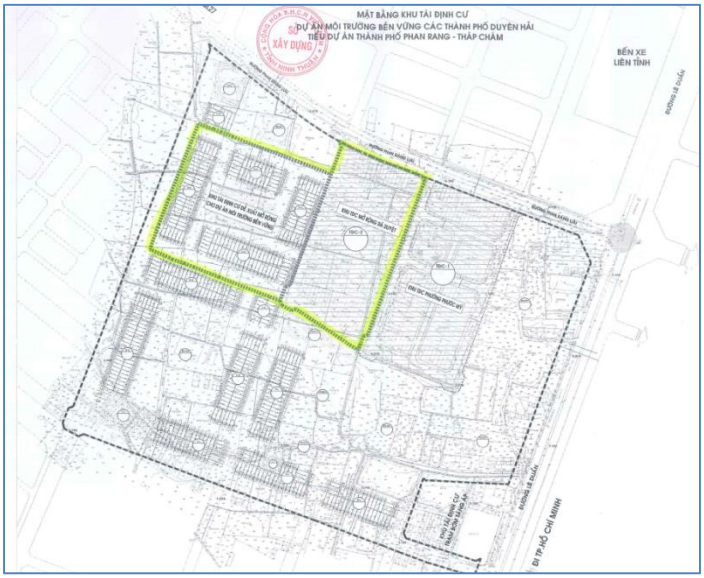


Figure 1.44: Layout of the proposed resettlement area.

CHAPTER 3. ENVIRONMENTAL AND SOCIAL IMPACTS ASSESSMENT

3.1. POSITIVE IMPACTS

The proposed Coastal Cities Sustainable Environment Project – Phan Rang - Thap Cham Subproject is expected to bring about significant positive impacts to the people and the environment in the Project area.

- Temporary short-term jobs will be created for local people with additional income during construction phase of the project;
- Environmental conditions and urban landscape would be improved through the improvements on roads, drainage and sewer systems. Better living conditions would also be expected to bring positive health impacts for the people. Specifically:
- Environmental quality in the city is expected to be improved after untreated wastewater is collected, treated, and discharged properly instead of being discharged directly into the environment, polluted canal have been cleaned up. Localised air, soil and water quality in project area is expected to be improved. Stormwater would be better drained, localised flooding and associated impacts such as traffic disruption, degradation of houses and property by flood, pollution and safety risks would be addressed.
- Air quality, landscape in the areas along the improved canals are expected to be improved after the canals and regulatory lakes had been cleaned up and improved or built, management roads are constructed etc.
- Flooding issues at many locations subjected to flooding will be addressed, related issues and impacts no longer exist
- Rainwater storage capacity is improved with the construction of the central lake and restoration of the Dong Hai lake to reduce localised flooding issues in the area, particularly at the downstreams of these lake. Issues negative impacts related to localised flooding would be address.
- Landscape in the city would be improved with the improvements of Dong Hai lake and the construction of the new Central lake, new green areas created surrounding these lakes, there would be more open space along the improved canals.
- Traffic jams at some roads in the city are expected to be prevented or reduced after the roads under component 2 are upgraded. City people can save time for travelling.
- Microclimate in the area surrounding the new/rehabilitated lakes is expected to be improved with lower temperature in hot days as more freshwater surface are created. These would be a significant values to local communities living in the driest city of the country.
- The sanitation conditions at some schools currently lacking toilets or having degraded toilets are improved through the investment in new construction of teachers' and students' toilets at schools. The Project will also construct public toilets at pressing locations in the centre and in the park of the city, enhancing the service quality and the convenience for the local people and tourists coming to the city.
- The people in project area would be benefited from positive health impacts and better quality of life through improved environmental quality. It is expected that the cases of illness reacted to water-born diseases would be decreased, healthcare cost would be

reduced, families have better opportunities concentrate on income-generation activities to improve household living standards.

- Environmental awareness of those who have been dumping wastes into the canal would be improved, garbage should not be continued throwing into waterway near their homes.
- A new resettlement site with all connection conditions of social and environmental infrastructures synchronously for the affected households of the Project with a total area of 6.7ha for a scope of about 250 households will be constructed in the city center, a convenient location which is expected to minimize the project's social impacts.

It is also expected that the capacity of related provincial authorities and project implementing agencies would be enhanced to be able to operate the facilities provided by the project in a sustainable manner.

3.2. IDENTIFICATION OF MAIN POTENTIAL NEGATIVE IMPACTS

There will be potential negative risks and impacts during the pre-construction, construction, and operation phases. Through basic data analysis, field surveys, and consultation with relevant parties, the potential environmental and social negative impacts and risks of the project are identified and classified as below:

High Impacts (H)

- Impacts on large land areas, important areas, or changes in environmental conditions in a period of more than 02 years.
- Impacts exceeding permitted standards and regulations. Long-term and large-scaled impacts;
- Changes in ecological systems, impacts on ecological systems at large areas, or medium impacts (lasting for more than 02 years) yet required recovery period of the affected ecological systems are 10 years;
- Impacts on health of the human beings;
- Economic losses and damages to the sub-project nearby people and communities.
- Potential significant social and environmental impacts which can only be controlled and mitigated if proper mitigation measures are implemented.

Medium Impacts (M)

- Impacts on large areas for a period from 6 months to 2 years
- Changes in ecological systems or ecological functions at the localities in a short time and recovery capacity are good. The impact levels are similar to current changes yet such impacts can cause cumulative effect.
- Impacts might (or might not) affect people's health, causing impacts on several persons in the surroundings of the sub-project areas.
- Impacts are medium, localized, and temporary and mitigation measures should be carried out.

Low Impacts (L)

- Social and environmental impacts that cause significant changes yet in less than 6 months or medium changes for a period of less than 2 years.
- Impacts are within permitted standards and regulations, causing minor changes at the present. Impacts are fully controlled;

- Impacts that might affect daily activities yet not cause any obstruction to communities;
- Insignificant impacts on health and living standards of people;
- Impacts are minor, localized, and can be neglected

No Impacts (N)

- Impacts that are unrecognizable or can be identified yet such impacts can also be caused by daily activities;
- No social and environmental impacts

Summary of environmental and social negative impacts identified for different phases of the Project is presented in Table 3.1 below.

Table 3.1: Identification of main negative environmental and social impacts of Project's Components

Phase	Natural environment										Ecosystem		Social environment												
	Air pollution	Surface water pollution	Soil& ground water	Solid wastes	Lake &canal sediment	Soil erosion	Landscape	Topography and geology	Hydrology	Meteorology	Terrestrial ecosystem	Aquatic ecosystem	Compulsory resettlement	Daily life of local people	Local socio-economic condition	Land use	Physical community division	Traffic system	Social infrastructure and service	Ethnic minorities	Local conflicts of interest	Water use	Sanitation, risks of epidemics	Risks of labour and fire safety	Historical and cultural structures
COMPONENT 1 – SANITATION INFRASTRUCTURE																									
Canals and lakes investment items under Component 1																									
Preparation	L	L	N	L	N	N	L	N	N	N	L	N	H	M	L	L	L	L	L	N	N	N	L	L	N
Construction	H	M	L	H	N	M	M	N	L	N	M	L	L	M	L	L	L	H	M	N	N	L	M	M	L
Operation	L	N	N	L	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	N
Investment items in drainage and sewerage systems and wastewater treatment under Component 1																									
Preparation	N	L	N	L	N	N	L	N	N	N	L	N	N	N	N	L	N	L	L	N	N	N	L	L	N
Construction	M	M	L	M	M	H	H	N	N	N	L	L	N	M	L	L	M	H	M	N	N	L	M	M	L
Operation	L	N/L	N	L	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	N
Public and school toilets under Component 1																									
Preparation	N	N	N	L	N	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Construction	M	L	N	M	L	N	M	N	N	N	L	L	N	N	N	N	N	L	N	N	N	L	L	L	N
Operation	L	N/L	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
COMPONENT 2 – URBAN CONNECTIVITY																									
Preparation	L	L	N	L	L	N	L	N	N	N	L	N	H	L	N	L	L	L	L	N	L	N	L	L	N
Construction	H	M	L	H	M	N	M	N	N	N	L	L	N	H	L	L	L	H	M	N	L	L	M	M	L
Operation	L	N	N	L	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	N
COMPONENT 3 – RESETTLEMENT AND SITE CLEARANCE																									
Preparation	L	L	N	L	L	N	M	N	N	N	L	N	H	M	L	L	L	L	L	N	L	N	L	L	N
Construction	H	M	L	M	M	N	M	N	L	N	L	L	N	M	L	L	L	M	L	N	L	L	M	M	L
Operation	L	L	N	M	N	N	N	N	L	N	N	N	N	N	N	N	N	N	N	N	N	L	L	N	N

3.3. POTENTIAL NEGATIVE ENVIRONMENTAL AND SOCIAL IMPACTS DURING PRE-CONSTRUCTION PHASE

Land acquisition and risks related to Unexploded Objects (UXO) would be the main concerns of pre-construction phase.

3.3.1. Land Acquisition and Resettlement

The Project would acquire permanently 517,085m^2 of land. Of which 25,936m^2 is residential land, 389,663m^2 is agricultural land, 101,486m^2 is transport and irrigation lands, and 1,418m^2 is grave land.

949 households (HH) with 3,985 persons would be affected by land acquisition. Among these,144 households would be displaced, 449 HH would be affected severely with more than 20% of family's production land be acquired, 35 graves would be relocated. The detail land acquisition scopes of every work item are shown in Table 3.2.

In addition, the Project would also acquire temporarily 113,872m^2 of lands along the Tan Tai, Dong Nam, Cha La, TH5 and Nhi Phuoc canals, and along the secondary drains and tertiary sewers in Dong Hai ward, and in northern and southern area of 16/4 road during construction phase. The temporary land acquisition is planned to use public land or unused land such as roads, public lands, etc. (not use private lands) for construction and material gathering.

Land acquisition would also affect jobs, incomes and livelihood of the affected HHs. According to social survey data presented in Section 2.2.2, 43.1 % of the interviewed HH working in business/services sector, 30.9% in agricultural sector, 19.2% working as staff/worker. The HH to be affected the most on income and livelihood would be those who have been living mainly on agriculture or home business/services and have to resettle. When being resettled, they may loose their current job and sources of incomes. If inadequate support are given or if there are not enough opportunities for finding new jobs and incomes, the affected households living under average standard may come back to poverty. In fact, after moving into the resettlement area, the farmers or business households will have to find alternative jobs and sources of incomes.

Social disturbance would also happen to the resettled households. Adults and children may have to travel further to work or schools, that may lead to change to jobs or schools. Accessibility to basic infrastructure such as power and water supply, health care, markets etc. may also be changed. 4 households in Dong Hai ward would be affected the most as the distance from there to the resettlement site is 8 km. The remaining majority are currently living closer to the new resettlement site Therefore, the potential social impacts associated with land acquisition is manageable through the implementation of RAP and the basic infrastructure provided for the resettlement site (e.g. roads, water supply etc.);

Grave relocation is not common practice under normal condition in Phan Rang (but it is quite common in the north of the country that remains are relocated to a permanent grave after 3 or 4 years of burial). Grave relocations require certain religious procedures to be followed. Therefore, in addition to cost and time, the relocation of 35 graves currently located mostly along the Alley 150 may also have some psychologically impacts, causing stress to the people in the affected households. This potential impacts is not avoidable, but manageable. During the second round of public consultation conducted in July 2016, some representatives of the affected household in Phuoc My ward expressed their willingness to arrange for the relocation of graves themselves, to a public graveyard belonging to their local Catholics community. The project can just pay compensation and or supports.

Table 3.2: Land acquisition

No	Investment item	Location (wards)	Acquired square area (m²)					Affected structure			Affected trees		Affected households/institutions			
			Total	Residential land	Agriculture land	Traffic, irrigation	Grave	House	Other Structure	Grave	Annual tree	Long-term tree	Total	Of which		
														Serious impact	Business	Relocation
I	COMPONENT 1		407,660	9,410	306,898	91,352	0	9,055	3,467	0	104,886	261,370	737	369	15	84
1.1	Tan Tai canal	Bao An, Phuoc My, Phu Ha, Kinh Dinh, Tan Tai	51,233	5,689	34,948	10,595	0	4,026	1,577	0	324	35,366	286	93	10	35
1.2	Dong Nam canal	Tan Tai, My Hai	10,178	0	10,133	45	0	118	0	0	4,985	4,985	40	30	0	0
1.3	Cha La canal	My Dong, Van Hai, Dai Son	55,194	236,1	22,055	32,903	0	721	1,304	0	17,663	1,939	162	64	1	0
1.4	TH5canal	Dai Son	4,105	0	1,642	2,463	0	245	0	0	0	1,397	14	5	0	4
1.5	Nhi Phuoc canal	My Hai	8,050	0	3,059	4,991	0	365	582	0	1,544	578	56	7	0	0
1.6	Central lake	My Binh	226,900	3,485	191,357	32,058	0	3,180	4	0	80,370	212,735	170	161	4	41
1.7	Dong Hai lake	Dong Hai	52,000	0	43,704	8,296	0	400	0	0	0	4,370	9	9	0	4
II	COMPONENT 2		42,435	11,577	25,551	5,307	1,418	5,700	635	35	10,731	14,820	177	50	2	52
2.1	Alley 150 of 21/8 road	Phuoc My	18,000	2,640	10,053	5,307	1,418	2,700	135	35	4,222	5,831	52	25	0	27
2.2	Huynh Thuc Khang road	Phuoc My	24,435	8,937	15,498	0	0	3,000	500	0	6,509	8,989	125	25	2	25
III	COMPONENT 3		66,990	4,949	57,214	4,827	0	800	125	0	24,030	33,184	55	30	0	8
	Resettlement area	Phuoc My	66,990	4,949	57,214	4,827	0	800	125	0	24,030	33,184	55	30	0	8
Total			517,085	25,936	389,663	101,486	1,418	15,555	4,227	35	139,647	309,374	969	449	17	144

Source: the Project's Resettlement Plan.

3.3.2. Risks Related to Bombs and Mines

The Project area suffered from wars in the past; therefore there are risks that some unexploded objects (UXO) such as bombs and mines are still remained under the ground. If not detected or removed before construction is started, these UXO may cause accidents with injuries, even deaths to human, and loss or damages to properties. This high risk is manageable.

3.4. POTENTIAL IMPACTS DURING CONSTRUCTION PHASE

The main operations which will take place during the construction phase include:

- Arrangement of camps and temporary gathering grounds for materials and waste;
- Mobilization of workers and machines to the site;
- Transportation of construction materials to the site and waste to disposal sites;
- Ground-levelling and site preparation;
- Construction operations such as excavation, backfilling, dredging, construction, welding, compacting, rolling, bulldozing, etc.; *and*
- Site reinstatement.

The potential negative impacts and risks which may occur during the construction phase include:

- Air quality reduction caused by dust, exhaust gases, bad odours, and noise;
- Water quality reduction (mostly increased in turbidity) at receptors due to discharge of untreated wastewater (domestic wastewater, construction wastewater, storm water run-off through construction sites), canal and lake dredging, embankment and bridge construction;
- Increased localised flooding risk due to drainage blockage related to construction materials and wastes;
- Soil and water pollution risk due to oil and grease leakage during maintenance and repairs of construction machines and equipment on site;
- Solid waste generation (from removal of top soil, excavation, dredging, construction waste, domestic waste from camps, and some hazardous waste);
- Loss of vegetation cover, trees, and disturbance to aquatic lives;
- Landslides and soil subsidence risks during the construction of canals;
- Traffic disturbance and increased traffic safety risks;
- Damages to existing infrastructure and disruption of related services;
- Disturbance to cultural and religious activities (at Thien Hung pagoda, Quan Thanh Temple, etc.);
- Social disturbance related to dust and noise generation, traffic disturbance or interruptions, waste generation, presence of workers in the area etc. Living conditions of roadside HH and business would be affected,
- Health and safety risks for both workers and the community.

Detailed assessment of environmental and social impacts during the construction phase of the Project is presented in the sections which follow.

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A. COMPONENT 1 – SANITATION INFRASTRUCTURES

Component 1 includes rehabilitation of existing canals (Tan Tai, Cha La, Nhi Phuoc, and TH5), Dong Hai lake, existing drains and wastewater pumping stations, construction of Dong Nam canal, the Central lake, pumping stations, public and school toilets, installation of drainage pipes and sewers, upgrading the existing wastewater treatment plant etc. The construction activities under Component 1 would *mainly include* removal of top soil, dredging of canals, road cutting, excavation on the road and at the lakes; ground levelling; transportation and disposal of waste materials; transportation materials such as stone, bricks, sand, gravel, cement, drainage pipes, iron and steel,... The potential negative impacts and risks are discussed in detail below.

3.4.1. Potential Impacts on Air Quality

3.4.1.1. Dust and Exhaust Gases

During construction phase, localised air quality would be reduced with increased level of dust and exhaust gases generated mainly from operations as excavation, backfilling, transportation of soil for ground levelling, temporary loading of construction materials , movement of vehicles, and operations of machinery and equipment such as bulldozers, excavators, generators, rollers.

The level of pollution would depend on factors such as the quality of roads and vehicles, methods of loading, unloading and gathering materials, weather conditions, terrain, etc. Especially, dust concentrations will be much higher during dry, sunny and windy days. Dust may be from materials dropping off during transportation and dispersed by the wind into the air, polluting areas in the vicinity.

Materials such as stone, sand, gravel, cement, etc. are expected to be transported by 16-ton trucks. The number of vehicle trips for transporting construction materials, waste and sludge can be calculated on total volumes of materials and the loads of the trucks.

Dust generated from excavation, backfilling and ground leveling

On average the excavation or backfilling of 1m^3 of soil will generate about 0.75kg of dust, in which 10% is suspended dust[15]. With a pollution coefficient of E= 0.075 kg/m^3 and a density of materials being 1.4 tons/m^3 on average. Based on the project implementation progress, dust dispersed from soil excavation, backfilling and ground levelling operations of each work item under the Project is forecasted to vary from 0.05kg/day(for public/school toilets) to 70.37 kg/day (for Cha La canal). Table 3.3a below presents detailed calculation results of dust dispersed from excavation, backfilling and ground levelling at each work item under the Component.

Table 3.3a: Forecasted volume of dust dispersed at Component 1 areas

No.	Work item	Construction volume (m^3)	Number of construction days	Total volume of dust of whole stage (ton)	Daily volume of dust (kg/day)
	COMPONENT 1				
1	Tan Tai canal	502,058	1092	37.7	34.48
2	Dong Nam canal	63,773	468	4.8	10.22
3	Cha La canal	439,101	468	32.9	70.37
4	Nhi Phuoc canal	86,229	468	6.5	13.82
5	TH5 canal	8,282	468	0.6	1.33

[15]Nguyen Khac Cuong. Environment in Construction Textbook – Ho Chi Minh City University of Technology.

No.	Work item	Construction volume (m^3)	Number of construction days	Total volume of dust of whole stage (ton)	Daily volume of dust (kg/day)
7	Central regulating Lake	325,325	1014	24.4	24.06
8	Dong Hai lake	95,244	1014	7.1	7.04
9	Secondary sewer lines	41,253	1092	3.1	2.83
10	Tertiary sewer line in Kinh Dinh and Phuoc My wards	25,913	1092	1.9	1.78
11	Tertiary sewer line in Phu Ha and Tan Tai wards	45,615	1092	3.4	3.13
12	Public/School toilets	149	234	0.0	0.05

The above table show that, in general, the greatest amounts of dust generated are from the construction sites at Tan Tai, Dong Nam, Cha La and Nhi Phuoc canals, the Central Lake. Dusts would affect local people the most in populated areas along the roads, drainage and wastewater collection pipelines and rehabilitation of Dong Hai lake. The impacts from dust during ground levelling operations are assessed as high level and require strict management measures.

Dust from transportation of construction materials and wastes

The total amounts of stone needed in phase 1 (2017-2018, covering 30% of civil works) and phase 2 (2019-2022, covering the remaining 70% of civil works) is 80,814 tons and 299,039 tons respectively. These volumes require 5,051 and 18,690 trips of 16-tons trucks, respectively. The proposed quarry at Hon Giai Mountain is 18km to the West of Phan Rang City, accessible from National Highway 27 (NH27) and 21/8 Street.

The total amounts of sand needed during 2017-2018 and 2019-2022 is 104,840 tons and 168,154 tons respectively. This means there will be 6,553 and 10,510 trips of 16-tons trucks, respectively. The proposed sand pit in Nhon Son commune is about 15km to the West of Phan Rang City, accessible from NH 27 and 21/8 street. Similarly, with 134,489 tons and 48,618 tons of soil needed for phase 1 and phase 2, respectively. The number of 16-ton truck trips needed will be 8,406 and 3,030 trips, respectively. The proposed borrow pit in west of Cha Bang Mountain is about 20km to the South of Phan Rang Thap Cham City, accessible through NH 1A.

The total main construction materials needed during 2017-2018 is 10,030 tons of cement (627 trips) and 10,326 tons of steel (645 trips); and those during 2019-2022 are 30,125 tons of cement (1,883 trips) and 6,624 tons of steel (414 trips). These materials would be purchased from dealers in the city.

On the other hand, there will also be large number of trips for transportation of the wastes to the final disposal sites, including at the new urban areas of Dong Bac and Dong Nam along 16/4 in the central part of the city (non-polluted excavated wastes for being used as levelling material, about 728,000m^3), and in the Nam Thanh Waste Treatment Site in Kien Kien village, Loi Hai commune, Bac Ai district, about 30km to the North-east of the City, accessible through NH 1A (for highly polluted material, about 61,000m^3). The routes for transporting excavated materials to disposal sites will include the inner-city streets of 16/4, 21/8, Yen Ninh, Bach Dang, Tran Thi, Hai Thuong Lan Ong, Ngo Gia Tu, and Nguyen Van Cu; and NH-1A.

According to the World Health Organization[16], 16-ton DO trucks would generate dust with a generation coefficient of 1.6kg/1000km/vehicle, CO at 3.7kg/1000km/vehicle, SO_2 at 7.43S*1000km/vehicle, and VOC at 3kg/1000km/vehicle (with oil having S of 0.3%). If the

[16] Asessment of Sources of Air, Water and Land Pollution –Part 1: Rapid Inventory Techniques in Environmental Pollution, WHO, 1993

construction time is 12 hours per day, the total number of trips of transportation vehicles and the amount of generated dust during the transportation of excavated and backfilling materials can be calculated with the following formula:

Daily number of vehicles (vehicle/day) = Quantity of materials (m^3)/ Vehicle load (m^3)/ Number of construction days.

Dust volume (mg/m.s) = Number of vehicles per day * Emission coefficient/construction time.

Table 3.4a: Calculated number of vehicle trips for transportation of excavated and filling materials (Vehicle: 16-tonne DO truck)

No.	Work item	Total quantity of materials (m^3)	Number of construction days	Total No. of vehicle trips	Daily No of vehicle trips (trip/day)
	COMPONENT 1				
1	Tan Tai canal	565,319	1092	80,760	74
2	Dong Nam canal	85,701	468	12,243	26
3	Cha La canal	96,324	468	13,761	29
4	Nhi Phuoc canal	136,661	468	19,523	42
5	TH05 canal	17,404	468	2,486	5
7	Central regulation lake	253,183	1014	36,169	36
8	Dong Hai lake	99,955	1014	14,279	14
9	Secondary sewer lines	15,072	1092	2,153	2
10	Tertiary sewer lines of Kinh Dinh and Phuoc My wards	13,796	1092	1,971	2
11	Tertiary sewer lines of Phu Ha and Tan Tai wards	46,870	1092	6,696	6
12	Public/School toilets	309	234	44	0.2

Table 3.5a: Calculated volumes of dust and exhaust gases during transportation of excavated & backfilling materials and construction materials (Vehicle: 16-ton DO trucks)

Item	No. of veh. /day	Generated emissions (mg/m.s)				
		Dust	CO	SO2	NO2	VOC
COMPONENT 1						
Tan Tai canal	74	0.0027	0.0063	0.0127	0.041	0.0051
Dong Nam canal	26	0.0010	0.0022	0.0045	0.015	0.0018
Cha La canal	29	0.0011	0.0025	0.0051	0.016	0.0020
Nhi Phuoc canal	42	0.0015	0.0036	0.0072	0.023	0.0029
TH05 canal	5	0.0002	0.0004	0.0009	0.003	0.0004
Central regulation lake	36	0.0013	0.0030	0.0061	0.020	0.0025
Dong Hai lake	14	0.0005	0.0012	0.0024	0.008	0.0010
Secondary sewer lines	2	0.0001	0.0002	0.0003	0.001	0.0001
Tertiary sewer lines of Kinh Dinh and Phuoc My wards	2	0.0001	0.0001	0.0003	0.001	0.0001
Tertiary sewer lines of Phu Ha and Tan Tai wards	6	0.0002	0.0005	0.0010	0.003	0.0004
Public/School toilets	0.2	0.00001	0.00002	0.00003	0.0001	0.00001

From the above calculation results of generated dust volume and exhaust gases, Sutton model can be applied for the calculation and determination of the average concentrations of dust and hazardous gases along the route of material transportation of the construction items of the Project.

$$C(mg/m3) = \frac{0{,}8E.\left\{\exp\left[\frac{-(z+h)^2}{2\sigma_z^2}\right] + \exp\left[\frac{-(z-h)^2}{2\sigma_z^2}\right]\right\}}{\sigma_z.u}$$

In which:

- C – Concentration of pollutants in the air (mg/m^3)
- E – Emission volume from generating sources (mg/ms). E is the calculation results in Table 3.5a above
- z – Height of design point (m); Given z = 0.5m
- h – Height of road surface in comparison with surrounding ground (m); agreed average h of 0.2m
- u – Average wind speed in the area (m/s); in Project area in the dry season, u=1.8 m/s, wind chiefly Southwest. in the rainy season, u=3 m/s, wind chiefly Northeast
- σz – Dispersion coefficient of pollutants in z direction (m).

The value of longitudinal pollutant diffusion calculated with Slade model, with atmospheric stability B and distance X(m) between the calculation point and the emission point,, taking into account wind direction is determined with the following formula: **$\sigma z = 0.53\ x^{0.73}$** (m).

The calculation results of dust concentrations in the dry season (From October to next April) at distances of X = 20 and 80 meters from the emission source (agreed to be the transportation road edge) during the transportation of excavated materials and backfilling materials are presented in Table 3.6a below.

Table 3.6a: Calculation results of dust concentration and hazardous gases dispersed by distance (calculated from transportation road edge) in the dry season

Item	Distance (m)	Dust (μg/m^3)	CO (μg/m^3)	SO2 (μg/m^3)	NO2 (μg/m^3)	VOC (μg/m^3)
COMPONENT 1						
Tan Tai canal	20	0.51	1.19	2.41	7.77	0.97
	80	0.18	0.43	0.87	2.81	0.35
Dong Nam canal	20	0.19	0.42	0.85	2.84	0.34
	80	0.07	0.15	0.31	1.03	0.12
Cha La canal	20	0.21	0.47	0.97	3.03	0.38
	80	0.08	0.17	0.35	1.10	0.14
Nhi Phuoc canal	20	0.21	0.68	1.36	4.36	0.55
	80	0.08	0.25	0.49	1.58	0.20
TH5canal	20	0.28	0.76	0.17	0.57	0.08
	80	0.10	0.27	0.06	0.21	0.03
Central regulating lake	20	0.038	0.57	1.16	3.79	0.47
	80	0.014	0.21	0.42	1.37	0.17
Dong Hai lake	20	0.25	0.23	0.45	1.52	0.19
	80	0.09	0.08	0.16	0.55	0.07
Secondary sewers/drains	20	0.09	0.04	0.06	0.19	0.019

Item	Distance (m)	Dust ($\mu g/m^3$)	CO ($\mu g/m^3$)	SO2 ($\mu g/m^3$)	NO2 ($\mu g/m^3$)	VOC ($\mu g/m^3$)
	80	0.03	0.01	0.02	0.07	0.007
Tertiary sewers in Kinh Dinh and Phuoc My wards	20	0.019	0.02	0.06	0.19	0.019
	80	0.007	0.01	0.02	0.07	0.007
Tertiary sewers in Phu Ha and Tan Tai wards	20	0.038	0.09	0.19	0.57	0.08
	80	0.014	0.03	0.07	0.21	0.03
Public and school toilets	20	0.002	0.004	0.006	0.02	0.002
	80	0.001	0.001	0.002	0.01	0.001
QCVN 05: 2013/BTNMT		**300**	**30000**	**350**	**200**	-

Remarks on dust generation:

In general the dust concentration generated on transportation roads does not exceed the applicable standards pursuant to QCVN 05:2013/BTNMT[17]. Dust concentrations quickly decreases with increased distances from sources. At a distance of 20m from the road edge, the dust concentrations calculated for all construction items under the Project are many times lower than the applicable standards.

However, the above calculations are for the dust generated from the vehicle engines only and do not include dust brought up from road surfaces by moving wheels or from materials or waste dropping/spilling out of vehicle bodies during transportation. The amounts of such dust will be much dependent on weather conditions, road surface quality, hygiene of vehicles and roads, wind strength. Therefore, impacts from dust generated on these roads are bound to be higher with these additional factors.

In addition, the above calculations are based on the assumption that there are only vehicles of each work item under Component 1 travelling on such roads, emissions from other vehicles travelling on the same roads not included. In reality, dust concentrations could probably increase a lot more than the calculation results. Especially, under this Project, there would be cases where many transportation vehicles for many work items under the Project travel at the same time on the same roads (For example, 21/8 Street, 16/4 Street, National Highway 1A, and National Highway 27 are the main transportation roads for backfilling materials and construction waste into/from the city). Besides, dust concentrations also depend on the frequency of construction and Contractor's vehicle mobilization at each point of time. There may be times when the construction progress must be sped up, requiring additional equipment, machines and vehicles and impacts from dust will thereby increase.

21/8 Street, 16/4 Street, Thong Nhat Street, Bach Dang Street, Hai Thuong Lan Ong Street, Nguyen Van Cu Street and local traffic roads to the South of the city are the main routes for transporting materials and also the arterial roads in the City. Such roads will be more affected by dust from higher flows of traffic means. According to the results obtained from the analysis and assessment of the air in Chapter 2, the current air quality in the above-mentioned areas is still fairly good. Therefore, the impacts of dust from Project activities will be significant. Nevertheless, such impacts are only temporary during the construction phase and can be mitigated. Yet, these impacts can only be terminated when the transportation and construction phase of the Project is completed.

The affected subjects will be road users and households living along the roads. Dust pollution can contribute to hindering business and service activities as customers would be more willing to

[17]QCVN 05:2013/BTNMT – National Technical Regulation on Ambient Air Quality

choose cleaner places for eating, drinking or buying goods. Especially, 21/8 Street, 16/4 Street and Yen Ninh Street are places with busy shops and a lot of visitors.

Remarks on exhaust gases emission:

The above calculations show that the concentrations of hazardous substances dispersed in the air from vehicle exhaust gases such as CO, SO2, NO2 and VOC along transportation routes and within a dispersion distance of 80m from the design point (edges of roads) are all within applicable standards QCVN 05:2013/BTNMT.

Similar to the comments given dust, the calculations are based on the assumption that there are only vehicles of one work item travelling along the routes. In reality, the concentrations of pollutants would be substantially higher than the calculated results; especially, such the 21/8 Street, NH 1A and NH 27 (main routes for transporting backfilling materials and construction waste into/from the city), and 16/4 Street (main route for transporting excavated materials to the disposal site at the new urban areas of Dong Bac and Dong Nam) are expected to be highly affected by exhaust gases from higher flows of traffic means.

Dust and emission would affect drivers on the roads and households living along the roads the most. These impacts are of high levels but temporarily and can be partially mitigated.

Bad Odors

Bad odours would be emitted during dredging of the existing canals, rehabilitation of the Dong Hai Lake, and the repair & replacement of 628 manholes. The sources of such bad odours are from the gases such as methane, H2S, NH3, etc. generated from the anaerobic decomposition of organic matters presence in domestic waste and wastewater. Depending on concentration and exposure period, these gases may cause negative impacts at different level to the health to affect local people as indicated in the boxes below.

H2S	
Concentration (ppm)	**Symptoms/Effects**
0.00011-0.00033	Typical background concentrations
0.01-1.5	Odor threshold (when rotten egg smell is first noticeable to some). Odor becomes more offensive at 3-5 ppm. Above 30 ppm, odor described as sweet or sickeningly sweet.
2-5	Prolonged exposure may cause nausea, tearing of the eyes, headaches or loss of sleep. Airway problems (bronchial constriction) in some asthma patients.
20	Possible fatigue, loss of appetite, headache, irritability, poor memory, dizziness.

Bad odours during construction are unavoidable at many areas around the construction sites of Component 1. The potential impacts are at medium level and mitigable.

Strong bad odours may also be released during the rehabilitation of Dong Hai lake and dredging the existing canals, particularly the downstream where the canals has been polluted with untreated wastewater and decomposed organic wastes for long time. The sections passing central areas of the city which is a populated area and downstream of Tan Tai canal would be affected the most by odour from canal dredging. This potential impact would be unavoidable but mitigable partly by successive construction method. According to Chapter 1, dredging (about 200-500m) with dredging operations taking place only in the first few days of the work and dredged materials will be transported immediately to disposal sites, the impacts from bad odours would temporarily occur within a localized and limited scope with affected subjects being mainly workers and residents

along the canal banks. For rehabilitation of Dong Hai lake, a coffer dumping cell will be constructed onsite with interface liner and outer face embankment for storage of the excavated/dredged materials; the dredged polluted top-layer sludge will be immediately transfered to be compacted at the bottom of the onsite dumping cell for stability; The natural mud/soil will be fulled up to form an artificial hill on top of the cell for later planting trees to create a green park. This construction method is expected could minimize the impact of odours for the ambient areas.

Bad odours also be emitted during the repair of 4 existing wastewater pumping stations (PS). As the PSs are located far from residential areas, only the workers and travellers near these stations would be directly affected. As the depths of the pumping stations are normally about 4-5m, high concentrations of the gases (H_2S, CH_4, etc.) may cause adverse impacts such as asphyxiation to the workers. This risk is mitigable.

3.4.1.2. Increased Noise Levels

Noise-generating sources

During the construction phase, noise is mainly generated from construction plants and equipment, and the operations related to rocks. The typical level of noise generated from construction plants are listed in Table 3.7 below.

Table 3.7: Norms of noise generated by construction means

No	Construction plant and equipment mean	Noise level at 1.5m from source (dBA)
1	Driller	87
2	Diesel air compressor	80
3	Concrete mixer of 90-120 m^3/h	75
4	Concrete pump of 60 m^3/h	84
5	Concrete compactor	80
6	Welding machine	72
7	18-ton truck	83
8	500MT crane	78
9	15MT forklift	72
QCVN 26:2010/BTNMT[18] (normal area)		70
Standards by Ministry of Health (contact duration of 8 hours)		85

Source: US Environmental Protection Agency, Noise from Construction Equipment and Machines NJID, 300,1, 31–12–1971.

Noise level at certain distance from sources can be calculated using the following formula:

$$\mathbf{Li = Lp - \Delta L_d - \Delta L_c \quad (dBA)}$$

Li – Noise level at design point located d(m) from noise-generating source,
Lp – Noise level at noise-generating source (from position 1.5m from equipment),
ΔL_d – Noise level decreasing by distance d at frequency i, $\Delta L_d = 20 \lg [(r_2/r_1)^{1+a}]$ (dBA)
r_1 – Distance to noise-generating source corresponding to Lp (m),
r_2 – Distance for calculation of noise level reduction by distance corresponding to Li(m),
a – Noise absorption coefficient taking of terrain; agreed at a=0,
ΔL_c –Noise reduction by obstacles; agreed at ΔL_c=0 for Project areas

[18]QCVN 26:2010/BTNMT-National regulations on noise.

The calculated noise levels at 100m and 200m from sources are shown in Table 3.8 below.

Table 3.8: Level of construction noise transmitted to surrounding environment

		Noise level (dBA)		
No	**Construction equipment**	**At 1.5m from source**	**At 100m from source**	**At 200m from source**
1	Driller	87	68.5	63.5
2	Diesel air compressor	80	65.5	60.5
3	Concrete mixer of 90-120 m^3/h	75	59.5	54.5
4	Concrete pump of 60 m^3/h	84	62.5	57.5
5	Concrete compactor	80	65.5	60.5
6	Welding machine	72	57.5	52.5
7	16-ton truck	83	66.5	61.5
8	500MT crane	78	64.5	58.5
9	15MT forklift	72	61.5	53.5
QCVN 26:2010/BTNMT		70	70	70

The calculation results have shown that at distance of 100 m from source, noise generated from construction machines and equipment meets the applicable standards, QCVN 26:2010/BTNMT the shorter the distance from source, the higher the noise level would be.

The potential impacts of noise are manageable. For example, construction equipment can be placed as far from residential areas as possible. Details about measures to mitigate the potential impacts of noise are discussed in details in Chapter 5.

3.4.1.3. Vibration

Vibration is generated mainly from trucks carrying construction materials and waste travelling on the roads. Vibration can be mitigated by the measures presented in Chapter 5. The construction process of work items under the Project will not cause considerable vibration to surrounding areas.

3.4.2. Potential Impacts on Water Quality

The main causes of water pollution during the construction phase of Component 1 are as follows:

- Surface runoff passing construction sites bring along suspended materials and waste to the canals, lakes and other surface water sources around the sites;
- Domestic wastewater generated by the workers and construction wastewater directly discharged into canals, lakes and other surface water bodies around construction sites;
- Canal dredging and embankment and bridge construction causing disturbance, increasing turbidity and decreasing the quality of canal water.

3.4.2.1. Impacts from Surface Runoff

Surface runoff would contain and bring suspended materials and waste into canals, lakes and other surface water bodies around construction sites, causing increases in turbidity and suspended solids in these water sources, causing water quality reduction and sedimentation. Surface runoff through camps, if without proper management, would take along domestic waste (wastewater and solid waste) generated by the workers, polluting surface water.

To calculate the volume of storm water runoff through construction sites under the Project, the following formula[19] can be used:

$$Q = q.C.F$$

In which:

Q: Volume of runoff (m^3/day);

C: Flow coefficient, selected at C = 0.6

q: Value of calculated rain density (mm/day); according to rainfall recorded data shown in Chapter 2, the average rainfall in Phan Rang is 763mm/75 days (equivalent to 0.01mm/day)

F: Area of catchment (m^2)

By using the above formula, the average storm water runoff for rainy days through construction sites under the Project is calculated as follows:

Table 3.9a: Calculation of average overflow rainfall for raining days at construction sites under the Project

No.	Work item	Area of construction site (m^2)	Stormwater runoff (m^3/day)
	Component1		
1	Road along Tan Tai canal	65,455	393
2	Road along Cha La canal	92,484	555
3	Construction of central regulating lake	332,000	1,992
4	Rehabilitation of Dong Hai lake	43,200	259

According to the study and measurement results in 2009 of Ho Chi Minh City Institute of Hygiene and Epidemiology, the concentrations of pollutants in storm water runoff in urban areas without polluting sources and with construction works are as follows:

Table 3.10: Concentrations of pollutants in storm water runoff

No.	Pollution parameter	Unit	Urban area	Urban area with construction works	QCVN 40:2011 (Column B)
1	COD	mg/l O_2	10 - 20	30 - 50	150
3	T-N	mg/l	0.5 - 1.5	1-1.5	40
4	T-P	mg/l	0.004 – 0.03	0.02-0.05	6
5	SS	mg/l	10 - 20	80-120	100
6	Mineral oil and grease	mg/l	<0.01	3-5	10

Source: Ho Chi Minh City Institute of Hygiene and Epidemiology, 2009.

Calculations were made for the construction of the lakes only, where construction area is centralised. Surface runoff is not calculated for aligned or very small construction sites such as sewer, pumping stations, canals, school and public sanitation facilities. The results show that storm water runoff through construction sites is relatively high. It has the potential to cause water quality reduction in surface water bodies in the area. In addition, storm water runoff run can also bring along soil, sand and waste causing sedimentation of drainage canals blocking the combined drainage system of the area.

[19]Extracted from TCVN 7957:2008- Drainage – Network and External Works – Design Standards

The impacts from storm water runoff during construction could be considered as medium level and require strict management measures.

3.4.2.2. Potential Impacts of Construction and Domestic Wastewaters

a) Domestic Wastewater

At peak time during the construction phase at major construction sites such as the central regulating lake, Dong Hai Lake, the roads, Tan Tai canal and Cha La canal, the maximum number of workers mobilized on site may reach about 100 – 120 persons per site. On average there are about 50-70 persons regularly present on each site. If the construction operations of all the work items under the Project take place simultaneously, the number of workers mobilized to all Project sites of the City will be high. However, as the Project is divided into 2 phases, the number of workers present at the sites at the same time will be much lower. Specifically, the Project implementation progress is divided as follows:

- Stage1: From 2017 to 2018, implementing 30% of the proposed works, including: Rehabilitation of Cha La and TH5 canals, construction of Dong Nam and Nhi Phuoc canals, and construction of school and public sanitation facilities
- Stage2: From 2019 to the end of the second quarter of 2022. implementing 70% of the proposed works, including: Rehabilitation of Tan Tai canal, construction of the central regulating lake, rehabilitation of Dong Hai lake and the drainage system of Dong Hai area, construction of the secondary sewer system for flooding prevention and tertiary wastewater collection system at Phu Ha and Tan Tai wards, rehabilitation of the Wastewater Treatment Plant (WWTP), supply and installation of equipment for wastewater pumping stations and the WWTP.

Therefore, the average number of workers mobilized every day in the whole city during the construction phase is about 300 to 400 people. During peak time, this number would reach 500-600.

Domestic water uses would be mainly for personal hygiene, washing, cooking, bathing at camps, etc. It is estimated that the average daily water use rate is 20-25 litres/person/day. Wastewater discharged is estimated at 90% of the water used. The wastewater generated can thus be calculated in the following table.

Table 3.11a: Domestic wastewater generated each day

No.	Construction site	No. of workers (person)	Quantity of wastewater generated	
			m^3/day	m^3/month
1	At each main construction site (daily average)	50 - 70	0.9 – 1.6	27 - 48
2	At each main construction site (during peak period)	100 -120	1.8 – 2.7	54 - 81
3	At all work items (daily average)	300 - 400	5.4 – 9.0	162 - 270
4	At all work items (during peak period)	500 - 600	9.0 – 13.5	270 - 405

According to the calculation above, the amount of domestic wastewater generated daily during the construction phase is relatively high but it is from numbers of separate construction sites.

The composition and concentration of pollutants in domestic wastewater was studied and indicated in the table below:

Table 3.12: Properties of domestic wastewater generated during construction stage

No.	Parameter	Average concentration (mg/l) (*)	QCVN 14:2008/BTNMT (Col. B)
1	pH	6,8	-
2	SS	220	120
3	COD	500	-
4	BOD5	250	60
5	Total N	40	-
6	Total P	8	-

Source: (*) Wastewater Treatment Technology Textbook - Tran Van Nhan, Ngo Thi Nga, Science and Technology Publishing House, 1999.

As shown in the table above, the concentration of suspended solids (SS) and organic substances (BOD5) in untreated domestic wastewater is relatively high and exceeds the standards. Therefore, without proper management and treatment, such domestic wastewater amounts would enter and pollute adjacent surface water bodies.

Impacts by domestic wastewater generated during construction phase could be considered at low level, can be mitigated by strictly management measures.

b) Construction Wastewater

Construction wastewater is generated from activities such as washing of materials, cleaning of machines & equipment, concrete curing, etc. The construction wastewater would contain some soil, sand, and high contents of suspended materials, and possibly even oil and grease. The volume of construction wastewater generated would be subject to many factors such as land area of construction site, time of the year, workers' awareness, construction method and technology applied, and the quality of construction materials, etc.

Construction Wastewater could also be generated from washing and mixing materials and concrete maintenance. Wastewater from concrete curing would contains sand and suspended materials but only generated in hot and dry days in very limited quantity. This wastewater from concrete curing can be used to water the sites to reduce dust.

In general, the construction wastewater mostly comes from the washing of trucks at the construction sites. This amount is generated the most during the excavation, backfilling and ground-levelling stage. Every time a truck gets out of the site, dust and soil must be flushed. With an average of 10 litres of water needed to wash a wheel, an amount of 60 litres of water will be used in wheels washing. The daily amount of wastewater needed for washing wheels at construction sites can be calculated as follows:

Wastewater amount (m^3) = Number of truck trips * (60/1000) (m^3)

The calculations of wastewater amount generated at construction sites from excavation, backfilling and ground-levelling operations are presented in Table 3.13a below.

Table 3.13a: Calculations of wastewater generated from on-site wheel washing during excavation, backfilling and ground-levelling stage

No.	Work item	Volume of materials (m^3)	Number of construction days	Total no. of trips	Water for wheel washing (m^3)	Daily wastewater amount (m^3)

	COMPONENT 1					
1	Tan Tai canal	565,319	1092	40,380	2423	2.22
2	Dong Nam canal	85,701	468	12,243	367	0.78
3	Cha La canal	96,324	468	6,880	413	0.88
4	Nhi Phuoc canal	136,661	468	9,761	586	1.25
5	TH05 canal	16,753	468	1,197	72	0.15
6	Central regulation lake	251,301	1014	17,950	1077	1.06
7	Dong Hai lake	97,208	1014	6,943	417	0.41
8	Construction of secondary sewer lines	14,341	1092	1,024	61	0.06
9	Construction of tertiary sewer lines in Kinh Dinh and Phuoc My wards	12,996	1092	928	56	0.05
10	Construction of tertiary sewer lines in Phu Ha and Tan Tai wards	44,862	1092	3,204	192	0.18
11	Public/School toilets	288	234	21	1	0.01

Wastewater from wheel washing often contains soil, sand and suspended materials but no oil or grease.

The washing of whole trucks is expected to be done every 5 days for each truck, subject to the weather conditions and how dirty a truck is. Cleaning of whole trucks will be performed at professional car service stations in the city, not on the construction site. Each cleaning time is estimated to require about 200 litres of water for each truck. Wastewater from truck washing would include soil, sand, suspended materials and oil. Therefore, the preliminary treatment of wastewater from washing trucks, in addition to sedimentation manholes, would also need oil and grease separating tanks.

The impacts from construction wastewater during construction could be considered as being medium and require proper management measures.

3.4.2.3. Potential Impacts on Water Quality of Canal Dredging and Embankment Lining

Dredging of canals and lakes would disturb the links between soil layers and bottom sludge, suspended substances and other pollutants in the sediments at the bottom of the canal diffused into the canal water causing water quality degradation. When the flow travels, it pollutes downstream areas which are paddy fields irrigated with water by the canals being rehabilitated under the Component 1.

Tan Tai and Cha La are two important canals functioning as main drainage and irrigation canals for Phan Rang-Thap Cham city. As indicated in Chapter 2, the quality of sediment in canals met QCVN 03-MT:2015/BTNMT for agricultural soil. Only one sample taken at the beginning point of Tan Tai canal out from 7 canals sludge samples has As concentration slightly (about 1.2 times higher) exceeded the standards for agricultural soil. As a result, concerning the increase in turbidity and content of suspended sediment in the canal water flowing downstream due to canal dredging and embankment, it is forecasted that the water quality is still be able to serve irrigation purposes in rice paddies in downstream areas of Tan Tai and Cha La canals.

The potential impacts related to degradation of surface water quality from dredging and embankment operations are therefore assessed to be medium and will be temporary during the construction phase and can be mitigated with the method of successive construction and strict management measures during construction.

3.4.3. Solid Waste Generation

3.4.3.1. Dredged and Excavated Materials

Ground levelling and excavation operations for the construction of the items in Component 1 of the Project are expected to generate a total of over one millions cubic meters of excavated materials in which 40,000 m^3 is top-soil/dredged materials. 362,000 m^3 can be reused and the balancing 815,202 m^3 will have to be disposed off. The quantity of dredged and excavated materials generated from each item are listed in Table 3.14a below:

Table 3.14a: Excavated materials of Component 1 (unit: m^3)

No	Item	Topsoil/dredged	Excavated soil		Disposed off
			Excavated	Reused	
	COMPONENT 1	**58,631**	**1,095,798**	**362,973**	**791,456**
1	Tan Tai canal	0	362,427	90,607	271,820
2	Dong Nam canal	1,288	41,607	0	42,895
3	Cha La canal	42,538	240,838	155,725	127,651
4	Nhi Phuoc canal	0	62,105	0	62,105
5	TH5canal	178	3,210	0	3,388
6	Central lake	11,538	256,382	57,405	210,515
7	Dong Hai lake	3,089	59,658	15,877	46,870
8	Secondary sewers	0	23,050	18,203	4,847
9	Tertiary sewers in Kinh Dinh& Phuoc My wards	0	14,250	11,663	2,587
10	Tertiary sewers in Phu Ha &Tan Tai wards	0	32,189	13,426	18,763
11	Public and school toilets	0	82	67	15

It is noticeable that the construction of the Tan Tai canal, the central lake and the Cha La canal would generate the highest volumes of excavated materials with respectively 362,427 m^3, 256,382 m^3 and 240,838 m^3 including 11,538 m^3 of top soil. According to the baseline information, the site is currently paddy rice and garden land, the concentration of arsenic contents in two tested samples were 17-2 to 18.5 ng/kg, which is slightly higher that allowable limit set for agricultural land in QCVN 03-MT:2015/BTNMT, at 15 mg/kg. All other heavy metal contents in that soil are below allowable limits.

Dredging and embankment lining of the Cha La canal would also generates 240,838 m^3 of excavated soil and dredged materials, in which 42,538 m^3 is dredged materials from the canal and the rests are the soil from the embankment. It is noticeable that the end section of the Cha La canal is subjected to salinity intrusion, thus 13,420 m^3 of the dredged and excavated materials at that section is also saline.

60,290 m^3 of saline soil will be excavated from the Dong Hai lake, the area that soil and surface water is saline as the site is subjected to salinity intrusion.

Parts of the solid wastes generated under the Project can be reused for backfilling. The top soil can be reused for beneficial purposes such as composting (as it is expected that the concentration of

arsenic contents in the final product would be under allowable limits but tests for arsenic contents in the compost would be required). The balancing volume would require some land for disposal.

Some other environmental concerns at risks would be arisen at temporary loading and final disposal sites of solid wastes. These include dust and erosion from granual materials on barren ground surface, sedimentation in drainage and canals due to washing off effect of storm water, landslide risks if the dump is too high, too steep and not compacted/protected properly.

If stormwater passing the saline materials enters water bodies would make salinity increases in water, affecting water use purposes at the receptor. For example, as indicated in the due diligence review carried out for the Nam Thanh landfill, there is no groundwater at the site, rainwater has been led to the grassland in front of the complex, and there is also an irrigation canal which is 100 m from the site. If saline materials is disposed off at the landfill and without any control on surface water runoff, saline runoff entering the grassland or irrigation canal may kill the grass or badly affect the crops irrigated with saline water.

The impacts from dredged materials and excavated soil generate from construction operations could be considered at high level and require strict and suitable management measures.

3.4.3.2. Construction Solid Waste

Solid waste from construction operations includes waste from construction materials such as packing materials including cement bags, scrap iron and steel, wooden chips, empty boxes, etc. This waste is composed of inert and non-hazardous substances, with some being able to be recycled for other purposes.

According to Document No. 1784/BXD-VP dated 16 August 2007 by the Ministry of Construction, construction solid waste generated from construction operations of the Project would be about 1,607 tons (321,350 tons (materials) * 0.05 % = 1,607 tons of construction waste),in which the volume of solid waste from Component 1 and Component 2 would be 1,267 tons and 97.5 tons respectively and construction solid waste from Component 3 for the construction of the resettlement site would be 243 tons. These volumes of construction waste would have to be collected daily on site, collected and handled in accordance with legal regulations.

The impacts from construction solid waste could be considered as high and require strict management measures.

3.4.3.3. Domestic Solid Waste

Each worker during working hours on site is estimated to generate about 0.5kg of domestic solid waste a day; meanwhile one person living in camps may generate 1.5 kg domestic solid waste a day. Since the construction sites are all in the city, most workers will go home or rented houses daily after working time, only a few workers (estimated 5 people) stay in camps as security guards on site. The volume of domestic solid waste generated by the workers can be estimated as presented in Table 3.15a.

Table 3.15a: Estimated Domestic Waste generated daily at Construction Sites

No.	Area	Number of workers (person)	Volume of generate solid waste (kg/day)
1	At each main construction site (daily)	50 - 70	30 – 40
2	At each main construction site (peak time)	100 -120	55 – 65
3	Total items of the project (daily)	300 - 400	175 – 225

4	Total items of the project (peak time)	500 - 600	275 – 325

According to the calculations in this table, the total volume of domestic solid waste generated daily in the construction phase is relatively high. However, the figure is distributed to many construction sites located around the city. The average volume of domestic solid waste in each main construction site is then only 30-40kg/ day. Without proper management and daily collection, this volume of domestic waste could cause air pollution and affect surface water bodies in the vicinity.

There are currently services of collecting urban solid waste collection that can serve the entire city Phan Rang City- Thap Cham City. With all construction items of the Project being located in the city area, the construction contractors can sign contracts with the domestic waste collection and transportation business (Nam Thanh Company) to collect and transport domestic solid waste generated in the construction sites.

The impacts could be considered at low level.

3.4.4. Hazardous Waste

Hazardous Wastes (HWs) include waste containing alkaline or acids, waste with discarded oil, oily rags, packing and packaging materials tainted with paint, packing and packaging materials for construction additives, and damaged electronic equipment. In addition, there are also tar and empty tar drums for road construction, construction chemicals, etc. Generally, the volume of hazardous waste generated in the construction phase of the Project is not very substantial, consisting of mainly discarded oil & grease and oily rags.

The amount of discarded oil and grease generated during the construction process is subject to the following factors:

- Number of means of transport and construction on site;
- Amount of oil and grease discarded from means of transport and construction;
- Frequency of oil replacement and machine &equipment maintenance.

On average the volume of oil discarded from means for transportation and construction is about 7litres for each replacement. The frequency for oil replacement and machinery maintenance is every 3 months. The number of transportation vehicles and construction machines which need oil replacement mainly utilized at Project sites at a same time is 72 (42 trucks and 30 construction equipment items). Therefore, the total average volume of discarded oil and grease generated at construction sites is: (72 vehicles x 7 litres/time)/3 months = 168 litres of discarded oil /month.

Table 3.16a: Forecasts of hazardous waste generated in construction phase

No.	Type of HWs	Unit	Average volume in each construction site	Average volume in the whole Project
1	Discarded oil	litres/ month	15 – 21	150 – 210
2	Oily rags	kg/ month	4 – 5	40 – 50
3	Packing &packaging materials tainted paint, damaged electronic devices, battery, ink cartridges, light bulbs, etc.	L\kg/ month	4 – 5	40 – 50

If without proper management, this volume of hazardous wastes, especially oily waste would cause soil and surface water pollutions. The hazardous wastes (especially liquid waste) will have to be collected, stored, transported and disposed of as provided for in Circular No.36/2015/TT-BTNMT.

The impacts caused by HWs could be considered as medium level.

3.4.5. Inundation Risks

At present, the areas in the central part of Phan Rang-Thap Cham City such as 21/8 Street (at the Stadium section), Le Quy Don Street, Ha Huy Tap Street, Ha Huy Tap Street, Pham Ngu Lao Street (section near the TV Station), Dong Dan discharge gate, Ngo Thi Nham Street, Nguyen Du Street, Bao An hamlet, Minh Mang-Tu Duc intersection, the Provincial Children's Culture House, Yersin-Thong Nhat intersection, the pressurized pump station on Tran Phu Street, Phu Ha-Tran Phu intersection, Phan Rang market and Nguyen Thi Minh Khai Street are hollow areas most likely to be inundated in heavy rains, with inundation often lasting from 20-30 minutes up to 2-3 hours. Without proper prepared plans for drainage, rains could cause inundate the sites for the construction of secondary and tertiary sewer networks, seriously affection construction operations.

Large volumes of construction materials and solid wastes generated during construction phase may cause blockage of existing drains and/or drainage canals, leading to localised flooding. Localised flooding, if any, are most likely occurred at the areas surrounding the temporary loading of construction materials or waste disposal where existing drains are blocked or natural drains are disturbed. Large volume of solid waste generated are at the Dong Hai and central lakes, however, new ponds and lakes are created thus localised flooding, if any, would be limited as rainwater can always find ways to these ponds and lakes. On the other hand, the Tan Tai and some other canals are the main drainage canals of Phan Rang, if being blocked for dredging and embankment lining, flooding may also occur at some locations after rain. Localised flooding may also happen at and surrounding the construction site of secondary and tertiary sewers. Heavy rains may also take along solid waste and construction waste into existing drains causing blockage.

3.4.6. Erosion, Soil Subsident and Landslide Risks

Erosion potentials would be increased, soil subsident and landslide risks happen at cut and fill place, where unstable slopes or deep holes are created. Soil subsident may also happen at or near relative shallow pipe trenches if there are existing weak structures nearby. Erosion may happen on barren disturbed ground, on relative unstable slope. Erosion rate is accelerated significantly by surface water runoff , particularly in cases where there is no proper drainage on the slope and on the foot. Erosion would make the slopes more unstable and result in landslide.

There will be risks of landslide risks during canal dredging, construction, and embankment lining at the canals and lakes, the construction of and road along the canals, and the construction of pipe trenches for secondary pipe installation. Landslide risk is higher in rainy weather.

In many segments of the Tan Tai canal (the upstream), some of the slopes are 6-7 m from foot to top while and there are also residential houses located close to the canal. Therefore, excavation for construction of vertical stone wall embankment and box culvert of Tan Tai canal, Cha La canal (Sections CL2, CL4 and CL5) and Nhi Phuoc canal would cause high landslides risk; damages would be caused to the households living along both sides of the canals.

Downstream sections of the canals including Tan Tai, TH5, and Nhi Phuoc run through the central urban area and are close to residential houses or roads. Therefore, deep excavation (3-4m) at the canals and in roads/streets would also cause landslide risks and damages to the existing roadside facilities and people. There are also land slide risks during the construction of the embankments of the Dong Hai and the Central lakes (2-2.5m).

With weak geological structure of the foundation in project area, excavation for new pipe trenches for secondary drainage (relative deep excavation for pipes D600-1200), the construction of pumping stations (at depths 5-12m), particularly in rainy weather. Soil subsident may also happen

if refill and compaction within the pipe trench is not good enough before roadsurface is fully reinstated. Loads from traffic travelling on the road would cause soil subsident in these place.

New embankments will be build at the Dong Hai and the Central lake, relative deep excavation and dredging will take place. There is a soil subsident risks and landslide on the unfinished on the embankments.

Landslides not only has the potential to cause damages to the existing structures but also present serious and direct threat to the workers and the public who presence on site. Such risks can also lead to accidents such as burying human or properties with the bulk of materials.

The landslides risks could be considered as medium level, manageable and require strict management measures.

3.4.7. Traffic Disturbance and Increased Traffic Safety Risks

The main impacts to the traffic system in the construction phase include the following:

- Temporary disturbances or disruption of the traffic may take place in the roads under construction (including two sides of the canals, area by Dong Hai lake, area around the central regulating lake), and in the road sections with the construction of drainage pipes. The disturbances are caused by the open trenches for pipe installation, placement of construction equipment, construction materials and wastes surround the construction sites, movement of trucks to and from the construction sites etc.
- Transportation of construction materials and wastes would lead to increases in traffic density in some roads in the city. According to the estimation presented in Table 3.4a, on average each day there will be 74 trips of 16T trucks going in and out of construction area at the Tan Tai canal, 42 trips along the Nhi Phuoc canal, 36 trips at the central lake, 29 trips at the Cha La canal, and 26 trips at the Dong Nam canal.
- Movements of heavy trucks carrying construction materials and wastes may affect or cause damage to the existing earth roads along the projected canals.

Increases in traffic density caused by the trucks and other construction plants mobilised by the project, the roads being narrowed down during construction, the temporary loading of materials at wastes and roadside, the fences placed along the roads would cause vision reduction to the drivers, these may lead to increased traffic accidents risks;

Moreover, vehicles would have to travel more slowly and speed variations are higher than usual, causing increases in exhaust gases emission from the vehicles along the route.

The roads most affected during the construction phase would be those where box culverts would be constructed (with relatively long construction time), or secondary drainage with relative big sizes (DN from 600mm to 1200mm) to be installed, canal side roads and areas around the central regulating lake and Dong Hai lake. In addition, the roads with a large number of truck trips of transporting construction materials and waste for disposal, especially road sections passing through densely-populated areas such as markets, schools, hospitals, etc. are also highly impacted in terms of traffic. Table 3.16a below presents in detail the roads significantly impacted during the construction phase of the Project.

Table 3.17a: Possibly affected roads during construction phase

No.	Impacted route	Description of impacts
1	21/8 Street	This is the main transportation route of the city, with very heavy traffic, with lots of tourists, residential houses and Thap Cham relics. This route is planned for the transportation of construction materials and waste for disposal during

No.	Impacted route	Description of impacts
		the construction of the following items: Alley150 on 21/8 Street, Huynh Thuc Khang Street, Tan Tai canal and pump stations PS1 and PS2.
2	Truong Dinh and Hai Thuong Lan Ong streets	This is the transportation route for the construction of Cha La canal, in which Truong Dinh street is planned to be the main route. However, there will be few impacts as this street is relatively sparsely inhabited.
3	Bach Dang Street	This is the main access route for transporting construction materials serving the construction of Dong Hai lake. The impacts will be high on this thickly-populated area. Especially, along Bach Dang Street and the access lane to the lake there are three (03) environmentally sensitive locations: Dong Hai Primary School, Dong Giang market and Quan Thanh Temple. Measures to secure safety and reduce noise are to be devised during construction.
4	Truong Chinh Street, Nguyen Van Cu Street, and Nguyen Thi Minh Khai Street	These routes are planned for the transportation of construction materials to the site for the central regulating lake. Especially, Nguyen Van Cu Street is also planned to be the transportation route serving the construction of Cha La canal. Measures to secure safety and reduce noise during transportation are to be worked out as Nguyen Van Cu Street is dense-populated and there are 2 sensitive areas: Ninh Thuan Provincial Hospital and Thien Hung Pagoda.
5	16/4 Street, Yen Ninh Street and inner-city roads of the new urban area	This is the construction site for tertiary sewers. The gathering of materials and increase of transportation vehicles and construction operation along internal roads of the ward may cause local traffic jams at times. However, as this new urban area is not densely populated with a lot of unoccupied land, suitable for gathering materials. Therefore the impact on traffic in this area is low.
6	Da Tuong Street and Tran Thi Street	The downstream segment of Tan Tai Canal of the Project will be constructed along Tran Thi street. At the end point of the route, there will be a sewer cutting across Tran Thi and Da Tuong streets (on Dinh river dike) discharging into Dinh river. Tran Thi and Da Tuong streets are planned to be the access route for construction. The construction of the sewer cutting across the dike might cause traffic disruption at the ends of these 02 streets during construction.
7	National Highway 1A, National Highway 27 and Thong Nhat Street	This is the route for transporting construction materials (stone, soil, sand). Note: Ground levelling materials from planned Tra Bang mine of Phuoc Ninh commune, Thuan Nam district can be transported on National Highway 1A and the seaside road. However, to prevent impact on the sea tourism environment, transportation along the seaside road should be avoided. Transportation route of waste to Nam Thanh solid waste treatment facility
8	16/4 Street	This is the transportation route for excavated materials to be used as backfill at Dong Bac and Dong Nam new urban areas.

The impacts on traffic in the area could be considered as medium level.

3.4.8. Potential Impacts on Existing Infrastructures and Services

Impacts on traffic infrastructure

For the construction of storm water and wastewater collection lines, road surface in many streets will be cut and then excavated or disturbed affected by temporary loading and transportation of construction materials and waste. After construction has been completed, the road surfaces will be reinstated with costs already included in the estimates.

Additionally, the affected roads and streets would be degraded by the transportation of materials. Especially, on such main routes for the transportation of excavated and backfilling materials as

21/8 Street, 16/4 Street, Hai Thuong Lan Ong Street, National Highway 27, Nguyen Van Cu Street, Tran Thi Street, Bach Dang Street and Yen Ninh Street. These impacts are unavoidable but can be mitigated with measures related to vehicle speeds and loads. Repairs of the affected road surfaces may be required.

Impacts on water supply and drainage

At present, the water supply pipelines mainly run along the sidewalks of the streets. The construction of drainage and sewers is likely affecting the existing water supply pipes in the area. Excavation for the installation of drainage/sewers may cause damages to existing water pipes, disrupting the water supply service. As presented in section 2.3.3, 81% of surveyed households have been using single water source and 19% survey HH has been using from two water sources. Therefore, interruptions of water supply service would cause lots of difficulties to local residents; their daily lives would be disturbed. They would have to limit water use and spend time to get water from alternative sources for domestic use and production activities. This would be harder for woman-headed HH or HH with elderly people.

The construction of the central regulatory lake where existing land use is paddy field may also disrupt some parts of the existing irrigation canals.

Rehabilitation of the existing drainage and irrigation canals would affecting the accessibility to water surface of residents along the canal (for example, those who are raising duck on Cha La canal, although raising duck on canals is illegal, notification and negotiation should be carried out to avoid unwanted conflicts).

Impacts on power supply infrastructure

During construction, demolition or relocation of existing infrastructure for site clearance may affect the existing power lines causing power cut off. Power connections for new pumping stations may also require power cut off for safety reason. This power cut-off would disturb the lives of households or disrupt the businesses such as restaurants or eating places. This potential impacts is not avoidable but can be mitigated.

Impacts on irrigation function of canals to be dredged

Phan Rang-Thap Cham city has long been known as the driest city of the country, often suffers from shortage of water for irrigation. The dredging and embankment lining of existing canals, repair of water intakes in irrigation canals would interrupt would affect the circulation and flow of irrigation canals. This may affect the productivity of crops, affecting the resident's income from agriculture. However, these canals are mostly connected together to create an irrigation network system for the city, thus the impacts level (if occurred) is expected to be only at small local scopes.

3.4.9. Potential Impacts on Biological Resources

During construction phase, a total of 261,370 trees will be cut down for the rehabilitation and construction of the work items in Component 1, including 212,735 trees at the Central Lake, 35,366 trees along the Tan Tai canal, and the balance at the Dong Nam, Cha La, TH5, Nhi Phuoc canals and Dong Hai lake. These trees are from the existing garden land or agricultural land of the households located along the existing canals or at the central lake area in the City. This potential impact is unavoidable and partly compensable with greening incorporated into engineering proposals of the proposed roads and lakes.

As discussed in Chapter 2, the ecosystem in the Project area is poor, which mostly consist of garden and agricultural land; Therefore, the potential impact on biodiversity in the area can be seen as negligible.

The composition of aquatic organisms in the canals and lakes in the urban areas is also very poor as the surface water in the city has long been heavily polluted (Ecoli in water sample from Tan Tai canal exceeded QCVN 08-MT:2015/BTNMT 60-600 times, from Cha La canal exceed the standard 3 to 30 times – Table 2.11, Chapter 2). As mentioned in Chapter 2, fish species living in the canals are all popular kinds in the area, with high adaptability and fast growth and without value in terms biodiversity. The Dong Hai lake used to be embanked into individual cells for aquaculture but has been abandoned due to pollution. Currently it is shallow, almost dry and high polluted in dry season, thus there are no valuable fish or aquatic species in the lake. Downstream of the canals to be dredged are agricultural land. Therefore, the potential impacts of construction phase onto aquatic biology in the project area are assessed to be negligible.

3.4.10. Potential Impacts on Urban Landscape

Site clearance, dust and noise would cause negative impacts on urban landscape.

- During construction, site clearance will involves demolition of existing facilities, cutting down of 261,370 trees, removal of existing vegetation cover (Component 1 requires the acquisition of 30.6 ha agricultural land, including 19.1 ha for the central lake) , generating dust and noise, lost of green view, decreasing urban landscape values. While dusts and noise affect the landscape temporarily, the lost of trees, vegetation cover, green landscape would be permanent. The lost of trees and vegetation cover would not be avoidable but partly compensable. Dust generated from the demolition of the existing facilities consists of both settled and suspended dust. The amount generated is much dependent on demolition measures and weather conditions. Past experience shows that dust level in the mostly affected areas would exceed limits specified in QCVN 05:2013/BTNMT by 2-3 times, but this dust would settle fast and last in short time. The permissible limits for a distance of 20-40 m from demolition sites. Demolition work would mainly affect the residential area near canals, pumping stations, regulating lakes.
- Dust generated from ground levelling during sunny and windy days may exceed the limits specified in QCVN 05:2013/BTNMT 1.5-2 times. Dust concentration in the air would be at limits at a distance of 25-35 m from the edge of the construction site, depending on the weather.
- Noise would also be generated from demolition and ground levelling operations. Within 80 m from source, noise level may exceed the limits specified in QCVN 05:2013/BTNMT (70 dBA). The households in residential areas adjacent to the construction site would be mostly affected.

Placement of fences, temporary loading of construction materials and wastes, particularly bulky pre-cast pipes, narrowing down road surface, open trenches for pipeline installation would affect urban landscape negatively.

Tree and gardens with water surface along the existing canals in the inner-city has been valuable landscape of Phan Rang. The rehabilitation of the existing canals, including the conversion of some sections with total length of 2,812 m from open canals to box culverts would leading to the loss of some water surface and localized green landscape. However, this potential impact would not be very significant as the lost would be mostly water surface, the sections to be converted from canal to culvers mostly be encroached with housing facilities and polluted with waste and wastewater being dumped into the canal. This potential will be unavoidable, can be compensated and mitigated.

The Dong Hai Lake has been polluted by wastewater and domestic waste. Trucks will be travelling in and out of the areas to transport 46,800 m^3 out of this lake to the disposal site which is 10 km away. Materials dropping off from trucks would also affect urban landscape and should be managed properly.

3.4.11. Community Disturbance and Social Impacts

Impacts on Business Environment and Income

Besides being affected by dust, noise, traffic disturbance, the local people living near the construction site may also be economically affected, especially those who have their business at roadside in construction area. According to survey, 30 households having restaurants and shops along the construction route of drainage and sewers. The income of the affected HHs and local people may be reduced due to:

- Roads closure or traffic diversion to other routes, or reduced traffic lanes lead to less passengers on these roads, subsequently less people visit the businesses on these roads;
- Reduced business of shops, restaurants and other businesses along the road due to land acquisition;
- Limited access for supplier to these shops and restaurants;
- Limiting the transportation of goods from the Project area to outside .

These are only temporary impacts during the construction phase. And, as construction is to be carried out with the successive method, the duration and scope of impacts on each particular segment will not be substantial long.

The impacts could be considered as low level.

Risks on Social Disorder and Security

The mobilisation of up to 500-600 workers during the peak period of construction phase may affect the security and lead to social disturbance in the project area. Contradictions and conflicts may arise owing to land acquisition, site clearance, construction environmental impacts such as noise, dust and waste generation, due the disparities of lifestyle and habits between the local communities and the workers, or if some workers involve in social evils such as gambling prostitution, drug use, etc. as most of the workers are males living far from home. Social disorder risk is highest in areas disturbed significantly during construction phase, and/or in populated areas such as along the Tan Tai canal, the Dong Hai lake, and along the secondary pipelines. The risk can be mitigated..

Additionally, temporary land acquisition during construction for material and waste gathering will cause certain disturbances and obstructions to the locals people, such as increased levels of dusts and noise, busy traffic and increased traffic safety risks, localised flooding, access to roadside houses, shops and other business are disrupted etc.. These impacts will be of a higher level with construction items close to residential areas such those near the construction of drainage and tertiary sewer, , Dong Hai lake and Tan Tai canal rehabilitation, and school and public sanitation facilities. The impacts will be of a lower level with construction items farther from residential areas such as management road and embankment of Cha La canal, upstream of Tan Tai canal, pumping and wastewater treatment stations, the central regulating lake, etc.

These impacts could be considered as medium level.

3.4.12. Health Safety Issues

Workers Health and Safety Risks

During the construction phase, up to 500-600 workers are mobilised to the Project area working and staying at various locations in the city. Construction packages of the central lake and the Dong

Hai lake would have the most number of workers. At the construction sites, there are health and safety risks associated with various construction activities as listed below:

- landslide, erosion
- falling into open holes
- health risks when being in contact with polluted water and dredged materials from the canal
- exposure to high level of dusts and noise, etc.
- accidents related to the operations of construction plants and movement of bulky construction materials and equipment
- accidents related to the storage and usage of fuels, gas, and electricity
- infection, injuries when in contact with or exposure to polluted canal bottom or wastes
- injuries if attacked by insects or reptiles during site clearance, cutting and removal of trees etc.

Camps or other temporary accommodations conditions would also have some health potential impacts to the workers. Without adequate bed, clean water, kitchen, drainage, bathroom, sanitation facilities would make the workers become vulnerable to disease and sickness. Particularly stagnant wastewater, if any, may lead to the outburst of water born diseases. On the other hand, the workers would also be exposured to the risks of having common diseases frequently recorded in Phan Rang City- Thap Cham City such as dengue fever, flu, varicella, measles, and HFMD. These risks could be considered as medium level and manageable.

Communities Health and Safety Risks

Dust, hazardous gases and noise could affect the health of local people living around the construction site, or along transportation roads as discussed in previous sections.

Open canals, excavated pits, bulky material piles, temporary parked machines and equipment, and waste and materials loads, etc., may pose safety risks to local residents and workers working on site.

Living and sanitation conditions as well as other technical/social infrastructures can be interrupted during the construction phase and increase the risks of health safety and diseases among the local community around the Project area.

Especially, in the construction of school sanitation facilities, the teachers and pupils would be affected by noise, dust and safety risks. These impacts and risks can be avoided or mitigated, particularly if the construction of school sanitation facilities is scheduled during the summer vacation.

These impacts and risks could be considered low level.

3.4.13. Potential Impacts on Existing Cultural and Historical Structures

No existing religious or cultural structures would be affected by land acquisition by the Project. However, construction impacts such as dust, noise, reduced accessibility may affect some cultural and religious facilities listed in Table 3.18a below. The specific locations of these sensitive works are presented in Figure 1.1

Table 3.18a: List of cultural and historical structures considered as temporarily affected during the project's construction phase

No	Structure	Cause of impact	Description of impacts
1	Quan Thanh Temple (from a distance of 50m)	Rehabilitation of Dong Hai lake	Located at 50m from the boundary of the site for the rehabilitation of Dong Hai lake; Impacts from dust, noise; affected landscape during construction, transportation and gathering of materials
2	Thien Hung Pagoda (from a distance of 100m)	Construction of central regulation lake	Located at 100m to the North of the construction site, 30m from Nguyen Van Cu Street (route for materials transportation) Main impacts from dust, noise, traffic on locals and visitors to the pagoda; affected landscape, security and order
3	Phan Rang Provincial Pagoda (from a distance of 50m)	Construction of Tan Tai canal	Located in Phuoc My Ward, to the right of Tan Tai canal-Section TT3; gate of pagoda on 21/8 Street; back fencing wall close to canal edge; Possible slumping of fencing wall at the back of the pagoda; dust, noise, affected traffic, landscape and security owing to transportation of construction materials and waste.
4	Church of Phan Rang Parish (from a distance of 50m)	Construction of Tan Tai canal	Located on Tran Thi Street, to the right of Tan Tai canal; Impacts from dust, noise and on landscape, traffic and security in the area

The impacts could be considered to be medium level.

The project involves considerable amount of earth works, therefore there are chances that some artefacts may be exposed during excavation Chance Find Procedures has been developed to address such cases and presented in detail in Chapter 5 .

The type-specific and Site-specific impacts are presented at the end of Chapter 3.

3.4.14. Sensitive Locations of Component 1

There are a number of project locations in Component 1 more sensitive to construction impacts such as dust, noise, and social impacts. These locations are listed in Table 3.19a below.

Table 3.19a: **Sensitive locations in Component 1**

No.	Construction item	Sensitive subjects
	COMPONENT 1	
1	Rehabilitation of Tan Tai canal and canal road	* Phan Rang provincial pagoda in Phuoc My ward located to the right of the canal route; of Segment 3 of Tan Tai canal: As the pagoda gate is on 21/8 Street, the pagoda will be affected mainly by dust, noise and traffic from transportation operations to be carried out in 21/8 Street. Besides, the construction of the box culvert of Tan Tai canal may cause slumping of the wall at the back of the pagoda.

		* Phan Rang Parish church on Tran Thi Street to the right of Tan Tai canal: affected mainly by dust, exhaust gases, noise and traffic; * Tran Thi Primary School on Tran Thi Street, located on the same side as Tan Tai canal; mainly affected by traffic, noise and dust generated by transportation and construction operations for the construction of Tan Tai canal; * Ninh Thuan Cham Culture Research Center, located to the left of Tan Tai canal (of Segment TT4): risk of slumping to the fencing wall as the canal edge is almost close to the wall. * Residential areas along Tan Tai canal (a distance 10m from the construction site of Tan Tai canal)
2	Construction of secondary drainage routes	Phat An pagoda, located to the left on Cao Ba Quat Street: affected mainly by dust, noise and hindered visitors' access to the pagoda
3	Construction of central regulating lake	Thien Hung pagoda, located about 100m to the North of the boundary of the construction site for the central regulating lake and about 30m from Nguyen Van Cu Street (route for material transportation); local residents and visitors to the pagoda mainly affected by dust, noise and traffic
4	Rehabilitation of Dong Hai lake	* Quan Thanh Temple, located about 50m from the boundary of Dong Hai lake and adjacent to the construction site; mainly affected by dust, exhaust gases, noise and vibration during construction, and transportation and gathering of materials; * Dong Hai 2 Primary School, located on Bach Dang Street at the section close to the turn into the construction site: transportation is expected to follow this route, which is one of the main roads of the City with heavy traffic. Impacts are mainly from dust, exhaust gases, noise and heavy traffic – affecting the school' teachers and pupils. * Dong Giang market, located close to access road to the construction site for Dong Hai lake and about 150m from this site; this is a narrow road in a thickly-populated area. *High density population around Dong Hai lake, at a distance of 10m from the lake. The main impact are from traffic (jams and accidents), dust, exhaust gases and noise generated from transportation and construction operations.
4	Construction of Nhi Phuoc canal	Residential areas along Nhi Phuoc canal (a distance 20m from the construction site)
5	Construction of tertiary sewer lines D 160-D315, total L = 41.2 km; And construction of combined sewers B400-B500	Residential households along 16/4 Street, municipality in the area of the central regulating lake, hotels along seaside Yen Ninh Street (a distance 20m from the construction sites)

B. COMPONENT 2 – URBAN CONNECTIVITY

Under Component 2, two road items will be upgraded including: (i) the Alley 150 in 21/8 road from existing 980 m long, 5m wide to be 980 m long, 27 m wide, and (ii) the Huynh Thuc Khang

road from existing 420 m long, 7m wide to be 920 m long, 20 m wide. Construction of Alley 150 would take place during 2017 to 2018, and construction of Huynh Thuc Khang street would be from 2019 to 2022.

The main construction activities include removal of top soil, ground levelling; filling, road surface and footpath construction, tree planting, transportation materials for ground levelling or main construction materials such as stone, bricks, sand, gravel, cement, drainage pipes, iron and steel,... for construction of the roads, transportation and disposal of waste materials.

The upgrading and rehabilitation of the two roads would cause the following potential impacts and risks during construction phase as discussed below[20].

3.4.15. Impacts on Air Quality

3.4.15.1. Dust and Exhaust Gases

Dust and exhaust gases generated during the construction phase are mainly from excavation, backfilling, transportation of materials and wastes, temporary loading of construction materials at the edges of construction sites, movement and operations of vehicles, construction machinery and equipment such as bulldozers, excavators, generators, rollers.

Dust generated from excavation, backfilling and ground leveling

Using the same method and assumptions presented for Component 1, the calculated results of dust generated from soil excavation, backfilling and ground levelling operations of each work item under Component 2 is presented in Table 3.3b below.

Table 3.3b: **Forecasted volume of dust at Component 1 areas**

No.	Work item	Construction volume (m^3)	Number of construction days	Total volume of dust of whole stage (ton)	Daily volume of dust (kg/day)
	COMPONENT 2				
1	Huynh Thuc Khang street	34,376	546	2.6	4.72
2	Alley 150 of 21/8 street	44,345	390	3.3	8.53

The above detailed calculation results show that dust generated from excavation, backfilling and ground levelling operations of the road construction sites would relatively high. The impacts by dust would have many affected targets as these sites are mostly along existing roads with densely-populated residential areas. The impacts from dust during ground levelling operations are assessed as high level and require strict management measures.

Dust generated from transportation of construction materials and wastes

Upgrading of Alley 150 would take place during 2017 to 2018, and upgrading of Huynh Thuc Khang street would be from 2019 to 2022.

Using the same assumptions in similar section of Component 1, the calculated amount of dusts generated along the transportation route of Component 2 are presented below

[20]The assumptions and theory used for Component 1 if still be applicable to Components 2 and 3 will not be repeated.

Table 3.4b: Calculated number of vehicle trips and volume of dust generated from transportation of excavated and filling materials (Vehicle: 16-tonne DO trucks)

No.	Work item	Total quantity of materials (m^3)	Number of construction days	Total number of vehicle trips	Daily number of vehicle trips (trip/day)
	COMPONENT 2				
1	Huynh Thuc Khang street	64,596	546	9,226	17
2	Alley 150 of 21/8 street	76,543	390	10,933	28

Table 3.5b: Calculated volumes of toxic gas emission by transportation of excavated & filling materials and construction materials (Vehicle: 16-ton DO trucks)

Item	No. of veh. /day	Generated emissions (mg/m.s)				
		Dust	CO	SO2	NO2	VOC
COMPONENT 2						
Huynh Thuc Khang street	17	0.0006	0.0014	0.0029	0.009	0.0012
Alley 150 of 21/8 street	28	0.0010	0.0024	0.0048	0.016	0.0019

The calculation results of dust concentrations in the dry season at distances of X = 20, 40, 60, 80, 100 and 120 meters from the emission source (agreed to be the transportation road edge) during the transportation of excavated materials and filling materials are presented in Table 3.6b below.

Table 3.6b: Calculation results of dust concentration and toxic gases dispersed by distance (calculated from transportation road edge) in the dry season

Item	Distance (m)	Dust ($\mu g/m^3$)	CO ($\mu g/m^3$)	SO2 ($\mu g/m^3$)	NO2 ($\mu g/m^3$)	VOC ($\mu g/m^3$)
COMPONENT 2						
Huynh Thuc Khang street	20	0,114	0,27	0,55	1,71	0,23
	40	0,068	0,16	0,33	1,02	0,14
	60	0,051	0,12	0,25	0,76	0,10
	80	0,041	0,10	0,20	0,62	0,08
Alley 150 of 21/8 street	20	0,190	0,45	0,91	3,03	0,36
	40	0,114	0,27	0,55	1,82	0,22
	60	0,085	0,20	0,41	1,35	0,16
	80	0,068	0,16	0,33	1,10	0,13
QCVN 05: 2013/BTNMT		**300**	**30.000**	**350**	**200**	**-**

Remarks on results obtained regarding dust:

The above calculated results show that in general the dust concentration generated on transportation roads normally does not exceed the applicable standards pursuant to QCVN 05:2013/BTNMT. The dispersion distance of dust is not very great with dust concentrations quickly decreasing over travelling distances. At a distance of 20m from the road edge, the dust

concentrations calculated for all construction items under the Project are many times lower than the applicable standards.

However, the above calculations are for only the dust amounts generated by the vehicle engines and do not include dust brought up from road surfaces by moving wheels and dust from materials or waste dropping/spilling out of vehicle bodies during transportation. These amounts of dust will be much dependent on weather conditions, road surface quality, hygiene of vehicles and roads, wind strength. Therefore, impacts from dust generated on these roads are bound to be higher with these additional factors.

In addition, the above calculations are based on agreed cases where there are only transportation vehicles for each work item under the Project circulating on such roads without considering cumulative impacts from other vehicles travelling on the same roads. In reality, dust concentrations could probably increase a lot more compared with the above calculation results due to the said cumulative impacts from other means. Especially, under this Project, there would be cases where many transportation vehicles for many work items under the Project travel at the same time on the same roads (For example, 21/8 Street, 16/4 Street, National Highway 1A, and National Highway 27 are the main transportation roads for backfilling materials and construction waste into/from the city). Besides, dust concentrations also depend on the frequency of construction and Contractor's vehicle mobilization at each point of time. There may be times when the construction progress must be sped up, requiring additional equipment, machines and vehicles and impacts from dust will thereby increase.

21/8 Street and 16/4 Street are the main routes for transporting materials and also the arterial roads in the City. Such roads will be more affected by dust from higher flows of traffic means. According to the results obtained from the analysis and assessment of the air in Chapter 2, the current air quality in the above-mentioned areas is still fairly good. Therefore, the impacts of dust from Project activities would be significant. Nevertheless, such impacts would be only temporary during the construction phase and can be mitigated. Yet, these impacts can only be terminated when the transportation and construction phase of the Project is completed.

The affected subjects will be road users and households living along the roads. Dust pollution could contribute to hindering business and service activities as customers would be more willing to choose cleaner places for eating, drinking or buying goods. Especially, 21/8 Street, 16/4 Street and Yen Ninh Street are places with busy shops and a lot of visitors.

Remarks on calculations results of exhaust gases:

The above calculations show that the concentrations of hazardous substances dispersed in the air from vehicle exhaust gases such as CO, SO2, NO2 and VOC along transportation routes and within a dispersion distance of 80m from the design point (edges of roads) are all within applicable standards in conformity with QCVN 05:2013/BTNMT.

Similar to the mentioned case for dust, the calculations are based on the assumption that there are only Project vehicles travelling along the routes for each of the Project construction works without taking into consideration cumulative impacts from other road using means. In reality, the concentrations of pollutants are bound to increase substantially in comparison with the calculated results; especially, such routes as 21/8 Street, 16/4 Street, National Highway 1A and National Highway 27 (main routes for transporting backfilling materials and construction waste into/from the city); and 16/4 Street (main route for transporting excavated materials to the disposal site at the new urban areas of Dong Bac and Dong Nam) are expected to be highly affected by cumulative impacts from the construction items of the Project.

21/8 Street and 6/4 Street are the main routes for transporting materials and also the arterial roads in the City. Such roads will be more affected by exhaust gases from higher flows of traffic means.

The affected subjects will be road users and households living along the roads. These are impacts of high levels but would take place temporarily during the construction phase and can be partially mitigated by maintenance and cleaning of transportation means in conformity with standard procedures and by complying with speed limits on the said routes.

3.4.15.2. Increased Noise Levels

During the construction process, noise is mainly generated from operating construction machines & equipment and transport vehicles for construction materials.

The calculation results have shown that noise generated by construction machines and equipment on site basically meets the applicable standards in accordance with QCVN 26:2010/BTNMT if construction equipment is operated at a distance of at least 100m.

Therefore, upon construction at places near residential areas, planned distances of construction equipment from residential areas need to be properly considered for the sake of safety. In case construction operations must be carried out close to residential areas included Alley 150 and Huynh Thuc Khang Street, mitigation measures should be applied to cut down noise from construction. Such measures include the use of only small-capacity machinery, avoidance of construction operations during sensitive hours, or installation of equipment mufflers.

3.4.15.3. Vibration

In general, vibration is generated mainly along the routes for transporting construction materials and construction waste from travelling trucks.

Low-level vibration is expected during compaction and ground rolling in Huynh Thuc Khang Street, Alley 150, 21/8 Street. Vibration is mitigable through construction method and time schedule .

3.4.16. Water Quality Degradation

The main causes of water pollution in Tan Tai canal during the construction phase of the Project Component 2 are:

- Risks of polluting the water environment when heavy rains or surface runoff construction sites bring along suspended materials and waste to Tan Tai canal and other surface water sources around the sites;
- Domestic wastewater generated by construction workers on site and construction wastewater directly discharged into Tan Tai canal and other surface water bodies around construction sites;
- The drainage and sewerage systems would possibly be blocked , temporarily causing localized and temporary flooding during the installation of sewer lines and construction of traffic roads.

3.4.16.1. Potential Impacts of Surface Runoff

With heavy rains, without proper drainage the volume of runoff through to the Project site can cause inundation, thus hindering construction. Besides, runoff would contain suspended materials and waste into canals, lakes and other surface water bodies around construction sites, increasing turbidity and content of suspended solids in the water, decreasing the water quality, and contributing to raising sedimentation. Surface runoff through camps, without good management measures, would take along domestic waste (wastewater and solid waste) generated by workers, polluting surface water.

Table 3.9b: Calculated average overflow rainfall for raining days

No.	Work item	Area of construction site (m^2)	Stormwater runoff (m^3/day)
	Component2		
1	Huynh Thuc Khang street	24,840	149
2	Alley 150 of 21/8 street	26,460	159

The impacts from stormwater runoff during construction could be considered as medium level and require strict management measures.

3.4.16.2. Potential Impacts by Construction and Domestic Wastewaters

Domestic Wastewater

As forecasted, during peak hours during the construction phase at the construction sites, the greatest number of workers mobilized on site could probably reach about 100 – 120 persons per site. On daily average there would be about 50-70 persons present on each site. However, as the component 2 is divided into 2 stages of implementation therefore there would be only one site occurred at each stage; the number of workers would be considered for only one site. Construction of Alley 150 would be from 2017 to 2018, and construction of Huynh Thuc Khang street would be from 2019 to 2022.

Clean domestic water on site is demanded mainly for personal hygiene needs, hand and foot washing, cooking, bathing at camps, etc. It is estimated that the daily water use demand of workers on site is about 20-25 litres/person/day. Wastewater discharged on site is estimated at about 90% of the used clean water. The wastewater amount generated on site can thus be calculated in the following table,

Table 3.11b: Calculated daily domestic wastewater generated under C2

No.	Construction site	No. of workers (person)	Amount of generated wastewater	
			m^3/day	m^3/month
1	At each construction site (on average every day)	50 - 70	0,9 – 1,6	27 - 48
2	At each construction site (during peak hours)	100 -120	1,8 – 2,7	54 - 81

According to the calculation above, the total daily amount of domestic wastewater generated during the construction phase of each site would be relatively small, on average about 0.9 to 1.6m^3/day.

Construction Wastewater

The construction waste is generated from such activities as washing of materials and cleaning of machines & equipment, concrete curing, etc. The composition of construction wastewater normally comprises soil, sand, high amounts of suspended materials and possibly even oil and grease. The generated amount of construction waste would be subject to many factors such as construction scale, construction point of time, workers' awareness, construction method and technology, quality of construction materials, etc.

Wastewater could be generated from washing and mixing materials and concrete curing. As such materials as stone and gravel purchased in the province have been already made in to finished

products at the quarries before being transported to the sites, washing of these materials is not needed. Contracts entered into between contractors and mining units should provide for the supply of clean materials so as to minimize the amount of water needed for material washing on site. Water used in curing concrete contains mainly such inorganic matter as sand and suspended materials and is only needed during hot and dry days and at very low amounts. This wastewater from concrete curing can be used to water the sites to reduce dust.

In general, the greatest amount of construction wastewater comes from the washing of transportation trucks before they get out of the construction sites. This amount is generated the most during the excavation, filling and ground-levelling stage of the work items. Every time a transportation truck gets out of the site, dust, dirty soil and sludge must be flushed off its wheels . With an average of 10 litres of water needed to wash a wheel, an amount of 60 litres of water will be used in wheels washing. The daily amount of wastewater needed for washing wheels at construction sites could be calculated,

Table 3.13b: Calculated Wastewater Generated from Wheel Washing

No.	Work item	Volume of materials (m^3)	Number of construction days	Total no. of trips	Water for wheel washing (m^3)	Daily wastewater amount (m^3)
	COMPONENT 2					
1	Huynh Thuc Khang street	64.596	468	4.614	277	0,59
2	Alley 150	76.534	390	5.467	328	0,84

According to forecasts, wastewater for vehicle wheel washing at the construction site contains only soil, sand and suspended materials and no oil. To minimize impacts on the surrounding surface water environment, this volume of wastewater needs to be preliminarily treated through installation of manholes for sand deposition before discharge to the general drainage system of the city.

The washing of whole trucks is expected to be done every 5 days for each truck, subject to the weather conditions and how dirty a truck is. To facilitate environmental management on site, the cleaning of whole trucks will be performed at professional car service stations in the city, not on the construction site. Each cleaning time is estimated to require about 200 litres of water for each truck. Wastewater from truck washing would include soil, sand, suspended materials and oil. Therefore, the preliminary treatment of wastewater from washing trucks, n addition to sedimentation manholes, would also need oil and grease separating tanks.

The impacts from construction wastewater during construction could be considered as being medium and require proper management measures.

3.4.17. Solid Waste Generation

Excavation for the construction of the roads in Component 2 are expected to generate a total of about 19,380 m^3 topsoil and other 17,650 m^3 residual excavated soil which need to be disposed off.

As assessed for Component 1 above, the volume of topsoil/dredged sludge will be disposed in Nam Thanh sanitary landfill; Meanwhile the volume of excavated soil can be used for ground-levelling in Dong Bac and Dong Nam new urban areas.

The impacts from excavated materials could be considered at low level. For road works, the amount of construction wastes such as empty cement bags, scrap iron and steel, wooden chips, empty boxes, etc is very small. These waste can be reused for sold to recycling businesses thus the

potential impacts are manageable. The impacts from construction solid waste could be considered as low level.

Domestic Solid Waste

Each worker during working hours on site is estimated to generate about 0.5kg of domestic solid waste a day; meanwhile one person living in camps may generated 1.5 kg domestic solid waste a day. Since the construction sites are all in the city, most workers will go home or rented houses daily after working time, only a few workers (estimated 5 people) stay in camps as security guards on site. The volume of domestic solid waste generated by the workers can be estimated as presented in Table 3.14b.

Table 3.14b: Calculated domestic solid wastewater generated daily at construction sites

No.	Area	Number of workers (person)	Volume of generate solid waste (kg/day)
1	At each construction site (daily)	50 - 70	30 – 40
2	At each construction site (peak time)	100 -120	55 – 65

According to the calculations in this table, the total volume of domestic solid waste generated daily in the construction phase is relatively high. The average volume of domestic solid waste in each main construction site is then only 25-35m^3/day. Without proper management and daily collection, this volume of domestic waste could cause air pollution and affect surface water bodies in the vicinity.

However, there are existing solid waste collection service in Phan Rang City- Thap Cham City being operated by the Nam Thanh company. The contractors can sign contracts with Nam Thanh Company to collect and transport domestic solid waste generated in the construction sites.

The impacts could be considered manageable at low level.

3.4.18. Hazardous Waste

Tar and containers construction chemicals, etc. Generally, the volume of hazardous waste generated in the construction phase of the Project is small. .

The amount of hazardous waste generated by the entire project has been estimated under the Hazardous section assessed for Component 1.

The impacts caused by HWs could be considered as medium level and manageable.

3.4.19. Traffic Disturbance and Increased Traffic Safety Risks

Increases in traffic density caused by the trucks and other construction plants mobilised by the project, the roads being narrowed down during construction, the temporary loading of materials at wastes and roadside, the fences placed along the roads would cause vision reduction to the drivers, these may lead to increased traffic accidents risks.

Table 3.17b below presents in detail the roads significantly impacted during the construction phase of the Component 2.

Table 3.17b: Possibly affected roads during construction phase

No	Impacted route	Description of impacts

1	21/8 Street	This is the main transportation route of the city, with very heavy traffic, with lots of tourists, residential houses and Thap Cham relics. This route is planned for the transportation of construction materials and waste for disposal during the construction of Alley 150 on 21/8 Street, Huynh Thuc Khang Street, Tan Tai canal and pump stations PS1 and PS2.
2	National Highway 1A, National Highway 27	This is the route for transporting construction materials (stone, soil, sand)
3	16/4 Street	This is the transportation route for excavated materials to be used as backfill at Dong Bac and Dong Nam new urban areas.

The impacts on traffic system could be considered as medium level.

3.4.20. Potential Impacts on Existing Infrastructures and Services

The main routes for the transportation of excavated and backfilling materials as 21/8 Street, 16/4 Street and National Highway 27.

3.4.21. Impact on Biological Resources

Approximately 14,820 trees planted in household gardens will be cut down along the alignment of the Huynh Thuc Khang road and Lane 150. As assessed in Chapter 2, the biological setting in the Project area is poor, mainly garden and agricultural land; The cutting of these trees would lead to the loss of some green space but would not affect biodiversity in the project areas. The lost of the trees can be mitigated.

Impacts on Urban Landscape

Some green space created by the existing trees and vegetation cover would be removed, 5,700 m^2 of houses and 625 m^2 of other structures would be demolished for the upgradation of Lane 150 and Huynh Thuc Khang roads. The removal of these objects would cause permanent changes in urban landscape along the road, not only in construction but also operation phase.

Placement of fences, temporary loading of construction materials and wastes, particularly bulky pre-cast pipes, would affect urban landscape negatively.

The potential impacts on urban landscape would be unavoidable but manageable.

3.4.22. Community Disturbance and Potential Social Impacts

Potential Impacts on Business Environment and Income

During construction phase, the residents living along the Huynh Thuc Khanh and Alley 150 on road 21/8 would be disturbed with traffic disturbance, air pollution, increased level of noise etc. Some households doing business along these two roads would also be affected with income. According to RAP, two households having restaurants and shops along the construction route of Alley 150 of 21/8 Street and Huynh Thuc Khang Street.

These are only temporary impacts during the construction time. And, as construction is to be carried out with the successive method, the duration and scope of impacts on each particular segment will not be substantial long.

The impacts could be considered as low level.

The large amount of workers concentrated for operations during the construction progress at peak time in the city area can be up to 100-120 people. This would cause certain impacts on the security

of the area. Contradictions and conflicts may arise owing to disparities of lifestyle and habits or to workers' involvement in social evils. Upon living in the construction area, workers would get in touch with local people and their movement would entail business with locals, probably including social evils as prostitution, drug use, thieving, etc. as most of the workers are males living far from home. The risks from these impacts can be mitigated through strict regulations management in labour contracts signed with workers and through close co-ordination with local authorities during the construction progress.

Additionally, temporary land appropriation of part of local people's land during construction for material and waste gathering will cause certain difficulties to locals' living conditions such as dust and noise, difficult traffic, temporary flooding, affected business activities, etc. These impacts would be of a higher level with the construction items close to residential areas such those near the construction of the roads.

These impacts could be considered as medium level.

3.4.23. Health Safety Issues and Risks

During the construction phase, average daily about 50-70 workers are mobilised to the Project area working and staying at various locations in the city. At the construction sites, there are health and safety risks associated with various construction activities as listed below:

- landslide, erosion
- falling into open holes
- health risks when being in contact with polluted water and dredged materials from the canal
- exposure to high level of dusts and noise, etc.
- accidents related to the operations of construction plants and movement of bulky construction materials and equipment
- accidents related to the storage and usage of fuels, gas, and electricity
- infection, injuries when in contact with or exposure to polluted canal bottom or wastes
- injuries if attacked by insects or reptiles during site clearance, cutting and removal of trees etc.

Camps or other temporary accommodations conditions would also have some health potential impacts to the workers. Without adequate bed, clean water, kitchen, drainage, bathroom, sanitation facilities would make the workers become vulnerable to disease and sickness. Particularly stagnant wastewater, if any, may lead to the outburst of water born diseases. On the other hand, the workers would also be exposured to the risks of having common diseases frequently recorded in Phan Rang City- Thap Cham City such as dengue fever, flu, varicella, measles, and HFMD. These risks could be considered as medium level and manageable.

Communities Health and Safety Risks

Dust, hazardous gases and noise could affect the health of local people living around the construction site, or along transportation roads as discussed in previous sections.

Open canals, excavated pits, bulky material piles, temporary parked machines and equipment, and waste and materials loads, etc., may pose safety risks to local residents and workers working on site.

Living and sanitation conditions as well as other technical/social infrastructures can be interrupted during the construction phase and increase the risks of health safety and diseases among the local community around the Project area.

Especially, in the construction of school sanitation facilities, the teachers and pupils would be affected by noise, dust and safety risks. These impacts and risks can be avoided or mitigated, particularly if the construction of school sanitation facilities is scheduled during the summer vacation.

These impacts and risks could be considered low level.

3.4.24. Impacts on Cultural and Historical Structures

The works proposed under Component 2 would not require land acquisition or site clearance that affect any existing historical, religious and cultural structures such as pagodas, temples, monuments etc.. However, 1418 graves would be relocated for road expansion. The impacts could be considered at moderate level and manageable.

There are chances that the earth work may make some artefacts exposed. Chance find procedure has been developed and specified in Chapter 5

C. COMPONENT 3 – RESETTLEMENT AND SITE CLEARANCE

A construction site will be provided for the relocation of the households affected with significant land acquisition. The proposed resettlement site has a total land area of 6.7ha, is located in Phan Dang Luu road. The Project would do the levelling and basic infrastructure including 1,693 m of internal roads, four transformer stations, and 2,700 m of HDPE D75-110 mm water supply pipeline, 3,033m of drainage and sewers etc. The households would build their own house.

The construction of the resettlement site would have the following potential impacts and risks

3.4.25. Potential Impacts on Air Quality

3.4.25.1. Dust and Exhaust Gases

Dust. The total volume of earthwork at the resettlement site is 223,793 m3. Table 3.3c below presents the calculated amount of dust from ground levelling at the resettlement site.

Table 3.3c: Dust generated from ground levelling

No.	Work item	Construction volume (m^3)	Number of construction days	Total volume of dust of whole stage (ton)	Daily volume of dust (kg/day)
	COMPONENT 3				
1	Resettlement area	223,793	624	16,8	26,90

Due to the construction site of the resettlement area is far from the existing residential areas (>250m), the number of affected people would be quite few, mostly the onsite workers and people going on Phan Dang Luu street. The impacts from dust during ground levelling operations could be considered as low level. The quantity of dust generated along transportation rout of the resettlement site is shown in Table 3.4 below

Table 3.4c: Calculated vehicle trips and volume of dust from transportation
(Vehicle: 16-tonne DO trucks)

No.	**Work item**	**Total quantity of materials (m^3)**	**Number of days**	**Number of trips**	**number of trips (trip/day)**
	COMPONENT 3				
1	Resettlement area	338,282	624	48,326	77

Table 3.5c: Calculated volumes of toxic gas emission by transportation of excavated & filling materials and construction materials (Vehicle: 16-ton DO trucks)

Item	No. of veh. /day	Emissions (mg/m.s)				
		Dust	CO	SO2	NO2	VOC
COMPONENT 3						
Resettlement area	77	0.0028	0.0065	0.0130	0.042	0.0052

The calculation results of dust concentrations in the dry season at distances of X = 20, 40, 60, 80, 100 and 120 meters from the emission source (agreed to be the transportation road edge) during the transportation of excavated materials and filling materials are presented in Table 3.6c below.

Table 3.6c: Calculation results of dust concentration and toxic gases dispersed by distance (calculated from transportation road edge) in the dry season

Item	Distance (m)	Dust ($\mu g/m^3$)	CO ($\mu g/m^3$)	SO2 ($\mu g/m^3$)	NO2 ($\mu g/m^3$)	VOC ($\mu g/m^3$)
COMPONENT 3						
Resettlement area	20	0.53	1.23	2.46	7.96	0.99
	40	0.32	0.74	1.48	4.78	0.59
	60	0.24	0.55	1.10	3.55	0.44
	80	0.19	0.45	0.89	2.88	0.36
QCVN 05: 2013/BTNMT		**300**	**30.000**	**350**	**200**	**-**

Transportation route of materials and wastes includes some roads used for transportation of the materials and wastes generated in Components 2 and 3. Assessment on the impacts on these roads were presented in the previous sections.

Increased Noise Levels. Noise is mainly generated from construction machines & equipment and transport vehicles for construction materials. As the resettlement area is far from the existing residential areas, the impacts of noise would not be significant.

Vibration. In general, vibration is generated mainly along the routes for transporting construction materials and construction waste from travelling trucks. In order to mitigate vibration caused by these means of transport, it is necessary to apply measures to limit the speed of vehicles travelling through sensitive areas and densely-populated areas.

The construction process of work items under the Project will not cause considerable vibration to surrounding areas. Low-level vibration is only generated during soil compaction and ground rolling in internal roads.

3.4.26. Impacts on Water Quality

The main causes of water pollution during the construction phase of the Project Component 3 are:

- Risks of polluting the water environment when heavy rains or surface runoff construction sites bring along suspended materials and waste to Tan Tai canal and other surface water sources around the sites;
- Domestic wastewater generated by construction workers on site and construction wastewater directly discharged into surface water bodies around construction sites;

3.4.26.1. Impacts from Surface Runoff

Table 3.9c: Calculation of average overflow rainfall for raining days at construction sites under the Component 3

No.	Work item	Area of construction site (m^2)	Stormwater runoff (m^3/day)
	Component3		
1	Resettlement area	489,200	2,935

The calculated volume of stormwater runoff through the construction sites is relatively high. Unless suitable drainage regulation measures are taken, it would cause negative impacts and decrease the quality of surface water bodies in the area. In addition to the said impact on surface water quality, stormwater run can bring along soil, sand and waste causing sedimentation, thus blocking the combined drainage system of the area.

Impacts from stormwater runoff during the construction of resettlement area could be considered as medium level and require strict management measures.

3.4.26.2. Impacts by Construction and Domestic Wastewaters

Domestic Wastewater

As forecasted, during peak hours during the construction phase at the construction site, the greatest number of workers mobilized on site could probably reach about 100 – 120 persons per site. On daily average there would be about 50-70 persons present on each site.

Clean domestic water on site is demanded mainly for personal hygiene needs, hand and foot washing, cooking, bathing at camps, etc. It is estimated that the daily water use demand of workers on site is about 20-25 litres/person/day. Wastewater discharged on site is estimated at about 90% of the used clean water. The wastewater amount generated on site can thus be calculated in the following table,

Table 3.11c: Calculation of daily domestic wastewater amount generated on site under Component 3

No.	Construction site	No. of workers (person)	Amount of generated wastewater	
			m^3/day	m^3/month
1	At each construction site (on average every day)	50 - 70	0,9 – 1,6	27 - 48
2	At each construction site (during peak hours)	100 -120	1,8 – 2,7	54 - 81

According to the calculation above, the total daily amount of domestic wastewater generated during the construction phase of each site would be relatively small, on average about 0.9 to 1.6m^3/day.

Construction Wastewater

The construction waste is generated from such activities as washing of materials and cleaning of machines & equipment, concrete curing, etc. The composition of construction wastewater normally comprises soil, sand, high amounts of suspended materials and possibly even oil and grease. The generated amount of construction waste would be subject to many factors such as

construction scale, construction point of time, workers' awareness, construction method and technology, quality of construction materials, etc.

Wastewater could be generated from washing and mixing materials and concrete curing. As such materials as stone and gravel purchased in the province have been already made in to finished products at the quarries before being transported to the sites, washing of these materials is not needed. Contracts entered into between contractors and mining units should provide for the supply of clean materials so as to minimize the amount of water needed for material washing on site. Water used in curing concrete contains mainly such inorganic matter as sand and suspended materials and is only needed during hot and dry days and at very low amounts. This wastewater from concrete curing can be used to water the sites to reduce dust.

In general, the greatest amount of construction wastewater comes from the washing of transportation trucks before they get out of the construction sites. This amount is generated the most during the excavation, filling and ground-levelling stage of the work items. Every time a transportation truck gets out of the site, dust, dirty soil and sludge must be flushed off its wheels . With an average of 10 litres of water needed to wash a wheel, an amount of 60 litres of water would be used in wheels washing. The daily amount of wastewater needed for washing wheels at the construction site could be calculated,

Table 3.13c: Calculations of wastewater generated from on-site wheel washing during excavation, backfilling and ground-levelling stage

No.	Work item	Volume of materials (m^3)	Number of construction days	Total no. of trips	Water for wheel washing (m^3)	Daily wastewater amount (m^3)
	COMPONENT 3					
1	Resettlement area	329,148	624	23,511	1411	2,26

According to forecasts, wastewater for vehicle wheel washing at the construction site contains only soil, sand and suspended materials and no oil. To minimize impacts on the surrounding surface water environment, this volume of wastewater needs to be preliminarily treated through installation of manholes for sand deposition before discharge to the general drainage system of the city.

The washing of whole trucks is expected to be done every 5 days for each truck, subject to the weather conditions and how dirty a truck is. To facilitate environmental management on site, the cleaning of whole trucks will be performed at professional car service stations in the city, not on the construction site. Each cleaning time is estimated to require about 200 litres of water for each truck. Wastewater from truck washing would include soil, sand, suspended materials and oil. Therefore, the preliminary treatment of wastewater from washing trucks, n addition to sedimentation manholes, would also need oil and grease separating tanks.

The impacts from construction wastewater during construction could be considered as being medium and require proper management measures.

3.4.27. Solid Waste Generation

Ground levelling and excavation for the construction of the resettlement area under Component 3 of the Project are expected to generate a total of about 36,500 m^3 residual top organic soil/sludge and 925 m^3 excavated soil which need to be disposed off. Same as the above mentioned in Components 1 and 2, the top-soil/sludge will be disposed in the Nam Thanh landfill site; the excavated soil will be transported to the Dong Nam and Dong Bac new urban areas.

Solid waste generated includes cement bags, scrap iron and steel, empty boxes, etc. However, as the project only build basic infrastructure at the resettlement site, and most of the waste could be sold to recycling businesses thus the potential impacts are manageable.

The potential impacts from construction solid waste could be considered as very low and manageable.

Domestic Solid Waste

Each worker during working hours on site is estimated to generate about 0.5kg of domestic solid waste a day; meanwhile one person living in camps may generated 1.5 kg domestic solid waste a day. Since the construction sites are all in the city, most workers will go home or rented houses daily after working time, only a few workers (estimated 5 people) stay in camps as security guards on site. The volume of domestic solid waste generated by the workers can be estimated as presented in Table 3.15c.

Table 3.15c: Calculations of domestic solid wastewater generated daily at construction sites

No.	Area	Number of workers (person)	Volume of generate solid waste (kg/day)
1	At each construction site (daily)	50 - 70	30 – 40
2	At ach construction site (peak time)	100 -120	55 – 65

According to the calculations in this table, the total volume of domestic solid waste generated daily in the construction phase is relatively high. However, the figure is distributed to many construction sites located around the city. The average volume of domestic solid waste in each main construction site is then only 25-35kg/day. Without proper management and daily collection, this volume of domestic waste could cause air pollution and affect surface water bodies in the vicinity.

There are currently services of collecting urban solid waste collection that can serve the entire city Phan Rang City- Thap Cham City. With all construction items of the Project being located in the city area, the construction contractors can sign contracts with the domestic waste collection and transportation business (Nam Thanh Company) to collect and transport domestic solid waste generated in the construction sites.

The impacts could be considered at low level.

3.4.28. Hazardous Waste

As the trucks would be maintained in workshops thus the volume of hazardous waste generated, if any, in the construction phase of Component 3 would be very small.

3.4.29. Increased Inundation Risks

The resettlement area is currently agricultural lands with low elevation and usually flooded. Ground disturbance during the first period of construction phase may cause localised flooding if the existing drains and canals are blocked. The risk is manageable by proper construction practice.

3.4.30. Traffic Disturbance and Increased Traffic Safety Risks

Increases in traffic density caused by the trucks and other construction plants mobilised by the project, the roads being narrowed down during construction, the temporary loading of materials at wastes and roadside, the fences placed along the roads would cause vision reduction to the drivers, these may lead to increased traffic accidents risks.

Table 3.17c below presents in detail the roads significantly impacted during the construction phase of the Component 3.

Table 3.17c: Possibly affected roads during construction phase

No	Impacted route	Description of impacts
1	21/8 Street	This is the main transportation route of the city, with very heavy traffic, with lots of tourists, residential houses and Thap Cham relics. This route is planned for the transportation of construction materials and waste for disposal during the construction of Alley 150 on 21/8 Street, Huynh Thuc Khang Street, Tan Tai canal and pump stations PS1 and PS2.
2	National Highway 1A, National Highway 27	This is the route for transporting construction materials (stone, soil, sand)
3	16/4 Street	This is the transportation route for excavated materials to be used as backfill at Dong Bac and Dong Nam new urban areas.

The impacts on traffic system could be considered as medium level.

3.4.31. Disturbance/Damage to Existing Infrastructures and Services

Impacts on traffic

The quality of affected roads and streets could be downgraded from transportation operations of materials. Especially, on such main routes for the transportation of excavated and backfilling materials as 21/8 Street, 16/4 Street and National Highway 27. These impacts are inevitable yet able to be mitigated with strict management measures related to vehicle speeds and loads. Besides, as these are the main traffic routes in the city, during the construction phase of the Project, the City's authorities are to devise policies on frequent examination and repairs of the road surfaces to prevent extreme down gradation.

Impacts on power supply infrastructure

During construction, if such operations as demolition of houses and construction of sewers are likely to affect underground cable lines or power connections to the equipment in pumping stations, power will have to be cut off for safety in demolition. This power cut-off will be bound to create disturbances of the people's living conditions and badly affect households running businesses such as eateries. To mitigate these impacts, the time schedule of power cut-off will be notified to local residents at least 2 days in advance so that they may take active steps in domestic activities and production.

3.4.32. Impact on Biological Resources

A number of additional trees may be cut down in site clearance operations during the construction phase, affecting the quality of the vegetation cover in the area. However, as assessed in Chapter 2, the ecosystem in the Project area is poor, which consist of only the urban ecosystem and garden and agricultural land; therefore, this impact can be seen as negligible on the terrestrial ecosystem and as absent in the ecosystem of the area. However, to protect the landscape and the vegetation cover of the area, during the construction phase it is necessary to minimize tree clearance in case clearance of the trees is not compulsory, especially for trees located outside the construction boundaries of the Project.

3.4.33. Impacts on Urban Landscape

During construction, site clearance would be carried out with such operations as demolition of houses (mainly temporary housing, tile-roofed houses, houses with one to 2 floors, workshops) and ground levelling, generating dust and noise.

- Dust generated from old construction works would consist of both settled and suspended dust, of which the amount is hard to determine as it is much dependent on demolition measures and weather conditions. Consultants' experience shows that in areas of demolishing civil construction works and houses the amount of dust most often exceeds the permissible limits specified in QCVN 05:2013/BTNMT by 2-3 times, but this dust would settle fast and last in just short periods of time. The permissible limits allow for a distance of 20-40 m from demolition sites. Demolition work would mainly affect the residential area on Huynh Thuc Khang Street and Alley 150 of 21/8 Street, households to be displaced in the resettlement site, households affected by the expansion of canals, households immediately adjacent to the pumping stations, households presently living in the planned area for the regulating lake, as well as other households around Dong Hai lake with moderate dispersion of dust and during a period of several weeks.
- Dust generated from ground levelling will be of considerable amounts during sunny and windy days and can exceed the permissible limits specified in QCVN 05:2013/BTNMT by 1.5-2 times. The dust concentration will reach permissible limits from a distance of 25-35 m from the edge of the construction site, depending on the weather. The duration of dust dispersion is about one week.
- Noise will be generated mainly from demolition and ground levelling operations. The noise from bulldozers, trucks, rollers and excavators will exceed the permissible limits specified in QCVN 05:2013/BTNMT (70 dBA) within a scope of 80m. This will impact the households in residential areas adjacent to the construction site.

As mentioned above, construction operations in the site would require demolition of houses, excavation of roads, cutting down of green trees and the setting up of protective fences. These tasks will change the landscape permanently and also affect urban beauty. Besides, materials will be transported and gathered in the site. Without proper management, the gathering of materials would be unplanned and indiscriminate, damaging urban beauty.

3.4.34. Community Disturbance and Potential Social Impacts

Impacts on Business Environment and Income

Besides such impacts as disrupted traffic, air pollution and noise, local people living near the construction site of the Project are also economically affected, especially for those who run their business in front of their houses. According to statistics, the Project would temporarily affect to the business activities.

The impacts could be considered as low level temporarily.

Risks on Social Order and Security

The large amount of workers concentrated for operations during the construction progress at peak time in the city area can be up to 500-600 people. This would cause certain impacts on the security of the area. Contradictions and conflicts may arise owing to disparities of lifestyle and habits or to workers' involvement in social evils. Upon living in the construction area, workers would get in touch with local people and their movement would entail business with locals, probably including social evils as prostitution, drug use, thieving, etc. as most of the workers are males living far from

home. The risks from these impacts can be mitigated through strict regulations management in labour contracts signed with workers and through close co-ordination with local authorities during the construction progress.

Additionally, temporary land appropriation of part of local people's land during construction for material and waste gathering will cause certain difficulties to locals' living conditions such as dust and noise, difficult traffic, temporary flooding, affected business activities, etc. These impacts would be of a higher level with the construction items close to residential areas such those near the construction of the roads.

These impacts could be considered as medium level.

3.4.35. Health Safety Issues and Risks

Workers' health

During the construction phase, many workers and free migrants would flock to the Project area. This can lead to more difficulties in medical examination and treatment as well as community health care to be carried out by medical establishments in case of epidemics and diseases. During this stage, , labour accidents might also happen if workers do not fully comply with labour and traffic safety regulations.

In case workers' labour and living conditions at the construction sites are not hygienic with insufficient supplies of clean water or protective gear, they may contract many digestive and dermatological diseases which badly affect their health.

Common diseases frequently recorded in Phan Rang City- Thap Cham City include dengue fever, flu, varicella, measles, and HFMD. During the construction phase, workers are likely to contract these diseases.

Improper use of electricity and fuel can also pose risks of fire and explosion. The setting up of workers' camps without measures to manage sanitation, solid waste and wastewater will also cause risks of workers' health and pollution, affecting the landscape and the surrounding communities.

These risks could be considered as low level.

Communities' health

Dust, hazardous gases and noise could affect local people living around the construction site, with those living along transportation roads and around construction sites being most heavily affected.

In construction sites during the construction phase, there will be excavated pits, material piles, machines, equipment and waste, etc., which poses safety risks to local residents and workers working on site.

Living and sanitation conditions as well as other social infrastructure items can be interrupted during the construction phase and increase the risks of health safety and diseases among the local community around the Project area.

Especially, in the construction of school sanitation facilities, teachers and pupils would be seriously affected by noise, dust and other risks if proper management measures are not devised and carried out. These impacts can be avoided if the construction of school sanitation facilities is scheduled during the summer vacation months.

These impacts could be considered as low level.

3.5. TYPE-SPECIFIC AND SITE-SPECIFIC IMPACTS OF PROJECT COMPONENTS

3.5.1. Type-specific Impacts

Among the common construction impacts discussed earlier, some of them would be more typical more critical to certain types of investments thus need to be considered more in depth than the other common construction impacts. The typical potential impacts during construction phase by type of investments proposed under Component 1 are summarised in the Table 3.20 below.

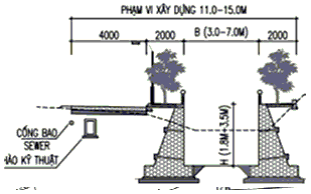
Table 3.20. Typical Impacts by Type of Investments

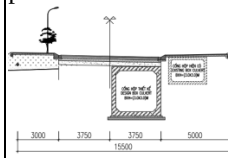
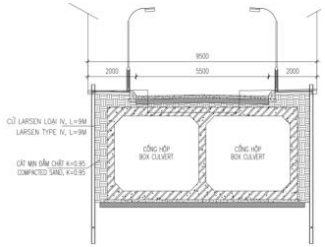
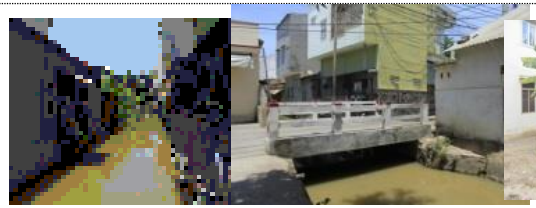
Type of Investment / Construction Site	Main Activity	Specific Issues/Impacts
Canal Rehabilitation and embankment lining	Dredging and embankment lining	- Very bad odor generated from the disturbed canal bed and dredged materials temporarily loaded on-site causing air pollution, affecting urban landscape and nuisance to the public - Dust and nuisance on transportation road, at temporary loading area of the dredged materials - Health risk to the workers when in contact with/working with sludge polluted with domestic wastes - Soil subsident, land slide risk at cut, fill and slopes - Interruption of drainage and/or irrigation function - noise from rock handling, unloading - Social disturbance, safety risks for to local households - Over cutting of trees or damages vegetation cover at canal side, particularly at sections passing garden land or having existing vegetation cover - Accessibility to watersuface, accessibility from one side to the other side of the canal may be interrupted
Secondary drainage pipelines construction	Open pipe trenches installation of pipes D600-1200	- Traffic disturbance or interruptions - Soil subsident, landslide risks due to deep excavation or on weak soil or excavation taking place too close to existing or structures - Urban landscape related to temporary loading of waste and bulky materials - Disruption or damage to existing underground facilities such as water pipes, power and telecommunication cables, etc. - Safety risks for the public and workers, particularly at night time, rush hours, during the loading/unloading and operations related to bulky items such as pre-casted pipes - Disrupt accessibility to roadside houses - Disturb, interrupt the business of roadside shops
Tertiary sewer pipelines construction		- Safety risks for the public - Disrupt accessibility to roadside houses, particularly shops - Dust and nuisance

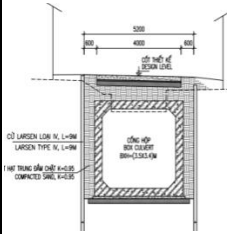
Type of Investment / Construction Site	Main Activity	Specific Issues/Impacts
Construction of new pumping stations	Deep Excavation and equipment installation	- Landslide risks from the walls/slops created at the pumping station chambers and temporary loading of excavated materials on-site - Safety Risks for the workers when working deep underground - Safety risks for the public and workers related to operations of excavators, cranes, existence of deep holes, temporary storage of stockpiles, electrical wires etc.
Upgrading the WWTP		- Drowning risk for the workers when working on the river for reconstruction of the outfall - occupational health risks for the workers working within the plant - Safety risks related to the transportation, loading and unloading of bulky materials
Rehabilitation of Dong Hai lake	Excavation, dredging, civil works	- Saline water and dredged materials may cause localized flooding and pollution to the surrounding area - Odor generated from excavated materials - Landslide and soil subsident risks at the cut and fill, slopes created - Health and safety of the workers at the camp - Social disturbance when workers are concentrated at the site - Safety risks for the workers - Dust and noise from dredged materials - traffic disturbance, increased traffic safety risks on the access road - temporary loading of materials may cause pollution to the surrounding, disturb existing drainage - Disturbance to a temple
Construction of New Central Lake	Excavation, embankment lining, roadside and greening areas construction	- Large volumes of excavated materials generated require land area for disposal - Dust when large areas is disturbed, large volume of soil is excavated, and large number of trucks travelling on the access road - Traffic safety risk on access roads when large number of trucks coming in and out of construction sites every day - Safety risks for workers - Landslide and soil subsident risks at the cut and fill, slopes created - Health and safety of the workers at the camp - Safety risks for the workers - temporary loading of materials may cause pollution to the surrounding, disturb existing drainages

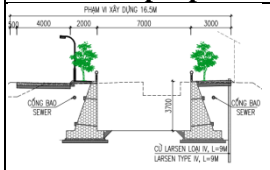
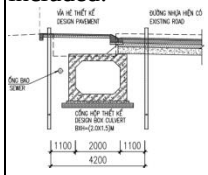
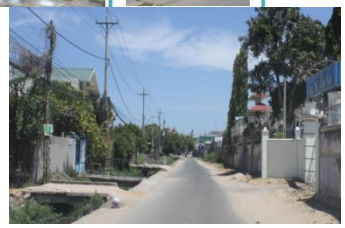
Type of Investment / Construction Site	Main Activity	Specific Issues/Impacts
Construction of school toilets	Construction of school toilets	- Accessibility to the existing toilets may be disrupted - Safety risks for the students and teachers during the demolition of the old/existing toilet and construction of the new one
Workers Accommodation	Camps	- Camp conditions, water supply, sanitation facility is inadequate to maintain good health for the workers particularly in long summer in Phan Rang - Solid waste not managed properly causing soil and water pollution, affecting the health of workers and nuisance to the public - Safety risks related to installation and usage of electricity and gases for cooking and other purpose - Social disturbance or even disorder due to worker's behaviors that are inappropriate to local customs and traditions
Road expansion and upgrading in component 2		- Accessibility to roadside households would be affected, particularly when the ground level of the upgraded road or footpath is significantly higher or lower than ground level of the roadside houses
New Resettlement site		- Large volumes of excavated soil generated - Elevated ground level may cause flooding to the surrounding areas where ground elevation remains low - Dust and traffic safety risks on the access roads - If not carefully considered, some invasive plants may be introduced in to the green area at the resettlement site
Disposal site	Disposal	- Blockage or disturb existing drainage - Dust from unleveled granual wastes, particularly when strong wind is around - Erosion and landslide if slopes created is too steepy, heavy rain

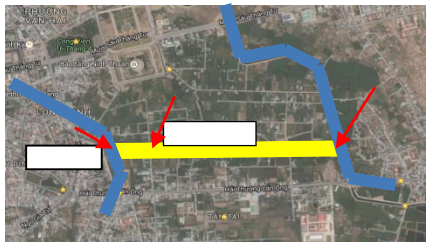
Table 3.21: Site-specific impacts at each construction item of the Project

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
COMPONENT 1		
Tan Tai canal		
Section TT1 of Tan Tai canal, L=3,435 m (Construction corridor is11-15 m wide along the canal) Build Vertical stone embankment, B = 3 - 7 m, H = 2.3-4 m. Build road on left side B=4m, footpath B = 2 m, CSO, Interceptors on the right side Bridge crossing canal, steps to access to water front  	  From Ba Hong sluice gate - Earthen embankment, B = 6-10 m wide - bottom has 0.7m deep sedimentation and waste; - residential invated on the right side, there is an existing road on the left side - 20 earthen graves about 10m from the canal, at 11o35’21.1’’N and 108o58’1’’E. - some agricultural land on left side with 7 irrigation water intake and one one gate connected to the canal dense houses in the middle section - Water quality meet standards, except coliform at 460,000, which is over sixty times higher than standard	- Disturbance to existing land use along the 11-15m construction corridor while the canal is 6-10 m wide - Very bad dour from temporary loading of sludge thus cause nuisance to the public - Dust from materials for roadbase construction - Noise from rock unloading - Public health and safety risks, social disturbances - Health and safety risk for workers in contact with the polluted sediment - Overdisturbance to vegetations and trees on existing household garden or agricultural land at canal side - increased traffic density and safety risks on the existing canal road - Canal water quality degradation (turbidity, TSS, organic matters) by dredging and wastewater leaked from from the temporary loaded dredged materials - Impacts on aquatic organism and fish, if anycome from the Dinh river - irrigation/drainage disrupted as 7 7 irrigation water intake and one gate affected - Accessibility to the graves yard may be obstructed, physiciologial impacts on families
Section TT 2 Tan Tai canal, L =332m	- Run along the road behind the stadium to Le Duan Road; Previously converted to narrow culvert, road for traffic on top - Polluted due to garbage cloged at the screen localized flooding and pollution	- Traffic disturbance/disruption when road is excavated to new drain construction;

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Retain the existing box drains BxH=2.4x1.6m; Construct new parallel box culvert BxH=3.5x3.0m 	  	- Health and safety risks for the workers when in contact with garbage and work in polluted environment - access to and from the side gate of the stadium interrupted - overdisturbance or cutting off trees - safety risk for the public
SectionTT3 of Tan Tai canal, L = 1,384 m, from Le Duan to Thong Nhat road, construction corridor is 9.5m. Build Convert canal to two parallel drains 2xBxH=2x3.5x3.0m Replace the existing road-crossing culvert on Thong Nhat - 16/4 road). Build road on the top B=5.5m, footpath, CSO, drainage, sewers, technical drain, lighting, manholes and maintenance staircases. 	   - 4 m wide. sediment layer of 0.8 m thick. invaded by residential house. - no existing canal-side roads, only houses and fence facing watersurface. - some trees, green space and bridges crossing the canal at some locations. - Two sub-sections: + Phan Rang Pagoda is located in the middle of this section; + Relatively densely-populated area.	- Disturbance to existing landuse along 5m-wide strip as existing canal is 4 m wide and construction corridor is 9 m wide - Loose waterfront permanently, but polluted water. Not avoidable. - Odour from temporary loading of sludge - Dust from excavated soil - Health and safety risk for workers in contact with the polluted sediment - Safety risks to canal side families - irrigation service disrupted - Social disturbance and safety risks to canal side houses - Traffic disturbance and safety risks at the Thong Nhat-16 April road during the replacement of the existing culverts - Over disturbance to vegetation or trees in households garden - Marginal impacts on aquatic biology in this polluted canal section - Obstruct accessibility on the existing bridge - Disturb access and religious activities in the Phan Rang pagoda
SectionTT4 of Tan Tai canal, L = 722m	- B=4 m, populated area; poor drainage, water nearly overflow in normal conditions.0.8 m thick sediment, cross section narrowed down by houses. Some sub- 	- Disturbance to existing landuse along 4.5m-wide strip as existing canal is 4 m wide and construction corridor is 9.5 m wide

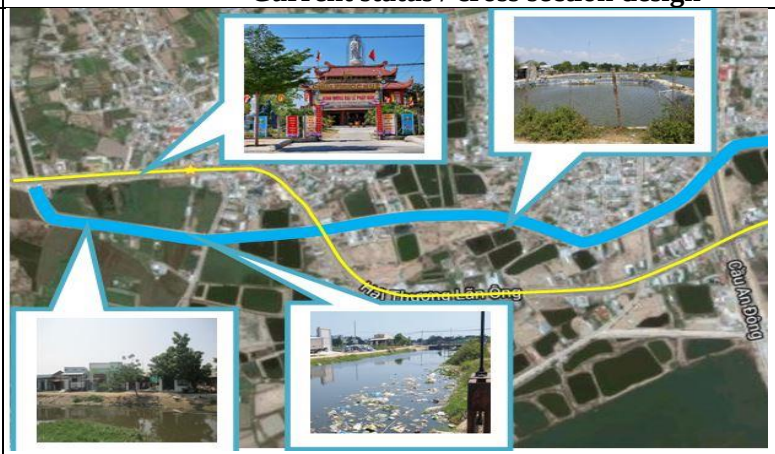
Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Total construction corridor is 9.5m wide. Build a new box drain dimension BxH=3.5x3.4m, road on the top B=4.2m, interceptor, footpaths, four sewer connections D400-800, drainage, technical drain, lighting, manholes and staircases 	sections have no canal-side roads and invaded with houses; the others have houses on one side and earth/concrete road at the other side.  -	- Health& safety risk for workers related to the polluted sediment - Odour, nuisance from temporary loading of smelly sludge - Social disturbance and safety risks for the public - irrigation disrupted - increased traffic density and safety risks on the existing canal-side roads - Social disturbance and safety risks to canal side households - Over clearance of trees or distub vegetation cover - Disturb activitities, safety for the public, visual impacts on the Cham Culture Research Center, soil subsident risk as excavation to 3.4 m - soil subsident risk to the Cham centre. - Noise, smell affect Anh Sang Kindergarten
SectionTT5 of Tan Tai canal, L = 427 m From Ngo Gia Tu road to Hai Thuong Lan Ong road. Construction corridor is 10.7m Construct vertical stone embankments BxH=(3.5-4.7)x3.9m. Left bank: road B=5.2m, CSOs, drainage, sewers, lighting and staircases. Right bank: road on the top B=5.2m, wastewater interceptor, footpath B=2.25 for both sides, rainwater drainage, technical box, lighting, manholes and maintenance steps. Construct an outlet BxH=2.0x1.8m including CSO and flap valve in HTLO street.	 - cross section BxH=2.3x0.8m, stone embankments.	- Disturbance to existing landuse along 4.5m-wide strip (B canal = 2.3 m, construction corridor is 9.5 m wide - Odour from temporary loading of smelly sludge thus cause nuisance to the public - Health and safety risk for workers in contact with the polluted sediment - Noise from rock unloading - Safety risks to the public - Dust from excavation during canal widening from 2.3 to 3.5-4.7 m - Soil subsident when excavation to 3.9 m while the existing depth is only 0.8 m - irrigation disrupted - increased traffic density and safety risks on the existing canal-side roads

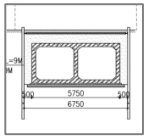
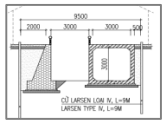
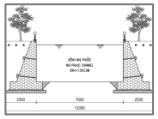
Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
	- sedimented with a layer of 0.75m; - Along the first 140m, there are 3-3.5m-wide road on both sides; the remaining part towards Hai Thuong Lan Ong road, there is 2.5m-wide earth road on the right bank, the left bank is covered with thick vegetation and there is no road. Drainage capacity is quite weak, water usually overflowing the bankment. There are power lines and poles running along the left bank. - No existing road to the left; earthen road 2.5m wide on average to the right; low traffic density; - Currently with poor drainage with water overflowing canal banks in normal conditions.	- Disturb or damages to the existing powerlines - worsen localised flooding risks
SectionTT6 of Tan Tai canal, L = 561mHai Thuong Lan Ong - the Dinh river dike road: Build box drain BxH=1.5x1.8m. Total construction corridor is 4.2 m. HTLO - Tran Thi road: build road on top of box drain. Along Tran Thi road: the box culvert will be a new pavement, interceptor, drainage included. 	 Residents' houses on the left, asphalted road on the right; medium traffic density; sediment layer of 0.75m thick. stone embankment in one side, earth on the other side. The end point is rice field, no connection with the Dinh river thus drainage capacity has been limited. canal is narrow, there are access to canal-side houses.  On third from the beginning there are houses but no management road. Tan Tai Parish Church located 50m from the right of construction site, the Tran Thi Primary School located on the left of the construction site in Tran Thi road;.	- Disturbance to existing landuse along 4.2m construction corridor is 9.5 m wide - irrigation/drainage services disrupted, three irrigation gates and a stop log affected - Social disturbance and safety risks to the public - aaccessibility to canal-side house affected - Dust and exhause gases affecting residents; - increased localised flooding risks due to existing limited drainage capacity - Safety risks to traffic means and the community, especially at night along Tran Thi Street - Traffic safety risks to pupils leaving school after classes; - Access to the Parish Church may be affected

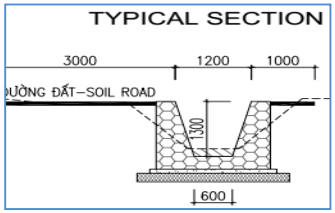
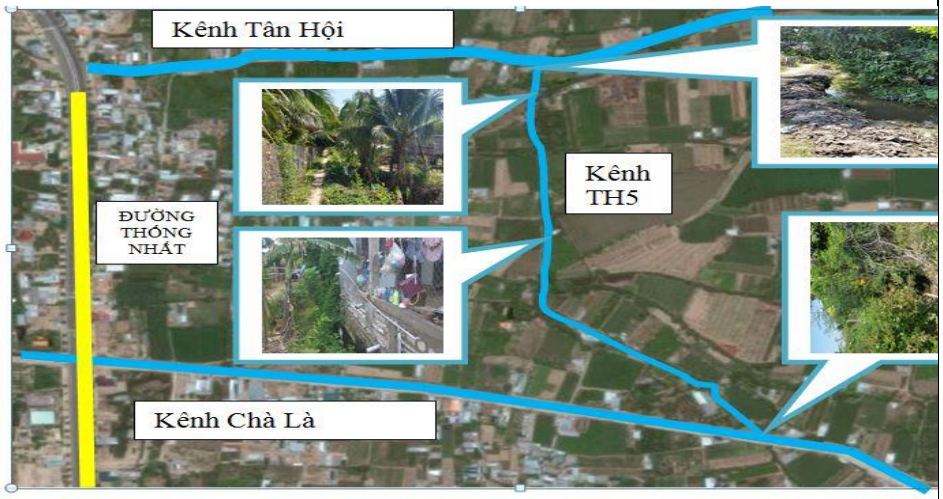
Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Dong Nam canal L= 1.379m, connecting the Tan Tai and Cha La canals, running parallely with Hai Thuong Lan Ong road widening the canal to BxH=10x2.7m; stone embankment for both sides; a sidewalk on the left side B=2.0m; a macadam road B=4.0m, lighting and tree planting on the right side. Reinstate agricultural irrigation works.	 Current this is a small irrigation canal, B=0.8-1.5m, Two sides of canal are garden land and paddy rice field. Canal to be expanded on the side with agricultural land. Both sides along the canal are mostly existing paddy fields and gardens. However, in the ending part towards Cha La canal, there are also some houses located along the canal-side earthen road. 	- Disturbance to existing landuse along construction corridor which is at least 16 m - disrupt irrigation service to roadside agricultural land; - some irrigation canal sections affected - Dust from large excavation to widen the canal from 0.8 to 10 m - Overdisturbance to existing vegetation and trees on agricultural land - noise from rock handling, unloading - Soil subsident, land slide risk when excavation down to 2.7 m - Social disturbance, safety risks for to local households at canal side
Cha La canal (no works proposed for Section 1, 3)	The Cha La canal is 7.6km, cross section has trapezoid shape, BxH=(2-10)x 1.2-3.7 m). Lined Embankments along 5.48 km, 2.23km earth embankments. At the downstream, the canal has been directly affected by tide of Dinh River, approximate 1.0 km from the tidal control gate at the downstream. There is a gate for salinity intrusion control. Some sections has beautiful landscape with trees and flowers. Many parts at downstream of Cha La canal has been seriously polluted by domestic waste. Canal cross sections at some locations have been reduced when road were built. Some sections have management road on one side only due to encroachment of the canal watersurface. There are only few houses along the canal, rice fields and fruit gardens are the main land use along the Cha La canal.  	
Section CL2 of Cha La canal, L = 942m	Exiting earthen canal; earthen management lanes on both sides 92 m on the left, 6 m on the right; sparsely-populated area	- Dust from excavation for canal widening affect crops and workers

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Canal: Embank with stone walls BxH =12.2x(2.8-3.5)m Left: Construct 4m wide concrete road and the auxiliary items Right: Construct 4m concrete road and the auxiliary items		- Disturbance to crop land and agricultural activities (temporary disposal of excavated materials) - Disturb or interrupt irrigation and drainage services for agricultural land - Affect water quality (turbidity) from concrete mixing, temporari load of dredged materials - Odour pollution
Section CL4,L = 1,651m Embank with stone walls BxH =(14.3-16)x2.8m Left: Construct 4m concrete road, and the auxiliary items Right: Construct 4m asphalt road and the auxiliary items	Concrete embankment, Earth road lanes on both sides, about 6.0m wide on the right and , about 2.0m wide on the left; sparsely-populated area.	- Disturbance to the trees along the road and river bank - Accessibility of the households may be affected - Affect water quality (turbidity) - noise from rock handling, unloading - Soil subsident as excavation down to 2.8 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, the canal may be interrupted.

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
	 	
Section CL5,L = 1,286m Embank with stone walls BxH =16x(2.7-3.7)m Left: Construct 4m wide concrete road and the auxiliary items Right: Widen the existing road, construct 4m wide concrete road and the auxiliary items	Earthen canal, left: Earthen road, 4.0-6.0m wide, right: Earthen road, 3.0-5.0m wide	- odour generated from the disturbed canal bed and dredged materials temporarily loaded on-site - Dust and nuisance on transportation road, at temporary loading area of the dredged materials - noise from rock handling, unloading - Health risk to the workers when in contact with/working with sludge polluted with domestic wastes

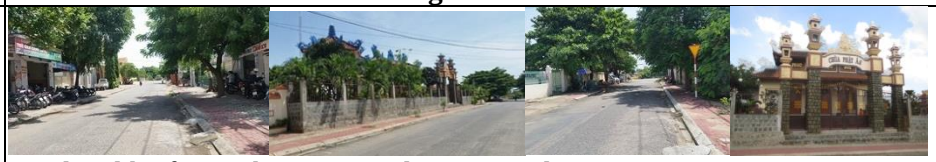
Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
	 populated area in My Dong Ward; Dredging amount to be about 7,790 m3; saline dredged soil.	- Soil subsident as excavation down to 3.7 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (mostly increases in turbidity, TSS and organic matters) when the canal bed and embankments are disturbed, or when runoff from temporary loaded dredged materials enters the canal - Saline soil and water may affect the trees and vegetation cover
CL 6: from Vo Nguyen Giap road Hai Thuong Lan Ong 3 road, 0.5 km long Dredging canal bottom 0.7-1.0m	Concrete embankment, left: Concrete road, 4.0-6.0m , right: Earthen road, 3.0-4.0m wide B1xB2xH=10x(20-21)x(3.3-3.7)m. Sediment layer is about 0.7-1.0m thick. A power line is running along the left side and houses are along both sides. Garbage is observed floating in the canal.  	- odour generated from disturbed canal bed - Dust and nuisance on transportation road, at temporary loading area - Health risk to the workers - Drowning risk as the canal is 3.7 m deep - Soil subsident as excavation down to 3.7 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for local HH - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (in turbidity, TSS) Saline soil and water may affect the trees and vegetation cover

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Nhi Phuoc canal, L=1,709m Nhi Phuoc canal is 1,660m long, starts at 16/4 road and ends at the connection to Cha La canal. **Section (L=93m)**: construct two parallel box culverts 2xBXH=2x2.5x2.5m.  **Section NP2 (708m) & NP3 (475m)**: maintain open canal and construct a box culvert BxH=3x3 in parallel. Management road is constructed on the right side.  **NP4 (384m):**rehabilitate open canal BxH=7.0x3.0m embanked with stone vertical walls on both sides. Two 2.5m-wide macadam roads will be constructed along both sides. 	The existing canal is about 2.5m wide. Section 1: from 16/4 road to the Center for Social Education. The existing canal is about 7.3-7.7m wide, and the concrete road on the right is about 4.8-5.2m. **Section NP2 (708m) & NP3 (475m)**: from the NP1's ending point to behind the museum. **NP4 (384m):** from the ending point of NP3 to Cha La canal **NP4 (384m):** from the ending point of NP3 to Cha La canal. On the beginning section from 16/4 Street to the Museum area: concrete roads and residential houses on both sides; canal bed sedimented and filled with sludge and waste, resulting in poor drainage in normal conditions; in area at the Museum, water level nearly reaching road surface.  	- Traffic safety risks; - Residents along canal affected by dust, noise and odour. - Health risks to the workers when in contact with the waste and contaminated water - Disturbance to the trees along the road and river bank - Accessibility of the households may be affected - Affect water quality (turbidity) - noise from rock handling, unloading - Soil subsident as excavation down to 2.8 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, the canal may be interrupted.

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
TH5 canal, L=662m TH5canal is 662m long, conveying water from Tan Hoi to Cha La canals. build new cross section and embankments B1xB2xH=0.6x1.4x1.58m and construct a 3m-wide earth road on the left side and a 1m-wide earth road on the right side, repair/rehabilitate 5 sluice gates along this canal. 	 The canal is about 2-3m-wide. Along the canal, there are 7 residential grade 4 houses with some animal cages and gardens. There is no existing road along some sections while in some parts there are2m-wide earth roads along the canal. Mainly fruit-tree land and only 6 households along canal	- Impacts on vegetation cover and trees, affect green landscape, - affect Accessibility to homes of 6 HHs - Dust and nuisance on transportation road, at temporary loading area - Drowning risk as the canal is 3.7 m deep - Soil subsident as excavation down to 3.7 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (in turbidity, TSS) Saline soil and water may affect the trees and vegetation cover
Secondary drainage		
D1 sewers – Alley 410 on 21/8 Street, L=500m, DN=600mm	Frequently flooded in heavy rains; Road width of 6m 	- Affect some roadside businesses - Risks to roadside power line and cables - Damages to the trees - traffic disturbance; traffic safety risks, particularly in rainy weather
D2 – Truong Dinh Street L=220m, DN=1,200mmm	Road width of 7m; Intersection between Truong Dinh Street and 21/8 Street always flooded in the rainy season. Many business households along the route 	- Landslides; - Affect some roadside businesses - Risks to roadside power line and cables - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather - Riks to power supply facilities nad the trees

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Item/proposed work	**Current status / cross section design**	**Site-specific Impacts and risks**
D3 sewers - 21/8 Street-Le Quy Don Street; L=222m, DN=1,200mm	Road width of 7m; Intersection between Le Quy Don Street and 21/8 Street prone to flooding during rains. Many business households along the route 	- Landslides; - Affect roadside businesses - Risks to roadside power line and cables - Damages to the trees - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather - Riks to power supply facilities and the trees
D5 sewers – 21/8 Street-Children's Culture House L=122m, DN=600mm	Road width of 11m;Thickly-populated area; relative heavy traffic on 21/8 Street; Area in front of Children's Culture House frequently flooded in the rainy season. 	- Dust and noise - Traffic, safety risks - Urban landscape may be affected
D6 sewers - Thong Nhat Street to Quang Trung Street; L=339m, D=1000mm	Road width of 6m; Densely-populated areas along the line with many high buildings and a lot of business establishments 	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line and cables - Damages to the trees - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather
D7 sewers - Le Hong Phong Street, Yersin Street and Thong Nhat Street; L=326; D=800mm	Road width of 7m;Area with no existing drainage sewers; Along the new sewer line: area with many administrative agencies of Ninh Thuan Province (provincial People's Committee, provincial Department of Internal Affairs, provincial Department of Education & Training)  	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Damages to the trees - Traffic disturbance

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Item/proposed work	**Current status / cross section design**	**Site-specific Impacts and risks**
D8 sewers- Thong Nhat Street section in front of the provincial People's Committee; L=130m; D=600mm	Road width of 7m; Sewer line to be installed in front of the provincial People's Committee and Phan Rang Parish Church  	- Dust, noise, community disturbance - Traffic disturbance - Urban landscape
D9 sewers - Cao Thang Street; L=450m, D=800mm	Road width of 6m; Densely-populate areas along the line; no existing sensitive location 	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line and cables - Traffic jams, traffic disturbance; traffic safety risks
D10 sewers - Vo Thi Sau Street; L=863m, DN=1,500mm	Road width 6m; Existing DN1200 sewer line, but now pressed down under present residential houses, with water unable to be discharged into Kinh Dinh lake resulting in flooding in the areas of Phan Rang market; existing B500 sewers on Thong Nhat not effective; Busy market areas; Mainly small businesses and residential houses along Vo Thi Sau Street. 	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line and cables - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
D11 sewers - Cao Ba Quat Street: D=1000m L=495m	 Road width of 8m; Phat An pagoda on sewer line	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Traffic jams, traffic disturbance; traffic safety risks
Tertiary wastewater drainage sewer line, L= 41.2 km	run through traffic roads of Dong Hai ward and Northern and Southern areas of 16/4 Street Senstive locations : restaurants and eateries, hotels along Yen Ninh Street and 16/4 Street, agencies and departments on Thong Nhat Street, Le Hong Phong Streetand 16/4 Street, schools on Bach Dang Street in Dong Hai ward 	- Dust - traffic safetyrisks - Disturbance to community, - Accessibility to roadside houses and shops - Safety risk related to open holes,
Pumping stations		- Landslide risks - Safety Risks for the workers
PS1	Site surrounded by residential areas 	- In general, construction on vacant land: therefore negligible impacts on the environment and local community
PS2	Construction site of PS 2 close to Tan Tai canal 	- In general, construction on vacant land: therefore negligible impacts on the environment and local community
PS3	Adjacent to existing residential areas 	- PS3 to be constructed in front of residential houses, affecting access and entrance; - Special attention to be paid to traffic safety and labor safety risks during both construction and operation; - Impacts from dust and exhaust gases.

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
PS4	Adjacent to Hai Thuong Lan Ong Street Area of the line section with high traffic density between PS4 to the intersection of Hai Thuong Lan Ong Street: special attention to be paid to traffic safety and labor safety during both construction and operation	- Impacts from dust and exhaust gases.
PS5	In Binh Son park and close to 16/4 Street  	- Attention to be paid to traffic safety during construction an transportation of materials, and to inconveniences caused to people in the park and a number of seafood eateries nearby; - Impacts from smoke and dust.
PS7	Located to the Southwest of Dong Hai lake; Construction site located within residential areas with large population and heavy traffic. 	- Attention to be paid to traffic safety during construction an transportation of materials, and to inconveniences caused to residents along Alley 62 on Bach Dang Street (with small internal traffic roads); - Impacts from smoke and dust.
PS8	Located on agricultural land with few inhabitants around 	- Negligible impact on the environment and the community: construction site being vacant land
PS9	Located on agricultural land with few inhabitants around 	- Negligible impact on the environment and the community: construction site being vacant land

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Construction of central regulation lake	Located in Van Hai ward; rice-planting land; currently with easy access; Transportation route 50m from Thien Hung pagoda 	- Impacts from land acquisitance, causing psychological problems; - Amount of organic matter to be dredged: 11,538m3, excavation amount: 256,382 m3; - Likely to be flooded during rains; - Vancant land, causing low impact on residents during construction; - Disturbances to vegetation cover; - Impacts from waste and wastewater; - Impacts on security and order; - Labor safety risks; - Rissk of fire and explosion.
Construction of Dong Hai lake	Abandoned lake, used mainly to collect stormwater from surrounding areas; Lake located within highly populated residential area, with surrounding area prone to flooding due high tides and prolonged heavy rains; Located 50m from Quan Thanh Temple; Transportation route for materials to run through Dong Giang market 	- Impacts from land acquisition, causing psychological problems; - Exacavation and dredging amounts of about 41,543m3;salinized soil; - Prone to flooding during rains; - High impacts on residents dueing construction operations; - Impacts from waste and wastewater; - Impacts on security and order; - Risks of labor safety; - Risks of fire and explosion; - Sensitive locations: Dong Giang market, Quan Thanh Temple, and Tan Xuan Parish.
WWTP	**Due diligence review carried out in the Annex** As discussed in Chapter 2, most of the proposed investments in the WWTP are equipment provision and installation. Two construction items are (i) reconstruction of the discharge outlet to Dinh River, and (ii) Compacting and relining HPDE layer in treatment lagoons	- Negligible impacts as minor repairs to be performed within the plant's premises

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
Public/school toilets		
Toilets of Phu Tho Primary School Area: about 40m2;	Location proposed by school authorities at current sanitation block; Nearest distance from classroom block: 10m 	- Impacts from dust and noise, affecting pupils; scope of impacts only within school premises; - Construction possibly causing inconveniences to pupils' snaitation needs ; - Attention to be paid to safety as pupils are very active.
Toilets of Do Vinh 2 Primary School Area: about 50m2	To be located in school premises at the back of existing sanitation block; 	
Toilets of Nguyen Van Troi Lower Secondary School Area: about 100m2	Location proposed by school authorities within the premises at the corner near Northern fence wall; 	
No existing sanitation facilities in Binh Son park	Toilet block of Binh Son park 	Impacts from smoke, dust, and noise affecting entertaining people in the park
Toilet block of 16/4 Park	One existing toilet within 16/4 Park, but already damaged 	

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
COMPONENT 2		
Huynh Thuc Khang Street	Existing Huynh Thuc Khang with 48 houses of grade IV and 4 two-floor houses, and especially Thuy Nguyen Restaurant 	- Impacts from land acquisition, causing spychological problems; - Affecting water quality of Tan Tai canal; - Impacts from dust and exhaust gases on residents along the street; - Inconveniences caused to business operations of residents: difficult access to businesses; - Labor safety risks during construction of the street; - Impacts on traffic on Huynh Thuc Khang Street, Alley 150 at the junction with 21/8 Street: risks of traffic accidents and jams; - Concentrated numbers of working people likely to give rise to social evils, risks to security and order, risks of comnflicts between workers and locals; - Generation of construction waste, wastewater, and domestic waste in construction site
Alley 150 on 21/8 Street	Alley 150 on 21/8Street currently only a pebble road of 4.0 m wide on average (with residential clusters on both sides); about 300m at the final section being paddy field banks of 2.0 m wide; 35 graves to be displaced	

Item/proposed work	Current status / cross section design	Site-specific Impacts and risks
COMPONENT 3		
Resettlement site	Currently low-lying agricultural land adjacent to existing resettlement site This segment receives water from Tan Tai canal and discharges to Cha La canal via a road-crossing sewer in Phan Dang Luu road. 	- Impacts from land acquisition, causing spychological problems; - Affecting water quality of Tan Tai canal; - Impacts from dust and exhaust gases on residents along the street; - Impacts on traffic at the intersection between Phan Dang Luu Street with National Highway 1A, causing risks of increased traffic accidents and jams; - Concentrated numbers of working people likely to give rise to social evils; - Risks of conflicts betwwen workers and locals; - Generation of construction watse in construction site; - Generation of wastewater; - Generation of domestic waste
OTHER		
Nam Thanh Solid Waste Treatment Complex	**Due diligence review carried out in the Annex**	
Dong Bac and Dong Nam New Urban Areas	**Due diligence review carried out in the Annex**	
Main Material Sources	**Due diligence review carried out in the Annex**	

3.6. POTENTIAL IMPACTS DURING OPERATION PHASE

Most of the potential impacts during constructionphase would be positive as discussed at the beginning of this Chapter. However, there are also some potential negative impacts and risks associated with some types of investments as listed below

Table 3.21. Potential Negative Impacts and Risks – Operation phase

Type of Investments	Potential impacts/Issues	Comments
Sewers and drainage	• Leakage of wastewater from the joins and sewers • Soil subsident, damages to roadside houses if refill and compaction during construction phase is not good enough	mitigable during construction phase by ensuring construction quality
Canals	• Urban green landscape	Permanent changes, partially compensable
	• Accessibility between the two sides of the canals would be affected as there are only some small existing bridges crossing some canals	Mitigable by design solution (replacement bridges)
	• Accessibility of the local residents to the water surface would be reduced, safety risks would be increased when the canals become deeper, earthen embankment perpendicular rock walls	Mitigable by Design solutions
Wastewater Treatment Plant	• Increased capacity lead to increased discharge volume to the Dinh river may affect flow or water quality • Due diligence review carried out for the existing WWTP and included in Annex • System failure risks	See details below
Central lake	• Hydraulic changes in the canals connected to the lake	
Dong Hai lake	• The risk that salinity in the dredge materials spread and harm/kill the vegetation in the surroundings	
Pumping stations	• Safety to the public	Manageable through design solutions and operational practise
Public toilets	• Affect the landscape of the surroundings • Accessibility of disabled people • Water and power use	
School toilets	• Odour, Hygiene conditions, safety of students • Water and power use	
Roads (component 2)	• Accessibility to roads is disturbed if the ground elevation of the upgraded road is significantly higher or lower than the existing ground level of the road-side houses • Increased traffic density is expected. Traffic safety risk would be increased, particularly at the junctions with the existing roads • localised emission would be increased when traffic density increase • Changes in landuse along the road alignment	More details analysis are given in Section 3.6.2
Resettlement Sites	• Solid waste and wastewater generated	Drainage and sewer collection included in the

	• Accessibility of resettled households to basic social infrastructure such as schools, market, health care etc.	investments so residual impacts is minimal Solid waste is manageable

3.6.1. Potential Impacts and Risks related to WWTP Operations

During the operation phase, the treated wastewater from the WWTP will meet QCVN 14:2008/BTNMT (Column B) and discharged into the Dinh river.

The following calculations were carried out to assess water quality in the Dinh river in case the treatment system in the WWTP is failed.

Wastewater quality at outlet when system failed

The current WWTP, officially put into operation in 2013, consists of 2 units, each of which is a series of ponds: aerobic ponds, facultative ponds and maturation ponds before discharging wastewater into the receiving environment (Dinh river).

According to original design, the capacity of the WWTP is 5,000 m3/day with the following specific design parameters of the ponds:

- Aerobic ponds: 2 aerobic ponds, each with a dimension of 46x79m; talus: 1:2, depth: 4.0 m; volume: 10,877 m3; water retention time: 4.35 days;
- Facultative ponds: 2 facultative ponds, after aerobic ponds; each with a dimension of 46x53 m; talus: 1:2, depth: 3.5 m; volume: 6,336 m3; water retention time: 2.53 days;
- Sedimentation ponds: 2 sedimentation ponds, after facultative ponds; each with a dimension of 46x53 m; talus: 1:2, depth: 3.0 m; volume: 5,767m3; water retention time: 2.27 days;
- Disinfection ponds: 01 disinfection pond for stabilizing and disinfecting treated wastewater before discharging into Dinh river; surface area: 1,700 m2; depth: 1.5m; volume: 15,000 m3; water retention time of 3.0 days.

Therefore, the total water retention time after wastewater has passed through all the ponds to the discharge point of Dinh river as calculated for the capacity of 5,000 m^3/day is:

Total water retention time (capacity of 5000 m3/day) = 4.35+2.35+2.53+2.27+3.00 = 14.5 (days)

The total water retention time at the WWTP for the capacity of7500 m3/day is:

Total water retention time (capacity of 7500 m3/day) = (14.5x5)/7.5 = 9.7 (days).

The result of the above calculations means that after being upgraded, it still takes 9.7 days for a wastewater drop to travel from the intake of the WWTP to the outlet. During that travel time, parts of the contaminants in the wastewater will be decomposed. As the result, even if the treatment facilities of the WWTP failed , parts of the pollutants in the wastewater are still be removed before the flow reaches the outlet after up to 9.7 days since entry.

According to Kriton Curi, 1980, normally BOD is divided into 2 stages: (1) carbonaceous stage with a period of about 12 days; and (2) nitrogenous stage with a period from the 13^{th} day to the 24^{th} day. Therefore, for this WWTP, the decomposition process of carbon compounds has been basically completed after a retention time of 9.7 days in the system of ponds. The remaining pollutants in the wastewater for emergency discharge into Dinh river only consists of organic nitrogen compounds.

In normal domestic wastewater, the content of carbonaceous BOD compounds account for about 70% of the total BOD content of wastewater. Thus, even in case where the WWTP encounters

adverse incidents nearly 70% of the BOD content in wastewater would be removed before the wastewater reaches the outlet of the WWTP. Meanwhile, the total nitrogen value will have a self-treatment efficiency of almost zero. According to design parameters of the WWTP, the BOD content in influent wastewater of the plant is about 300 mg/l O_2 (in the worst case) while the total nitrogen content of the influent wastewater of the plant is about 21.6 mg/l (in the worst case). In case the plant fails, these contents would not decrease significantly after a retention time of 9.7 days at the plant. On the contrary, the BOD content in wastewater is forecasted to decrease approximately by 70%, i.e. the remainder is about 90 mg/l O_2.

However, results of practical operation in the past time have shown that the quality of the influent wastewater to the WWTP is much lower than the initial design parameters. In fact, the BOD5 value in the influent wastewater measured at the plant is on average about 72 mg/l of O_2 and the total nitrogen content of about 17.1 mg/l.

Therefore, when system failed, the effluent at the outlet would have BOD concentration at 90 mg/l O_2, total nitrogen and other pollutants would be the same as in untreated wastewater. The following calculations determine the quality of the Dinh river after receiving the effluent from WWTP when treatment system fails:

Receiving Capacity of Dinh river

The capacity to receive wastewater-of the river is calculated based on MONRE guidelines given in Circular No.02/2009/TT-BTNMT dated 19 March 2009.

The following formula is applied:

Pollutant-receiving capacity of water sources	≈	Maximum pollution load of pollutants	-	Available pollution load of pollutants in water bodies

In which the maximum load of pollutants load a water body can receive can be calculated as follows:

$$\mathbf{L_{td} = (Q_s + Q_t) * C_{tc} * 86,4}$$

In which:

L_{td} (kg/day): maximum pollution load of water body for the pollutant under consideration;

Q_s (m^3/s): minimum spontaneous flowrate at a river segment; for Dinh river, the minimum flowrate in the dry season is $Q_s = 3.5$ m^3/s

Q_t (m^3/s): maximum wastewater flowrate (Qt equal to WWTP capacity: 0.08 m^3/s)

C_{tc} (mg/l): limit value of concentration of the pollutant under consideration as stipulated in water quality standards and regulations to guarantee the purposes of use of the water body under assessment (QCVN 08:2008/BTNMT- Column B2)

86.4: conversion factor for the dimensional unit from (m^3/s)*(mg/l) to (kg/day)

The calculated maximum pollution loads the Dinh river can receive are presented in Table 3.22 below.

Table 3.22: Calculation of maximum pollution loads that Dinh river can receive

Pollutant	Unit	C_{tc}: QCVN 08:2015- col B2 (mg/l)	Receiving load (L_{td}–kg/day)
BOD5	mg/l	25	7754
TSS	mg/l	100	31,017
NH4-N	mg/l	0.9	279
Total N*	mg/l	20	12,908

Total P*	mg/l	10	6,454

Note: * Not stipulated in QCVN 08:2015; data taken from QCVN 14:2008/BTNMT.

The following formula is for calculating pollution loads from discharging sources to receiving bodies: $L_t = Q_t * C_t * 86,4$

Q_t (m^3/s): maximum flowrate of wastewater (Q_t equal to WWTP capacity = 0.08 m^3/s)

C_t (mg/l): maximum value of concentrations of pollutants in wastewater

The input parameters applied for untreated wastewater sources in Phan Rang – Thap Cham city are presented in Table 3.23 below.

Table 3.23: **Content of pollutants in untreated wastewater (at WWTP capacity of7,500m^3/day)**

No.	Parameter	Concentration in wastewater of emergency discharge	Total amount discharged into Dinh river (Lt, kg/days)
1	BOD	90 (mg/l O_2)	645
2	TSS	250 (mg/l)	1875
3	NH4-N	20 (mg/l)	150
4	Total N	21.6 (mg/l)	129.6
5	Total P	8.12 (mg/l)	48.7

Pollutant loads available in receiving bodies can be calculated with the following formula:

$$\mathbf{L_n = Q_s * C_s * 86,4}$$

In which:

L_n (kg/day): pollutant load available in receiving body

Q_s (m^3/s): minimum spontaneous flowrate at river segment; for Dinh river, the minimum flowrate in the dry season is Q_s = 3.5 m^3/s

C_s (mg/l): maximum value of concentration of pollutants in water body before receiving wastewater; C_s is the result obtained from surveys on the water environment of Dinh river

86.4**:** conversion factor for the dimensional unit from (m^3/s)*(mg/l) to (kg/day)

The calculated existing pollution loads in the receiving body are presented in Table 3.24 below.

Table 3.24: Calculations of pollution loads available in the water of Dinh river

Pollutant	Unit	Current status of Dinh river water Cs, max (mg/l)	Pollution load (Ln –kg/day)
BOD5	mg/l	5.4	1,633
TSS	mg/l	51.8	15,664
NH4-N	mg/l	0.57	172
Total N	mg/l	1	302
Total P	mg/l	0.13	39

The wastewater receiving capacity of a water body can be calculated with the following:

$$\mathbf{L_{tn} = (L_{td} - L_n - L_t) * F_s}$$

In which:

L_{tn} (kg/day): wastewater receiving capacity of water body

L_{td} (kg/day): maximum pollution load of water source for pollutant under consideration;

L_n(kg/day): pollution load available in receiving water body
L_t (kg/day): pollution load of pollutant in discharging water source
F_s: safety factor; F_s = 0.4

The calculated wastewater-receiving capacity of Dinh river are presented in Table 3.25 below.

Table 3.25. Calculations of wastewater-receiving capacity of Dinh river

Pollutant	Unit	Maximum pollutant load the river can receive (L_{td})	Existing pollution load in the Dinh river (L_n)	Pollutant load in wastewater effluent when system fails discharging source (L_t)	Receiving capacity (L_{tn})
BOD5	kg/day	7,754	1,633	645	2,179
TSS	kg/day	31,017	15,664	1,875	5,391
NH4-N	kg/day	279	172	150	-17.3
Total N*	kg/day	12,908	302	129.6	4,991
Total P*	kg/day	6,454	39	48.7	2,581

Conclusions:

The results above show that the values of Ln for all the parameters are relatively high. This may lead to the following conclusions:

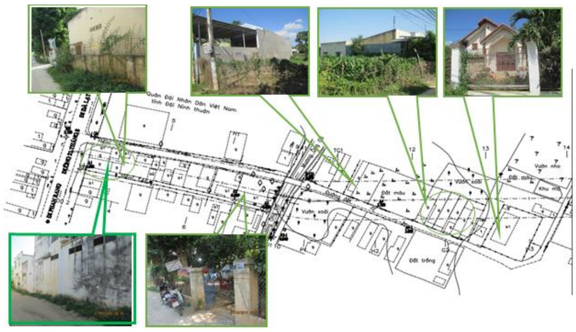
- In case the system fails, the WWTP will be still able to treat part of pollutants by the pond system with a total water retention time of up to 9.7 days.
- The Dinh river is capable to receive and flowrates of emergency discharge, equivalent to the WWTP capacity (7,500 m3/day). That means most of water quality parameters in the Dinh river meet standards, except that ammonia NH4-N would exceed standard by 15%. However, the calculations were made with maximum wastewater flow rate and minimum spontaneous river flow rate, therefore, the risk could be considered as very low possibility.

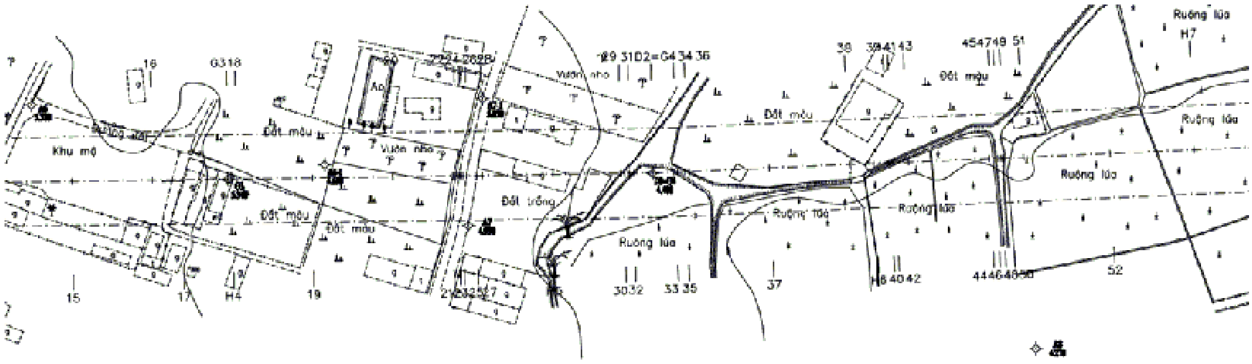
3.6.2. Lane 150 and Huynh Thuc Khang Roads

Accessibility from roadside houses or other land use to the upgraded road and footpaths would be obstructed or even disrupted if ground level of houses are significantly higher or lower than that of the foothpaths infront of the house.

For Lane 150, the proposed design ground elevation will be higher than the existing one from 0.2 to 1.2 m: 20 cm from km 0+400m, up to 70 cm from km 0+400m – km 0+600m and up to 1.2 m from 0+600 to the end point. There are houses along the firest 500 m along this 980 m long alignment only, the rest is currently mostly paddy ricefield.	

Raising 20 cm at km 0+400 would not cause any significant impacts are currently the road is lower than the houses

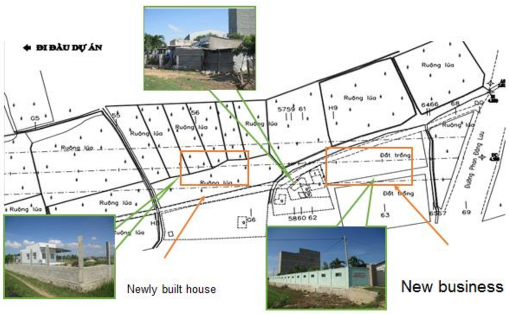




Alignment design shows that the houses are sparsely distributed, other than the existing househous to be relocated or largely affected that need to be rebuild if the remaining land is sufficient, the other existing structure stay behind the roadside and there is no direct contact with the upgraded road. Therefore, the impacts of ground elevation on this section is marginal.

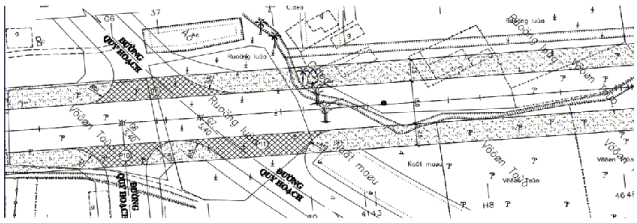
Google map shows that the end section is mainly paddy rices however there are some structures built recently right near then centerline thus would be relocated.

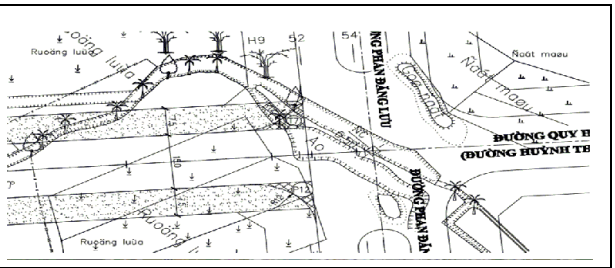
Although not affecting any house in this section, 1.2 m higher would cause difficulties for the farmers to access their cultivation land. On the other hand, irrigation and drainage may be affected. 1.2 m higher would also pose a landslide and erosion risks at the slopes during operation phase.



For Huynh Thuc Khang road which is 919 m long,

The design round elevation of the road is 10, 30 and 70 cm cm higer than existing level from the starting point to km 0+400, km 0+400mto km0+600 m, and the end section, respectively. As the houses are mostly located along the section from the beginning point to km 0+400 where the ground would be elevated by 10 cm, the potential impacts would be insignificant.





As shown in the design alignment of the last 300 m , the existing land use at the end section is mostly rice field, and an existing drain would be affected. When the road is built at 70 cm higher than the surroundings, it would function as a dyke obstructing drainage and irrigation

For both lanes 150 and Huynh Thuc Khang roads, traffic density will be increased during operation phase, dust and exhaust gas levels would be increased locally. Traffic safety risks would also be increased along the road, particularly at the beginning and ending points where they joins with the other existing roads. Speed and visions are the two key factors should be considered for proposing mitigation measures during the detail design of the roads.

3.6.3. The Resettlement Site

Accessibility of resettled households to transport, power and water supply, drainage, solid waste collection service, power, social infrastructures such as market, recreational services etc are the key social and environmental concerns related to the operation of a resettlement site.

As the project's 6.7 ha is resettlement area is part of the 25.8 ha of land reserved for the construction of resettlement sites for various projects in the province, all of the issues listed above have been considered and incorporated fully in the detail master plan scale 1/500 prepared for the entire resettlement area.

The directions and requirements relevant to safeguard set in the approved Master plan scale 1/500 for the Resettlement site

Design

- The site include number of zones such as land slots for houses, public land, service and trade area, cultural centre, green area/park, roads, and land for resettlement.
- Basic infrastructure included with design criteria taking into environmental and safety considerations:
- Ground level: based on the control points specified in the city master plan and approved plans of two resettlement sites, ensure smooth access to the existing urban roads surrounding the resettlement area
- Roads: ensure smooth connections between different zones, ensure good urban landscape, follow technical standards and economical.
- Stormwater drainage: ensure rainwater is drained properly without any localised flooding and low cost. Make use natural slop of topography for maximum gravity conveyance, avoid excessive excavation and filling, avoid overuse of or pumping stations. ensure the alignment is shortest. Minimise drainage passing river, lakes, bridges and other existing underground structures. Avoid cutting through other existing structures, and pipes, cables perpendicularly.
- Water supply: connected to the existing pipes in Le Duan street. HDPE pipes will be laid at 0.6 to 0.7 m under road surface. Fire hydrants will be placed at every 150-200 m along the road. Flow rate design must include adequate volumes for fire fighting. When fire happen, additional water will be taken from the nearest location accessible on the Dinh river.
- Sewerage collection and treatment: combined sewers will be built along the internal roads. Wastewater from households and public structures must be treated by septic to meet QCXD

14: 2008 BTNMT – National standard on wastewater quality before being discharged into the combined sewer. On average 357 447 m3 of wastewater will be generated each day.

- Solid waste collection service: Garbage bins capacity 0,5m3 will be place at very 50 - 100m along the internal roads, at locations convenience for garbage trucks access. Garbage will be transported to landfill for treatment.(on average each person will generate 1kg of solid waste per day, the total amount of solid waste generated in the entire resettlement site is 1.98 – 2.48 T/d

Construction:

The master plant requires that mitigation measures are implemented during construction phase, for example: prepare and implement good construction plans in order to minimize impacts, provide environmental training for the workers to raise their awareness, apply advanced construction technique and use machine as much as possible to minimise socio-environmental impacts, install fences to isolate dangerous locations and dust generated areas, water dusty areas, build temporary toilets for the workers to use, avoid the use of too old machines and vehicles, maintain drainage including sedimentation traps to ensure not to cause localised flooding or increased turbidity in water bodies, trucks carrying wastes and materials must be covered, waste must be transported away from the construction site within 24 hours, avoid spreading of the waste to the nearby residential areas, void construction activities at night time, and avoid encroaching areas outside project areas to avoid conflicts,

Operation Phase:

Wastewater preliminarily treated in septic tanks will be collected to the combined sewers. Garbage will be disposed off in the bins placed at the site. Trees must be planted,, water the road regularly to reduce dusts

As the design, construction and operation of CCSEP will be compliance with the approved master plan.

3.7. INDUCED IMPACTS

The upgradation of the existing Alley 150 and Huynh Thuc Khang roads were proposed with the immideately objectives of reducing traffic density in the 21/8 – the main road of Phan Rang City. As the result, after the two roads being upgraded, traffic density in the 21/8 road will be under control, traffic jam can be avoided. Currently due to lack of connectivity, traffic density in Phan Dang Luu is low, thus increases in traffic density on this road in the future will also be under control.

The upgradation of the roads are in accordance with the approved masterplan prepared for the northwest area of the city. In the future, if there is any changes in land use in the areas, these will be following the approved master plan, and these changes are not considered as induced impacts of existing road expansion or upgradation.

3.8. CUMULATIVE IMPACTS

According to the Planned Implementation Schedule, the construction phase of the Project would last between 2017 and 2022, which is in turn phased into 2 stages, specifically:

Stage 1 (30% of the volume): from 2017 to 2018, consisting of the following items:

- Improvement and rehabilitation of Cha La, Nhi Phuoc and TH5 canals;
- Construction of Dong Nam canal;
- Construction of secondary drains in Thong Nhat, Ngo Gia Tu and HTLO streets.

- Construction of 03 school toilet blocks and 04 public toilets;
- Construction of the infrastructure of Phan Dang Luu Resettlement Site; and
- Expansion and prolongation of Alley 150 on 21/8 Street.

Stage 2 (70% of the volume): from 2019 to 2022, consisting of the following items:

- Improvement and rehabilitation of Tan Tai canal;
- Construction of the city's central regulating lake;
- Construction of the regulating lake and wastewater collection system of Dong Hai ward;
- Construction of secondary drains and tertiary sewers of Kinh Dinh and Phuoc My wards;
- Construction of secondary drains and tertiary sewer lines of Phu Ha and Tan Tai wards;
- Rehabilitation and improvement of the WWTP; and
- Expansion and prolongation of Huynh Thuc Khang Street.

Assessment of the cumulative impacts within the Project

In case all the construction items are performed at the same time, there will be cumulative and interactive impacts on the environment and society among the items of the Project. These cumulative impacts mainly are as follows:

- The simultaneous establishment of many construction sites in many different locations in the province would give rise to a substantial increase in the scope and scale of environmental and social impacts.
- The operations of transporting materials and waste for disposal of many different construction items of the Project will share the same routes, triggering rising numbers of transportation vehicles along the routes and thus increasing the rate and frequency of environmental and social impacts from dust, exhaust gases, noise, and vibration, and increased risks of traffic accidents and jams which may damage the traffic infrastructure of the roads in the city, specifically those forecasted to be most affected by cumulative impacts as: National Highway 1A, National Highway 27, 21/8 Street and 16/4 Street. The calculations of forecasted amounts of construction materials that need to be transported, amounts of truck trips to be mobilized, concentrations of dust and exhaust gases cumulatively generated on a number of roads from excavation and back filling operations during the construction of the Project items are presented in Table 3.26 below.
- Additionally, social impacts related to security and order, diseases and epidemics, and conflicts between locals and migrant construction workers, and impacts linked to the use of social service infrastructure are also forecasted to take place at a higher rate and frequency.

Table 3.26. Calculations of concentrations of dust and exhaust gases cumulative generated on a number of roads from operation of transporting excavated and filling materials, and construction materials during the construction stage for the Project items

Stage	Main transportation routes	Total volume of materials (tons)	No. of construction days	No. of trips/ day	Generated amounts of dust, exhaust gases (mg/m.s)					Concentrations of dust and exhaust gases dispersed at a distance of 20m from the edge of transportation roads (µg/m^3)				
					Dust	CO	SO2	NOx	VOC	Dust	CO	SO2	NOx	VOC
Stage 1: 30% (2017-2018)	21/8 Street	440.072	468	67	0.0025	0.0058	0.0116	0.0333	0.0047	0.47	1.10	0.23	6.25	0.95
	16/4 Street	319.650	468	49	0.0018	0.0042	0.0084	0.0242	0.0034	0.34	0.80	1.52	4.55	0.57
	Nat. Highway 1A	231.943	468	35	0.0013	0.0030	0.0061	0.0175	0.0025	0.25	0.57	1.14	3.41	0.38
	Nat. Highway 27	156.362	468	24	0.0009	0.0020	0.0041	0.0118	0.0017	0.17	0.38	0.76	2.27	0.38
Stage 2: 70% (2019-2022)	21/8 Street	649.650	1092	42	0.0016	0.0036	0.0073	0.0211	0.0030	0.30	0.68	1.33	3.98	0.57
	16/4 Street	707.105	1092	46	0.0017	0.0040	0.0080	0.0229	0.0032	0.32	0.76	1.52	4.36	0.57
	Nat. Highway 27	139.598	1092	9	0.0003	0.0008	0.0016	0.0045	0.0006	0.06	0.15	0.38	0.95	0.19
	21/8 Street	467.193	1092	31	0.0011	0.0026	0.0053	0.0151	0.0021	0.21	0.49	0.95	2.84	0.38
					QCVN 05: 2013/BTNMT					**300**	**30,000**	**350**	**200**	**-**

Cumulative impacts in relation with other projects in the locality

The assessment of cumulative environmental and social impacts also takes into consideration impacts created in the relationship between the Project and other projects which have been, are and will be implemented in the future in the city. As mentioned in Section 1.3 of the introducing chapter, there are a number of other projects related to the CCSEP (of a connected nature or with the same time of implementation) in the city, including:

*/ Project for establishing a system, of collecting, treating and re-using wastewater in Phan Rang – Thap Cham City (hereinafter "ORIO Netherlands"):

- The new Project will be designed to be connected to and completing the infrastructure of wastewater collection and drainage harmoniously with ORIO Netherlands. During the implementation stage, the two projects will assist each other in collecting and treating wastewater for the City.
- However, according to the progress schedule not until 2018 will ORIO Netherlands complete its construction stage. In the meantime, the period of 2017 to 2018 is also the construction stage construction phase for the items of Stage 1 of the new Project. Therefore, more or less, the two projects will have definite cumulative impacts in their construction phase. In order to minimize these impacts, the tow projects need to devise a plan for exchanging information and notifying each other on construction plans so as to carry out most effectively the measures to mitigate impacts on the environment and society.

*/ Project of general management of water sources and urban development in the relationship with climate change in Ninh Thuan Province (financed by the government of Belgium):

This project will carry out research studies on the hydrological regime of Dinh river, work out a scenario of climate change for Ninh Thuan Province, and launch communication activities to raise the awareness of environmental sanitation in Phan Rang – Thap Cham City. The implementation stage of this project will be between 2013 and 2019. Thus, the new Project would have very great opportunities to coordinate with this project in its communication programs on gender and pubic hygiene.

*/ Project of general agricultural development in Central provinces - Ninh Thuan Sub-Project:

This construction site of this project is in Do Vinh ward of Phan Rang-Thap Cham City, of which investments are made in the rehabilitation and improvement of the upstream segment of Chinh Bac canal on a segment length of nearly 1km to ensure the supply of irrigational water to 6,000ha of agricultural land. The construction phase of this project is forecasted to have cumulative impacts with the transportation of construction materials and waste for disposal of the new Project, especially in the item of constructing the sanitation blocks for Do Vinh Primary School.

Apart from these above-mentioned projects, there will possibly be other future projects proposed to be implemented in the city, and naturally such projects will have cumulative impacts to various extents with the implementation of the construction phase of this Project.

Cumulative impacts from natural increase in traffic flow

As presented in Section 3.4.7, the rate of natural increase in traffic flow in the City of Phan Rang -Thap Cham in the future until 2022 will be relatively high, with an average annual rise of about 6-8%. Thus in general such risks as traffic jams and the amount of people affected will be even higher if the progress schedule of the Project items is to lag. The stage for the construction of the items of Stage 1 (30% of the volume) of the Project will cause fewer impacts on the traffic than those items of Stage 2 (70% of the volume) of the Project. The increase rate of impacts and the

number of objects to be affected is about 6-8% year after year. The increase in the amount and density of heavy-duty trucks mobilized in the transportation of materials and waste of the Project; increased gathering of construction machines and equipment; the setting up of barricades and fences along the roads, etc. will certainly reduce the visibility of road users. This would raise the risks of traffic accidents and labor accidents. Hence, vehicles will have to move slower than normal and give rise to greater amounts of exhaust gases and dust along the roads.

CHAPTER 4. ALTERNATIVES ANALYSIS

4.1. WITH OR WITHOUT THE PROJECT

If without the project, there would be many disadvantage issues remained as they have been existing so far,

- The 18 points frequently flooded during heavy rains in the city would not be solved. These points are mostly located in 21/8, Thong Nhat, Ngo Gia Tu, Nguyen Thi Minh Khai and 16/4 roads.
- In some urban areas in the city where have not yet constructed wastewater collecting system, the generated domestic wastewater would not be collected and treated properly, but would be infiltrated into soils or discharged directly to the sea. These would cause environmental pollutionsand infectious diseases for the areas, affect on the living quality of the local residents. Especially, the city population as well as the number tourists have been continuously increasing timely, leading to continuously increase in scales and levels of the environmental issues timely.
- Currently the city already constructed a WWTP with the original designed capacity of 5,000 m^3/day and brought into operation in 2013. Due to the lackage of tertiary sewer network in many urban areas, the wastewaters have not been collected effectively. The wastewater transported to the WWTP is quite limited. So far, the WWTP has never operated fully with the designed capacity, thus not promoted the investment effectiveness.
- Public and school toilets have been degraded and damaged, would not meet the required demands for the schools' pupils and teachers.

Table 4.1: Alternative analysis of with and without the project

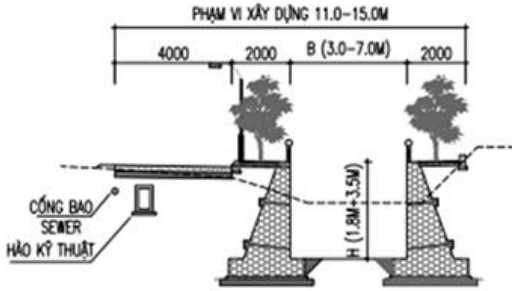
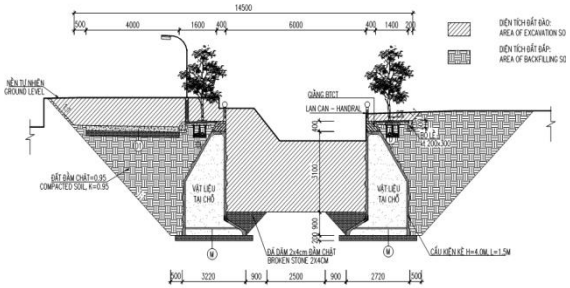
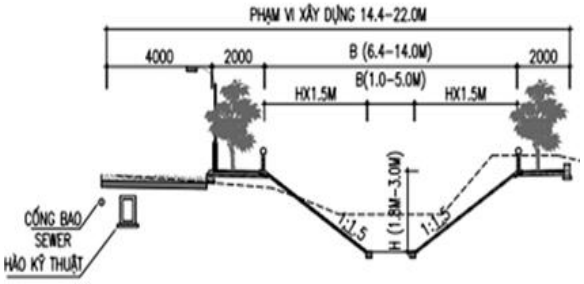
Field	Without the project	With the project
Flooding situation	- Would not be improved; even timely worse in level and frequency. - Drainage system would be not promoted the investment maximum effectiveness. - Increasing risks of establishment of more new flooded points in the city.	- Drainage system will be rationally structured; direction of each drainage basin will be determined - Flooding will be under controlled; Risks of lost caused by flooding is minimized - Main canals in the city such as Tan Tai, Cha La... will be improved ensuring the drainage capability
Wastewater collection and treatment	- Wastewater would not be collected and transported to the WWTP for treatment. - Environmental pollutions and infectious diseases would not be improved, but more serious timely; affecting on living quality of the local residents. - Air environmental would be worse timely caused by bad odour from wastewater obstructed. Surface water quality of Dinh river, canals and lakes, and coastal water quality	- The city environment will be improved; the local residential living and health quality will improved. - The WWTP will be promoted the investment maximum effectiveness. - Wastewater will be collected and treated to meet QCVN 14:2008/BTNMT, (column B) before discharged to Dinh river.

Field	Without the project	With the project
	would be more and more polluted timely.	
Public and school toilets	Not meeting the required demands; affecting negatively on activities and health of pupils and teachers.	Improving school and public sanitary conditions.
Traffic system	- Existing loads on 21/8 road and other main roads in the city would be timely more and more serious	- Traffic jams in the will be reduced as a result of sharing traffic loads to the new upgraded roads by the project. - The investment in road items will help travelling in the city facilitated and accelerated the development of new residential areas creating favourable conditions for the city socio-economic development. - Since the road quality is improved, the solid waste collecting system will also be improved as the waste collected vehicles would access directly to the site for collected wastes; dust, noise, exhaust emission, vibration and accidents along the upgraded roads will also be reduced.
Landscape	- The canals and lakes are being polluted by wastewater and solid wastes from riparian areas - No or corrupted management roads on banks. - The area of the proposed central lake is currently agricultural land. - The area of Dong Hai lake is currently polluted with wastewater and solid waste.	- The project entirely will improved the landscape according to environment friendly along the rehabilitated canals and lakes. - Creating better living environment for local people -

4.2. ANALYSIS OF ALTERNATIVES

4.2.1. Alternatives for Tan Tai Canal

Table 4.2. Analysis of the proposed alternatives for **Section TT1** of Tan Tai canal

	Option 1 (the selected option)	**Option 2**	**Option 3**
Proposal	 Stone wall	 Reinforced concrete wall	 Stone slopped embankment
Solution	This section is divided into 7 sub-section with different dimensions, BxH=(3.0-7.0)x(2.3-4.0), total construction width is 11.0-15.0m. The canal is constructed with a stone wall.	This section is divided into 7sub-sections with different dimensions. Reinforced concrete wall, BxH=(3.0-7.0)x(1.8-3.5), total construction site is 11.0-15.0m.	The section is also divided into 7 sub-sections with different dimensions. Stone slopped embankment, B1xB2xH=(1.0-5.0)x(6.4-14.0)x(1.8-3.0)m, total construction site is 14.4-22.0m.
Comparison	Less square area, while increasing water drainage capability through the increase in cross section. Consistent with ground conditions;less number of affected households; appropriate to the existing conditions of the construction site. Stone retaining wall is strong enough for minimizing the possibility of canal bank erosion, environment friendly; meanwhile the investment cost is acceptable, suitable tothe local conditions.	Less square area, while increasing water drainage capability through the increase in cross section. Consistent with ground conditions;less number of affected households; appropriate to the existing conditions of the construction site. Reinforced concrete retaining wall is very strong to minimize the risk of canal bank erosion, increase the water drainage capability due to the smooth embankment surfacet. However, the investment cost is really high, not suitable tothe local conditions.	Less water drainage capability due to the small cross section. To meet the drainage requirements, it is necessary to widen the canal, leading to increase strongly in number of affected households. Stone embankment is relatively not strong; however due to slopewise, the stone embankment could also meet the technical requirement for controlling erosions, and environmental friendly. Construction cost is the chippest to compare with the option 1&2, but the cost of resettlement and site clearance and social impacts would be increased very much.

	Option 1 (the selected option)	Option 2	Option 3
	Due to the construction of vertical retaining wall, there would be a risk of safety with the local residents, especially the children. However, a safety handrail was designed to be installed along the canal bank for preventing the accidents of fallen into the canal. Less excavated and filled volumes; less environmental and social impacts during the site clearance and construction in comparison with the option 3.	Due to construction of vertical retaining wall, there would be a risk of safety with the local residents, especially the children. However, a safety handrail was designed to be installed along the canal bank for preventing the accidents of fallen into the canal. Less excavated and filled volumes; less environmental and social impacts during the site clearance and construction in comparison with the option 3.	Due to construction of slopped embankment, it would be safer for the local residents. More environmental and social impacts during the site clearance and construction in comparison with the option 1&2.
Conclusion	There would be several advantages such as environmental firendly, less impacts by land acquisition and resettlement, acceptable cost while meeting the technical requirements; therefore **to be selected**	Reinforced concrete wall is very strong, but less environmental friendly to compare with the option 1&3. Investment cost is higher than option 1.	Most environmental friendly and chippest construction price. However, the cost and environmental and social imactes of compensation and resettlement would be extremely increased.

Table 4.3. Analysis of the alternatives for **Section TT2** of Tan Tai canal

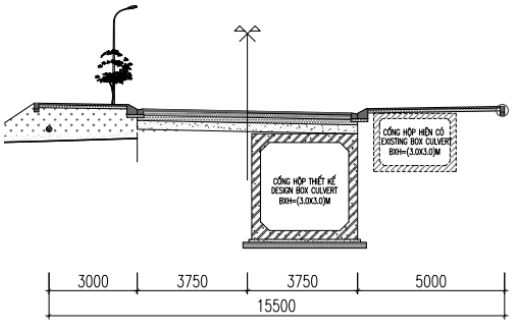
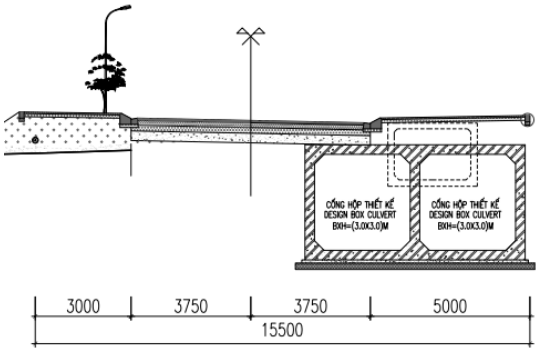
	Option 1(**the selected option)**	Option 2
Proposal		
Solution	Maintaining the existing box culvert BxH=2.4x1.6m on the sidewalk and construction of one more box culvert running along the existing box culvert in dimension of BxH=3.5x3.0m. That culvert alignment is laid on the existing road, thus reinstatement of road surface after construction is required.	Demolition of existing culvert and replacement of new culvert with dimension of 2xBxH=2x3.0x3.0m laid on the sidewalk to guarantee the hydraulic sections.
Comparison	Not required land acquisition. Less construction volume. Not required to demolish the old culvert, thus less environmental impacts during construction phase. Less investment budget. Saving by continuously using the existing box culvert. Not completed investment; however can also ensure the required drainage capability. Necessary to restate the road surface. It would be more convenient to implement the construction and ensuring the irrigation for agricultural production during construction.	Not required land acquisition. More construction volume. It would neccessary to remolish the old culvert, thus longer construction period and more environmental impacts during construction phase. More investment budget. Causing waste by not taking advantage of the existing box culvert. Complete investment simultaneously; ensuring both nice landscape and drainage requirements in the operation phase. Necessary to restate the road surface. It would be more complicated to implement the construction and irrigate for agricultural production during construction. However, if complete construction the first half of the new double culvert for being used as a tream alignment before demolishment of the old cultvert, it would continuously ensure the agricultural irrigation.
Conclusion	Saving by continuously using the existing box culvert. Drainage capability is improved by the construction of a new box culvert parallelly with the existing one. Less environmental and social impacts. therefore to be selected.	This option will meet all drainage requirements and simultaneous investment. However, this causes waste by not taking advantage of the existing box culvert. More environmental and social impacts, thus shall not be selected.

Table 4.4. Analysis of the alternatives for **Section TT3** of Tan Tai canal

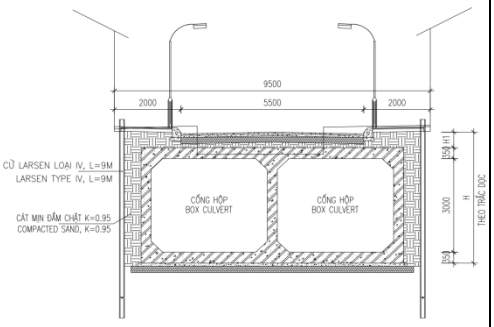
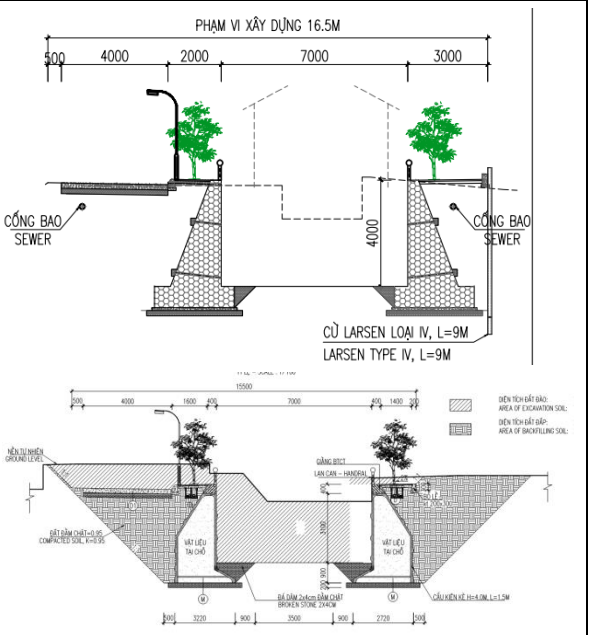
	Option 1 (**the selected option**)	Option 2
Proposal		 Concrete or stone wall.
Solution	Culvertilization of that section with dimension of 2xBxH=2x3.5x3.0m, total construction width would be 9.5m. The section from Thong Nhat to 16/4 is a box culvert with a small size 2x2.5m should be replaced by a new one.	The canal will be vertical rock embankment in dimension of BxH=7.0x4.0, total construction width shall be 16.5m.
Comparison	Due to many residential houses located closely on the banks, the solution of culvertilization would be reasonable aiming to reduce impact of resettlement and other social impacts caused by land acquisition. Lower excavation volume, lower environmental impacts during construction. A road on the box culvert would improve traffic conditions for the local area during the operation phase.	This would not be reasonable with the existing narrow space and causing more social impacts by land acquisition and resettlement. Higher excavation volume, more environmental impacts during construction. An extra water surface would be remained, thus improve the environmental quality for the local area during the operation phase. However, the traffic conditions would be more difficult as the lack of road surface
Conclusion	With more advantage points thus selected	Not selected.

Table 4.5. Analysis of the alternatives for **Section TT4** of Tan Tai canal

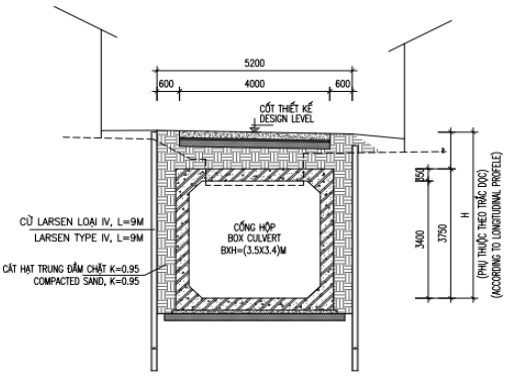
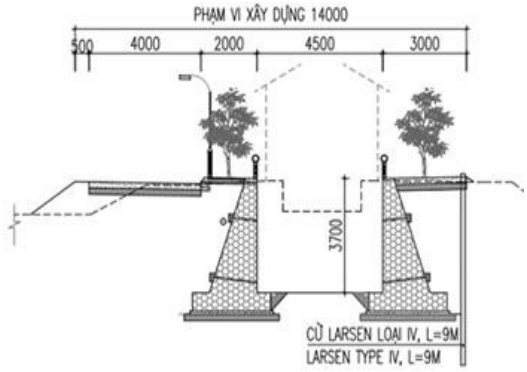
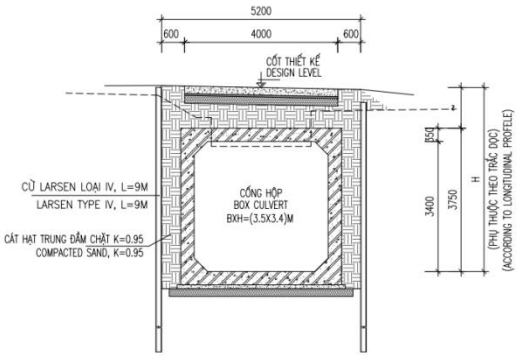
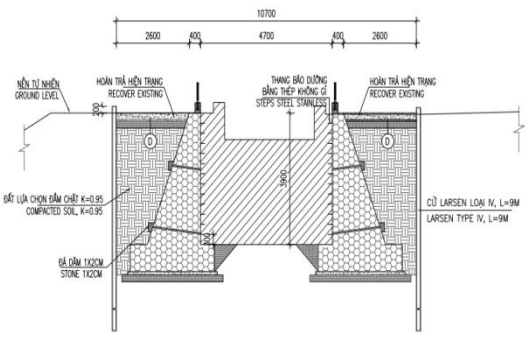
	Option 1 (**the selected option**)	Option 2
Proposal	 Culvertilized	 Reinforced concrete wall
Solution	The canal section will be culvertilized with dimension BxH=x3.5x3.4m, total construction width of 5.5m. Management road on the top of box culvert, B= 5.5m including 4.2m box culvert and 0.65m extension for both sides.	The canal is vertically banked in dimension of BxH=7.0x4.0, total construction width of 16.5m.
Comparison	Due to many residential houses located closely on the banks, the solution of culvertilization would be reasonable aiming to reduce impact of resettlement and other social impacts caused by land acquisition.. Lower excavation volume, lower environmental impacts during construction. A road on the box culvert would improve traffic conditions for the local area during the operation phase.	This would not be reasonable with the existing narrow space and causing more social impacts by land acquisition and resettlement. Higher excavation volume, more environmental impacts during construction. An extra water surface would be remained, thus improve the environmental quality for the local area during the operation phase. However, the traffic conditions would be more difficult as the lack of road surface
Conclusion	With more advantage points thus selected	Not selected.

Table 4.6. Analysis of the alternatives for **Section TT5** of Tan Tai canal

	Option 1	Option 2 (**the selected option**)
Proposal	 Culvertilized	 Stone wall

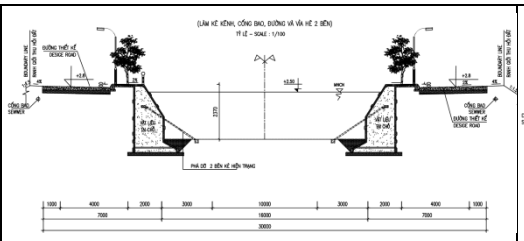
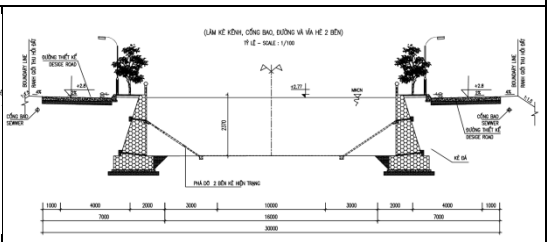
	Option 1	Option 2 (**the selected option**)
Solution	The canal is culvertilized with dimension of BxH=3.5x3.9m, total construction width is 5.2m.	The canal will be vertically embanked with stone walls, dimension of BxH=4.7x3.9m with L1= 271m from T197 toT205, and BxH=3.5x3.9m with L2=144m from T205 to T207
Comparison	There are also some residential houses located closely on the banks, the solution of culvertilization would reduce impact of resettlement and other social impacts caused by land acquisition. Lower excavation volume, lower environmental impacts during construction. Higher construction cost. Creating more road surface on the box culvert.	There is still enought space for this solution. Some land acquisition would be required. Higher excavation volume, more environmental impacts during construction. Lower construction cost. This would remain some area of high valuable water surface in the city center, while there would be still some land fund for construction the management road on one bank.
Conclusion	Not selected	Selected

4.2.2. Alternatives for Dong Nam Canal

There were two options for construction of Dong Nam canal including (i) box culvert and (ii) open canal. The later option of open canal was selected for remaining water surface environmental friendly in the city.

4.2.3. Alternatives for Cha La Canal

Table 4.7. Analysis of the alternatives for Cha La canal

	Option 1	Option 2 (**the selected option**)
Section CL2: from Nguyen Van Cu road to the existing Sinh Thai lake Section CL4: from 16/4 road to Hai Thuong Lan Ong road Section CL5: from Hai Thuong Lan Ong road to Vo Nguyen Giap road		
Proposal	 Vertical reinforced concrete embankment	 Stone retaining wall
Solution	Replace the curent embankment by concrete wall and dredge sediment to previous design level in order to improve drainage capacity.	Replace the existing embankment by a stone wall. Section divide is similar to option 1.
Evaluation	Dimension of canal meets the requirement of drainage Concrete water is stable and long life time.	Dimension of canal meets the requirement of drainage Concrete water is stable and long life time.

	Option 1	Option 2 (**the selected option**)
	Reduce construction time, guarantee water supply for irrigariton during and after construction periods.	Construction time is longer than Option 1, guarantee water supply for irrigariton during and after construction periods.
Comparison	Appropriate with the existing space, while increasing water drainage capability through the increase in cross section. Consistent with ground conditions. Same number of affected households. Reinforced concrete retaining wall is very strong to minimize the risk of canal bank erosion, increase the water drainage capability due to the smooth embankment surface. However, the investment cost is really high, not suitable to the local conditions. Due to construction of vertical retaining wall, there would be a risk of safety with the local residents, especially the children. However, a safety handrail was designed to be installed along the canal bank for preventing the accidents of fallen into the canal. The same excavated and filled volumes; same environmental and social impacts during the site clearance and construction	Appropriate with the existing space, while increasing water drainage capability through the increase in cross section. Consistent with ground conditions. Same number of affected households. Stone retaining wall is strong enough for minimizing the possibility of canal bank erosion, environment friendly; meanwhile the investment cost is acceptable, suitable to the local conditions. Due to the construction of vertical retaining wall, there would be a risk of safety with the local residents, especially the children. However, a safety handrail was designed to be installed along the canal bank for preventing the accidents of fallen into the canal. The same excavated and filled volumes; same environmental and social impacts during the site clearance and construction
Conclusion	Reinforced concrete wall is very strong, but less environmental friendly to compare with the option 1&3. Investment cost is higher than option 2.	There would be several advantages such as environmental friendly, less impacts by land acquisition and resettlement, acceptable cost while meeting the technical requirements; therefore **to be selected**

4.2.4. Alternatives for Dong Hai Lake

Table 4.8. Analysis of the alternatives for rehabilitation of Dong Hai lake

	Option 1 (**the selected option**)	Option 2
Description of option	Onsite dumping cell: construction of coffer dam, plastic liner for interface, embankment for outerface. Layers of sludge by wastes and natural mud to be leveled and compacted to form stability. The natural mud is fulled up to form artificial hill. Topsoil would use the natural soil and planted with salt-tolerant crops for strengthen, stalize the topsoil and landscaping formation.	Transport the excavated sludge out to dispose in other dumpsite. Currently, dumpsite is not available. Location and construction of dumpsiste for sludge to be proceed.
Comparison	Sludgewould be dumped onsite, thus potentially environmental impacts caused by saline excavated sludge and material transport could be mitigated. The lake construction cost could be higher, while it would be able to save the cost for construction a disposal site and material transport as well.	More environmental impacts and risks of salinity pollution for the disposal site area. Construction cost could be lower to compare with the option 1.Meanwhile there would be needed some cost for

	Reduction of lake surface, while increase in onbank park area.	construction of disposal place and material transport. Disposal of sludge to other place would increase the lake capacity.

CHAPTER 5. MITIGATION MEASURES

5.1. MITIGATION MEASURES AND ENVIRONMENT FRIENDLY SOLUTIONS INTEGRATED INTO ENGINEERING PROPOSALS

The following measures have been proposed in the Feasibility Study and will be fully integrated into the detailed design of the work items:

Canals

Where possible, maintain water surface and green landscape at the surrounding. Only the sections heavily polluted or encroached by human houses are converted to boxed drains as there are no other alternatives. Design of canal management roads and sidewalks included trees planting and lighting systems. Interceptors are designed along the management roads to collect wastewater from households for treatment before being discharged into the environment.

Small bridges and staircases are included in the design of embankments in order to maintain accessibility to waterways and the other side of the canals during operation phase.

Wastewater Pumping Stations, Secondary and Tertiary Sewer Lines

Where the wastewater pumping stations located within the boundary of parks or school, fences and warning signs will be installed to ensure safety.

The alignment of the pipelines has been chosen to follow existing roads in order to minimise land acquisition and other social and environmental impacts..

The City's Central Regulation Lake

The construction area of the lake will be about 32.69ha, in which the water surface area will be only 17.7ha. The remaining land areas are reserved for side walks, landscaping and greening (prioritising native species and avoid invasive plants). The embankment will be protected by engineering (concrete frames) combined with greening (grass planted) measures. Lighting system will be installed around the lake. Steps with handrails will be built for accessing watersurface by operators.

Dong Hai Lake

The soil and water in Dong Hai lake area is saline as it is located close to the sea. Design of the lake included an area which allow on-site disposal of the saline dredged materials so as salinity spreading can be managed. The materials dump will be landscaped and greening will be applied.

Design of the lake also include landscaping with management roads, tree-planting (prioritising native species and avoid invasive plants), lighting and steps for accessing water surface. Similar to the Central lake, the embankment at Dong Hai lake will also be protected with concrete frame and grass. The entire bottom and embankment of the lake will be lined with HDPE geotextiles or waterproof plastic to prevent polluted water from entering the lake and penetrating into the soil during the dry season. The lake is designed with capacity that enables holding 3 hours highest rainfall or 6 hours rainfall of flood with occurrence frequency at 5 years.

Wastewater Treatment Plant

The project will upgrade and repair a number of items such as sterilizing ponds, replace the HDPE lining of settling tanks, install a continuous water monitoring system, and reconstruct the discharge outlet of wastewater into Dinh river to improve the treatment capacity from the originally designed 5,000m^3/day to 7,500 m^3/day, meanwhile treated wastewater quality safely meeting the standards.

School Sanitation Facilities

The following measures are included in the design of school toilets in order to promote aesthetical values, energy-saving, environment-friendly and safety for the pupils:

- Roofed concrete walkways linking classroom blocks with the sanitation facilities are included so as the student can access to toilet safely and conveniently in rainy weather.
- The floor of the toilet block is lined with non-slippery -slip tiles but also can be cleaned easily. The doors and windows ensure adequate ventilation and make the most use of natural lights.
- Power and water appliances are energy saving types; the size of taps and sinks suit the pupils' age.
- Inner and outer walls are decorated with eye-catching pictures with messages on proper hygiene behaviour, such as washing hands after using toilets, etc.
- Trees and flowers are planted around the facility and along the access road to the area.
- Discharge pipes from septic tanks will be connected directly to the wastewater collection pipes of the city.
- The school toilets will be designed to ensure aesthetic beauty, friendliness and safety for the pupils, and for children with disabilities and include: i) separate toilets for girls and boys; ii) inside locks; iii) antisloppy floor; iv) enough light; v) separate toilets for children with disability which include safe wheel chair access and wall mounted grab rail.

Roads

Design of Huynh Thuc Khang street and Alley 150 of 21/8 street includes sewers and drainage pipes. Trees will be planted at every 10 m along the two sidewalks, 120W LED lamps and 25W JUPITER lamps will be installed for lighting.

Resettlement Site

The Project will build a 1.6 ha green park within the Resettlement Site. The species to be planted shall be consulted with URENCO, prioritising native species and avoid invasive plants. Inside the park, there will be open spaces, leisure paths, green trees, decorative electrical lights and stone benches along the walkway.

Internal roads with drainage and sewers will also be built within the Resettlement Site. Trees are planted at every 10 m on sidewalks along the roads. 90W LED lamps will be used for lighting.

5.2. MITIGATION MEASURES FOR PRE-CONSTRUCTION PHASE

5.2.1. Resettlement Actions Plan

In order to minimize the potential social and environmental impacts of land acquisition and resettlement, a Resettlement Action Plan (RAP) has been prepared for Phan Rang-Thap Cham Subproject. The key principles and contents of RAP are summarised below:

- Involuntary resettlement should be avoided as much areas as possible, or minimized by optional measures applied in the technical design;
- Affected Persons (AP) should be assisted in their efforts to improve their livelihoods and living standards, or at least to restore them.
- All AP who have assets within or reside within the area of project land-take before the cut-off date are entitled to compensation for their losses. Those who have lost their income and/or subsistence will be eligible for livelihood rehabilitation assistance based on the criteria of eligibility defined by the project in consultation with the PAPs. If, by the end of the project, livelihoods have been shown not to be restored to pre-project levels, additional measures will be provided.
- Land will be compensated "land for land" or in cash at replacement costs. Those loosing 20% or more of their land will have to be assisted to restore their livelihood. The same principles apply for the poor and vulnerable people losing 10% or more of their productive land holding.
- Compensation for all residential, commercial, or other structures will be offered at the replacement cost.
- Additional efforts, such as economic rehabilitation assistance, training and other forms of assistance, should be provided to PAPs losing income sources, especially to vulnerable groups.

HHs

- Individual graves are considered physical cultural resources (PCR), and even though the costs associated with their relocation will be covered in the RAP plan, the WB OP 4.11 on PCR should be triggered, and relevant cross references should be made to the Environmental Management Plan or Project Implementation Manual.
- For annual and perennial crops, and aquatic livestock which are not due to be harvested at the time of land recovery, compensation will be paid to HH at full replacement cost.
- AH's telephone system, water meter, electric meter, cable TV, internet access etc. shall be compensated according to the unit price of installing new units.
- If community infrastructure such as schools, factories, water sources, roads, sewage systems, medical centers, distribution/transmission, communication and fiber cables are damaged and the community wishes to reuse them, the project will ensure that these are restored or repaired as the case may be, at no cost to the community.
- Public infrastructure directly related to people's livelihoods and developmental needs, such as irrigation canals, schools, clinics, transportation road, electricity, telecommunication, cable lines will be restored/rebuilt to pre-project or higher quality levels or compensated at replacement cost.
- If the project need land temporarily for construction, the PMU rents the land of the owners complying with regulations stipulated by the Civil Law. Damaged caused to property will

be restored to its former condition by contractors, immediately upon completion of civil works.

- Besides the compensation for affected assets, PAPs will be provided with financial assistance to cover their expenses during the transition period. The assistance levels will be adjusted, taking into account inflation factor and price increase to be appropriate to the payment time. They include, but are not limited to:

Table 5.1: Entitlements for Affected Households (AHH) and Persons (AP)

Type of Impacts	Entitlement by Category
Affected with residential lands	• PAPs who have to relocate will receive relocation allowance atup to 3,000,000 VND/HH;. • House renting allowance of 810,000 VND/HH/m will be provided to eligible PAPs who may be forced to relocate from their homes and are still awaiting the replacement land plots or apartments. • Relocated HH who are eligible for resettlement, but self-arrange for accommodation will receive support for a minimum land plot in the project's resettlement site. • Repair allowance: If house/structure is partially affected and the remaining structure is viable for continued use, the project will provide a repair allowance to enable PAPs to restore it to former or better conditions. • For HHs/individuals relocated by residential land combined with business: allowance for vocational training and job creation will be provided according to the provisions of the PPC. • Assistance for living rehabilitation: PAP who is relocated or rebuilt house on the remaining land area will receive assistance for living rehabilitation in the transition period. • The amounts of supports/allowances will be determined by Ninh Thuan PPC.
Agricultural land acquisition	• Eligible HHs will receive allowance for living rehabilitation (during transition period): in cash equal 30kg rice/person/month, specifically: • PAPs losing 20 - 70% of their agricultural landholding (or 10 - 70% for the poor/ vulnerable HHs) will be compensated of 6 months if they do not have to relocate, and 12 months of they have to relocate.; • PAPs losing more than 70% of land will be assisted at the above rate for a period of 12 months if they do not have to relocate, and 24 months in case of relocation; • HHs affected by loss of less than 20% of land, where the remaining land is rendered unviable for continued use, will be assisted with the above support plus any additional support as determined, for a period of 12 months. • Allowance for production rehabilitation: HHs, individuals who are compensated by agricultural land will be, supported production rehabilitation,. • Allowance for vocational training and job creation: The support will be 2 times of agricultural land price of the same kind in the local land price list for the whole acquired area but not exceeding the limit of local allocation.
HH affected with non-agricultural land and business	• Allowance for production, business rehabilitation: • Businesses / HH with business registration will be compensated or supported up to 30% of after-tax income of 01 years based on their average annual of the last three years which have been declared to the tax authorities;

Type of Impacts	Entitlement by Category
	• HHs without business license but met their tax obligations will be entitled to compensation equivalent to 50% of support level for businesses/households with business registration. • Removal Support: Organizations and PAPs that are allocated or leased land by the state or are lawfully using land and have to relocate their productive and/or business establishments are entitled to financial support for dismantling, relocating and re-installation of the establishment. Support levels will be determined by actual costs at the time of removal, based on self-declaration of the organizations and verification by the agency in charge of compensation. This will then be submitted to the relevant authorities for approval. • Allowance for interrupted employment: Employees who work in affected manufacturing facilities or businesses with labour contract will receive allowance equivalent to the minimum salary as per the regulations to affected employees during the transition period which can be for a maximum of 6 months as wel as assistance in seeking job opportunity if needed.
Vulnerable HHs	• For landless HHs: Assistance provided to buy or rent an apartment. • Relocated HHsunder Social Treatment Policy (heroic mothers, army heros, war invalid soliders, veterans…) will receive support at level regulated by Ninh Thuan PPC. • Vulnerable groups:Apart from allowanced descirbed above, they shall be also received addtional support: Poor PAPs who have to relocate or lose more than 10% of their agricultural landholding, or lose less than 10% of their land but such land area is not enough to continue cultivation will receive cash equal to 30kg rice/person/month for a period of 24 months or in accordance with provincial policy; whichever is higher. Other poor PAPs will be assisted in cash equal to 30kg rice/person/month for a period of 6 months or in accordance with provincial policy; whichever is higher. • Other vulnerable groups: Female headed households with dependents, household with disabled persons, elderly without any source of support, poor households and ethnic minority households will get the same support given to poor households in accordance with the provincial policy or assisted in cash equal to 30 kg of rice per person per month for 6 months; ; whichever is higher. • PAPs who lose income sources will be entitled to take part in Income Restoration Programs. Rehabilitation measures like agricultural extension services, job training and creation, credit access and/or other measures as appropriate will be given to PAPs losing income sources to ensure their livelihood could be restored to the pre-project level. • Apart from the assistances mentioned above, based on the actual situation, the Project may consider other assistances to secure life stabilization, culture, production and livelihoods of PAPs.

- Households that have to resettle, relocate will identify and select options of relocation on their existing plots or to move to plots provided by the district or to receive cash compensation to make their own arrangements for relocation. For HHs affected with acquired agricultural land, apart from the compensation and assistance fore said, they are entitled to assistance for job creation and vocational training for the persons at the working age free of charge.
- During implementation, the Project will pay special attention to the vulnerable groups including women and female-headed HHs, disabled people, the elders and children.

It is estimated that 949 HHs will be with affected by land acquisition, of those, 144 HHs with about 600 persons would have to be relocated. The Project will build a resettlement site in Phuoc My ward with full technical and social infrastructures.

The estimated cost for RAP implementation is VND 340,591,187,099 (equivalent to USD 15,137,386) as detailed below (training costs is not included as it is covered under Component 4)

Table 5.2. Estimated cost for implementation of the project's RAP

No	Affected content		Unit	Quantity	Unit price (VND)	Cost	
						VNĐ	USD
A	COMPENSATION						
I	*Land*						
	Residential land	Cha La canal	m2	236.1	660,000	155,826,000	6,926
		Tan Tai canal	m2	5,689	770,000	4,380,414,500	194,685
		Central lake	m2	6,970	880,000	6,133,600,000	272,604
		Alley150	m2	2,640	1,030,000	2,719,200,000	120,853
		Huynh Thuc Khang road	m2	8,937	1,309,000	11,698,533,000	519,935
		Resettlement area	m2	4,949	770,000	3,810,730,000	169,366
	Agricultural land		m2	440,256	80,000	35,220,487,520	1,565,355
	Traffic & irrigation lands		m2	98,068	80,000	7,845,466,880	348,687
	Cemetery		m2	1,418	800,000	1,134,400,000	50,418
II	*Works, structures*						
	House		m2	18,417	4,000,000	73,666,612,000	3,274,072
	Other structures		m2	4,252	100,000	425,244,900	18,900
	Graves		unit	35	5,000,000	175,000,000	7,778
III	*Crops, trees*						
	Annual trees		m2	160,068	44,800	7,171,042,332	318,713
	Long term trees		m2	296,151	80,000	23,692,087,264	1,052,982
B	ASSISTANCE						
	Residential land	Relocation	hh	142	3,000,000	426,000,000	18,933
		House renting	hh	142	6,000,000	852,000,000	37,867
	Agricultural land	Living recovery	pers	2,482	3,600,000	8,935,920,000	397,152
		Production recovery	m2	0	1,000	0	0
		Changing job, trainings	m2	538,324	200,000	107,664,886,000	4,785,106
	Loss of income and business	Business assistance	base	17	62,500,000	1,062,500,000	47,222
		Changing job	base	17	3,000,000	51,000,000	2,267
	Vulnerable group		hh	22	1,800,000	39,600,000	1,760
	Incentive bonus		hh	957	3,500,000	3,349,500,000	148,867
C	Sum of costs					300,610,050,396	13,360,447
D	Service cost (=2%xC)					6,012,201,008	267,209
E	Monitoring (=1%xC)					3,006,100,504	133,604

F	Standby (=10%x (C+D+E))				30,962,835,191	1,376,126
	Total cost (=C+D+E+F)				340,591,187,099	15,137,386

5.2.2. UXO Clearance

The Project will allocate a budget of about $ 100,000 USD to hire specialised army units to carry out UXO clearance in the proposed area before handing over the site to the Contractors.

5.3. MITIGATION MEASURES FOR CONSTRUCTION PHASE

As identified in Chapter 4, the main potential impacts and risks that may occur during the construction process include: (i)impacts on the air environment from dust, exhaust gases, noise, vibration, and bad odours; (ii) impacts on the water environment from stormwater runoff, waste and wastewater, dredging activities; (iii) solid waste generation; (iv) Localised flooding risks; (v) Soil subsidence and landslides risks; (vi) traffic disturbance and increased traffic safety risks, (vi) Disturbance or damages to existing infrastructure and related services; (vii) Biological Impacts; (viii) Social Disturbance; (ix) impacts on physical cultural resources; (x) impacts/ risks relating to public safety and health; (xiii) Impacts on security and from epidemics, and (iv) cumulative impacts. There are also some specific impacts by type and locations of investments. The measures to mitigate potential social and environmental impacts during the construction phase are presented below.

5.3.1. Measures to Mitigate Common Construction Impacts

5.3.1.1. Air Quality: Dust, Noise and Vibration

- Maintain emission level at construction sites below allowable limits set in QCVN 05: 2013/BTNMT: National Technical Standard on Ambient Air Quality;
- Only use machines with emission level meeting TCVN 6438-2005 and with valid registrations.
- Load and gather materials and waste neatly. Arrange workers to collect and gather construction materials and waste to designated places at the end of each day or shift.
- Where construction site is near residential houses or public buildings, water the roads at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25^{o}C, or in windy weather. Avoid overwatering as this may make the surrounding muddy.
- Cover trucks carrying waste and bulky materials tightly before leaving construction sites.
- Do not overload materials/soil and stone as they would drop along transportation routes causing dust and accidents. Trucks carrying waste and bulky materials must be tightly covered so as to limit.
- Guard or cover loads of materials or waste loads with volume from 20m^3 to avoid dust dispersion.
- Avoid preparation of construction materials such as mixing concrete near local people's houses or other sensitive structures such as pagodas, schools, medical stations or offices. Transport the waste out of construction sites to designated locations for reuse or to disposal sites soonest possible.

- Avoid temporary loading on-site of dredged materials from canals. If temporary loading is not avoidable, implement pollution control measures such as covering, put in bags, isolation. Inform community in advance so as they can be prepared or odour and nuisance problems.
- Burning waste in construction sites is prohibited, except for burning invasive plants if found on-site.
- Turn off the engines of vehicles and machines if vehicles is parked longer than 2 minutes. Wash the vehicles used for transporting material and construction waste periodically in designated areas.
- Set up areas for vehicle washing at the exit/entrance of centralised construction sites such as the lakes to prevent the dusts from trucks spreading onto the streets. Apply speed limits at 40 km/h or lower to trucks when running on inner-city roads or through residential areas. Acceleration and horn flaring are prohibited near sensitive areas such as hospitals, schools, sites of religious practice, etc.
- Avoid to implement the activities that likely generating loud noise and vibration between 6 pm to 7 am of the next day if the construction site is near residential areas or health care facilities. If construction at nighttime is unavoidable, inform communities at least 2 days in advance.
- Place machines generating high level of noise as far as possible from residential areas so as noise level at receptor can be maintained at below 70dBA, i.e. Avoid activities that generate high noise during sensitive hours, or install mufflers onto devices to reduce the noise.
- Inspect, maintain and clean construction plants periodically.
- Schedule transportation plans which avoid the cases where large numbers of machines and equipment are presence at the same time and in a same site.
- Apply successive construction methods to construction routes with relative long alignments such as canals, secondary drains/sewers, and tertiary sewers.
- Install and maintain 2.5-metre high solid fences at construction sites with significant volumes of earthworks or near sensitive receptors. .
- Where possible, use power supply from existing grid instead of using generator in order to avoid the noise from diesel generators which are extremely noisy.
- Provide dust mask for the workers and enforce the use when working in dusty conditions.

5.3.1.2. Wastewater Management

- Toilets must have septic tanks for treating wastewater before it can be discharged into the environment.
- Mobile toilets or septic tanks toilets should be provided for the workers to use at centralised construction sites.
- Load construction materials in elevated sites to avoid flooding. Cover the piles of materials.
- Avoid temporary loading of excessive volume of construction materials at one time at construction sites;.
- Store excavated materials in designated areas approved by the Construction Supervisor only. Protect such storages to avoid direct contact with surface runoff;

- Minimise the quantity of fuel stored on-site. Fuel storage area must be at least 20m from any water sources, roofed, fenced, on impermeable and bound ground for spill control.
- Do not maintain vehicles or replace oil on site. Collect and store wasted oil in plastic containers with lida. Place these containers on impermeable and bound surface for spill control...
    - Locate workers' camps at least 10m from any surface water bodies.;
    - Provide adequate sanitation facilities, bathroom with proper drains for the workers to use. Wastewater must be collected and treated before being discharged into the environment. Ditches must be cleaned up periodically.
- Create and maintain sedimentation traps periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the site.
- Inspect, dredge, and clear the drains on site and the surrounding area periodically to prevent sedimentation and blocking .
- Wastewater from designated truck washing area, equipment washing etc. if any, must be collected and treated before being discharged into the environment
- At completion of construction works, refill and seal safely the drains, ditch etc. soak pits and septic tanks, dismantle contractor's site office and any areas disturbed during construction, reinstate the disturbed areas d before handing over the site. Remove and transport to acceptable disposal site the soil contaminated with oil, if any.
- Set up toilets in the camp areas and large construction sites for the workers to use. There are separately toilets for male and female workers, one toilet room for every 25 workers. When construction is over, these toilets will be refilled and sealed safely. Domestic wastewater generated at workers' camps must be collected and treated before being discharged into the environment.

5.3.1.3. Solid Waste Management

As discussed in Chapter 3, it is estimated that earthworks would generate a total of 815,202 m^3 of dredged materials and excavated soil. It is planned that:

- 15,880 m^3 of excavated materials from Dong Hai lake, which is saline, will be disposed off on-site with landscaping and isolation by HDPE materials.
- 60,290 m^3 of excavated/dredged materials from Dong Hai lake (46,870 m^3) and Section CL6 of the Cha La canal (13,420 m^3), which are also saline, will be disposed off in Nam Thanh landfill area located about 25 km from the city.
- About 40,000 m^3 of top soil and dredged sludge generated from construction of the canals, lakes, roads and resettlement site will also be transported to the Nam Thanh Waste Treatment Site to be mixed with the products generated from the municipal solidwaste composting treatment for production of agricultural fertilizer.
- The remaining is excavated soil with a volume of 647,000 m^3 which will be disposed off for ground-levelling in the Dong Bac and Dong Nam new urban areas located next together in 16/4 road in Phan Rang Thap Cham city.

Non-hazardous Waste Management

- Solid waste will be managed in accordance with Decree No. 59/2007/ND-CP dated 09 April 2007 on solid waste management and Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and waste materials.
- Minimise the generation of garbage.
- Carry out waste separation at source.
- Promote reuse and recycling. Materials such as glass, wooden plates, steel, plastic, scaffolding material, site holding, packaging material, etc. shall be collected and separated for reuse for other projects or sold for recycling.
- Provide garbage bins at construction sites, site office and camps; The bins shall be covered with lids, weather-proof and scavenger proof to avoid dispersion of bad odors, leachate leakage, attracting flies, mice and other vermince.
- Collect the waste and tidy up construction sites at the end of each working day/shift. Transport the waste out of the construction sites soonest possibly.
- Collect all the wastes and residual materials and transport to the disposal sites by Nam Thanh Company (licensed waste management contractor) or for use later.
- Dispose off the saline excavated/dredged materials from Dong Hai lake and Section CL6 of the Cha La canal in Nam Thanh landfill area located 25 km from the city.
- Transport the top soil and dredged sludge from the canals, lakes, roads and resettlement site to the Nam Thanh Waste Treatment Site for production of agricultural fertilizer.
- Dispose off the remained excavated soils for ground-levelling in the Dong Bac and Dong Nam new urban areas in the city.

Hazardous Waste Management

- All hazardous waste (waste oil and grease, organic solvents, chemicals, oil paints, etc.) must be temporarily stored, handled, and transported and disposed off in accordance with Circular No. 36/2015/TT-BTNMT dated 30 June 2015 by the Ministry of Natural Resources and Environment on management of hazardous waste.
- Transportation of hazardous waste off the site should be done in cooperation with an approved and authorized partner.
- Collect and store used oil and grease separately in specialized containers. Place these containers in safe and fire-free areas with impermeable floors, roofs, at a safe distance from fire sources.
- Return unused or rejected tar or bituminous products to the suppliers or producers.

5.3.1.4. Water Quality Management

- The Contractor is responsible for controlling the surface water quality when discharging it out of the construction site, in accordance with QCVN 08-MT:2015/BTNMT – National Technical Regulation on Surface Water Quality and QCVN 14:2008/BTNMT – National Technical Regulation on Domestic Wastewater Quality.
- Store used and unused oil and petrol on impermeable ground covered with roofs, with warning (flammable and danger) signs, and contained within surrounding fences for easy control and collection in case of leakage. Locate oil and petrol storages areas at least 25m

from any ponds, lakes, rivers, and streams. Restrict accessibility to this temporary storage, only to authorised persons can access.

- Perform concrete mixing on impermeable ground only, at least 20m from any water sources. Collect the waste and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit the amount of solids entering receptors.
- Maintain vehicles and replace the oil at designated workshops only. Do not perform these activities on-site.
- Collect and keep used/waste oil and materials polluted with oil/chemicals in containers, store in safe place (on impermeable ground, roofed, fenced and with warning signs) for regular collection by licensed dealers.
- Carry out concrete mixing on impermeable ground only. Collect the waste and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit the amount of solids entering receptors.
- Provide sedimentation pits and ditches at big construction sites such as the regulatory lakes
- Provide appropriate toilets for the workers to use.
- Avoid carrying out excavation and backfilling in rainy weather.
- Collect, gather and transport materials and waste generated during excavation and backfilling materials to designated site for reuse or final dispose at soonest possible.
- Temporary loading of construction materials or concrete mixing are allowed only at places which are at least 50m from any ponds, lakes, rivers, streams, or other water sources, or at maximum possible distances between the temporary loading locations and the canals.
- Collect and transport the excavated soil out of the construction site within 24 hours. Dredged materials must be transported away from temporary disposal sites as soon as they are dry enough.
- Carry out maintenance of vehicles and equipment, including oil replacement or lubrication in designated areas only. Ensure that no chemicals, petrol, oil, or grease are leaked into the soil, the drains or water sources. Use trays to hold the rags and materials used in maintenance. Collect and dispose off the wastes in accordance with hazardous waste management.

5.3.1.5. Management of Flooding Risks

- Check the existing drains within and surrounding the construction sites, improve before levelling to ensure rainwater can be drained properly.
- Load construction material and wastes at least 10 m from any existing drainage ditches or water sources to minimise materials from entering the channels which may lead to sedimentation and blockage.
- Clean up the existing drains regularly.

5.3.1.6. Erosion and Sedimentation Control

- Strictly monitor excavation and backfilling operations especially in the rainy season. Minimise disturbance to existing vegetation and trees. Re-establish vegetation cover in disturbed areas soonest possible.
- Transport the waste out of the site within the shortest time possible but should not last more than 2 days.

- Install and maintain sedimentation traps within and/or surrounding centralised construction sites. Remove the soil, stone and waste periodically from the traps to maintain their functions.
- Gather the materials and waste neatly to limit the amount of materials being swept away by stormwater.
- Carry out levelling and rolling after waste disposal at the disposal sites in order to minimise erosion.
- Use Larsen sheet piles for protecting the walls/slopes when excavation is deeper than 2.5m.Reinforcing piles must be checked and maintained to ensure stability of excavated trenches and holes.
- Levelling the disturbed areas to prevent erosion
- Strictly avoid disturbance or damages to the existing vegetation and trees.

5.3.1.7. Traffic Disturbance and Safety Risks Management

- Install and maintain sign boards, fences, signal lights to direct traffic to ensure traffic safety. Ensure adequate lighting at night time.
- Arrange and provide private entrances for people with disability and mobility issues especially the areas in proximity of schools;
- Provide additional hard sheets crossing open trenches/holes passing houses/shops as and when needed;
- Arrange staff/workers to assist young children and aged people crossing temporary access if possible
- Ensure temporary access for wheelchairs to affected households having disabled people if required;
- Before transportation, trucks must be covered very carefully, materials must not be loaded to 10cm higher than the truck body so as materials are not dropped or scatter onto roads causing dusts dust and accident risks.
- Place speed limits signs at a distance of 100m from the construction site. Place additional signs if construction site is within 20 m from the gate of any schools, markets, hospitals, pagodas, densely populated areas, narrow roads, etc., arrange worker to guide the traffic in rush hours.
- Coordinate with the police for traffic diversions as necessary.
- Collect and tidy up the waste and wastewater containing cement at the sedimentation traps, ditches regularly to limit the amount of solids entering receptors.
- Avoid loading and unloading materials in rush hours.
- Only use vehicles with valid registration. Trucks must be covered to prevent materials from dropping along the routes to cause dusts and accidents.
- Do not park construction vehicles on the roads longer than needed. Vehicles should be parked only for loading/unloading materials and wastes.
- Plan and implement construction activities at night time at locations where traffic is too busy in order to reduce traffic disturbance and traffic safety risks.

5.3.1.8. Measures to Minimize Impacts on Existing Infrastructure and Services

- Only use vehicles with sizes and loads within permissible limits set for the roads along such vehicles' route.
- Inform the affected households at least two days in advance when water or power is cut-off for construction
- The Contractors shall be responsible for repairing, restoring all damages of the road, bridge due to overload transportation.
- Arrange workers to observe and crane drivers when operating with bulky items such as large pipes or cranes in order to avoid damages to electric lines or any other existing infrastructures near by
- Reinstate all disturbed or damages infrastructure including road surface and footpath.
- The Contractors will be responsible for repairing, recovering, and compensating at their own costs for all the damages caused to existing infrastructure at the contractors' faults
- Reinstate the road surface and sidewalks disturbed by construction after construction has been completed.

5.3.1.9. Measures to Minimize Biological Impacts

- Minimise the areas disturbed, especially in locations having trees or vegetation.
- Do not load materials and wastes at places having vegetation cover. Load them on barren land instead.
- If trees can be replanted somewhere, move them instead of cutting the trees down.
- If any invasive species are found during construction phase, burn them before disposed off to prevent them from regrowing at disposal site
- Chemicals must not be used to clear vegetation.
- Maintain flow where possible to retain aquatic lives (More details are described in specific mitigation measures)

5.3.1.10. Measures to Minimize Impacts on Landscape

- Place the signboard "Sorry to disturb" at the construction sites located in popular area.
- Keep the disturbed areas to be minimal; re-establish vegetation cover as soon as construction is completed.
- All facilities are maintained in a neat and tidy condition and the site shall be kept free of litter.
- Fence the construction site with solid materials if the construction site is exposed to sensitive sites or exposed to tourist areas.
- Do not load construction materials or waste within 10 m from the gate of any public building or cultural structures such as government offices, temples, school etc.
- Collect and transport excavated materials and construction wastes to the disposal site within 24 hours.
- Clean up the construction site daily if the site is located in populated areas.
- Wash vehicles periodically to prevent dust dispersions onto roads.

5.3.1.11. Measures to Minimize Impacts on Cultural and Historical Structures

- Load materials and waste at places at least 20m from any cultural, historical, and religious works such as temples, pagodas, churches, monuments, historic relics, etc.
- Water the road when construction sites are within 20 m from any cultural works.
- Avoid using construction plants generating loud noise and high vibration near any cultural, historical, and religious works.
- Where artifacts are exposed during the implementation of earthwork, the chance find procedures described below shall be followed:
- Suspend construction and strictly protect the site where artifacts exposed;
- The contractor notify the Supervision Engineer (SE) prepare a preliminarily description of the area where the artifacts exposed; then the SE inform the PMU and local authorities;
- Protect the whole area to avoid damages or losses of the exposed items. Protection must be maintained continuously until local authorities and other functional agencies take over.
- The SE inform of the event and will in turn immediately inform the PMU.
- The PMU report the case to relevant authorities such as Department of Culture, Department of Sports & Tourism, the Institute of Archaeology, etc. for coordinated handling.
- Department of Culture, Sports & Tourism and/or the Institute of Archaeology carry out assessment of the unearthed objects based on different criteria related to the nature of cultural heritages; such criteria would include aesthetic, historical, scientific, social or economic values; and make decision on how to
- handle the case. Such decisions can result in changes in site arrangements (e.g. when the found item is a cultural relic which cannot be displaced or is archaeologically important), it may be necessary to preserve, recover and excavate the site;
- The implementation of such decision by relevant agencies related to the management of found objects will be communicated in writing by local competent agencies; .
- Construction operations at the site can only be resumed after being permitted by relevant local agencies being responsible for managing such objects.

5.3.1.12. Measures to Minimize Community Disturbance and Social Impacts

- The Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on safety in construction.
- Register the list of workers with the local authorities for temporary residence.
- Train workers on issues related to environment, safety and health, thus enhancing their awareness of HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months.
- The contractor shall Provide workers with and request them to use adequate safety gear such as masks, helmets, shoes/boots, goggles, etc. depending on job characteristics.
- Safely install power lines at offices and in construction sites and do not lay connectors on the ground or water surface. Electric wires must be with plugs. Place outdoor electric panels in protection cabinets.
- The contractor shall Inform the community about construction plan at least 2 weeks before commencement of the construction.

- In case electricity and water supplies are to be disrupted, the PMU must inform PAHs at least 2 days in advance.
- Fence off the construction sites of the lakes with solid materials of at least 2mhigh.
- Avoid construction operations at night time. Where construction at nighttimes is inevitable the community must be informed at least 2 days in advance
- Construction should be performed within the shortest possible time, particularly at sections passing populated residential or business areas. Carry out construction in stages to minimise the impacts of pipeline installation on local community.
- Construction site should be kept tidy and safe.
- Wooden planks with adequate strength and width must be placed over the open ditches to provide temporary access to roadside houses and shops
- Hire local laborers to carry out simple tasks.
- Workers must be trained on environmental issues, safety and health before construction tasks are assigned.
- Do not park construction vehicles on the roads in populated areas longer than needed. Vehicles should be parked only for loading/unloading materials and wastes; Keep duration of temporary storage of materials and wastes at the site to be minimal. Refill the pipetrench /open holes soonest possible.
- If visions to shops/businesses are blocked by construction activities, instruction signs observable from the main road will be provided.
- Provide additional hard sheets crossing open trenches/holes, arrange staff/workers to assit local people taking their motorbikes/goods in and out of the houses/shops as and when needed;
- Ensure temporary access for wheelchairs to affected households having disabled people if required
- Allowances are provided for the affected business households located along the road in accordance with RAP;
- Provide training to workers on the Code of conducts and modes of communication with local communities which cover, but not limited to the followings:
    - Use adequate safety gears provided
    - Smoke designated places only. Do not litter the construction sites
    - Storing, using weapons and toxic substances is prohibited;
    - Do not cut the trees outside the construction sites, set fire, burning waste on-site(except invasive plants);
    - Drinking alcohols, during working hours is prohibited;
    - Do not operate construction plants if not authorised;
    - Do not quarrelling fighting, involving in gambling or social evils such as drug use, prostitution.

- Workers are strictly banned from:
    + Storing and using weapons and toxic substances;

+ Cutting trees outside the construction sites, making fire, burning waste and plants after clearing the site (except invasive plants, which must be approved the environmental specialist in the Supervision Consultant Team and the PMU);
+ Consuming alcoholic drinks during working time;
+ Quarreling and fighting;
+ Gambling and indulging in social evils such as drug use and prostitution;
+ Disposing of garbage indiscriminately;
+ Controlling trucks, machines or construction vehicles on their own initiative and without authorization;

Maintaining trucks, construction machines, and equipment beyond permitted areas.

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

5.3.1.13. Community Health and Safety Management

- The contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on labour safety in construction operations.
- In case of epidemic outbursts, the Project shall cooperate closely with the local government to carry out the required mitigation and control measures
- Fence centralised construction sites with solid materials of at least 2mhigh.
- Place warning signs and fence the open pits, channels to prevent accident.
- Sufficient lighting will be provided when construction is carried out at night.
- Apply speed limits at 20km/h within 200m from the construction
- Where possible, place the machines generating high level of noise as far as possible from residential houses and public areas so as noise level and be kept below 70dBA.
- Use static compactors when the construction site is constructed near weak structures

5.3.1.14. Workers' Health and Safety

- Provide trainings to workers on environment, safety and health including raising awareness on HIV/AIDS and other infectious diseases..
- Provide adequate protective clothing and gear such as masks, helmets, boot/shoes, gloves, goggles, belts, lifevest, lifeboys, etc. (depending on each nature of work) and request the workers to use when working.
- Power lines, switches etc. must be installed and maintained safely at site-offices, construction sites and camps. Electrical cables must not be laid on the ground or water surface. Electric wires must be with safe plugs. Outdoor electric panels must be placed in protection cabinets.
- Apply speed limits to vehicles travelling inside construction sites.
- Provide fire extinguishers, first aid kits, and medicine cabinets with medicines for common diseases in the locality at the site office and the camp.
- The workers' camp must be provided with clean water, electricity and mobile toilets. Workers' beds must be protected with mosquito nets.

- The camp, kitchen, bathing place and mobile toilets should be cleaned up and tidied up regularly and kept in good hygienic conditions. The flow of drainage ditches around the camp should be periodically cleared.
- Fuels and chemicals must be safely stored in areas with impermeable ground with roofs and surrounding banks, equipped with safety warning signs located at least 20m from the camps and at the end of prevailing winds.
- In the event that accidental leakage or spillage of diesel/chemicals/chemical wastes takes place, the following response procedures shall be followed immediately by the Contractor(s):
    - The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Contractor(s), Supervision Engineer and PMU.
    - The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/ leaked;
    - Should the accidents/ incidents generate serious environmental pollution (e.g. spillage / leakage of toxic or chemicals, large scale spillage / leakage, or spillage / leakage into the nearby water bodies, the Contractor shall immediate inform PMU;
    - In such cases, the Contractor(s) shall take immediate action to stop the spillage / leakage and divert the spilled / leaked liquid to nearby non-sensitive areas;
    - The Contractor(s) shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/chemical waste. This may be achieved through soaking with sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground); and
    - Depending on the nature and extent of the chemical spill, evacuation of the activity site may be necessary.
    - Spilled chemicals must not be flushed to local surface drainage systems. Instead, sawdust or sandbags used for cleanup and removed contaminated soil shall be disposed of by following the procedures for chemical waste handling and disposal already described.
    - The Contractor(s) shall prepare a report on the incident detailing the accident, clean up actions taken, any pollution problems and suggested measures to prevent similar accidents from happening again in future. The incident report shall then be submitted to the Supervision Engineer and PMU for review and keep in the records. The incident report shall also be submitted to DONRE, if required.
    - In case occurring the accident, the contractor should immediately cease the execution, take the first aid to the victim then to move to the nearest medical firm, to report the supervisor and investor.

5.3.1.15. Measures to Minimize Cumulative Impacts

Domestic solid, hazardous waste, and domestic wastewater must be managed in conformity with mitigation measures as outlined in Sections 5.1.3.2 and 5.1.3.3.

Such waste must not be kept at the site for long periods and have to periodically transported to disposal sites.

Cumulative impacts of associated projects: the Netherland-funded water management project will be implemented at the same time with CCSEP, however, on different catchment area without spatial overlapping of construction sites. The cumulative impacts are mainly caused by the combined emissions of exhaust gases, dust, solid waste, wastewater, traffic safety risks of CCSEP's three components and the ADB-funded project. On the part of the CCSEP project, these cumulative impacts would be limited by the mitigation measures presented in Sections 5.1.3.1, 5.1.3.2, 5.1.3.3, 5.1.3.9, 5.1.3.11.

Beside, to mitigate the cumulative impacts caused by conflicts in the use of traffic infrastructure, electricity and water supply, etc. of the Project with other construction projects in the city during construction phase, contractors would need to share information about construction plans to each other and with the other projects. Good cooperation in information exchange would help to adjust appropriately their construction schedules and limit conflicts on overload usage of transportation roads and services.

5.3.2. Type-Specific and Site-Specific Mitigation Measures

In addition to the common mitigation measures presented above, type-specific and site-specific mitigation measures will also be applied to certain types of investments and specific locations.

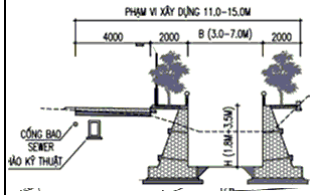
Table 5.3: Mitigation Measures for Type-specific Impacts

Typology of Investments	Type-specific Issues, Impacts and Risks	Mitigation Measures/Plan
Lake construction/ rehabilitation/ resettlement site	- Large volumes of excavated soil generated. Erosion, landslide risk, pollution of soil and water may happen at the temporary and final disposal sites, depending on the characteristics of the excavated materials - dust, traffic disturbance, increased traffic safety risks on the access road to the construction sites - erosion risks, soil subsident and safety risks at on slopes created - Safety risks for the workers to be presence in areas largely disturbed with excavation and construction materials, plant, equipment - Social disturbance when relative large number of workers are concentrated at one location - Safety risks related to the transportation, loading and unloading of	The excavated materials will be disposed off a sites specified in the Dredging Management Plan (which also mentioned disposal sites for all work items) Contractors are required to prepare Site-specific Environmental Management Plan (SEMP) and submit to the CSC and PMU for review and approval. In addition to the measures proposed by the Contractor, the following mitigation measures will be included in the SEMP for implementation by the contractor: - Avoid scheduling construction activities in rainy seasons. - Inform community at least two weeks before construction is started - Install and maintain Project information board with names and contacts - Install warning signs and speed limit (10 km/h) signs at least 100 m outside the entrance to the construction site - Fence the site with solid materials at least 2.5 m tall - Arrange wheel washing spot at the entrance and all wheels must be washed before leaving the site. - Wastewater from wheel washing must be collected and treated before being discharged into the environment

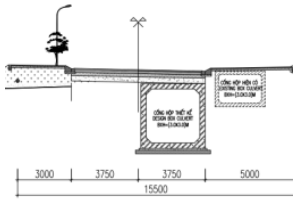
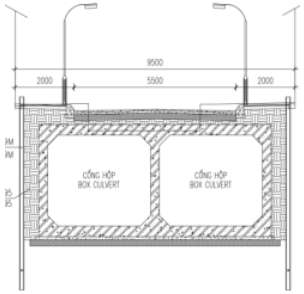
Typology of Investments	Type-specific Issues, Impacts and Risks	Mitigation Measures/Plan
	bulk/heavy materials such as rocks - Risks of localized flooding in the areas surround the resettlement site after ground level has been raised to design level - Increase turbidity in surface runoff discharged from the construction site	- Water at least 100 m of the access road outside the entrance at least twice everyday in days without rain - Protect slopes by sand bags on slope >45^o if excavation is on sandy foundation - Place warning signs and fence place at risky locations within the construction site. Safe access to the bottom of holes must be provided - Electrical wires must be hang, not let running on the ground. Outdoor switch and panels must be covered with water-proofed box - Renting local houses for workers to live is preferred - Bulky materials such as concrete block, rocks, HDPE membrane etc. must be loaded in such away that ensure safety on the road (e.g. rocks and concrete must be contained entirely in the truck tank, HDPE sheets must be tightly protected with covers and chains or roofed trucks etc.) - Build, clean up or maintain drainage surrounding the construction areas to ensure drainage size is adequate to discharge the storm runoff to the nearest receptor to ensure localized flooding is not happened in areas surrounding the resettlement site - Build, install sedimentation ditch or holes and maintain regularly
Pipeline construction and installation, pumping station	- Soil subsident, landslide risks due to deep excavation or on weak soil, or excavation taking place too close to existing or structures - Safety risks related to the transportation, loading and unloading of bulk/heavy materials such as rocks	- Before construction commencement, carry out field survey to identify the existing weak structure or permanent structures but at risks of being cracked/collapsed, take photos and make record. Propose appropriate construction method and special mitigation measures to avoid or fully address the risks. - Compensate if damages are caused during construction - Apply Larsen sheet piles when excavation is deeper than 2.5 m - Ensure construction quality control and road surface reinstatement after backfilling and compaction so as the ground is not sink/collapsed after construction is completed - Arrange staff to guard and guide traffic while uploading/unloading bulky pipes - During drain construction at roads where there are offices, schools, and business households, temporary access must be

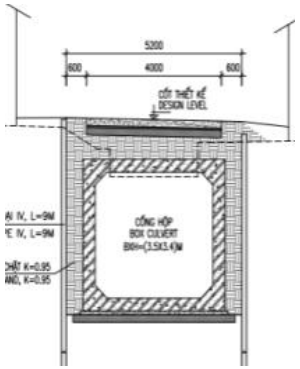
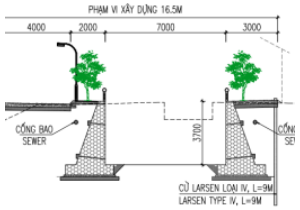
Typology of Investments	Type-specific Issues, Impacts and Risks	Mitigation Measures/Plan
		provided over excavation trenches to ensure safety, especially for pupils and business households; - Allowances are provided for affected business households along the road in accordance with RAP; - Successive construction will limit impacts on daily activities and business of the local people living along the alignments;
Expansion, upgrading of existing roads	- Accessibility to roadside households would be affected, particularly when the ground level of the upgraded road or footpath is significantly higher or lower than ground level of the roadside houses	- Build new access to ensure safe and smooth access to the houses, taking into account aesthetical values - Provide temporary access to road side houses - Arrange workers to help householders moving motorbike in-out of the house if helps are needed
Canal Dredging	Type-specific Impacts and Mitigation Measures are included in the Dredging Management Plan (Annex 2)	

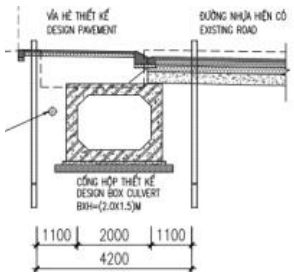
Table 5.4: Mitigation Measures for Site-specific Impacts at Each Construction Item of the Project

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
COMPONENT 1		
Tan Tai canal		
Section TT1 of Tan Tai canal, L=3,435 m  	- Disturbance to existing land use along the 11-15m construction corridor while the canal is 6-10 m wide - Very bad dour from temporary loading of sludge thus cause nuisance to the public - Dust from materials for roadbase construction - Noise from rock unloading - Public health and safety risks, social disturbances - Health and safety risk for workers in contact with the polluted sediment - Overdisturbance to vegetations and trees on existing household garden or agricultural land at canal side - increased traffic density and safety risks on the existing canal road - Canal water quality degradation (turbidity, TSS, organic matters) by dredging and wastewater leaked from from the temporary loaded dredged materials - Impacts on aquatic organism and fish, if anycome from the Dinh river - irrigation/drainage disrupted as 7 irrigation water intake and one gate affected - Accessibility to the graves yard may be obstructed, physiciologial impacts on families	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canal dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
		neighbouring section to mitigate the potential impacts on other water sources. - Provide adequate protective clothings, particularly masks, boots and gloves, life vests, and enforce the use when working in polluted canals. - Where the odour from dredged materials is excessive or if there are complaints from community, sludge must be covered or put into bags/containers which still allow leakage water to drain. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - If space is adequate, install and maintain solid fence of at least 2.5m high to separate the construction site with populated areas. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water materials transport roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - As recommended by DONRE and committed by the disposal site owners, dredged wastes and polluted excavated materials will be transport to the Nam Thanh Solid Waste Treatment Complex Ninh Thuan, while non-polluted excavated materials

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
		will be used for ground-levelling in the Dong Bac and Dong new urban areas.
Section TT 2 Tan Tai canal, L =332m 	- Traffic disturbance/disruption when road is excavated to new drain construction; - Health and safety risks for the workers when in contact with garbage and work in polluted environment - Access to and from the side gate of the stadium interrupted - Overdisturbance or cutting off trees - Safety risk for the public	- Relevant measures for Section TT1 will be applied. - Use the existing box culvert to continue the canal flow for drainage and agriculture irrigation during construction of new box culverts. - Deploy staff to guide traffic during construction operations at the stadium side gate and both ends of the construction route. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits.
SectionTT3 of Tan Tai canal, L = 1,384 m 	- Disturbance to existing landuse along 5m-wide strip as existing canal is 4 m wide and construction corridor is 9 m wide - Loose waterfront permanently, but polluted water. Not avoidable. - Odour from temporary loading of sludge - Dust from excavated soil - Health and safety risk for workers in contact with the polluted sediment - Safety risks to canal side families - irrigation service disrupted - Social disturbance and safety risks to canal side houses - Traffic disturbance and safety risks at the Thong Nhat-16/4 road during construction of the new new culverts - Over disturbance to vegetation or trees in households garden - Marginal impacts on aquatic biology in this polluted canal section - Obstruct accessibility on the existing bridge - Disturb access and religious activities in the Phan Rang pagoda	- Relevant measures for Section TT1 will be applied. - Rolling method will be applied with 200m each segment. Box culvert shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Only small sized machines/equipment to be deployed at the site. Limit the speed of transport vehicles lower than 15km/h when operation in and near to the site area, lower than 30kmh when passing along the Phan Rang pagoda. - Water twice per day on Thong Nhat and 16/4 streets - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - Establish temporal bridges/solutions for accessibility. - Limit noise by using silencers for construction machines/equipment/vehicles or keep at distance more than 100m to the sensitive areas when operation near to residential houses and the Phan Rang pagoda. - Apply larsen piles to protect the canal banks from erosion/landslides when construction behind the pagoda.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
SectionTT4 of Tan Tai canal, L = 722m  	- Disturbance to existing landuse along 4.5m-wide strip as existing canal is 4 m wide and construction corridor is 9.5 m wide - Health& safety risk for workers related to the polluted sediment - Odour, nuisance from temporary loading of smelly sludge - Social disturbance and safety risks for the public - Irrigation disrupted - Increased traffic density and safety risks on the existing canal-side roads - Social disturbance and safety risks to canal side households - Over clearance of trees or distub vegetation cover - Disturb activitities, safety for the public, visual impacts on the Cham Culture Research Center, soil subsident risk as excavation to 3.4 m - Soil subsident risk to the Cham Cultural Centre. - Noise, smell affect Anh Sang Kindergarten	- Relevant measures for Section TT1 will be applied. - Apply rolling method will be applied with 100-150m each segment. Use surface of the newly completed box culvert segment for transportation and gathering materials serving construction of next segments. - Create a temporal earth canal along the route to align the canal flow during construction periods. - Limit disturbance to existing landuse, trees along the route by deploying only small sized machines/ equipment and garther materials tydily at the site. - Water twice per day on 21/8 and 16/4 streets. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Apply Larsen piles to protect the canal banks from erosion/landslides when construction passing along Cham Cultural centre and Anh Sang Kindergarten. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits.
SectionTT5 of Tan Tai canal, L = 427 m  	- Disturbance to existing landuse along 4.5m-wide strip (B canal = 2.3 m, construction corridor is 9.5 m wide - Odour from temporary loading of smelly sludge thus cause nuisance to the public - Health and safety risk for workers in contact with the polluted sediment - Noise from rock unloading - Safety risks to the public - Dust from excavation during canal widening from 2.3 to 3.5-4.7 m - Soil subsident when excavation to 3.9 m while the existing depth is only 0.8 m - Irrigation disrupted	- Relevant measures for Section TT1 will be applied. - Avoid scheduling construction activities in rainy seasons. - Dredging and embankment lining require to be implemented in dry canals. - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Rolling method will be applied with 200m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
	- Increased traffic density and safety risks on the existing canal-side roads - Disturb or damages to the existing powerlines - Worsen localised flooding risks	- Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on side in order to avoid odour problems. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Deploy staff to guide traffic during construction operations at both ends of the route. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Only small sized machines/equipment to be deployed at the site. Limit the speed of transport vehicles lower than 15km/h when operation in and near to the site area. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - Install and maintain solid fence of at least 2.5m high to separate the construction site with populated areas
SectionTT6 of Tan Tai canal, L = 561m  	- Disturbance to existing landuse along 4.2m construction corridor is 9.5 m wide - Irrigation/drainage services disrupted, three irrigation gates and a stop log affected - Social disturbance and safety risks to the public - Accessibility to canal-side house affected - Dust and exhause gases affecting residents; - Increased localised flooding risks due to existing limited drainage capacity - Safety risks to traffic means and the community, especially at night along Tran Thi Street - Traffic safety risks to pupils leaving school after classes; - Access to the Parish Church may be affected	- Relevant measures for Section TT1 and TT4 will be applied. - Apply rolling method will be applied with 200m each segment. Use surface of the newly completed box culvert segment for transportation and gathering materials serving construction of next segments. - Where the odour from dredged materials is excessive or if there are complaints from community, sludge must be covered or put into bags/containers which still allow leakage water to drain. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Create a temporal earth canal along the route to align the canal flow during construction periods. - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes. - Apply larsen piles to protect the canal banks from erosion/landslides. - Install and maintain solid fence of at least 2.5m high along Tran Thi road.

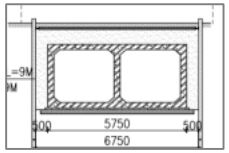
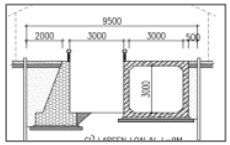
Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
		- Limit noise by using silencers for construction machines/equipment/vehicles or keep at distance more than 100m to the residential areas when possible, especially when construction passing along Tran Thi school and the Parish Church. - Deploy staff to guide traffic at the Tran Thi School during rush hours. - Only small sized machines/equipment to be deployed at the site. Limit the speed of transport vehicles lower than 15km/h when operation in and near to the site area. - Dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water materials transport roads 2 times/day in Tran Thi street, and daily cleaning within 200m from the construction site to reduce dust dispersion. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Garther materials tydily at the site.
Dong Nam canal L= 1.379m, connecting the Tan Tai and Cha La canals, Project will widen the open canal to BxH=10x2.7m; stone embankment for both sides.	- Disturbance to existing landuse along construction corridor which is at least 16 m - Disrupt irrigation service to roadside agricultural land; - some irrigation canal sections affected - Dust from large excavation to widen the canal from 0.8 to 10 m - Over disturbance to existing vegetation and trees on agricultural land - Noise from rock handling, unloading - Soil subsident, land slide risk when excavation down to 2.7 m - Social disturbance, safety risks for to local households at canal side	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Build coffer dam to block both ends of the canal to prevent water coming into the canal; applying open digging method. Using pumps and hoses to supply water for agricultural irrigation from Tan Tai and Cha La canals during the construction phase. - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes

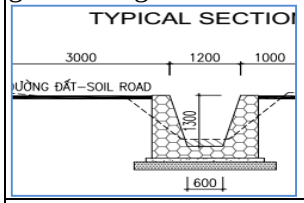
Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
		- Dredging and embankment lining require to be implemented in dry canals. Rolling method will be applied with 200m each segment. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Provide adequate protective clothings, particularly masks, boots and gloves, life vests, and enforce the use when working in polluted canals. - Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - Install and maintain solid fence of at least 2.5m high along the existing canal side road to separate the construction site with the road users. - Water materials transport roads 2 times/day the canal side road and within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
Cha La canal		
Section CL2 of Cha La canal, L = 942m Canal: Embank with stone walls BxH =12.2x(2.8-3.5)m Left: Construct 4m wide concrete road and the auxiliary items Right: Construct 4m concrete road and the auxiliary items.	- Dust from excavation for canal widening affect crops and workers - Disturbance to crop land and agricultural activities (temporary disposal of excavated materials) - Disturb or interrupt irrigation and drainage services for agricultural land - Affect water quality (turbidity) from concrete mixing, temporary load of dredged materials - Odour pollution	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Transport the excavated soil and dredged materials to final disposal site as soon as possible.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
		- Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - Install and maintain solid fence of at least 2.5m high along the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water transportation roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Non-polluted excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas in 16/4 road.
Section CL4, L=1,651m Embank with stone walls BxH =(14.3-16)x2.8m Left: Construct 4m concrete road, and the auxiliary items Right: Construct 4m asphalt road and the auxiliary items	- Disturbance to the trees along the road and river bank - Accessibility of the households may be affected - Affect water quality (turbidity) - Noise from rock handling, unloading - Soil subsident as excavation down to 2.8 m affecting roadside houses - Drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, the canal may be interrupted.	- Apply the measures applied for Section CL2; and - Establish temporal bridges/solutions for accessibility.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
Section CL5,L = 1,286m Embank with stone walls BxH =16x(2.7-3.7)m Left: Construct 4m wide concrete road and the auxiliary items Right: Widen the existing road, construct 4m wide concrete road and the auxiliary items	- Odour generated from the disturbed canal bed and dredged materials temporarily loaded on-site - Dust and nuisance on transportation road, at temporary loading area of the dredged materials - noise from rock handling, unloading - Health risk to the workers when in contact with/working with sludge polluted with domestic wastes - Soil subsident as excavation down to 3.7 m affecting roadside houses - Drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (mostly increases in turbidity, TSS and organic matters) when the canal bed and embankments are disturbed, or when runoff from temporary loaded dredged materials enters the canal	- Apply the measures applied for Section CL2; and - Establish temporal bridges/solutions for accessibility. -
CL 6: from Vo Nguyen Giap road Hai Thuong Lan Ong 3 road, 0.5 km long Dredging canal bottom 0.7-1.0m	- Odour generated from disturbed canal bed - Dust and nuisance on transportation road, at temporary loading area - Health risk to the workers - Drowning risk as the canal is 3.7 m deep - Soil subsident as excavation down to 3.7 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for local HH - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (in turbidity, TSS) Saline soil and water may affect the trees and vegetation cover	- Relevant measures for Section CL2 will be applied; and - Saline dredged waste will be transported to and dumped in the Nam Thanh landfill site.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
Nhi Phuoc canal, L=1,709m Section NP1 (L=93m): construct two parallel box culverts 2xBXH= 2x2.5x2.5m.  Section NP2 (L=708m) & NP3 (L=475m): maintain open canal and construct a box culvert BxH=3x3 in parallel. Management road is constructed on the right side.  NP4 (384m): rehabilitate open canal BxH=7.0x3.0m embanked with stone vertical walls on both sides. Two 2.5m-wide macadam roads will be constructed along both sides.	- Traffic safety risks; - Residents along canal affected by dust, noise and odour. - Health risks to the workers when in contact with the waste and contaminated water - Disturbance to the trees along the road and river bank - Accessibility of the households may be affected - Affect water quality (turbidity) - Noise from rock handling, unloading - Soil subsident as excavation down to 2.8 m affecting roadside houses - Drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, the canal may be interrupted.	Relevant measures for Sections TT1, TT2 and TT3of Tan Tai canal will be applied.
TH5 canal, L=662m build new cross section and embankments B1xB2xH=0.6x1.4x1.58m and construct a 3m-wide earth road on the left side and a 1m-wide earth road	- Impacts on vegetation cover and trees, affect green landscape, - Affect cccessibility to homes of 6 HHs - Dust and nuisance on transportation road, at temporary loading area - Drowning risk as the canal is 3.7 m deep - Soil subsident as excavation down to 3.7 m affecting roadside houses	- The proposed measures for Sections TT1 of Tan Tai canal will be applied. And - Establish temporal bridges/solutions for accessibility.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
on the right side, repair/rehabilitate 5 sluice gates along this canal. 	- drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (in turbidity, TSS) Saline soil and water may affect the trees and vegetation cover	
Secondary Drainage		
D1– Alley 410 on 21/8 Street, L=500m, DN=600mm, Road width= 6m	- Affect some roadside businesses - Risks to roadside power line and cables - Damages to the trees - Traffic disturbance; traffic safety risks, particularly in rainy weather	- Informing community of construction plan - Do not construct many routes in the same area at the same period. - Rolling method will be applied for 200m each segment. - Providing working with adequate protective clothing: protective clothes, boots/shoes, gloves;workers to wash themselves cleanly after each working shift - Daily transporting excavated waste out of site as soon as possible. - For installation of larger pipes (sizes of ≥1000mm), apply larsen piles to protect the dug drains from erosion/landslides. - Gathering materials tidily; transporting enough materials for each construction job - Watering 2 times/day to reduce dust dispersion - Construction site to be neatly tidied up after each construction session - Setting up hedges surrounding the construction site for safety. Warning signs and temporary traffic diversion signs are to be placed at the construction site area. Lighting is to be provided along the hedges. Luminously painted solid fences are to be installed at both ends of the sites.
D2 – Truong Dinh Street L=220m, DN=1,200mmm, Road width= 7m	- Landslides; - Affect some roadside businesses - Risks to roadside power line and cables - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather - Riks to power supply facilities nad the trees	
D3 - 21/8 Street-Le Quy Don Street; L=222m, DN=1,200mm, Road width= 7m	- Landslides; - Affect roadside businesses - Risks to roadside power line and cables - Damages to the trees - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather - Riks to power supply facilities and the trees	
D5– 21/8 Street-Children's Culture House, L=122m, DN=600mm, Road width= 11m	- Dust and noise - Traffic, safety risks - Urban landscape may be affected -	
D6 - Thong Nhat Street to Quang Trung Street;	- Landslides; - Dust, noise, community disturbance	

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
L=339m, D=1000mm, Road width= 6m	- Disrupt accessibility - Affect roadside businesses - Risks to roadside power line and cables - Damages to the trees - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather	- Standby pumps on site to drain stormwater in case of possible inundation - Deploying staff to guide traffic during construction operations at sensitive locations (markets, schools, temples, pagodas, …)
D7 - Le Hong Phong Street, Yersin Street and Thong Nhat Street; L=326m, D=800mm , Road width= 7m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Damages to the trees - Traffic disturbance	
D8 - Thong Nhat Street section in front of the provincial People's Committee. L=130m; D=600mm, Road width= 7m	- Dust, noise, community disturbance - Traffic disturbance - Urban landscape	
D9 - Cao Thang Street; L=450m, D=800mm, Road width= 6m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line and cables - Traffic jams, traffic disturbance; traffic safety risks	
D10 - Vo Thi Sau Street; L=863m, DN=1,500mm, Road width= 6m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line and cables - Traffic jams, traffic disturbance; traffic safety risks, particularly in rainy weather	
D11 - Cao Ba Quat Street: D=1000m, L=495m, Road width= 8m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility	

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
	- Affect roadside businesses - Traffic jams, traffic disturbance; traffic safety risks	
Tertiary wastewater drainage sewer line, L= 41.2 k	- Dust - traffic safetyrisks - Disturbance to community, - Accessibility to roadside houses and shops - Safety risk related to open holes,	- Informing community of construction plan - Putting up warning signs; ensuring lighting conditions at night - Rolling method will be applied for routes. - Providing working with adequate protective clothing: protective clothes, boots/shoes, gloves;workers to wash themselves cleanly after each working shift - Daily collect and ransport construction wastes out of site as soon as possible. - Gathering materials tidily; transporting enough materials for each construction job - Construction site to be neatly tidied up after each construction session - Covering and shielding unfinsihed construction jobs at the end of the day - Standby pumps on site to drain stormwater in case of possible inundation
Pumping stations	Landslide risks; Safety Risks for the workers	
PS1	- In general, construction on vacant land: therefore negligible impacts on the environment and local community	- Put and maintain bulletin boards at the construction site, containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work; - Larsen piles are to be applied to protect the construction well from erosion and landslides. - Corrugated iron fence of 2.5m high should be set up surrounding the construction site. Lighting is to be provided along the fence. - Setup warning signs of construction site, deep pits, and speed limits on the section passing the construction site.
PS2	- In general, construction on vacant land: therefore negligible impacts on the environment and local community	
PS3	- PS3 to be constructed in front of residential houses, affecting access and entrance; - Special attention to be paid to traffic safety and labor safety risks during both construction and operation; - Impacts from dust and exhaust gases.	
PS4	- Impacts from dust and exhaust gases.	
PS5	- Attention to be paid to traffic safety during construction an transportation of materials, and to inconveniences caused to people in the park and a number of seafood eateries nearby; - Impacts from smoke and dust.	

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
PS7	- Attention to be paid to traffic safety during construction an transportation of materials, and to inconveniences caused to residents along Alley 62 on Bach Dang Street (with small internal traffic roads); - Impacts from smoke and dust.	- Gather materials and excavated soils around foundation pits and properly monitored to ensure minimum scope of disturbance. - The construction site should be watered 2 times/day to retain moisture. - After each day's work has been completed, workers must tidy up the site. - Provide ladders to the workers for safe operations in deep pits.
PS8	- Negligible impact on the environment and the community: construction site being vacant land	
PS6	- Negligible impact on the environment and the community: construction site being vacant land	

Construction of central regulation lake	- Impacts from land acquisitance, causing psychological problems; - Amount of organic matter to be dredged: 11,538m3 and excavation amount: 256,382 m3; - Likely to be flooded during rains; - Vancant land, causing low impact on residents during construction; - Disturbances to vegetation cover; - Impacts from waste and wastewater; - Impacts on security and order; - Labor safety risks; - Rissk of fire and explosion. - Sensitive locations: Thien Hung pagoda.	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - The construction site is to be enclosed by corrugated iron fence of 2.5 m high. - The areas inside and outside the construction site should be watered 2 times/day. - Daily construction materials and waste on site must be completely collected after construction operations have been finished. - The beds of transportation means for construction materials, stone and soil entering and exiting the site must be properly covered in accordance with regulations, and in no case can overloading be allowed. - Stations for washing transport vehicle wheels will be set up at the main entrances to the construction sites for Dong Hai lake and the central regulation lake. Vehicle wheels must be cleanly washed before these means exit the sites in order to reduce dust dispersion into surrounding areas along transport routes. These stations may be designed with manholes of appropriate dimensions for settling sand before water from vehicle wash is discharged into the common drainage system. - Materials gathered inside and around the construction sites must be carefully covered to prevent dust from being dispersed by winds and soil and sand from being washed out into surrounding areas by heavy rains. - Lighting is to be provided at night inside the construction site and along its fence walls as well as places of gathering materials.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
Construction of Dong Hai lake	- Impacts from land acquisitance, causing psychological problems; - Exacavation and dredging amounts of about 41,543m^3;salinized soil; - Prone to flooding during rains; - High impacts on residents dueing construction operations; - Impacts from waste and wastewater; - Impacts on security and order; - Risks of labor safety; - Risks of fire and explosion; - Sensitive locations: Dong Giang market, Quan Thanh Temple, Dong Hai School and Tan Xuan Parish.	- During construction and transportation operations in the construction site for the central regulation lake, attention should be paid to reducing impacts from dust and noise, especially for operations taking place near Thien Hung pagoda (on Nguyen Van Cu Street, close to the boundary of lake construction. Construction and transportation operations are also to be avoided near the pagoda during events (the 1st and 15th days of each lunar months). Especially, construction operations must be limited near this area during the first weeks of a new lunar year, as large crowds of locals and visitors are expected to gather at the pagoda. - As for the area for the construction of Dong Hai lake, because the access roads to the lake are relatively narrow and this is a thickly-populated area, the travelling speed of vehicles transporting materials and waste need to be limited down to below 30km/h. And in no case should transportation operations be carried out during rush hours (6:30 am until 8:00 am and 16:30 until 18:30). - To mitigate impacts and secure traffic safety, the following measures can be carried out for Dong Hai lake construction phase: - Transportation operations for construction materials must be limited during times when pupils leave the school after classes (11:30 am to 12:00 pm and 16:30 to 18:00); - The contractor will deploy traffic guiding staff in the area of Dong Giang market during the time of transportation operations; - Vehicle speed is to be limited down to <15km/h when the means pass by Dong Giang market and the entrance. - Transportation operations should be limited on the 1st and 15th days of each lunar month and the first weeks of a new lunar year.

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
		- Arrange staff to guide traffic at the school and Dong Giang Market gates. - To minimize bad odours generated by decomposed organic sludge into the environment, dredging operations of the lake must be carried out successively: dredged sludge must be transported right after each operation to the backfilling positions for the planned park; dredged materials must not be temporarily gathered in the construction site.
WWTP	- Negligible impacts as minor repairs to be performed within the plant's premises	-
Public/school toilets	- Impacts from dust and noise, affecting pupils; scope of impacts only within school premises; - Construction possibly causing inconveniences to pupils' snaitation needs ; - Attention to be paid to safety as pupils are very active. - Impacts from smoke, dust, and noise affecting entertaining people in the park	- During construction, the contractor will be requested to shield off the site with fence walls to mitigate impacts on the school environment and safety of both teachers and pupils. Corrugated iron fence walls of 2.5m wide must also be set up to shield off the construction site for public sanitation facilities to minimize impacts on visitors and locals pedestrians entertaining themselves in the park. - The construction site area must be tidied up daily. Only small capacity machines and equipment with low noise level generation should be used. - Warning signs are to be placed to prevent pupils from approaching the construction site. - Construction plans should be scheduled during summer vacation time in order to limit negative impacts on pupils and teachers.
COMPONENT 2		
Alley 150 of 21/8 road and Huynh Thuc Khang road	- Impacts from land acquisition, causing spychological problems; - Affecting water quality of Tan Tai canal; - Impacts from dust and exhaust gases on residents along the street;	- Construction operations are to be successively carried out in each part of road surfaces to maintain limited traffic on road sections under construction. o Construction phase of road bases: Corrugated iron fence walls of 2.5m high will be set up to separate the construction site for the road base of extensions and

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
	- Inconveniences caused to business operations of residents: difficult access to businesses; - Labor safety risks during construction of the street; - Impacts on traffic on Huynh Thuc Khang Street, Alley 150 at the junction with 21/8 Street: risks of traffic accidents and jams; - Concentrated numbers of working people likely to give rise to social evils, risks to security and order, risks of comnflicts between workers and locals; - Generation of construction waste, wastewater, and domestic waste in construction site	prolongations. Meanwhile, the existing road is kept intact for maintaining limited traffic; o Construction phase of road surfaces: Corrugated iron fence walls will be dismantled. Traffic channelization is carried out to facilitate successively each part of the road. Portable barricades of 1.2m iron poles, luminously painted in red and white, with cement bases are placed at distances of 5m, linked with red-white tapes to separate traffic lanes, to maintain limited traffic during construction. - The contractor is to set up temporary warning signs and deploy traffic guiding staff at both ends of the section under construction. - The areas inside the construction site and the roads around the site should be watered 2 times/day. - Waste must be collected and the construction site tidied up every day when working hours are over. - Stations for wheel washing are to be set up at the entrances to the construction sites. - The beds of transport means must be carefully covered and shielded before the vehicles set out on their routes. - Lighting should be provided at night in the construction site, along the barricades, and at places of gathering materials.
COMPONENT 3		
Resettlement Area	- Impacts from land acquisition, causing spychological problems; - Impacts from dust and exhaust gases on residents along the street; - Impacts on traffic at the intersection between Phan Dang Luu Street with National Highway 1A, causing risks of increased traffic accidents and jams;	- Notice boards with information on the Project must be installed and maintained at the construction site with the following contents: full names and telephone numbers of the site manager, the supervision consultant and the Project Owner, construction duration and scope time. - Barricades, warning signs, construction lights for roads under construction are to set up in accordance with applicable

Item/proposed work	Site-specific Impacts and risks	Mitigation Measures
	- Concentrated numbers of working people likely to give rise to social evils; - Risks of conflicts betwwen workers and locals; - Generation of construction watse in construction site; - Generation of wastewater; - Generation of domestic waste	regulations. "We are sorry for inconveniences caused" signs are to be placed in Alley 150. - Look-outs for warning danger and guiding the traffic are to be deployed during construction, especially when vehicles enter or exit the construction site or stop for loading or unloading materials and waste. - Excavated soil must be transported immediately out of the site to designated disposal sites outside the construction site. - Construction operations likely to generate loud noise must be avoided during noon, at midnight and in the early morning in areas near residential areas or health care facilities. Construction operations which are to be carried out at night must be informed to the community at least 2 days in advance.
OTHERS		
Disposal sites	**Due diligence review carried out in the Annex**	**Due diligence review carried out in the Annex**
Borrow pits	**Due diligence review carried out in the Annex**	**Due diligence review carried out in the Annex**

Cultural and Historical Structures

Mitigation measures for site-specific impacts on cultural and historical structures presented in Table 5.5 below.

Table 5.5: Mitigation Measures for Impacts on Cultural and Historical Structures

No.	Name of works	Cause of impacts	Mitigation Measures
1	Quan Thanh Temple	Construction and rehabilitation of Dong Hai lake	Temple located along the construction route and transportation route of Dong Hai lake Component; 5 m from material gathering site for Dong Hai lake construction; Access road to Dong Hai lake: relatively narrow; thickly-populated residential area;; therefore, speed of transport vehicles to be less than 30 km/h; absolutely no transportation operations in rush hours (6:30 am to 8:00 pm and 16:30 to 18:30); Speed for vehicles passing Temple gate: 15 km/h; no horn flaring; materials in truck beds to be carefully covered; Limited transportation operations on in the 1st and 15th days of lunar months and during first two weeks of the lunar new year.
2	Thien Hung Pagoda	Construction of Central regulation lake	Thien Huong Pagoda located on Nguyen Van Cu Street, adjacent to construction boundary to the North of regulation lake; Dust and noise generation to be reduced during construction and transportation in area close to pagoda (recommended: speed limit < 30 km/h and no horn flaring while passing pagoda gate); Transportation and construction operations to be avoided near pagoda on pagoda's special days (1st and 15th of lunar months): large crowds local people and tourists expected to visit pagoda
3	Phan Rang Provincial Pagoda	Construction of Tan Tai canal	Phan Rang Provincial Pagoda: located in Phuoc My ward, to the right of construction route of Segment 3 of Tan Tai canal; Pagoda gate looking out onto 21/8 Street; Fence wall at the back of pagoda close to canal: to be reinforced with piles; Dust and noise generation to be reduced during transportation of materials and waste along 21/8 Street; Same measures to mitigate impacts on traffic and landscape for other routes to be applied; additional measures: speed limit <30km/h, no horn flaring while running pass pagoda gate; transportation operations to be limited on 1st days and 15th days of lunar months, first weeks of lunar new year
4	Phan Rang Parish church	Construction of Tan Tai Channel	Phan Rang Parish church: located on Tran Thi road, to the right of Tan Tai canal construction route; Dust and noise generation to be reduced during transportation of materials and waste in the area; additional measures: speed limit <30km/h; transportation operations to be limited on religious festive days (Christmas, Easter, …)

5.4. MITIGATION MEASURES FOR OPERATION PHASE

During operation phase, no mitigation measure are required for the works under Components 1,2 except the wastewater treatment plant, at which the following measures will be implemented.

- Maintain the existing vegetation cover and trees within and in the buffer zone of the wastewater treatment plant. Plant more foliage trees to create a green buffer zone around the premises of the treatment plant.
- Carry out good waste management practice Lidded thrash containers with lids will be placed at each pumping station and in the premises of the WWTP to hold collected waste. Crude waste will be pressed and put into $6m^3$ containers. Full containers will be replaced with empty containers and then collected and transported to the plant for treatment every day by the working team from Nam Thanh Co., Ltd.
- Sludge dredged from the lakes in the WWTP (periodically every 2-3 years, when the amount of sludge has substantially accumulated) will be tested to identify the quality and classify in conformity with QCVN50:2013/BTNMT before being considered for proper treatment and disposal plans. Normally, this sludge is forecasted to be normal waste and contracts will be signed with Nam Thanh Co., Ltd. for transportation to the plant for treatment.
- Dredged sludge must be transported immediately by specialized vehicles to treatment facilities and should not be gathered at the site, as this would give rise to bad odours.
- Provide adequate protective clothings for the workers to use
- Carry out periodical monitoring and submit to DONRE for review and advice

The following mitigation measures will be implemented at the resettlement sites

- Arrange for domestic waste collection services.

CHAPTER 6. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

On the basis of the assessment of negative impacts presented in Chapter 3 and the measures of impact mitigation recommended in Chapter 5, this Chapter will present the Environmental and Social Management Plan (ESMP) for Phan Rang Sub-project. The ESMP will identify the activities/actions to be implemented in PR-TC city, including the environmental monitoring program and its implementation schedule, taking into account the compliance with the provisions of the Government's EIA and safety policies of the World Bank (WB).

6.1. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

To ensure that all sources of pollution arising from the Project activities during the preparation stage and the construction stage as well as in the operation period would not cause any negative impacts on the environment and public health, it is compulsory that the management, monitoring and supervision of environmental quality be executed in a scientific, systematic and regular manner. Below is a summary of environmental impacts, mitigation measures and responsibilities of stakeholders.

ESMP's mitigation measures are divided into 3 basic parts: (1) ECOPs, (2) mitigation measures for the Project's components, and (3) site-specific mitigation measures for each location of the Project's items.

(1) This ECOP will outline impacts of a typically low level which may occur in a series of project construction operations. An ECOP includes measures to mitigate those impacts and is a procedure to be integrated into contractors' construction contracts. The mitigation measures in this ECOP will be developed and integrated into all the construction contracts under this Project.

(2) Mitigation measures for project's components will describe specific mitigation measures for the Project's components and are included in the contracts for corresponding packages.

(3) All those impacts specific to each position of the Project of which mitigation measures are not included in the general ECOPs or take place at a level that necessitates other measures beyond the scope of ECOP will be included in part 3: Site-specific mitigation measures for each location of the Project's items.

Measures to mitigate impacts from land acquisition and resettlement are mentioned separately in the Resettlement Plan (RP) and those measures will be carried out and supervised separately.

6.1.1. Common Mitigation Measures

Typical common impacts which will be minimized by mitigation measures defined in ECOP include: (1) Dust, exhaust gases, noise and vibration; (2) wastewater management; (3) Solid waste management; (4) Hazardous waste; (5) Water pollution management; (6) Impacts on aquatic species and terrestrial ecology; (7) Management of impacts on urban landscape and beauty; (8) Management measures of sedimentation, erosion and flooding; (9) Subsidence and slide management; (10) Traffic safety management; (12) Management of impacts on social activities; (13) Management of impacts on cultural and religious works; (14) Measures to secure community health and safety; (15) Measures to secure worker's health and safety.

Table 6.1. ECOPs

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
1. Dust generation	+ The Contractor is responsible for compliance with relevant Vietnamese legislation with respect to ambient air quality. + The Contractor shall ensure that the generation of dust is minimized and is not perceived as a nuisance and shall implement a dust control program to maintain a safe working environment, minimize nuisance for surrounding residential areas/dwellings and protect damage to natural vegetation, crops, etc. + The Contractor shall implement dust suppression measures (e.g. water spray vehicles, covering of material stockpiles, etc.) if and when required. + Material loads shall be suitably covered and secured during transportation to prevent the scattering of soil, sand, materials or dust. + Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors.	+ QCVN **05: 2009/BTNMT:** *National technical regulation on ambient air quality*
2. Air pollution	+ All vehicles must comply with Vietnamese regulations controlling allowable emission limits of exhaust gases. + There should be no burning of waste or materials on site.	+ **TCVN 6438-2005:***Road vehicles. Maximum permitted emission limits of exhaust gas.* + QCVN 05:2009/BTNMT: *Nationaltechnical regulation on ambient air quality*
3. Noise impact	+ The contractor is responsible for compliance with the relevant Vietnamese legislation with respect to noise and vibration. + All vehicles must have appropriate maintenance certifications to avoid exceeding noise emission from poorly maintained machines. + Operations that would result in a level of noise that would be perceived as a nuisance by local communities and/or residents (e.g. blasting, crushing, etc.) should be restricted to daylight hours on weekdays]	+ **QCVN 26:2010/BTNMT:** ***National technical regulation on noise*** + **QCVN 27:2010/BTNMT:** ***National technical regulation on vibration***

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	+ When needed, measures to reduce noise to acceptable levels must be implemented and could include silencers, mufflers, acoustically dampened panels and acoustic sheds or shields, etc.	
4. Water pollution	+ The Contractor must be responsible for compliance with the relevant Vietnamese legislation relevant to wastewater discharges into watercourses. + Portable or constructed toilets must be provided on site for construction workers. Wastewater from toilets as well as kitchens, showers, sinks, etc. shall be discharged into a conservancy tank for removal from the site or discharged into municipal sewerage systems; there should be no direct discharges to any water body. + Wastewater not meeting technical standard because of contamination must be collected in a conservancy tank. + Wastewater collected in conservancy tanks must be collected and removed from site by licensed waste collectors. + At completion of construction works, soak pits and septic tanks shall be covered and effectively sealed off.	+ QCVN 09-2008: Water Quality - National Technical Standard on Ground Water Quality Standards; + QCVN 14-2008: National Technical Standard on quality of domestic wastewater; + QCVN 24: 2009/BTNMT: National Technical Standard on quality of industrial wastewater; + TCVN 7222: 2002: General requirements on centralized wastewater treatment plant;
5. Drainage and sedimentation control	• The Contractor shall follow he detailed drainage design included in the construction plans. • Ensure drainage system is always maintained cleared of mud and other obstructions. • Areas of the site not disturbed by construction activities shall be maintained in their existing conditions. • To avoid sediment-laded runoff that could adversely impact watercourses, install sediment control structures where needed to slow or redirect runoff and trap sediment until vegetation is established. Sediment control structures could include windrows of logging slash, rock berms, sediment catchment basins, straw bales, Inletsoxx™ (storm drain inlet protection),or brush fences. • A cofferdam consists of a temporary dam used to isolate areas adjacent to or sections of a watercourse canal. When more than 1/3 of a stream is isolated, the impact to the local canal section should be assessed by qualified personnel; All sediment laden water	• TCVN 4447:1987: Earth works-Codes for construction • Decree No. 22/2010/TT-BXD on regulation of construction safety

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	pumped from behind the cofferdam must be directed through a sediment trap or other suitable control measure prior to re-entering the stream; No fuel or other hazardous materials should be stored behind a cofferdam. If high flows are expected all equipment must be removed from behind the cofferdam and placed well back from the stream. • Site de-watering and water diversions: In the case that construction activities require that work be carried out within the watercourse (e.g. culvert or bridge crossing construction, retaining wall construction, erosion protection works), the work area must be dewatered to provide for construction in dry conditions. The sediment laden water pumped from the work area must be discharged to an appropriate sediment control measure for treatment before re-release to the stream.	+ QCVN 08:2008/BTNMT– National technical regulation on quality of surface water
6. Solid waste	• The Contractor shall include in the detailed construction plans a plan for a solid waste control system (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.). The plan must be carefully followed during construction activities. + Before construction, all necessary waste disposal permits or licenses must be obtained. + Measures shall be taken to reduce the potential for litter and negligent behavior with regard to the disposal of all refuse. At all places of work, the Contractor shall provide litter bins, containers and refuse collection facilities. + Solid waste may be temporarily stored on site in a designated area approved by the Construction Supervision Consultant and relevant local authorities prior to collection and disposal through a licensed waste collector, for example, URENCO. + Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. + No burning, on-site burying or dumping of solid waste shall occur. + Recyclable materials such as wooden plates for trench works, steel, scaffolding material, site holding, packaging material, etc shall be collected and separated on-site from other waste sources for reuse, for use as fill, or for sale. • If not removed off site, solid waste shall be disposed of only at sites identified and approved by the Construction Supervision Consultant and included in the solid waste plan. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas, such as in areas of natural habitat or in watercourses.	+ Decree No. 59/2007/ND-CP on solid waste management

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
7. Chemical or hazardous wastes	+ Chemical waste of any kind shall be disposed of at an approved appropriate landfill site and in accordance with local legislative requirements. The Contractor shall obtain needed disposal certificates. + The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers. + Used oil and grease shall be removed from site and sold to an approved used oil recycling company. + Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and sent back to the supplier or removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. + Used oil or oil-contaminated materials that could potentially be contaminated with PCBs shall be securely stored to avoid any leakage or contact with workers and verification and disposal shall be determined by consulting with the local DONRE. + Unused or rejected tar or bituminous products shall be returned to the supplier's production plant. + Relevant agencies shall be promptly informed of any accidental spill or incident. + Initiate a remedial action following any spill or incident. In this case, the contractor shall provide a report explaining the reasons for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions.	+ Decision No. 23/2006/QD-BTNMT with list of hazardous substance
8. Sludge management	+ Major sludge management issues (from wastewater treatment plants or large dredging operations) would need to be addressed through a separate plan and set of measures in the EMP; the mitigation measures here are only for minor sludge management Dredging plan should be established including time schedule, method statement to meet the requirements of traffic safety, public health and environmental sanitation. In order to ensure dredging that is consistent with environmental regulations, key decision makers (local authority, DONRE, utility company, CSC, etc.) must be involved and concur in each key decision point in the process leading to preparation and implementation of a plan. + Characteristics of sludge/sediment should determined by sampling and analysis if not already done during the EIA.	+ Decision No. 23/2006/QD-BTNMT with list of hazardous substance + Decree No. 59/2007/ND-CP on solid waste management

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	+ Ensure that dredged material management plans incorporate environmental considerations in the identification of short-term and long-term disposal alternatives, consider methods to reduce dredging, and maximize the beneficial use of dredged materials. + Dredging work should be conducted when water flow is high to allow the dredged materials can be separated into the sediment and the supernatant water (i.e., spoil) by settling. + Leakage from dredged materials should not be allowed to enter watercourses without appropriate screening or treatment. + Collected dredged materials have to be processed, as per Vietnamese regulations on waste collection, to ensure safe and environmentally secure transportation, storage, treatment and management + Those involved in handling of sludge should be specialized and have appropriate certification. + Sanitary landfill site should meet technical requirements, based on level of potential contamination.	
9. Disruption of vegetative cover and ecological resources	• Areas proposed for clearing of vegetation shall be identified and listed in the construction plan. Only those proposed areas shall be cleared in accordance with the Plan and approved by Construction Supervision Consultant. Areas to be cleared should be minimized as much as possible. • The Contractor shall remove topsoil from all areas where topsoil will be impacted on by rehabilitation activities, including temporary activities such as storage and stockpiling, etc; the stripped topsoil shall be stockpiled in areas agreed with the Construction Supervision Consultant for later use in re-vegetation and shall be adequately protected. • The application of chemicals for vegetation clearing is not permitted unless this has been explicitly authorized in the construction plan and has the prior approval of the PMU. • Prohibit cutting of any tree unless explicitly authorized in the vegetation clearing plan. • When needed, erect temporary protective fencing to efficiently protect the preserved trees before commencement of any works within the site.	+ Law on Environment protection No. 52/2005/QH11

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	• No area of potential importance as an ecological resource should be disturbed unless there is prior authorization from CMS. This could include areas of breeding or feeding of birds or animals, fish spawning areas, or any area that is protected as a green space.	
10. Traffic management	+ Before construction, carry out consultations with local government and community. + Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. + Installation of lighting at night must be done if this is necessary to ensure safe traffic circulation. + Place signs around the construction areas to facilitate traffic movement, provide directions to various components of the works, and provide safety advice and warning. + Employing safe traffic control measures, including road/rivers/canal signs and flag persons to warn of dangerous conditions. + Avoid material transportation for construction during rush hour. + Passageways for pedestrians and vehicles within and outside construction areas should be segregated and provide for easy, safe, and appropriate access. Signpost shall be installed appropriately in both water-ways and roads where necessary. + Provide additional hard sheets crossing open trenches/holes passing houses/shops as and when needed; + Arrange staff/workers to assist young children and aged people crossing temporary access if possible + Ensure temporary access for wheelchairs to affected households having disabled people if required;	+ Law on traffic and transportation No. 23/2008/QH12 + Law on construction No. 16/2003/QH11 + Decree No. 22/2010/TT-BXD on regulation of construction safety
11. Interruption of utility services	• Planned and unplanned interruptions to water, gas, power, internet services: the Contractor must undertake prior consultation and contingency planning with local authorities about the consequences of a particular service failure or disconnection.	

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	• Coordinate with relevant utility providers to establish appropriate construction schedules. • Provide information to affected households on working schedules as well as planned disruptions (at least 5 days in advance). • Interruptions of water supply to agricultural areas must also be avoided. • For water, the contractor should ensure alternative water supply to affected residents in the event of disruptions lasting more than one day. • Any damages to existing utility systems of cable shall be reported to authorities and repaired as soon as possible.	
12. Restoration of affected areas	• Cleared areas such as borrow pits no longer in use, disposal areas, site facilities, workers' camps, stockpiles areas, working platforms and any areas temporarily occupied during construction of the project works shall be restored using landscaping, adequate drainage and revegetation. • Revegetation shall start at the earliest opportunity. Appropriate local native species of vegetation shall be selected for the planting and restoration of the natural landforms. • Spoil heaps and excavated slopes shall be re-profiled to stable batters, and grassed to prevent erosion; • All affected areas shall be landscaped and any necessary remedial works shall be undertaken without delay, including green-spacing, roads, bridges and other existing works • Trees shall be planted at exposed land and on slopes to prevent or reduce land collapse and keep stability of slopes • Soil contaminated with chemicals or hazardous substances shall be removed and transported and buried in waste disposal areas.	+ Law on Environment protection No. 52/2005/QH11

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
13. Worker and public Safety	• Contractor shall comply with all Vietnamese regulations regarding worker safety. • Ensure that ear pieces are provided to and used by workers who must use noisy machines such as piling, explosion, mixing, etc., for noise control and workers protection. • Fences must be constructed around the construction site to restrict access of public whenever there is any potential danger that needs to be avoided. • The contractor shall provide safety measures as fences, warning signs, lighting system against traffic accidents as well as other risk to people and sensitive areas.	+ Decree No. 22/2010/TT-BXD on regulation of construction safety + Instruction No. 02 /2008/CT-BXD on safety and sanitation issues in construction agencies + TCVN 5308-91: Technical regulation on safety in construction
14. Communication with local communities	• Maintain open communications with the local government and concerned communities; The contractor shall coordinate with local authorities (leaders of local wards or communes, leader of villages) for agreed schedules of construction activities at areas nearby sensitive places or at sensitive times (e.g., religious festival days). • Reduced playground space, loss of playing fields and car parking: The loss of amenities during the construction process is often an unavoidable source of inconvenience to users in sensitive areas. However, early consultation with those affected, provides the opportunity to investigate and implement alternatives. • Disseminate project information to affected parties (for example local authority, enterprises and affected households, etc) through community meetings before construction commencement; • Provide a community relations contact from whom interested parties can receive information on site activities, project status and project implementation results; • Provide all information, especially technical findings, in a language that is understandable to the general public and in a form of useful to interested citizens and elected officials through the preparation of fact sheets and news release, when major findings become available during project phase; • Monitor community concerns and information requirements as the project progresses; • Respond to telephone inquiries and written correspondence in a timely and accurate manner;	

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	• Inform local residents about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition, as appropriate; • Provide technical documents and drawings to PC's community, especially a sketch of the construction area and the EMP of the construction site; • Notification boards shall be erected at all construction sites providing information about the project, as well as contact information about the site managers, environmental staff, health and safety staff, telephone numbers and other contact information so that any affected people can have the canal to voice their concerns and suggestions.	
15. Management of Social Impacts	- Register the list of workers with the local authorities for temporary residence. - Train workers on issues related to environment, safety and health, thus enhancing their awareness of HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months. - The contractor shall Provide workers with and request them to use adequate safety gear such as masks, helmets, shoes/boots, goggles, etc. depending on job characteristics. - Safely install power lines at offices and in construction sites and do not lay connectors on the ground or water surface. Electric wires must be with plugs. Place outdoor electric panels in protection cabinets. - The contractor shall Inform the community about construction plan at least 2 weeks before commencement of the construction. - In case electricity and water supplies are to be disrupted, the PMU must inform PAHs at least 2 days in advance. - Fence off the construction sites of the lakes with solid materials of at least 2m high. - Avoid construction operations at night time. Where construction at nighttimes is inevitable the community must be informed at least 2 days in advance - Construction should be performed within the shortest possible time, particularly at sections passing populated residential or business areas. Carry out construction in stages to minimise the impacts of pipeline installation on local community.	

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	- Construction site should be kept tidy and safe. - Wooden planks with adequate strength and width must be placed over the open ditches to provide temporary access to roadside houses and shops - Hire local laborers to carry out simple tasks. - Workers must be trained on environmental issues, safety and health before construction tasks are assigned. - Do not park construction vehicles on the roads in populated areas longer than needed. Vehicles should be parked only for loading/unloading materials and wastes; Keep duration of temporary storage of materials and wastes at the site to be minimal. Refill the pipetrench /open holes soonest possible. - If visions to shops/businesses are blocked by construction activities, instruction signs observable from the main road will be provided. - Provide additional hard sheets crossing open trenches/holes, arrange staff/workers to assit local people taking their motorbikes/goods in and out of the houses/shops as and when needed; - Ensure temporary access for wheelchairs to affected households having disabled people if required - Allowances are provided for the affected business households located along the road in accordance with RAP; - Provide training to workers on the Code of conducts and modes of communication with local communities which cover, but not limited to the followings: o Use adequate safety gears provided o Smoke designated places only. Do not litter the construction sites o Storing, using weapons and toxic substances is prohibited; o Do not cut the trees outside the construction sites, set fire, burning waste on-site(except invasive plants); o Drinking alcohols, during working hours is prohibited; o Do not operate construction plants if not authorised; o Do not quarrelling fighting, involving in gambling or social evils such as drug use, prostitution. Workers are strictly banned from:	

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	+ Storing and using weapons and toxic substances; + Cutting trees outside the construction sites, making fire, burning waste and plants after clearing the site (except invasive plants, which must be approved the environmental specialist in the Supervision Consultant Team and the PMU); + Consuming alcoholic drinks during working time; + Quarreling and fighting; + Gambling and indulging in social evils such as drug use and prostitution; + Disposing of garbage indiscriminately; + Controlling trucks, machines or construction vehicles on their own initiative and without authorization; Maintaining trucks, construction machines, and equipment beyond permitted areas. Medical checkups for workers are to be periodically performed. People with highly infectious diseases shall not be employed.	
16. Chance find procedures	If the Contractor discovers archaeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall: • Stop the construction activities in the area of the chance find; • Delineate the discovered site or area; • Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Department of Culture and Information takes over; • Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property of Viet Nam (within 24 hours or less); • Relevant local or national authorities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;	• Law on Cultural Heritage (2002) • Law on Cultural Heritage (2009) for supplementary and reformation • Decree No. 98/2010/ND-CP for supplementary and reformation

ENVIRONMENTAL – SOCIAL ISSUES	MITIGATION MEASURE	VIETNAM CODE/REGULATION
	• Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage; • If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Project's Owner will need to make necessary design changes to accommodate the request and preserve the site; • Decisions concerning the management of the finding shall be communicated in writing by relevant authorities; • Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage.	

6.1.2. Specific Mitigation Measures

On the basis of identification results and forecasts, detailed assessment of the environmental and social impacts in Chapter 3, and measures to prevent and mitigate the negative impacts proposed in Chapter 5, the ESMP for Phan Rang Thap Cham Sub-project is proposed for the project as shown in Table 6.2.

The environmental impacts listed in column (3) and mitigation measures for the negative environmental impacts listed in column (4) of Table 6.2 have been summarized from Chapter 3 and Chapter 5. Detailed assessment of the environmental and social impacts caused by the project are presented in Chapter 4. The corresponding management and mitigation measures for environmental impacts are proposed in details in Chapter 5 of this report. During the implementation process, it is required to strictly adhere to the detailed measures presented in Chapter 5.

Table 6.2. Summary of the proposed ESMP of the project

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
Pre-constr	Planning, project formulation	Causing worries and concerns to the	Select the option that mitigates the land acquisition and resettlement;	Included in consulting contracts	To be completed before the	PMU, consultants	PMU, WB

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
	and detailed design	residential community whose land is acquired.	Publicly announce the information of the Project; Prepare SA, RP and ESIA reports; Consult affected people, community and government.		construction phase		
	Land acquisition and resettlement	517,085 $m^2$of acquired land; 949 households affected by land acquisition in which 144 households are in need of resettlement.	Compensation according to the resettlement action plan, including: - Compensation according to replace unit prices; - Resettlement support; - Livelihood restoration program.	Costs for compensation are included in the total investment.	To be completed before the construction phase	Municipal compensation and land acquisition council	PMU, RP supervision consultant, WB
	Site clearance	Impacts on air, noise and vibration Impacts on surface water and solid waste Impacts on ecological system	- Keep the site leaned and tidy by collecting wastes, garbage and other materials daily after working hours; - Regularly transport materials and wastes out from the sites; - Watering for keeping moisture - Avoid to cut trees outside the construction scope of the Project - Cover demolishing works by canvas to prevent dust dispersion to the surrounding areas; - Fully cover waste transporting trucks; - Cover piles of disposed material;	Costs are included in the construction contract value	1 week of demolition	Phan Rang – Thap Cham city compensation and land acquisition council; works' owners	PMU, CSC

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
			- Limit the vehicles speed during operation in the inner city and especially near the construction site **Implementing organization:** - Project will allocates some budget for assisting relocation and site clearance, the affected land owners shall themselves implementing the site clearance; - The city Compensation Council shall be responsible for organizing the land acquisition and site clearance; - It is recommended to keep about last 15-20% of the assistance amount and only to be paid when the land owners have fully completed satisfactorily the site clearance.				
	UXO clearance	Risks of UXOs	Detecting remained mines	PMU will sign contract with a functional unit	After site clearance and before construction	Contracted functional unit	PMU, local government
Construction phase	Construction; transportation and storage of materials and wastes	Impacts on air, noise and vibration	- Only construction machines with the emission level of exhaust gases meeting TCVN 6438-2005 may be used; - Only transport vehicles with valid vehicle registry may be used; - Loads of vehicles transporting construction materials and waste must not exceed the loads	Costs are included in the construction contract value	Implement and complete during the construction of work items	Contractor according to the contract with PMU, CSC	PMU; CSC, IEMC, local government,

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
			permissible for the route and for the vehicles; - bodies of trucks transporting construction materials and waste must be tightly covered, allowing no dropping off along the route; - Watering to keep the road surface moist within the 200m distance on roads from the construction sites; - Temporary sites for gathering material or storing soil larger than 20m3 must be enclosed or covered; - Never burning wastes/garbage onsite; - Specific gates of each site should be designated for entering and exiting transport vehicles. Vehicles must only use these gates; - Wheels washing stations are to be established at the entrance of major construction sites; - Transport vehicles for waste and materials must be periodically washed (expectedly every 5 days, depending on the weather and the hygiene of vehicles); - Speed of trucks is to be kept at 40 km/h or lower on inner-city roads and when travelling through residential areas. - Noise generating machines should be deployed at suitable distances so that				

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
			noise emitted to residential areas is no greater than 70dBA; - Inspection, maintenance and cleaning of the machines must be performed periodically; idle operation of machines and equipment should be avoided; - Reasonable transportation plans must be formulated; - For long construction routes as those for canals, secondary drains/sewers, and tertiary sewers, a successive construction method should be carried out section by section; - 2.5-metre high fences enclosing construction sites must be set up at the sites; - Set up night lighting system at the site				
	Construction; transportation and storage of materials and wastes; workers' camp	Impacts on water due to overflowed rainwater	- Construction materials are to be stockpiled in elevated sites to avoid being flooded. The piles of materials must be carefully covered to prevent bust and stormwater. - The amounts of construction materials should not be gathered in extremely large quantities or stored too long at construction sites; construction materials should be gathered in logically distributed parts suiting the construction schedule. Maintenance and oil replacement for	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
			transportation vehicles should not carried out on site; - At the contractors' warehouse of materials at the site, there will be a safe area (highly elevated, dry, distant from away from surface water bodies, roofed) for temporary storage of plastic trays containing waste oil and other hazardous waste; - Strict management measures to be applied at workers' camps on site. - The Contractor will build a temporary drainage system on the site to prevent stormwater runoff from overflowing the site. - Periodically inspect, dredge, and clear the temporary drainage system on site and the surrounding area.				
	Dredging and embanking canals	Disturb the canal water	- Canal dredging and embankment will be carried out in a successive manner for each half canal of each 200m canal segment.; - Make impounding dam of Larsen iron sheets for construction of every half of each canal segment. - Avoid to construct in rainy season and stop construction in case of heavy rain.	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
	Construction; camp activities;	Construction and domestic wastewater	- Water for daily use of works at the site will be provided by tank trucks. - Use local workers	Included in the contract with	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
	truck wash on site		- Domestic wastewater required preliminary treatment through the excavation and installation of sand sedimentation manholes before reuse for dust prevention watering or discharging into the receiving drains in the general drainage canal system of the region - Such car wash station require preliminary treatment system for car wash wastewater by sand sedimentation manholes and oil separation tank.	Construction contractors			
	Canal and lake dredging; excavation and backfilling work	Solid waste from dredging sludge and excavation materials	Used as filling material in the Dong Nam and Dong Bac new urban areas in the city	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
	Construction of works	Construction solid waste	- Classify construction residues at source. Place the waste at least 20m away from the surface water source - Reuse, recycle (corrugated bins, carton, etc.)	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
		Domestic solid waste	- Contractor needs to set up waste management regulations on site - Equip and arrange 100-liter domestic solid waste bin.	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
		Hazardous waste	- Set up temporary hazardous waste storage	Included in the contract with	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
			- Do not maintain and change oil for transportation vehicles at site - Transport and treat hazardous waste every 6 months	Construction contractors			
	Construction activities	Impacts on ecological system	Limit the tree cutting in case of not compulsory	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
	Transportation of materials, residues; stock of machinery and equipment; stockpiling of materials and residues	Impacts on the traffic system and infrastructure	- Coordinate to exchange information among contract packages - Coordinate with local government and traffic police - Inform the construction schedule to the local people - Apply for road bed excavation permit - Separate traffic flow - Speed sign, construction site sign - Assign staff in charge of traffic guide - Do not transport excessive load as regulated - Arrange reasonable transportation time - Educate the consciousness of complying with traffic rules - Arrange mobile pumps to suck water from holes and grooves	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
			- Clean the site and tidy the stockpiling - Repair damaged road sections due to the project activities				
	Construction activities; transportation of materials and residues, etc.	Impacts on people's life	- Do not absolutely prohibit the traffic - Carry out the construction as fast as possible - Regularly consult and timely receive comments - Stock materials neatly and safely within the construction site - Ensure social security and order	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
	Construction activities	Impacts on safety and health of workers	- Provide sufficient labor protection clothing - Limit the speed of vehicles in the site - Equip fire extinguishers, first aid kits, medicine cabinets - Workers' area is required to be cleaned regularly and kept hygienic.	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
	Construction of canals, lakes; Transportation of materials and residues	Impacts on cultural and historic works	Limit the transportation of materials on the on the fifteenth days and first days in lunar calendar and the first two week of the lunar new year.	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
	Construction; Transportation of materials and residues	Resonance impacts	- Contractors are required to well coordinate in information exchange about construction schedules among contract packages	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
			- Exchange information with other projects in the area - Closely coordinate with the local government				
	Construction; Transportation of materials and residues	Environmental impacts at the disposal site	- Identify exact locations in preferential need of receiving leveling materials	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
	Construction; Camp activities	Risks of fire and explosion	Prepare fire and explosion fighting and prevention plan in compatibility with actual conditions	Included in the contract with Construction contractors	2017 – 2022	Contractors, CSC	PMU, IEMC, CSC, WB, DONRE
Operation phase	Operation of wastewater treatment plan, wastewater pumping station and drainage system; school and public sanitation	Impacts on air	- Fully implement trees planting and caring - Fully install signs, traffic control signals, road markings, etc. - Sewage collection drain system will have smell proof manholes and be dredged periodically - School and public toilets are required to be provided with sufficient water. - Conduct communication campaigns in the community on the environmental protection consciousness.	Operation costs	During the operation period	Operation management unit	Municipal government; DONRE
	Operation of drainage and wastewater	Impacts on water and sediment	- Carry out dredging work annually - Online monitoring system is required to be installed for wastewater treatment plant				

Phase	Project activities	Environmental impacts	Proposed mitigation measures	Implementation costs	Implementation time	Implementation responsibilities	Supervision responsibilities
	treatment work items		- Prepare plans for incident recovery				
		Environmental impacts of solid waste	Collection, landfill				
		Risks and incidents of wastewater treatment plant	- Prohibit people who are not on duty to enter the pumping station and wastewater treatment plant - Operation unit will have to mobilize maximum resources to address and set right the incidents as quickly as possible.	Operation costs	During the operation period	Operation management unit	Operation management unit; DONRE
		Other risks and incidents					

6.1.3. Site-specific Impacts and Mitigation Measures

Table 6.3. Each Construction Item Site-specific Impacts and Mitigation Measures

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
COMPONENT 1				
Tan Tai canal				
Section TT1 of Tan Tai canal, L=3,435 m	- Disturbance to existing land use along the 11-15m construction corridor while the canal is 6-10 m wide - Very bad dour from temporary loading of sludge thus cause nuisance to the public - Dust from materials for roadbase construction - Noise from rock unloading	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttime	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
	- Public health and safety risks, social disturbances - Health and safety risk for workers in contact with the polluted sediment - Overdisturbance to vegetations and trees on existing household garden or agricultural land at canal side - increased traffic density and safety risks on the existing canal road - Canal water quality degradation (turbidity, TSS, organic matters) by dredging and wastewater leaked from from the temporary loaded dredged materials - Impacts on aquatic organism and fish, if anycome from the Dinh river - irrigation/drainage disrupted as 7 irrigation water intake and one gate affected - Accessibility to the graves yard may be obstructed, physiciologial impacts on families	- Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canal dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Provide adequate protective clothings, particularly masks, boots and gloves, life vests, and enforce the use when working in polluted canals. - Where the odour from dredged materials is excessive or if there are complaints from community, sludge must be covered or put into bags/containers which still allow leakage water to drain. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - If space is adequate, install and maintain solid fence of at least 2.5m high to separate the construction site with populated areas. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site.		

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
		- Water materials transport roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - As recommended by DONRE and committed by the disposal site owners, dredged wastes and polluted excavated materials will be transport to the Nam Thanh Solid Waste Treatment Complex Ninh Thuan, while non-polluted excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas.		
Section TT 2 Tan Tai canal, L =332m	- Traffic disturbance/disruption when road is excavated to new drain construction; - Health and safety risks for the workers when in contact with garbage and work in polluted environment - Access to and from the side gate of the stadium interrupted - Overdisturbance or cutting off trees - Safety risk for the public	- Relevant measures for Section TT1 will be applied. - Use the existing box culvert to continue the canal flow for drainage and agriculture irrigation during construction of new box culverts. - Deploy staff to guide traffic during construction operations at the stadium side gate and both ends of the construction route. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits.	Contractor	PMU, CSC, IEMC
SectionTT3 of Tan Tai canal, L = 1,384 m	- Disturbance to existing landuse along 5m-wide strip as existing canal is 4 m wide and construction corridor is 9 m wide - Loose waterfront permanently, but polluted water. Not avoidable. - Odour from temporary loading of sludge - Dust from excavated soil - Health and safety risk for workers in contact with the polluted sediment	- Relevant measures for Section TT1 will be applied. - Rolling method will be applied with 200m each segment. Box culvert shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Only small sized machines/equipment to be deployed at the site. Limit the speed of transport vehicles lower than 15km/h when operation in and near to the site area, lower than 30kmh when passing along the Phan Rang pagoda. - Water twice per day on Thong Nhat and 16/4 streets	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
	- Safety risks to canal side families - irrigation service disrupted - Social disturbance and safety risks to canal side houses - Traffic disturbance and safety risks at the Thong Nhat-16/4 road during construction of the new new culverts - Over disturbance to vegetation or trees in households garden - Marginal impacts on aquatic biology in this polluted canal section - Obstruct accessibility on the existing bridge - Disturb access and religious activities in the Phan Rang pagoda	- A station for washing vehicle wheels is to be established at the entrance of the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - Establish temporal bridges/solutions for accessibility. - Limit noise by using silencers for construction machines/equipment/vehicles or keep at distance more than 100m to the sensitive areas when operation near to residential houses and the Phan Rang pagoda. - Apply larsen piles to protect the canal banks from erosion/landslides when construction behind the pagoda.		
SectionTT4 of Tan Tai canal, L = 722m	- Disturbance to existing landuse along 4.5m-wide strip as existing canal is 4 m wide and construction corridor is 9.5 m wide - Health& safety risk for workers related to the polluted sediment - Odour, nuisance from temporary loading of smelly sludge - Social disturbance and safety risks for the public - Irrigation disrupted - Increased traffic density and safety risks on the existing canal-side roads - Social disturbance and safety risks to canal side households - Over clearance of trees or distub vegetation cover - Disturb activitities, safety for the public, visual impacts on the Cham	- Relevant measures for Section TT1 will be applied. - Apply rolling method will be applied with 100-150m each segment. Use surface of the newly completed box culvert segment for transportation and gathering materials serving construction of next segments. - Create a temporal earth canal along the route to align the canal flow during construction periods. - Limit disturbance to existing landuse, trees along the route by deploying only small sized machines/ equipment and garther materials tydily at the site. - Water twice per day on 21/8 and 16/4 streets. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Apply Larsen piles to protect the canal banks from erosion/landslides when construction passing along Cham Cultural centre and Anh Sang Kindergarten. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
	Culture Research Center, soil subsident risk as excavation to 3.4 m - Soil subsident risk to the Cham Cultural Centre. - Noise, smell affect Anh Sang Kindergarten	- Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits.		
SectionTT5 of Tan Tai canal, L = 427 m	- Disturbance to existing landuse along 4.5m-wide strip (B canal = 2.3 m, construction corridor is 9.5 m wide - Odour from temporary loading of smelly sludge thus cause nuisance to the public - Health and safety risk for workers in contact with the polluted sediment - Noise from rock unloading - Safety risks to the public - Dust from excavation during canal widening from 2.3 to 3.5-4.7 m - Soil subsident when excavation to 3.9 m while the existing depth is only 0.8 m - Irrigation disrupted - Increased traffic density and safety risks on the existing canal-side roads - Disturb or damages to the existing powerlines - Worsen localised flooding risks	- Relevant measures for Section TT1 will be applied. - Avoid scheduling construction activities in rainy seasons. - Dredging and embankment lining require to be implemented in dry canals. - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Rolling method will be applied with 200m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on side in order to avoid odour problems. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Deploy staff to guide traffic during construction operations at both ends of the route. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Only small sized machines/equipment to be deployed at the site. Limit the speed of transport vehicles lower than 15km/h when operation in and near to the site area. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - Install and maintain solid fence of at least 2.5m high to separate the construction site with populated areas	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
SectionTT6 of Tan Tai canal, L = 561m	- Disturbance to existing landuse along 4.2m construction corridor is 9.5 m wide - Irrigation/drainage services disrupted, three irrigation gates and a stop log affected - Social disturbance and safety risks to the public - Accessibility to canal-side house affected - Dust and exhause gases affecting residents; - Increased localised flooding risks due to existing limited drainage capacity - Safety risks to traffic means and the community, especially at night along Tran Thi Street - Traffic safety risks to pupils leaving school after classes; - Access to the Parish Church may be affected	- Relevant measures for Section TT1 and TT4 will be applied. - Apply rolling method will be applied with 200m each segment. Use surface of the newly completed box culvert segment for transportation and gathering materials serving construction of next segments. - Where the odour from dredged materials is excessive or if there are complaints from community, sludge must be covered or put into bags/containers which still allow leakage water to drain. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Create a temporal earth canal along the route to align the canal flow during construction periods. - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes. - Apply larsen piles to protect the canal banks from erosion/landslides. - Install and maintain solid fence of at least 2.5m high along Tran Thi road. - Limit noise by using silencers for construction machines/equipment/vehicles or keep at distance more than 100m to the residential areas when possible, especially when construction passing along Tran Thi school and the Parish Church. - Deploy staff to guide traffic at the Tran Thi School during rush hours. - Only small sized machines/equipment to be deployed at the site. Limit the speed of transport vehicles lower than 15km/h when operation in and near to the site area. - Dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water materials transport roads 2 times/day in Tran Thi street, and daily cleaning within 200m from the construction site to reduce dust dispersion. - A station for washing vehicle wheels is to be established at the entrance of the construction site. - Garther materials tydily at the site.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
Dong Nam canal L= 1.379m,	- Disturbance to existing landuse along construction corridor which is at least 16 m - Disrupt irrigation service to roadside agricultural land; - some irrigation canal sections affected - Dust from large excavation to widen the canal from 0.8 to 10 m - Over disturbance to existing vegetation and trees on agricultural land - Noise from rock handling, unloading - Soil subsident, land slide risk when excavation down to 2.7 m - Social disturbance, safety risks for to local households at canal side	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Build coffer dam to block both ends of the canal to prevent water coming into the canal; applying open digging method. Using pumps and hoses to supply water for agricultural irrigation from Tan Tai and Cha La canals during the construction phase. - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Dredging and embankment lining require to be implemented in dry canals. Rolling method will be applied with 200m each segment. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Provide adequate protective clothings, particularly masks, boots and gloves, life vests, and enforce the use when working in polluted canals. - Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - Install and maintain solid fence of at least 2.5m high along the existing canal side road to separate the construction site with the road users.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
		- Water materials transport roads 2 times/day the canal side road and within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas.		
Cha La canal				
Section CL2 of Cha La canal, L = 942m	- Dust from excavation for canal widening affect crops and workers - Disturbance to crop land and agricultural activities (temporary disposal of excavated materials) - Disturb or interrupt irrigation and drainage services for agricultural land - Affect water quality (turbidity) from concrete mixing, temporary load of dredged materials - Odour pollution	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
		- Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - Install and maintain solid fence of at least 2.5m high along the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water transportation roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Non-polluted excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas in 16/4 road.		

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
Section CL4, L=1,651m	- Disturbance to the trees along the road and river bank - Accessibility of the households may be affected - Affect water quality (turbidity) - Noise from rock handling, unloading - Soil subsident as excavation down to 2.8 m affecting roadside houses - Drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, the canal may be interrupted.	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - Install and maintain solid fence of at least 2.5m high along the construction site.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
		- Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water transportation roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Non-polluted excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas in 16/4 road.; and - Establish temporal bridges/solutions for accessibility.		
Section CL5, L = 1,286m	- Odour generated from the disturbed canal bed and dredged materials temporarily loaded on-site - Dust and nuisance on transportation road, at temporary loading area of the dredged materials - noise from rock handling, unloading - Health risk to the workers when in contact with/working with sludge polluted with domestic wastes - Soil subsident as excavation down to 3.7 m affecting roadside houses - Drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
	- Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (mostly increases in turbidity, TSS and organic matters) when the canal bed and embankments are disturbed, or when runoff from temporary loaded dredged materials enters the canal	- Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - Install and maintain solid fence of at least 2.5m high along the construction site. - Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water transportation roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Non-polluted excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas in 16/4 road.; and - Establish temporal bridges/solutions for accessibility. -		

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
Section CL 6 of Cha La canal, L= 500m (only dredging canal bottom 0.7-1.0m)	- Odour generated from disturbed canal bed - Dust and nuisance on transportation road, at temporary loading area - Health risk to the workers - Drowning risk as the canal is 3.7 m deep - Soil subsident as excavation down to 3.7 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for local HH - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (in turbidity, TSS) Saline soil and water may affect the trees and vegetation cover	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttimes - Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canals dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - Install and maintain solid fence of at least 2.5m high along the construction site.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
		- Minimize cutting trees if not necessary and prohibit disturbance/cutting trees outside the construction limits. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water transportation roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Non-polluted excavated materials will be used for ground-levelling in the Dong Bac and Dong new urban areas in 16/4 road.; and - Saline dredged waste will be transported to and dumped in the Nam Thanh landfill site.		
Nhi Phuoc canal, L=1,709m NP1 (L=93m), NP2 (L=708m), NP3 (L=475m), NP4 (384m).	- Traffic safety risks; - Residents along canal affected by dust, noise and odour. - Health risks to the workers when in contact with the waste and contaminated water - Disturbance to the trees along the road and river bank - Accessibility of the households may be affected - Affect water quality (turbidity) - Noise from rock handling, unloading - Soil subsident as excavation down to 2.8 m affecting roadside houses - Drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Warning signs and fences must be placed at dangerous places. Ensure adequate lighting at nighttime - Dredging and embankment lining require to be implemented in dry canals. - Rolling method will be applied with 200m each segment. Open canal dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
	- Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, the canal may be interrupted.	- Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Provide adequate protective clothings, particularly masks, boots and gloves, life vests, and enforce the use when working in polluted canals. - Where the odour from dredged materials is excessive or if there are complaints from community, sludge must be covered or put into bags/containers which still allow leakage water to drain. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - If space is adequate, install and maintain solid fence of at least 2.5m high to separate the construction site with populated areas. - To mitigate offensive odours, dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water materials transport roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site.		

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
		- Keep standby pumps on site to drain stormwater in case of possible inundation. Relevant measures for Sections TT2 and TT3of Tan Tai canal will be applied.		
TH5 canal, L=662m	- Impacts on vegetation cover and trees, affect green landscape, - Affect cccessibility to homes of 6 HHs - Dust and nuisance on transportation road, at temporary loading area - Drowning risk as the canal is 3.7 m deep - Soil subsident as excavation down to 3.7 m affecting roadside houses - drainage and/or irrigation disrupted - Social disturbance, safety risks for to local households - Increased traffic density and safety risks on the existing canal-side roads - Accessibility to watersuface, accessibility from one side to the othe side of the canal may be interrupted. - Water quality degradation (in turbidity, TSS) Saline soil and water may affect the trees and vegetation cover	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - Place warning signs and fences at dangerous places. Ensure adequate lighting at nighttime - Apply Rolling method with every 200m each segment. Open canal dredging and embankment shall be implemented for every half canal using Larsen piles to prevent water entry, to protect slops from erosion and landslides and also to ensure the continuous water flow in the canal during construction period. - Suspend construction if extreme weather conditions such as flood, typhoon (rarely occur in Phan Rang though) is forecasted. - Tidy up construction sites and apply measures to protect construction plants and materials, transport all the temporary loaded wastes to final disposal sites. - Avoid temporary loading of dredged materials on site in order to avoid odour problems. Trucks carrying dump materials must have water-tight tanks. Dredged will be transported to the Nam Thanh landfill. - Where temporary loading of materials is unavoidable, ensure leakage wastewater from dredged materials is diverted to the neighbouring section to mitigate the potential impacts on other water sources. - Provide adequate protective clothings, particularly masks, boots and gloves, life vests, and enforce the use when working in polluted canals.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
		- Where the odour from dredged materials is excessive or if there are complaints from community, cover or put sludge into bags/containers which still allow leakage water to drain. Transport the excavated soil and dredged materials to final disposal site as soon as possible. - Arrange staff to observe and rescue during entire shifts in case accidents such as drowning happen. - If space is adequate, install and maintain solid fence of at least 2.5m high to separate the construction site with populated areas. - Dredged sludge should be transported immediately to Nam Thanh landfill and no dredged materials could be gathered temporarily at the construction site. - Water materials transport roads 2 times/day within a distance of 2km, and daily cleaning within 200m from the construction site to reduce dust dispersion. - Specific gates of each a construction site will be designated for entering and exiting transport vehicles. Vehicles must only use these gates. A station for washing vehicle wheels is to be established at the entrance of the construction site. - Keep standby pumps on site to drain stormwater in case of possible inundation. - Establish temporal bridges/solutions for accessibility.		
Secondary Drainage			Contractor	PMU, CSC, IEMC
D1– Alley 410 on 21/8 Street, L=500m, DN=600mm, Road width= 6m	- Affect some roadside businesses - Risks to power line and cables - Damages to the trees - Traffic disturbance; traffic safety risks, particularly in rainy weather	- Informing community of construction plan - Do not construct many routes in the same area at the same period. - Rolling method will be applied for 200m each segment. - Providing working with adequate protective clothing: protective clothes, boots/shoes, gloves;workers to wash themselves cleanly after each working shift - Daily transporting excavated waste out of site as soon as possible. - For installation of larger pipes (sizes of ≥1000mm), apply larsen piles to protect the dug drains from erosion/landslides.		
D2 – Truong Dinh Street. L=220m, DN=1,200mmm, B = 7m	- Landslides risks; - Affect roadside businesses - Risks to power line and cables - Traffic disturbance and safety risks, particularly in rainy weather - Riks to the trees			

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
D3 - 21/8 Street-Le Quy Don Street; L=222m, DN=1,200mm, Road width= 7m	- Landslides risks; - Affect roadside businesses - Risks to power line and cables - Damages to the trees - Traffic jams, disturbance; safety risks, particularly in rainy weather - Riks to the trees	- Gathering materials tidily; transporting enough materials for each construction job - Watering 2 times/day to reduce dust dispersion - Construction site to be neatly tidied up after each construction session - Setting up hedges surrounding the construction site for safety. Warning signs and temporary traffic diversion signs are to be placed at the construction site area. Lighting is to be provided along the hedges. Luminously painted solid fences are to be installed at both ends of the sites. - Standby pumps on site to drain stormwater in case of possible inundation - Deploying staff to guide traffic during construction operations at sensitive locations (markets, schools, temples, pagodas, …)		
D5– 21/8 Street-Children's Culture House, L=122m, DN=600mm, Road width= 11m	- Dust and noise - Traffic, safety risks - Urban landscape may be affected			
D6 - Thong Nhat Street to Quang Trung Street; L=339m, D=1000mm, B = 6m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line, cables - Damages to the trees - Traffic jams, disturbance; safety risks, particularly in rainy weather			
D7 - Le Hong Phong, Yersin and Thong Nhat Streets; L=326m, D=800mm , Road width= 7m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Damages to the trees - Traffic disturbance			
D8 - Thong Nhat Street (in front of PPC office). L=130m; D=600mm, Road width= 7m	- Dust, noise, community disturbance - Traffic disturbance - Urban landscape			

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
D9 - Cao Thang Street; L=450m, D=800mm, Road width= 6m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line,cables - Traffic jams, disturbance; safety risks			
D10 - Vo Thi Sau Street; L=863m, DN=1,500mm, Road width= 6m	- Landslides; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Risks to roadside power line,cables - Traffic jams, disturbance; safety risks, particularly in rainy weather			
D11 - Cao Ba Quat Street: D=1000m, L=495m, Road width= 8m	- Landslides risks; - Dust, noise, community disturbance - Disrupt accessibility - Affect roadside businesses - Traffic jams, disturbance; safety risks			
Tertiary wastewater drainage sewer line, L= 41.2 k	- Dust - traffic safetyrisks - Disturbance to community, - Accessibility to roadside houses and shops - Safety risk related to open holes,	- Informing community of construction plan - Putting up warning signs; ensuring lighting conditions at night - Rolling method will be applied for routes. - Provide workers with adequate protective clothing: protective clothes, boots/shoes, gloves;workers to wash themselves cleanly after each working shift - Daily collect and ransport construction wastes out of site as soon as possible. - Gather materials tidily; transporting enough materials for each construction job - Construction site to be neatly tidied up after each construction session - Cover and shield unfinsihed construction jobs at the end of the day - Standby pumps on site to drain stormwater in case of possible inundation	Contractor	PMU, CSC, IEMC
Pumping stations	Landslide risks; Safety Risks for the workers		Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
PS1	- Construction on vacant land	- Put and maintain bulletin boards at the construction site, containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work; - Larsen piles are to be applied to protect the construction well from erosion and landslides. - Corrugated iron fence of 2.5m high should be set up surrounding the construction site. Lighting is to be provided along the fence. - Setup warning signs of construction site, deep pits, and speed limits on the section passing the construction site. - Gather materials and excavated soils around foundation pits and properly monitored to ensure minimum scope of disturbance. - The construction site should be watered 2 times/day to retain moisture. - After each day's work has been completed, workers must tidy up the site. - Provide ladders to the workers for safe operations in deep pits.		
PS2	- Construction on vacant land			
PS3	- PS3 is in front of residential houses, affecting access and entrance; - Traffic safety and labor safety risks during both construction and operation; - Dusts and exhaust gases.			
PS4	- Impacts from dust and exhaust gases.			
PS5	- Traffic safety, impacts on people in the park and nearby seafood eateries nearby; - Impacts from smoke and dust.			
PS7	- Traffic safety, social impacts onto the residents along Alley 62 on Bach Dang Street (with small roads); - Smoke and dust.			
PS8	Construction on vacant land			
PS6	Construction on vacant land			

Construction of central regulation lake	- Impacts from land acquisitance, causing psychological problems; - Amount of organic matter to be dredged: 11,538m3 and excavation amount: 256,382 m3; - Likely to be flooded during rains; - Vancant land, causing low impact on residents during construction; - Disturbances to vegetation cover; - Impacts from waste and wastewater; - Impacts on security and order; - Labor safety risks; - Rissk of fire and explosion. - Sensitive locations: Thien Hung pagoda.	- Inform the community at least two weeks before construction commencement - Avoid scheduling construction activities in rainy seasons. - Erect and maintain information boards with the following information at the construction site: full name and phone number of the Site Manager, Supervision Consultants and Owner, duration and scope of work - The construction site is to be enclosed by corrugated iron fence of 2.5 m high. - The areas inside and outside the construction site should be watered 2 times/day. - Daily construction materials and waste on site must be completely collected after construction operations have been finished. - The beds of transportation means for construction materials, stone and soil entering and exiting the site must be properly covered in accordance with regulations, and in no case can overloading be allowed. - Stations for washing transport vehicle wheels will be set up at the main entrances to the construction sites for Dong Hai lake and the central regulation lake. Vehicle wheels must be cleanly washed before these means exit the sites in order to reduce dust dispersion into surrounding areas along transport routes. These stations may be designed with manholes of appropriate dimensions for settling sand before water from vehicle wash is discharged into the common drainage system. - Materials gathered inside and around the construction sites must be carefully covered to prevent dust from being dispersed by winds and soil and sand from being washed out into surrounding areas by heavy rains. - Lighting is to be provided at night inside the construction site and along its fence walls as well as places of gathering materials. - During construction and transportation operations in the construction site for the central regulation lake, attention should be paid to reducing impacts from dust and noise, especially for operations taking place near Thien Hung pagoda (on Nguyen Van Cu Street, close to the boundary of lake construction. Construction and transportation	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
Construction of Dong Hai lake	- Impacts from land acquisitance, causing psychological problems; - Exacavation and dredging amounts of about 41,543m^3;salinized soil; - Prone to flooding during rains; - High impacts on residents dueing construction operations; - Impacts from waste and wastewater; - Impacts on security and order; - Risks of labor safety; - Risks of fire and explosion; - Sensitive locations: Dong Giang market, Quan Thanh Temple, Dong Hai School and Tan Xuan Parish.	operations are also to be avoided near the pagoda during events (the 1st and 15th days of each lunar months). Especially, construction operations must be limited near this area during the first weeks of a new lunar year, as large crowds of locals and visitors are expected to gather at the pagoda. - As for the area for the construction of Dong Hai lake, because the access roads to the lake are relatively narrow and this is a thickly-populated area, the travelling speed of vehicles transporting materials and waste need to be limited down to below 30km/h. And in no case should transportation operations be carried out during rush hours (6:30 am until 8:00 am and 16:30 until 18:30). - To mitigate impacts and secure traffic safety, the following measures can be carried out for Dong Hai lake construction phase: - Transportation operations for construction materials must be limited during times when pupils leave the school after classes (11:30 am to 12:00 pm and 16:30 to 18:00); - The contractor will deploy traffic guiding staff in the area of Dong Giang market during the time of transportation operations; - Vehicle speed is to be limited down to <15km/h when the means pass by Dong Giang market and the entrance. - Transportation operations should be limited on the 1st and 15th days of each lunar month and the first weeks of a new lunar year. - Arrange staff to guide traffic at the school and Dong Giang Market gates. - To minimize bad odours generated by decomposed organic sludge into the environment, dredging operations of the lake must be carried out successively: dredged sludge must be transported right after each operation to the backfilling positions for the planned park; dredged materials must not be temporarily gathered in the construction site.	Contractor	PMU, CSC, IEMC
WWTP	- Negligible impacts as minor repairs to be performed within the plant's premises	-	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
Public/school toilets	- Impacts from dust and noise, affecting pupils; scope of impacts only within school premises; - Construction possibly causing inconveniences to pupils' snaitation needs ; - Attention to be paid to safety as pupils are very active. - Impacts from smoke, dust, and noise affecting entertaining people in the park	- During construction, the contractor will be requested to shield off the site with fence walls to mitigate impacts on the school environment and safety of both teachers and pupils. Corrugated iron fence walls of 2.5m wide must also be set up to shield off the construction site for public sanitation facilities to minimize impacts on visitors and locals pedestrians entertaining themselves in the park. - The construction site area must be tidied up daily. Only small capacity machines and equipment with low noise level generation should be used. - Warning signs are to be placed to prevent pupils from approaching the construction site. - Construction plans should be scheduled during summer vacation time in order to limit negative impacts on pupils and teachers.	Contractor	PMU, CSC, IEMC
COMPONENT 2				
Alley 150 of 21/8 road, Huynh Thuc Khang road	- Impacts from land acquisition, causing spychological problems; - Affecting water quality of Tan Tai canal; - Impacts from dust and exhaust gases on residents along the street; - Inconveniences caused to business operations of residents: difficult access to businesses; - Labor safety risks during construction of the street; - Impacts on traffic on Huynh Thuc Khang Street, Alley 150 at the junction with 21/8 Street: risks of traffic accidents and jams; - Concentrated numbers of working people likely to give rise to social evils, risks to security and order, risks	- Construction operations are to be successively carried out in each part of road surfaces to maintain limited traffic on road sections under construction. o Construction phase of road bases: Corrugated iron fence walls of 2.5m high will be set up to separate the construction site for the road base of extensions and prolongations. Meanwhile, the existing road is kept intact for maintaining limited traffic; o Construction phase of road surfaces: Corrugated iron fence walls will be dismantled. Traffic channelization is carried out to facilitate successively each part of the road. Portable barricades of 1.2m iron poles, luminously painted in red and white, with cement bases are placed at distances of 5m, linked with red-white tapes to separate traffic lanes, to maintain limited traffic during construction. - The contractor is to set up temporary warning signs and deploy traffic guiding staff at both ends of the section under construction. - The areas inside the construction site and the roads around the site should be watered 2 times/day.	Contractor	PMU, CSC, IEMC

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
	of comnflicts between workers and locals; - Generation of construction waste, wastewater, and domestic waste in construction site	- Waste must be collected and the construction site tidied up every day when working hours are over. - Stations for wheel washing are to be set up at the entrances to the construction sites. - The beds of transport means must be carefully covered and shielded before the vehicles set out on their routes. - Lighting should be provided at night in the construction site, along the barricades, and at places of gathering materials.		
COMPONENT 3				
Resettlement Area	- Impacts from land acquisition, causing spychological problems; - Impacts from dust and exhaust gases on residents along the street; - Impacts on traffic at the intersection between Phan Dang Luu Street with National Highway 1A, causing risks of increased traffic accidents and jams; - Concentrated numbers of working people likely to give rise to social evils; - Risks of conflicts betwwen workers and locals; - Generation of construction watse in construction site; - Generation of wastewater; - Generation of domestic waste	- Notice boards with information on the Project must be installed and maintained at the construction site with the following contents: full names and telephone numbers of the site manager, the supervision consultant and the Project Owner, construction duration and scope time. - Barricades, warning signs, construction lights for roads under construction are to set up in accordance with applicable regulations. "We are sorry for inconveniences caused" signs are to be placed in Alley 150. - Look-outs for warning danger and guiding the traffic are to be deployed during construction, especially when vehicles enter or exit the construction site or stop for loading or unloading materials and waste. - Excavated soil must be transported immediately out of the site to designated disposal sites outside the construction site. - Construction operations likely to generate loud noise must be avoided during noon, at midnight and in the early morning in areas near residential areas or health care facilities. Construction operations which are to be carried out at night must be informed to the community at least 2 days in advance.	Contractor	PMU, CSC, IEMC
OTHERS				
Disposal sites	**Due diligence review carried out in the Annex**	**Due diligence review carried out in the Annex**		

Item	Site-specific Impacts and risks	Site-specific Mitigation Measures	Implement by	Monitor by
Borrow pits	**Due diligence review carried out in the Annex**	**Due diligence review carried out in the Annex**		

6.2. IMPLEMENTATION ARRANGEMENTS, ROLES AND RESPONSIBILITIES

6.2.1. Organization

The tables and figures below summarize the roles and responsibilities of the key parties and their relationships regarding the implementation of the EMP.

- Contractors will be responsible for implementing mitigation measures. These measures will be included in bidding documents and their costs are to be included in construction bid packages;
- CSC will be responsible for monitoring the day-to-day implementation of mitigation measures. Related costs are included in the CSC service contract;
- IEMC will be responsible for overall environmental monitoring which includes support to the PMU in implementing environmental supervision and monitoring, and responsible for reporting on the implementation through monitoring reports.

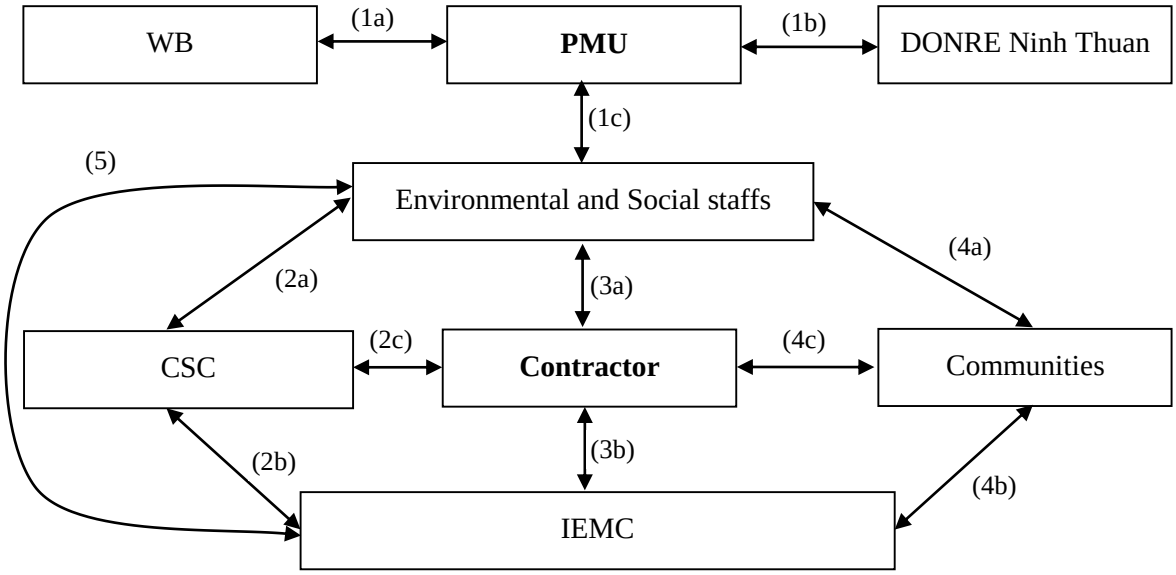


Figure 6.1. Organization chart for ESMP implementation.

Table 6.4. Roles and responsibilities of key parties

Description	Roles/Responsibilities
(1a) (1b)	Based on quarterly reports by IEMC, PMU will be responsible for preparing periodic reports to submit to WB and to Ninh Thuan Provincial DONRE.
(1c)	PMU shall assign the safeguard staff (ESU) the tasks of reviewing and checking the related sections in the Contract Documents on the bidding packages for construction items of the project to ensure compliance with EMP. PMU shall assign the safeguard staff (ESU) the tasks of supervising, managing and carrying out EMP activities and also assign CSC the tasks of closely supervising/monitoring safeguard performance of the contractor, including undertaking the environmental monitoring program.

	PMU/ESU will establish a hotline for communication with local communities to be responsive to the complaints, comments, and/or recommendations from local people and/or the public throughout the site clearance and construction stage.
(2a)	CSC will submit periodic monitoring report on environmental mitigation measures to PMU; make recommendations to the PMU to suspend in part or completely, construction works if the contract fails to meet contract provisions on labor safety and environmental protection requirements. PMU shall reviews CSC's periodical reports to ensure compliance with mitigation measures.
(2b)	CSC is to support and collaborate with IEMC to establish, collect and point out information about essential field environmental parameters and information for construction implementation; IEMC will monitor the implementation of the EMP every 3 months including submission of field reports. ILMC will also create database of results from environmental supervision and monitoring and train PMU in using such database. IEMC is to coordinate with CSC on monitoring and preparation of safeguard reports on EMP performance; enhance capacity for CSC through a training program on environmental supervision.
(3a)	Contractor: Before construction, with the assistance from IEMC, the Contractor will prepare a site-specific environment management plan (SEMP) during site clearance and construction process as part of their construction method statement, then submit the same to CSC and/or PMU for review and approval; During construction, the Contractor has to submit monthly reports on safeguard issues, mitigation, and results throughout the construction stage. In case of unexpected problems, the Contractor will consult CSC/PMU. PMU/CSC will review the SEMP and may propose changes as deemed necessary to be in line with legal prescriptions as well as appropriate to each specific site. Daily supervision and monitoring of the contractor's safeguard performance will be the responsibility of CSC.
(3b)	Contractor: The Contractor will carry out the required EMP during site clearance and construction, including self-monitoring and submission of report. IEMC will periodically supervise and monitor the overall project EMP implementation, including provision of safeguard training to PMU/ESU staff, community, CSC, and contractors as needed. The training will be designed to enhance the effectiveness of the EMP implementation and reporting.
(4a)	Community: According to Vietnamese practice, the community has the right and responsibility to routinely monitor environmental performance during construction to ensure that their rights and safety are adequately protected and that the mitigation measures are effectively implemented by contractors and/or PMU. In case of unexpected problems, they will report to CSC/PMU and/or call the hotline. PMU will encourage, support and create good conditions for local communities to participate in the environmental supervision and monitoring activities. PMU/CSC will review and respond to the requests and/or recommendations made by communities to ensure that the potential negative impacts are adequately mitigated.
(4b)	Communities will support and collaborate with IEMC during periodic monitoring and provide inputs to the overall safeguard issues that require attention and/or mitigation. IEMC is to strengthen local communities' capacity and relevant agencies through preparation of relevant documents necessary for monitoring, supervision, and reporting including the preparation of a database for the activities.

	IEMC will assist PMU and communities in the implementation of Information-Education-Communication (IEC) activities within Component 4 with regard to environmental hygiene, sanitation, road safety, etc.
(5)	IEMC is to support PMU/ESU in implementing the EMP in line with the Government's environmental regulations as well as the WB safeguard policies. In consultation with DONRE, IEMC will establish specific environmental monitoring programs for the project to be implemented by CSC at key locations as shown in detailed design documents. PMU is responsible for preparation of the 6-month progress reports to be submitted to WB and DONRE, based on quarterly reports submitted by IEMC.

6.2.2. Detail Responsibilities

Project Management Unit (PMU)

- PMU is responsible for implementing the EMP during the detailed design and construction stages. EMP implementation during operation stage is the responsibility of the facilities operators. PMU will set up an Environmental and Social Unit (ESU) to ensure timely and effective implementation of the EMP, including preparation of reports on safeguard compliance as required by the Vietnamese Government and WB.
- PMU/ESU is responsible for ensuring that the related sections in the Contract Documents on the bidding packages for construction items of the Project are in compliance with the EMP.
- PMU/ESU is responsible for communicating with relevant local, provincial and national departments, and with parties responsible for implementing and supervising EMP, especially with the provincial Department of Natural Resources and Environment (DONRE) and the concerned wards/communes during planning, monitoring, operation, and management.
- PMU/ESU will coordinate with community organizations to encourage them to actively participate in the planning, management, and implementation of the Project, including monitoring of the Contractor's performance.
- To ensure effective monitoring and correct implementation of the EMP, PMU/ESU will hire national environmental consultants to assist in carrying out and monitoring the EMP implementation. The responsibilities of the Independent Environmental Monitoring Consultant (IEMC) will be described below.
- For supervision and monitoring of contractors' performance, PMU will be responsible for: (a) Checking project implementation indicators relating to environment; (b) Unannounced inspections to ensure that mitigation measures are being implemented as presented in construction contract by contractors; (c) Reviewing periodic reports by the construction supervision consultant (CSC) to ensure compliance with mitigation measures; and (d) Based on the periodic reports by CSC and IEMC, PMU will prepare reports on environmental compliance of subproject to submit to WB and DONRE, which is part of the submission of a 6-month progress report to WB.
- PMU will need to coordinate closely with relevant enterprises on water supply, environmental sanitation, solid waste collection, etc. to monitor operation and maintenance during project implementation.
- **PMU Environmental Officer (EO):** The PMU will assign an Environmental Officer (EO) in charge to help solving environmental issues induceof the Project, supervising the environmental compliance with the WB safeguard policies and Vietnam's regulations in

various project phases. The EO will advise the PMU leaders on solutions for environmental issues to ensure the compliance with WB's safeguard polices and regulations stipulated by Vietnamese Government.

The EO will coordinate with the CSC team and the contractors to carry out due diligence review of borrow pits, quarries identified during construction phase and decide whether they are eligible for use in the Project

PMU Social and Resettlement Officer: The PMU will assign at least a Social and resettlement Officer (EO) in charge to help solving social and resettlement issues of the Project, supervising the compliance with RPF and RAP, participate in investigation and solvings complaints related to social issues and land acquisition.

Independent Environmental Monitoring Consultant (IEMC)

The IEMC will be responsible for assisting the PMU in EMP implementation. This also includes advising the CSC, contractors and communities on environmental compliance, and carrying out the monitoring program in accordance with regulations and procedures of the Vietnamese Government and World Bank. Once the detailed operational implementation of the environmental monitoring program is discussed by PMU and World Bank, the IEMC will be responsible for quarterly checking, and supporting the PMU staff to supervise overall project activities to ensure that unified environmental protection policies of the Vietnamese Government and World Bank are applied and supervised during project implementation. The IEMC will be responsible for: (1) providing training and capacity building for construction management for PMU/ESU staff, including field engineers and/or consultants (CSC) in supervising the EMP implementation of the contractors; (2) ensuring active participation of the local communities and schools in the project areas, (3) monitoring environmental parameters to assess the overall impacts of the Project, and (4) establishing an environmental training program to be included in Component 4.

Specifically, the IEMC's responsibilities include:

- Ensuring that the approved EMP and all project loan agreements related to safety and environment are fully applied and complied with during project implementation;
- Assessing the effectiveness of mitigation measures which are provided by the Contractor and CSC during implementation process; providing recommendations to the PMU on necessary improvement and supplementation to meet the safety requirements;
- Reporting regularly (every 3 months) to the PMU on actual EMP performance during project implementation;
- Establishing standard procedures, methods and forms to assist the PMU and CSC with assessment of contractors' progress in implementing required impact mitigation and monitoring measures;
- Assisting the PMU's environmental staff in reviewing the related parts of the Contract Documents on the bidding packages for construction items of the project to ensure compliance with environmental protection policies and impact mitigation and monitoring requirements;
- Performing measurement, taking samples and monitoring periodically environmental parameters (once per 6 months) during the period of environmental monitoring contract performance;
- Assisting with the preparation of documents and implementation of training programs on environmental monitoring and supervision for contractors, CSC and relevant staffs of PMU (environmental staffs and coordinators of packages);

- Discussing with relevant enterprises (if necessary) via PMU, to find suitable solutions for unexpected risks relating to environmental sanitation.

Construction Supervision Consultant (CSC)

The CSC is responsible for monitoring how the Contractor performs safety measures during site clearance and construction, including oversight of the self-monitoring to be conducted by the Contractor. This duty is shown in Term of Reference (TOR) for CSC. With regard to safety policies, the CSC's main responsibility will include, but not be limited to, the following:

- Assisting IEMC in establishing, collecting and providing information about both essential environmental indicators on site and construction work;
- Ensuring that construction work complies with the approved ESMP, relevant indicators and standardized operation specified in the environmental impact mitigation and monitoring documents;
- Monitoring the Contractor's performance of mitigation measures, timely propose and implement additional measures to complete mitigation measures and to meet the environment and safety management requirements of the Project;
- Making action plans/urgent alternatives to cope with environmental problems, emergency situations and damage occurring during construction process;
- Recommending PMU to suspend partially or completely construction work if the Contractor fails to comply with labor safety and environmental protection requirements specified in the contract;
- Holding regular meetings with the stakeholders to provide information about necessary plans and work programs to raise the concerned people's awareness of environmental protection during construction process.

Construction Contractors

- The construction contractors' responsibilities in respects of all aspects of the works, including the environmental aspects, are set out in the contract between the contractors and the PMU.
- Contractors have their own responsibilities for both carrying out environmental impact mitigation measures and compliance with approved ESMP during construction and installation process of project packages. In the preparation of technical method statement, contractors will study the project's approved ESIA report and propose a construction method that includes environmental protection and mitigation measures that are in line with the recommendations of the approved ESMP.
- Contractors' method statement will be submitted to PMU and CSC for review, as well as to IEMC as deemed necessary. Changes, if any, will be evaluated in terms of feasibility and legislation(laws, decrees, circulars and other regulations) before appropriate revisions are approved for specific cases onsite.
- During work construction, the contractors will be closely supervised by PMU, CSC, IEMC, environmental authorities and local communities on ESMP observation.

6.2.3. Reporting Arrangement

The PMU will prepare reports twice per year for submission to the World Bank and MONRE/ Ninh Thuan DONRE, including the compliance with the ESMP. The report will contain the monitoring results and assessments of the IEMC that show project progress and the state of implementation of the ESMP.

6.2.4. Estimated Costs for Each Environmental Protection Works/Measures

Table 6.5. Costs for environmental protection items

No.	Works	Estimated costs (VND)
1	Renting areas for dumping mud/dredged soil	100,000,000
2	Construction site fencing	200,000,000
3	Prevention and control of fire and explosion(fire extinguishers, fire hoses, emergency lights)	200,000,000
4	Watering and sprinkling/month	10,000,000
5	Trash bins on site	30,000,000
6	Portable toilet	50,000,000
7	Standby pump	150,000,000
8	Planting trees at the treatment plant	300,000,000
9	Demining	1,200,000,000
10	Wastewater treatment plants, sewer lines, drainage lines	75,762,697,000

6.3. ENVIRONMENTAL MONITORING PROGRAM

Table 6.6. Monitoring locations, parameters and frequency

Parameter, frequency	Location
CONSTRUCTION PHASE	
A. Monitoring air quality (Reference standards: QCVN 26:2010/ BTNMT, QCVN 05:2013/BTNMT)	
Noise, Dust, CO, SO2, NOx Frequency of one time per three months	KK1 – near Huynh Thuc Khang street – at the gate of Thuy Nguyen restaurant KK2 – near Alley 150 of 21/8 street – at the joint with Tan Tai canal KK3 – at the joint between Cha La and Tan Tai canal KK4 – point near to Chà Là canal and PS9 construction site KK5 – at the main gate of WWTP KK6 In Dong Hai lake area – point at the gate of Quan Thanh temple KK7 – in Dong Hai area –point near to PS13 construction site. KK8 – on Nguyen thi Minh Khai street – near the construction site of the central lake KK9 –point near to the PS 8 construction site KK10 – point near to Binh Son park and PS14 construction site KK11 - near to the resettlement site, on Phan Dang Luu street
B. Monitoring surface water quality (Reference standards: QCVN 08-MT:2015/BTNMT)	
pH, temperature, salinity, TSS, BOD5, NH_4^+, Cl^-,	NM1 – upstream of Tan Tai canal, coordinate at 11°35'36,5"N 108°57'25,8"E

T-N, T-P, Mn, Fe, As, Oil & grease, Coliforms, Frequency of one time per three months	NM2 – downstream of Tan Tai canal, , coordinate at 11°33'09,7"N 108°59'45,3"E NM3 – upstream of Cha La canal, coordinate at 11°35'25,3"N 108°58'49,6"E NM4- downstream of Cha La canal, coordinate at 11°33'04,9"N 109°00'36,5"E NM5 – conjunction of Chà Là and Tan Tai canals, coordinate at 11°33'31,8"N 109°00'30,2"E NM6- input point of TH5 canal, coordinate at 11°35'26,8"N 108°59'46,2"E NM7- in Chợ Tấn Tài canal, coordinate at 11°33'30,5"N 108°59'35,3"E NM8- Dong Hai lake NM9 and NM10 - in Dinh River at a 100m distance up and down stream from the WWTP discharge point, coordinates at 11°32'41,9"N 109°00'37,4"E and at 11°32'41,9"N 109°00'37,4"E NM12a; M12b: Ecological lake
C. Monitoring dredged/excavated materials quality (Reference standards: QCVN 03-MT:2015/BTNMT: As, Cr, Cd, Pb, Zn, Ni) Since the number of sludge/soil samples taken in the canals and lakes during ESIA preparation is not enough for detail assessment of the materials quality, it is recommended to carry out a detailed assessment of material quality of the dredged and excavated layers at all the projected canals and lakes initially before dredging/excavation for proposing properly a disposal method. The number of samples is depending on the number of construction sites and the total volume of materials. proposed that during construction phase of the project, estimatedly one sample for every per ten thousand cubic metres of materials. As calculated in Chapter 1, the total dredged and excavated materials of the project will be about 1,230,000 m^3, thus a total number of 123 sludge/soil samples needs to be taken and analyzed during the construction phase. It should be noted that the samples here must be composite samples; one sample is presented for each 10,000m^3 of materials, sampled from at least 10 locations on every 5,000 m^2 by using a core, then mixed together homogenously before re-sampling at least 2kg readily to in laboratory treatment and analysis.	
OPERATION PHASE	
A. Monitoring air quality (Reference standards: QCVN 26:2010/BTNMT, QCVN 05:2013/BTNMT and QCVN 06:2009/BTNMT)	
TSP, CO, NO_x, SO_2, HC, NH_3, H_2S, temp, humidity Frequency of one time per three months	KK5 – at the main gate of WWTP KK5b- point in the compound of WWTP (downstream of wind direction)
B. Surface water quality (Reference standards: QCVN 08-MT:2015/BTNMT – col B2)	
pH, temp, salinity, SS, BOD5, NH_4^+, Cl^-, T-N, T-P, Mn, Fe, As, Oil & grease, Coliforms, Frequency of one time per three months	NM9 and NM10 - in Dinh River at a 100m distance up and down stream from the WWTP discharge point, coordinates at 11°32'41,9"N 109°00'37,4"E and at 11°32'41,9"N 109°00'37,4"E NM12: Ecological lake
C. Wastewater quality	

(Reference standards: QCVN 14:2009/BTNMT-Col B)	
Temp, pH, COD, BOD_5, SS, Total N, Total P, Coliforms, Oil & grease. Frequency of one time per three months	NT 1 - Treated wastewater at the outlet of WWTP NT 2 - Raw wastewater at the input point of WWTP
D. Sludge generated from the WWTP (Reference standards: QCVN 50:2013/BTNMT)	
As, Cr, Cd, Pb, Zn, Ni.(before sludge dredging)	Four samples in the sludge dredged lagoons in WWTP

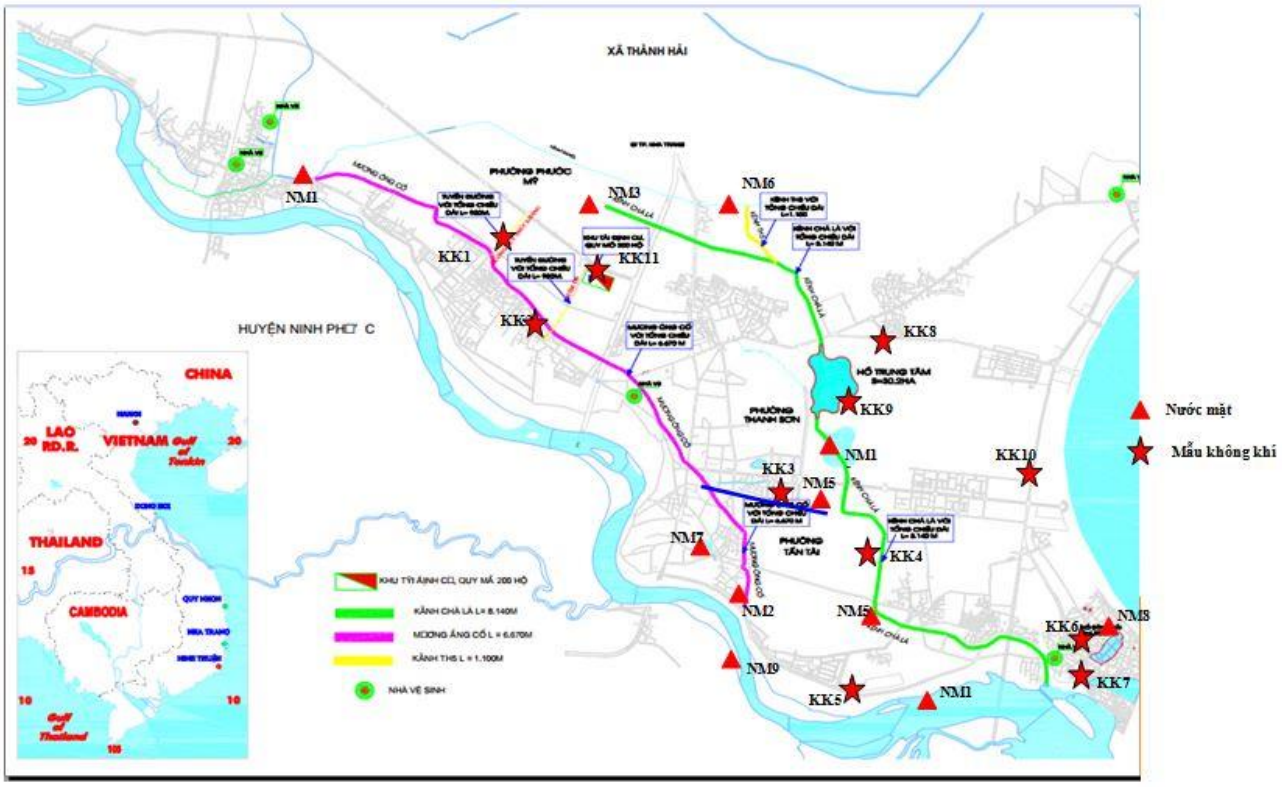


Figure 6.2. Sampling locations during construction phase.

6.4. CAPABILITY BUILDING PROGRAM

6.4.1 Safeguard Management Capacity of the Implementing Unit

The Implementation Unit for Capacity Development and ODA Water Resources Projects in Ninh Thuan province (the PMU) has 6-year experience in implementation and management of ODA projects including safeguard, social and environmental related issues/topics. The PMU's staffs have experiences in organizing and conducting communities' awareness-raising communication campaigns and surveys about clean water, sanitation, climate change adaptation, disaster risk reduction, sustainable managemant and operation of drainage and water supply systems, public and school toilets etc. The PMU also conducted or managed other activities such as revolving fund for household toilet construction or arrangement for the International Symposium on Drought and Recovery Solutions in the Central Coastal Province of Vietnam, the Workshop on Climate Change, and the workshops about the ORIO Netherland Project.

The PMU staff and management have been familiarised with the project's potential environmental issues, impacts and risks as well as mitigation measures and management plan through their engagements during the preparation of the ESIA for CCSEP and ORIO (Netherland funded projects). PMU arranged and actively took part in field survey and two rounds of public consultations during the preparation of CCSEP safeguard documents including ESIA and RAP. At early stage of CCSEP preparation, the PMU has also asigned staffs with relevant qualifications to be in charge of social and environmental aspects of the project. However, as CCSEP will be the first WB-finance project, the PMU has not had practical experience on environmental and social management during construction and operation phase.

6.4.1 Safeguard Capacity Building Program

PMU's gap in practical construction safeguard management experience will be addressed by the mobilisation of Construction Supervisors who will also be in charge of environmental supervision during construction phase, the contracting of an Independent Monitoring Consultant who will provide some trainnig activities and checking on compliance, and the expected close supervision by the Bank Task Team during operation phase. Learning, experience sharing activities with Nha Trang PMU, the strongest PMU among the four PMU of CCSEP, has been and will continued be arranged for improving Phan Rang PMU capacity on different aspects including safeguard management.

Table 6.7 provides a typical training program on safeguards policies. PMU & IEMC with the help of the Technical Assistance Team will provide training for contractors, CSC and other groups.

- *Trainee groups:* the PMU staff, the ESU department staff, the field engineers (FE), construction supervision consultants (CSC), the building contractors, representatives of relevant stakeholders and local communities in the project area. The contractors take the responsibility for training workers and drivers.
- *Training Schedule:* Training will be given at least one month before performing the first construction contract. Subsequent training sessions can be modified to suit the construction schedule for project components.
- Frequency of training: The basic training programs given in the table below will be provided every 6 months annually, and the contents will be updated and tailored to items to be implemented. Training programs for PMU staff are expected to continue in the first 3 years of the Project. Three-day training for CSC and contractors is also planned to take place twice a year for at least 2 years.

Table 6.7. Advanced training program on environmental monitoring

I. Subjects	**PMU**
Training course	Environmental monitoring and reporting
Participants	Staff in charge of environmental issues; environmental managers
Training frequency	Immediately after the project becomes valid, but at least one month prior to the first bid package. The next training will be planned on demand.
Duration	Four days
Content	Project-related general environmental management including the request from World Bank, Department of Natural Resources and Environment, in collaboration with competent authorities and concerned stakeholders; Environmental monitoring for the Project includes: • Requirements of environmental monitoring;

	• Monitoring and implementation of mitigation measures; • Community involvement in environmental assessment; • Guiding and monitoring contractors, CSC and community representatives in the implementation of environmental monitoring; • Forms used in environmental monitoring processes; • Reaction and risk control; • Manner of receiving and submit forms; • Other issues to be determined.
Responsibility	With the help of the Technical Assistance Team, the Independent environmental Monitoring Consultant (IEMC) and PMU implement safety policies.
II. Subjects	**CSC, CONTRACTORS, REPRESENTATIVES OF LOCAL WARDS/COMMUNES, COMMUNITIES**
Training course	Implementation of mitigation measures
Participants	CSC; construction engineers, site construction field manager. staff in charge of environment issues, the contractor; representatives of local authorities; representatives of urban groups
Training frequency	Shortly after awarding contracts to the contractors with updates on demand
Duration	Three-day training for CSC and contractors, and two-day training for others
Content	• Overview of the overall environmental monitoring; • Requirements of environmental monitoring; • The roles and responsibility of the contractors and CSC; • The content and method of environmental monitoring; • Reaction and risk control; • Introducing monitoring forms and instructing on filling out forms and reporting incidents; • Other issues to be determined • Preparing and submitting reports
Responsibility	With the help of technical assistance teams, PMU, IEMC implement safeguards policies.
III. Subjects	**COMMUNITIES / WORKERS**
Training course	Safety and environmental sanitation
Participants	Representatives of workers (team leaders) working directly for the project components
Training frequency	As appropriate
Duration	One day of presentation and one day of on-site presentation
Content	• Brief presentation on safety issues and overview on the environment; • Key issues requiring the attention of the community and construction workers to mitigating safety risks (land roads, waterways, equipment, machinery, etc.) as well as reducing pollution (dust, exhaust gases, oil spills, waste management, etc.); • Management of safety and environmental sanitation on site and at workers' camps; • Mitigation measures applied on site and camps;

	• Safety measures for electricity, mechanical engineering, transportation, air pollution; • Methods of dealing with emergency situations; • Other issues to be determined
Responsibility	Contractors, PMU with the assistance of IEMC

6.5. COST ESTIMATION

The following table provides a cost estimate for the implementation of environmental management plan (EMP). The cost of EMP[21] implementation will include (i) the costs of implementing mitigation measures by the contractor, (ii) expenses supervised by CSC, (iii) cost of the independent environmental monitoring consultant (IEMC), (iv) the costs of environmental quality monitoring, (v) the cost of safety management for the PMU, including both technical assistance in implementing safety policies and training programs. The costs of implementing mitigation measures during construction will be a part of the value of construction contracts, while the costs for a site-specific environmental monitoring plan(SEMP) by the construction supervision consultant (CSC) will be provided in construction supervision contracts. The costs of the PMU operations relating to EMP are allocated from the project management budget of the PMU, including safety training programs, and basic allowances to participants in the monitoring programs. After the project has been completed, the costs of environmental monitoring of constructed works will be taken from the operation and maintenance budget of the city.

Therefore, the following table only provides the estimated costs for environmental quality monitoring and IEMC package (in accordance with national practices) for reference purposes. However, final costs will be updated in the detailed design phase.

Table 6.8. Estimated cost for environmental quality monitoring

No	Parameter	Unit price (VND)	Quantity	Cost (VND)
Construction phase (total)				
1	Air quality	1,570,000	144	226,080,000
2	Surface water quality	5,900,000	144	849,600000
3	Soil/sludge quality	3,744,000	123	460,512,000
3	Sampling	500,000	267	133,500,000
Total cost during construction phase				1,669,690,000
Operation phase (one year)				
1	Air quality	1,570,000	4	6,280,000
2	Surface water quality	5,900,000	4	23,600,000
3	Wastewater quality	5,900,000	4	23,600,000
8	Sampling	500,000	12	6,000,000
Annual cost during operation phase				59,500,000

Table 6.9. Estimated cost for IEMP package

[21]Excluding costs for RP implementation and independent monitoring the performance of RP/EMP

No	Content	Unit	Quantity	Unit price (mil. VND)	Cost (mil. VND)	Cost (USD)
1	Experts salary (3 persons * 5 years)	Person-month	51	28	1,428	64,909
2	Management cost (50%*(1))	LS	1	50%*(1)	714	32,455
3	Allowance	Person-day	326	0.5	163	7,409
4	Travelling	Person-trip	75	6	450	20,455
5	Training	Course	6	7	42	1,909
6	Office materials and communication	LS	1	350	350	15,909
7	Environmental quality monitoring	Table 6.8			1,670	75,.909
9	SUM				4,817	218,955
10	VAT tax				481	21,895
	Total cost for IEMC				**5.300**	**240,000**

6.6. GRIEVANCE REDRESS MECHANISM (GRM)

Complaints relating to any subproject's problems will be solved through negotiations to achieve the consensus. A complaint will go through three stages before it can be transferred to the court. The enforcement unit will pay all administrative and legal fees relating to the acceptance of complaints. This cost is included in the project budget.

Complaint procedures and resolution will be performed as follows:

The first level *People's Committee of ward / commune*. An affected household is to take his/her complaint to any member of the People's Committee of the ward / commune, through the village head or directly to People's Committee of the commune / ward, in written or oral form. The said member(s) of the People's Committee or the village head will inform the People's Committee of the ward/commune on the complaint. The People's Committee of Ward/Commune will work directly in person with the said affected household and will decide on the settlement of the complaint 5 days after receiving such complaint (this may take 15 days in mountainous or remote areas). The Secretariat of the People's Committee of the relevant commune/ward is responsible for documenting and recording all the complaints that it is handling.

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

The second level *The CPC*. Upon receiving a complaint from a household, the CPC will have 15 days (or 30 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The CPC is responsible for filing and storing documents on all complaints that it handles.

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

The third level *The PPC*. Upon receiving a complaint from the household, the PPC will have 30 days (or 45 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The PPC is responsible for filing and storing documents for all complaints to be submitted.

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

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

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

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

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

Independent monitoring consultants (environmental, social and resettlement), who have enough the specialized capacity, would be selected by PMU through bidding. Independent monitoring consultants are responsible for checking the procedures and decisions on settling complaints. Independent monitoring consultants may propose additional measures to address any outstanding complaints. While checking the procedure for complaint resolution and reviewing the decision on complaint resolution, the independent monitoring agencies are required to closely coordinate with the Vietnam Fatherland Front, whose members are responsible for monitoring law enforcement of local complaints.

As part of overall implementation of the project, a grievance redress mechanism (GRM) will also be developed by the ESU of the PMU, according procedures, responsible persons and contact information will be developed. It will be readily accessible to ensure that grievances shall be handled and resolved at the lowest level as quickly as possible. The mechanism will provide a framework within which complaints about environmental and safety issues can be handled, grievances can be addressed and disputes can be settled promptly. The GRM will be in place before construction commencement.

During construction, the GRM will be managed by the contractors under supervision of the CSC. The contractors will inform the affected communities and communes about the GRM availability to handle complaints and concerns about the project. This will be done via the community consultation and information disclosure process under which the contractors will communicate with the affected communities and interested authorities on a regular basis. Meetings will be held at least quarterly, monthly information brochures will be published, announcements will be placed in local media, and notices of upcoming planned activities will be posted, etc.

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

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

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

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

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

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

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

The World Bank's Grievance Redress Mechanism: Communities and individuals who believe that they are adversely affected by a WB-financed project may submit complaints to the available project-level grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS will ensure that complaints received are promptly reviewed to adddress project-related concerns. The affected communities and individuals of the project may submit their complaints to the WB's independent Inspection Panel that will determine whether harms occurred, or can occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at anytime after concerns have been brought directly to the WB's attention, and the Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit www.worldbank.org/grs. For information on how to submit complaints to the World Bank Inspecition Panel, please visit www.inspectionpanel.org.

CHAPTER 7. PUBLIC CONSULTATION AND DISCLOSURE

7.1. PUBLIC CONSULTATION PROCESS

During ESIA study, the PMU and Consultants have conducted two public consultation stages with local ward/commune level authorities and local communities in the affected areas of the Project. Accordingly the local affected residents and authorities in entire 15 wards and one commune in the project area were consulted twice for the comments/ideas contribution. Summary of the public consultation process and results are presented in the following sections.

7.1.1. First Public Consultation

From 23 February to 3 March 2016, under the chairmanship of the ward/commune level People's Committee (PC), the consultation meetings have been held in the above mentioned 16 wards/communes. Total number of participants was 421 people; of which women accounted for 41.6%.

The purpose of the first public consultation stage was to disseminate information about the proposed project, to present the scope of the ESIA of the project, and to collect suggestions/ advices for the ESIA's TOR.

The meeting participants included:

- Representatives of the PMU.
- Representatives of the local authorities.
- Representatives of the local organizations.
- Representatives of the households in and around the project areas.
- Representatives of the ESIA consultants.

Contents of the meetings:

- To present briefly information and proposed contents of the project and it's benefits.
- To present the main expected impacts of the project and the scope of project's ESIA.
- To consult with the local residents and authorities for their comments/ideas about the local environmental issues that need to be considered during ESIA process.
- The participants were encouraged to provide comments, advices and questions.

(Minutes of the consultation meetings were recorded and attached in Appendix 4 of this report)

7.1.2. Second Public Consultation

The second public consultation stage was conducted from 5 to 12 July 2016. Total number of participants to the meetings was 444 people; of which women accounted for 43.2%.

The purpose of the second stage public consultation meetings were to present in detailed the proposed project's investment components and briefly the contents of draft ESIA to the local residents, organizations and authorities for their providing comments. All comments, opinions from the meetings on project's proposals and ESIA contents were collected for sufficient consideration during finalization of the project's proposals and ESIA.

The meeting participants included:

- Representatives of the PMU.

- Representatives of the local authorities.
- Representatives of the local organizations.
- Representatives of the households in and around the project areas.
- Representatives of the ESIA consultants.

Contents of the meetings:

- Present briefly information and proposed contents of the project and it's benefits;
- Present in detailed about the proposals, implementing plans and progress of the project's items in the specific local ward/commune where the meeting taken place of the project.
- Present briefly the draft ESIA (potential impacts and proposed mitigation measures of the impacts).
- Discuss on the specific environmental issues in the locality.
- The participants were encouraged to provide comments, advices and questions.

(Minutes of the consultation meetings were recorded and attached in Appendix 4 of this report)

7.2. RESULTS OF PUBLIC CONSULTATION

7.2.1. Results of First Public Consultation Stage

a) Opinions from Ward/Commune People's Committee

Table 7.1. Summary of the local authorities' opinions in the 1st stage consultation

Local authorities' opinions	Correspondance by PMU
• Agreed and be supportive to the project to improve general sanitation of the city, • The project should have a suitable compensation policy of resettlement for people to help them settle down quickly, • There should be measures to ensure traffic safety during the construction; • During the project construction, if residents' houses are damaged, it's necessary to fix and compensate for them; if public works such as roads is damaged, they should be repaired; • There should be good management of on-site waste; • PMU is responsible to clean up after the construction field; • People propose to facilitate jobs for people who suffer from loss of productive land	• Agrees and obtains comments of the Communal People's Committees • Considering the proposals of people and obtain comments • Reviewing and assessing detailed at sensitive environmental areas/ locations and take measures to prevent and minimize the impact scientifically, feasibly and appropriately to the particular local conditions, • The role of the community and local government on environmental monitoring during the implementation of the project

b) Opinions from Local Affected Residents

Table 7.2. Summary of opinions from local residents during the first public consultation meetings

No	Opinions from local residents	Correspondance by PMU
1	**My Dong Ward** • Cha La canal sections passing My Dong ward is a low area, where suffered discharged water and garbage from the upstream, and suffered water from the downstream (Dong Hai ward) during the high tidal periods. • We are very glad as the project will address the situation of flood discharge affected residents' houses. • We propose for a more appropriate compensation than the policy applied by the provincial government. • Have fund to build WC system • PMU should study on a wastewater treatment plan from the beginning • Due to the traffic flow exceeds the roads capacity, it's recommended to construct 5m-wide roads and improving road edges to ensure traffic safety • Consider planting trees, working on the lighting systems after the project completed • Coordinate better with local authorities and communities in the project areas	• PMU agrees, records and obtains the comments of the residents • World Bank is the sponsor for the project to address non-profit environmental issues, to help the local in upgrading, cleaning canals and widening roads • WB policies are based on the demand, urgency priority for the whole city • In the coming time, PMU will conduct a survey about connecting to the sewage system, so that the wastewater treatment plants will operate more efficiently
2	**Phu Ha Ward** • Totally agrees to support the project because it helps changing is the drawbacks of the 1993 planning which led to the current environmental pollution • Construction of the dyke is not enough to solve the flooding situation. The canal bed should be lower than the surface residential area of 1m at least • Should have a plan to prevent the influx of garbage every year, • Should put an end to the situation of cleaning canal and then throw the garbage back again • It's recommended to make box culverts • The compensation should comply with the state policy and WB's policy, to avoid having the residents waiting too long • There are some vulnerable locations on the area such as: • At Ong Cop canal, the water is drained which raises mosquitoes in the rainy season • Ha Nhi field: the bed of canal is polluted • Flooding in the city downtown, at 09/73 Hoang Hoa Tham Street • Implement mitigation measures to reduce dust during the construction such as spray water regularly • Clean up after construction, do not discharge solid waste on the area, • Seriously comply with the environmental protection measures during the construction	• PMU agrees, records and obtains the comments of the residents • PMU also has plans to make the canal wall of 2m height for rain water drainage mainly
3	**Kinh Dinh Ward**	

No	Opinions from local residents	Correspondance by PMU
	• It's recommended to review the environmental quality of Nhi Phuoc canal, • Rubbish is stuck at the barrier a lot , which was not collected regularly. This make rain water cannot flow and creating bad smells • There should have waste separation bins • During the implementation of the project, it's suggested to supervise the process along with the local residents • Arrange a meeting to inform specific information to the local residents in the project area • Some vulnerable locations - 16/4 To Hieu Street: concrete road is only on one side of the road. The other side is not concreted yet - From To Hieu Street to Ngo Gia Tu Street: 2 sides of the road are occupied	• PMU agrees, records and obtains the comments of the residents • Waste classification will be done in the fourth phase of the project: Technical assistance and institutional reform
4	**Tan Tai Ward** • The residents pay concerns to the scope of the project so that they can calculate the impact level to their own family. • How is the specification of the canal design? • Where is the canal expanded towards? • Currently the volume of irrigation water is inadequate. It's suggested that the bed of the canal should not be expanded, but just keep the current width of 2.5m	• PMU agrees, records and obtains the comments of the residents • The project is currently in the prefeasibility stage, so we haven't got a specific design solutions yet. We are pleased to sum up the comments of the residents to offer tailored solutions
5	**My Binh Ward** • Because the project is planned on the entire area of Block 2, and the local residents here are mainly poor farmers, therefore, PMU should have an appropriate resettlement policy to solve unemployment for them • The compensation money for taking their land cannot afford to buy another slot from the state	• The purpose of career changing is aims at creating more jobs for residents of working age, vocational training, employment and labor export • All construction categories are given a number of plans to choose the most optimal one • Mitigation measures such as employment support, way to use money effectively
6	**Dai Son Ward** • Residents highly agree to support the project, including those have lost their lands, as long as the living environment is improved, clean, beautiful and have adequate welfare facilities • Cha La canal have a low volume of irrigation water. During the dry season, the water do not flow. It's suggested for PMU to review carefully to avoid waste of money • Cha La canal have an uneven slope, which requires the bottom to be flatten	• PMU agrees, records and obtains the comments of the residents • PMU has been implementing a review on the canal to draw out the most optimal plan • Regarding the issue of compensation: WB is interested in residents' life and social security and will work out the most appropriate policy

No	Opinions from local residents	Correspondance by PMU
7	**Bao An Ward** • Residents are excited about the project implementation and permanent improvement of canal and environmental sanitation. It's proposed that PMU should publish specific information about the scope of the project area, so that they will have preparation and create favorable conditions for the project , • Creating favorable conditions for households along the area that have been compensated at a fixed price 3 year • Regarding mitigation measures, it's suggested that the surface of the canal should be smaller than 4m and the height should be increased • The upstream is the major source of pollution and make it difficult for construction. It's suggested that the project should reconstruct all these locations	• PMU agrees, records and obtains the comments of the residents
8	**Dong Hai Ward** • Residents totally agree with the project and support for early implementation, • PMU should calculate a plan to accelerate progress, • There should be a reasonable compensation policy, avoid enforcement and dissatisfactory among the local residents • Is the quality of treated wastewater good enough?	• PMU agrees, records and obtains the comments of the residents • PMU will provide full information and policies to the residents so that they will understand and support for the project
9	**My Hai Ward** • Residents highly agree to support the project, and support to early implementation to improve environmental sanitation, even the project may take their land, however PMU need to calculate the best plan to keep their house. • The residents hope the project will be synchronized implemented, thoroughly and completely constructed, • During the construction phase, the Ward People's Committee should hold a meeting with the local residents to take their comments, and avoid affecting people's travel	• PMU agrees, records and obtains the comments of the residents
10	**Phuoc My Ward** • There are many flooded locations on the area of the Ward, where rain water flows into residents' house just after a shower • If the project plans to have land acquisition, it's suggested to have a rehabilitation for residents • Residents raised a question: Is it necessary to construct a 20m-wide road?	• PMU agrees, records and obtains the comments of the residents • Currently the project is in the stage of pre-feasibility study, PMU will continue to offer the most reasonable plans to ensure priority categories for the whole city

7.2.2. Results of Second public Consultation Stage

a) Opinions from Ward/Commune People's Committee (2nd stage)

Table 7.3. Summary of the local authorities' opinions in the 2nd stage consultation

No	Local authorities' opinions	Correspondance by PMU
1	**Bao An Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: Local residents have no comments • Regarding mitigation measures against negative impacts of the project on the environment: Local residents have no comments • Recommendations for project owners: About the improvement of Ong Co irrigation canal, it's recommended that the improvement should be taken in the whole canal from Lam Cam dam to the end of the canal (in Bao An ward) to prevent the flow slows down at the area of Bao An ward, and to avoid landslides in the rainy season	• PMU agrees, records and obtains the comments of Bao An Ward People's Committee
2	**Thanh Hai Commune** • Regarding the negative impact of the project on the natural environment, economic - social and public health: When the project is completed and goes into operation, it will bring a brand new, clean, well-organized and environmental-friendly appearance to the city. Besides, it helps paving for the development of agriculture in the region. Particularly, the transportation of goods and agricultural products will be much more convenient. • Regarding mitigation measures against negative impacts of the project on the environment: Through the study of mitigation measures as introduced in the EIA, Thanh Hai Communal People's Committee agreed on the contents and mitigations measures of the project on the natural environment, economic - social and public health. However, further measures should be taken to regulate the irrigation flow for the cultivation in the project area. • Recommendations for project owners: During the project implementation, it's suggested for the investors to pay attention and support for the affected households whose land is acquired and those who are cultivating on the project area to gain their acquiescence.	• PMU agrees, records and obtains the comments of Thanh Hai Commune People's Committee • PMU have figured out irrigation solutions for the cultivation in the project area
3	**My Huong Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: After the construction is completed and goes into operation, the sewer system has to ensure the regular flow and should be hydraulic guaranteed in flood season to avoid cracking, affecting the environment and residents' daily life. • Regarding mitigation measures against negative impacts of the project on the environment: • Agree on the proposed measures of the project	• PMU agrees, records and obtains the comments of the Ward People's Committee • The cleaning for sewer system to ensure the flow and environmental sanitation had been calculated and designed appropriately.

No	Local authorities' opinions	Correspondance by PMU
	• Recommendations for project owners: It's suggested that investors should survey and prepare the route for sewer system, to ensure that the system must have drain and lids for cleaning, monitoring the flow and troubleshooting arising problems, ensuring sanitation at the residential area.	
4	**Do Vinh Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: Agree with the EIA of the project. • Regarding mitigation measures against negative impacts of the project on the environment: Agree with the mitigation measures of the project. • Recommendations for project owners: • It's required to fully implement the commitments in environment protection, addressing pollution, and thorough handling of hazardous waste during the construction. • Pay attention to the setting range of treatment machines, security and order, traffic safety during the transportation and construction. • Need adequate compensation to the farmers for land acquisition and resolve all questions thoroughly (if any)	• PMU agrees, records and obtains the comments of the Ward People's Committee • We will collect all the comment of the local people to figure out the most suitable design and solutions.
5	**Dao Long Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: Summary document has specified the environmental impact in every phase of the project • Regarding mitigation measures against negative impacts of the project on the environment: Agrees with the mitigation measures for each impact of the report • Recommendations for project owners: • Project owners must implement the set out measures to cope with the impact as stated in the report, to minimize the environmental impacts and avoid affecting local residents' lives. To comply with the commitments undertaken by the investors. • Fully prepared all aspects to implement the project and put into operation soon.	• PMU agrees, records and obtains the comments of the Ward People's Committee • All construction categories are given a number of plans to select the most optimal one. • Mitigation measure such as: Support in solving unemployment, how to invest money effectively
6	**Dai Son Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: The project has fully evaluated the negative impact on the environment, socio-economic and public health • Regarding mitigation measures against negative impacts of the project on the environment: all the mitigation measures are relatively completed. • Recommendations for project owners: • Pay attention to the possibility of rain water drainage and water supply for agricultural production • Minimize flooding locations	• PMU agrees, records and obtains the comments of the Ward People's Committee

No	Local authorities' opinions	Correspondance by PMU
7	**Phu Ha Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: In the process of upgrading Ong Co canal, the canal area will be expanded, which will affect residents 'houses, surrounding trees, and create more dust and noise from materials transporting vehicles. Therefore, the project will have negatively impact on the economic - social and public health. • Regarding mitigation measures against negative impacts of the project on the environment: During the construction, water spray is necessary to reduce dust. • Recommendations for project owners: During the construction, it is suggested that the Board of Capacity Planning should ensure all rights for the people, labor safety and no traffic jams	• PMU agrees, records and obtains the comments of the Ward People's Committee
8	**Thanh Son Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: Taking residents' comment about ecologic environment, physical environment, traditional culture and construction activities • Regarding mitigation measures against negative impacts of the project on the environment: Ensuring the construction follows the approved project. • Recommendations for project owners: Must ensure conformity with traditional cultural and local community activities	• PMU agrees, records and obtains the comments of the Ward People's Committee
9	**My Hai Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: • Create an adequate environment • Minimize waste disposal issues to the surrounding environment • Regarding mitigation measures against negative impacts of the project on the environment: • Adequate drainage when it is raining or flooding • Ensure environment hygiene • Recommendations for project owners: Early implement the project to bring benefit for the people	• PMU agrees, records and obtains the comments of the Ward People's Committee
10	**My Dong Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: Agrees with the contents stated in the document • Regarding mitigation measures against negative impacts of the project on the environment: Should comply with the mitigation measures to protect the environment as stated in the report • Recommendations for project owners: It's necessary to identify the new construction location of Dong Hai eco-lake (not upgrading lake). During the construction, it's suggested to combine with the construction planning of Dong Hai residential area to avoid consequences later	• PMU agrees, records and obtains the comments of the Ward People's Committee

No	Local authorities' opinions	Correspondance by PMU
11	**Dong Hai Ward** • Regarding the negative impact of the project on the natural environment, economic - social and public health: • Causing smog, regional flooding and traffic jam • Causing epidemics due to air and water pollution • May cause traffic accidents during the construction of works blocking the roads • Regarding mitigation measures against negative impacts of the project on the environment: • Take measures to prevent flooding during the construction of the drainage canal • There are signs, notices for local people at places with possible landslide • Recommendations for project owners: Public project procedures, and all the records of the project such as design portfolio, scope of work and expected implementation duration must be sent to local government to keep track of the process.	• PMU agrees, records and obtains the comments of the Ward People's Committee
12	**Kinh Dinh Ward** • The Kinh Dinh Communal People's Committee totally agree with the content of EIA documents of the project and have no further comments./.	• PMU agrees, records and obtains the comments of the Ward People's Committee

b) Opinions from Local Affected Residents in the Second Public Consultation Stage

Table 7.4. Summary of opinions from local residents during the second public consultation meetings

No	Opinions from local residents	Correspondance by PMU
1	**Bao An Ward** The community's ideas of social and environmental impact assessment • The residents in the region agreed to take part in implementing the project The community's comments on the positive environmental impacts • Pre-construction: Notifying the project owners, the compensation and assistance policies, and the benefits that the project will bring to the beneficiaries. • During construction: Commit to implementing fully in the right components and progress of project. • After construction: Clean up waste and materials that are discharged from the construction process The community's ideas of the potential adverse effects	• Agree and obtain comments of the residents • WB is the project donor which deals with environmental issues to support the localities in improving, dredging canals and extending roads • WB develops the policies on the basis

No	Opinions from local residents	Correspondance by PMU
	• Pre-construction: Notify the project owners, the compensation and assistance policies, and the benefits that the project will bring to the beneficiaries. • During construction: Commit to implementing fully in the right components and progress of project. • Post-construction: Remove waste and materials that are discharged from the construction process The community's comments on the compensation, assistance and resettlement • The affected households select compensation payment methods: receiving cash for compensation; receiving resettlement land. • The affected households select the preferential alternatives of resettlement: compensation for land users with the replacement cost /market value; with favorable conditions for business in the resettlement sites. • For graves to be relocated: The affected households select to find a relocation land by themselves. • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	of more urgent needs and priorities for the whole city
2	**Dao Long Ward** The community's ideas of social-environmental impact assessment • The residents in the region agreed to take part in implementing the project • The community's comments on positive environmental impacts • Pre-construction: widely notify the residents to reach the broad consensus • During construction: Agree with the items in the report The community's comments on the potential negative effects • Pre-construction: Guarantee traffic issues to prevent congestion and accidents from happening • During construction: Caution to the flood in case of heavy rain to ensure the safety of people in the night. • Post-construction: Carrying out the corrective measures as the employer recommended in the report The community's comments on compensation, assistance and resettlement • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	• PMU agrees and gets the comments of residents • PMU also plans to segregate traffic and build temporary bridges for the people's movement
3	**Do Vinh Ward** The community's comments on social and environmental impact assessment • The residents and community in the project area agreed to carrying out mitigation measures adverse environmental impacts • The residents and community in the project area agreed to take part in monitoring the compliance with environmental management	PMU agrees, obtains the comments of residents and give thanks to the residents for helping PMU implement the project

No	Opinions from local residents	Correspondance by PMU
	plans during pre-construction, construction and post-construction phases. The community's comments on compensation, assistance and resettlement • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	
4	**Dong Hai Ward** The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project • The residents in the project area agreed to implement mitigation measures for environmental impacts • The residents in the project area agreed to take part in monitoring the compliance with environmental management plans during pre-construction, construction and post-construction phases. The community's comments on compensation, assistance and resettlement • The affected households select compensation payment methods: receiving cash for compensation and being granted loans • The affected households select the preferential alternatives of resettlement: compensation for land users with the replacement cost /market value; with favorable conditions for business in the resettlement sites. • For graves to be relocated: The affected households select to find a relocation land by themselves. • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	PMU agrees, obtains and summarize the comments of residents to adopt the most appropriate plans. Mitigating the damage to the people and their properties.
5	**Kinh Dinh Ward** The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project • The residents and community in the project area agreed to carrying out mitigation measures for environmental impacts • The residents in the project area agreed to take part in monitoring the compliance with environmental management plans during pre-construction, construction and post-construction phases. The community's comments on compensation, assistance and resettlement • The affected households select compensation payment methods: receiving cash for compensation; receiving resettlement area from the project. • Income restoration alternatives: assistance in seeking jobs, occupational training, loans • The affected households select the preferential alternatives of resettlement: compensation for land users with the replacement	• PMU agrees and obtains the comments of the residents • The aims of career shift is to create jobs for the residents in working age to get vocational training or labor export.

No	Opinions from local residents	Correspondance by PMU
	cost /market value; resettlement on the remaining land of their family; with favorable conditions for business in the resettlement sites; suitable infrastructure of resettlement areas; resettlement sites with healthy environment • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	
6	**My Binh Ward** The community's comments on social and environmental impact assessment • With 21 out of 29 households, the residents in the area agreed to take part in carrying out the project	PMU agrees and obtains comments of the Communal People's Committees
7	**My Dong Ward** Meeting on July 12th 2016 The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project • The community's comments on the positive environmental impacts • Pre-construction: Notifying of the detailed plans on environmental protection measures • During construction: Notifying the local authorities and people of potential environmental issues • Post-construction: Timely preventing the adverse impacts on the environment • The residents and community in the project area agreed to carrying out mitigation measures for environmental impacts • The residents in the project area agreed to take part in monitoring the compliance with environmental management plans during pre-construction, construction and post-construction phases. The community's comments on compensation, assistance and resettlement • The affected households select the compensation payment methods: receiving cash for compensation • Income restoration alternatives: Be granted a loan • The households select the preferential methods of resettlement: Resettlement sites have appropriate infrastructure • For graves to be relocated: The affected households select to find a relocation land by themselves. • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	• PMU agrees and obtains comments of the Communal People's Committees. • Compensation issues: WB points out the best frame of policy, with much attention to the lives, social welfare of the people
8	**My Hai Ward** The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project	• PMU agrees, records and obtains the comments of residents.

No	Opinions from local residents	Correspondance by PMU
	• The community's comments on the positive environmental impacts • Pre-construction: Conduct a survey on the site which are prepared to implement the project • During construction: Protect the environment of the surrounding areas • Post-construction: Ensure good management and utilization • The community's opinion on the potential negative impacts • Pre-construction: Notifying of the period when the project will be implemented • During construction: Guarantee the protection of environment and water drainage to avoid flooding • Post-construction: Good water drainage • The residents and community in the project area agreed to carrying out mitigation measures for environmental impacts • The residents in the project area agreed to take part in monitoring the compliance with environmental management plans during pre-construction, construction and post-construction phases. The community's comments on compensation, assistance and resettlement • The affected households select compensation payment methods: receiving cash for compensation; receiving resettlement sites from the project. • The affected households select the preferential alternatives of resettlement: resettlement right on the remaining land of their family • For graves to be relocated: The households select to move graves to the shared cemetery • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	• PMU will fully provide the residents with the information and policies to make them be aware of the project and support it.
9	**My Huong Ward** The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project • The community's comments on the positive environmental impacts • Post-construction: Agree with the system of closed canals to ensure the conservation of ecological environment The community's opinion on the potential negative impacts • During construction: Ensure the environmental sanitation (waste, water penetration into houses may pollute the residential areas) • Post-construction: Water flow in the canal is smooth enough to prevent congestion and deposited waste from causing unpleasant odor? • The residents and community in the project area agreed to carrying out mitigation measures for environmental impacts	• PMU agrees, records and obtains the comments of residents. • PMU will fully provide the residents with the information and policies to make them be aware of the project and support it.

No	Opinions from local residents	Correspondance by PMU
	• The residents in the project area agreed to take part in monitoring the compliance with environmental management plans during pre-construction, construction and post-construction phases.	
10	**Phu Ha Ward** The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project The community's comments on the positive environmental impacts • During construction: For canal construction projects releasing unpleasant odor, PMU needs take necessary steps to prevent the odor from emitting from that. • The residents and community in the project area agreed to carrying out mitigation measures for environmental impacts • The residents in the project area agreed to take part in monitoring the compliance with environmental management plans during pre-construction, construction and post-construction phases. The community's comments on compensation, assistance and resettlement • The affected households select compensation payment methods: receiving cash for compensation; receiving resettlement sites from the project. • Income restoration alternatives: assistance in seeking job, occupational training, loans • The affected households select the preferential alternatives of resettlement: compensation for land users with the replacement cost /market value • For graves to be relocated: The affected households select to find a relocation site by themselves • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	• PMU agrees, records and obtains the comments of residents. • PMU will fully provide the residents with the information and policies to make them be aware of the project and support it
11	**Phuoc My Ward** The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project The community's comments on compensation, assistance and resettlement • For graves to be relocated: With 15 out of 17 households, the affected households select to find a relocation site by themselves	• PMU agrees, records and obtains the comments of residents. • PMU will fully provide the residents with the information and policies to make them be aware of the project and support it.
12	**Tan Tai Ward** The community's comments on social and environmental impact assessment • No more comments were added	PMU gives thanks to the people for agreeing that the project should be implemented

No	Opinions from local residents	Correspondance by PMU
	The community's comments on compensation, assistance and resettlement • No more comments were added	
13	**Thanh Hai communes** The community's comments on social and environmental impact assessment • The residents and community in the project area agreed to carrying out mitigation measures for environmental impacts • The residents in the project area agreed to take part in monitoring the compliance with environmental management plans during pre-construction, construction and post-construction phases. The community's comments on compensation, assistance and resettlement • The affected households select compensation payment methods: receiving cash for compensation; receiving resettlement sites from the project. • For graves to be relocated: The affected households select to find relocation site by themselves	• PMU agrees, records and obtains the comments of residents. • The project is now in the period of feasibility study, so PMU continues studying it to find out the best alternatives in order to ensure the prioritized items for the whole city
14	**Thanh Son Ward** The community's comments on social and environmental impact assessment • The residents in the area agreed to take part in carrying out the project The community's comments on the positive environmental impacts • Pre-construction: Get public comments on the ecological environment, physical environment, traditional culture and community activities • During construction: Ensure the quality of construction in accordance with the plan • Post-construction: Restore society and ecological environment in the approved plan • The community's comments on the potential negative impacts • Pre-construction: Conduct a survey on the social environment, take use of existing physical and ecological environment so as to recover and maintain traditional culture in the community • Post-construction: Ensure the suitability with the traditional culture and community activities at the locality The community's comments on compensation, assistance and resettlement • For graves to be relocated: The households select to move graves to the shared cemetery • The affected households select compensation payment methods: receiving cash for compensation; receiving resettlement area from the project. • The affected households select the preferential alternatives of resettlement: compensation for land users with the replacement	• PMU agrees and obtains comments of the Communal People's Committees • WB develops the policies on the basis of more urgent needs and priorities for the whole city

No	Opinions from local residents	Correspondance by PMU
	cost /market value; with favorable conditions for business in the resettlement sites • The residents in the project area agreed to take part in mitigation measures for adverse impacts of the project	
15	**Van Hai Ward** The community's comments on social and environmental impact assessment • No more comments were added The community's comments on compensation, assistance and resettlement • No more comments were added	PMU agrees and confirms the people's agreement that the project should be implemented
16	**Dai Son Ward** The community's comments on social and environmental impact assessment • No more comments were added The community's comments on compensation, assistance and resettlement • No more comments were added	PMU agrees and confirms the people's agreement that the project should be implemented

7.3. PROJECT INFORMATION DISCLOSURE

First draft ESIA had been announced at the office of Phan Rang Thap Cham City People's Committee and the headquarters of all ward/commune level People's Committee since the implementation 2nd public consultation stage in early July 2016. Therefore, the local people can approach and continue to contribute their comments. The provided comments would be sent to the PMU's office in Phan Rang Thap Cham city. The final draft report was disclosured locally at ward/commune level on 6th October 2016.

The final draft ESIA was also sent to the World Bank office in Vietnam and disclosured on the World Bank's Infoshop on 6th October 2016.

After getting approved, hard copies of the report will be sent to the PR-TC City and ward/commune level People's Committees' offices in the project area for being publicly posted during implementation of the project. During the construction phase of the project, the report should be always available at the construction site's office of contractors for implementation and supervision.

Some examples of the public consultation meetings.

CONCLUSIONS, RECOMMENDATIONS AND COMMITMENT

I. CONCLUSIONS

1) In accordance with the name "Project on Environmental sustainability", Project on Environmental Sustainability in Phan Rang - Thap Cham City is expected to bring enormous benefits of improvement in sanitation and environmental landscape in a sustainable way for the city after being put into operation. The main environmental benefits that the project will bring about include:
   - Improve surface water drainage capacity, minimizing the number of flooding spots and enhancing freshwater storage for the city;
   - Strengthen waste water collection and treatment capacity, contributing to improve water, soil and air;
   - Strengthen waste collection capacity and efficiency;
   - Improve the sanitation of schools and public areas;
   - Improve traffic conditions, environmental sanitation and urban landscape;
   - Improve project control, management and operation capacity for PMU, government departments, public institutions and project stakeholders; and
   - Mitigate environmental and social impacts on affected people due to the implementation of the project.
2) This is one of environmentally-friendly projects among investment projects of Phan Rang - Thap Cham city contributing to the improvement of living conditions, awareness raisingof environmental protection of the people. Therefore, the project meets the expectation of the people for a clean living environment and contributes to beautifying the urban landscape.
3) In the design stage of the Project, technical plans were proposed for analysis and selection of the best one to minimize the social and environmental impacts during the implementation stages. However, it is impossible to avoid certain negative impacts of the project on the naturual and social environment during the site clearance and construction phases.
4) Chapter 4 of the report basically identified and fully evaluate potential impacts on the natural and social environment in all stages including preparation, construction and operation of the Project. Major negative environmental impacts of the project mainly occur in the site clearance and construction phases. Chapter 5 of the report proposed effective and feasiblemitigation measures respectively.
5) Environmental problems arising in the site clearance process is not big; however,the arising permanent land acquisition of many households could lead to potential social negative impacts. Mitigation measures for such impacts were proposed through satisfactory compensation according to replaced unit prices; construction of new settlement areas with full technical, environmental and social infrastructure at a convinient location to address the relocation and resettlement needs of the project; support in the relocation implementation; design and implementation of programs to support career change and recovery of income and so on.
6) Main environmental problems arising during the site clearance and construction phases are mostly temporary and mitigable, including:
   - Impacts on surface water due to overflowed rainwater, domestic sewage and constructionw wastewater;

- Impacts on greenery due to tree cutting and site clearance;
- Impacts due to the generation of construction solid waste and domestic solid waste;
- Impacts on traffic environment due to increase in transportation vehicles on routs and generation of dust, exhaust and noise;
- Negative impacts on people's daily activities, business, social security and order at the construction site;
- In addition, during the construction phase of the project,some risks related to landslides, traffic safety and labor safety may come up, some social problems may arise and affect cultural and religious activities at some sensitive locations.
- Possible resonance impacts of the Project mainly relate to traffic conflicts and overuse of power and water supply and security and order services.

7) Environmental impactsin the operation phase are generally beneficial to the environment. However, at the location of wastewater treatment plants and sewage pumping stations, there are risks of negative impacts on the air and water and generation of sludge and solid waste. Risks of impactsare not at high level and can be managed and mitigated.
8) ESIA report also proposed a reasonable environmental and social management and monitoring program for implementation stages of the Project. The report also identified the responsibilities of stakeholders, funding sources for the implementation of mitigation measures, management and environmental protection in implementation stages of the Project..
9) With strict adherence to the laws and regulations on environmental protection and strict implementation of management and mitigation measures proposedin this report, negative environmental impacts will be controlled and the Project will bring many great benefits for the local environment, health, and socio- economy.

II. RECOMMENDATIONS

1) State management agencies of environment of Phan Rang – Thap Cham city support the Project owner to conduct training for capacity improvement of officers and workers in management and operation; organizing communication activities and community eduation to raise the awareness of environmental protection of the local people.
2) The close coordination between the government and local people and the stakeholders during the project implementation, from site clearance, supervision of construction activities, management of security and order in the area and so on will be critical conditions contributing to the success of the Project. In addition, to reduce the conflicts causing resonance impacts among different projects at the same time in the city, it is recommended that other Project Management Units in the area closely coordinate in exchanging information on construction schedules to make necessary adjustments and minimize risks of conflicts.
3) In the course of the Project implementation, the PMU recommend Ninh Thuan Provincial People's Committee and Phan Rang - Thap Cham city People's Committee to instruct related departments, agencies and divisions to closely coordinate in environmental protection throughout the project implementation process from the preparation stage, construction phase to the operation of projectitems.

ANNEXES

ANNEX 1- DUE DILIGENCE FOR QUARRIES AND BORROW PITS

1. Hòn Giài Quarry

Address: Nhon So commune, Ninh Son district, Ninh Thuan province

Person in charge of: Hồ Như Khương Mobile: 0937383963

No	Main content	Description
1	General information	Time put into operation: 2002 Total mining area: 14.8 ha Mining capacity: 200,000 m^3/year Mining depth: From FL+75 to FL+25 Documents licensed by the State: Mining license, Decision of EIA approval, blasting license, Certificate of security and order… (attached with file) Mining technology: Removing topsoil - blasting - mining–transporting stone to crushing and screening system–classifying stone - Sale and consumption.
2	Main environmental issue	Dust: Generated from blasting activities, mining, transport and processing. Noise: Generated from operation of crushing and screening system and transport vehicles Blasting safety: Dust, noise, vibration Occupation safety: possibly occurring due to incompliance with technical and labour safety procedure. Distance to residential area: 800m Buffer zone of trees: planted fully Solid waste: Generated from removing topsoil. Domestic waste: raised by workers' daily activities.
	Equipment/machineries	The number: Type of machine: 04 Drilling machines, 05 BMK5 drillings, 02 excavators, 02 Power shovels, 05 12-ton truck, 02 crushing and screening systems(150 tons/hour), 02 HITACHI air compressor, …
3	Pollution control measures	Dust: - Installing 03 tanks for water spraying, 03 pumping motors (2Hp and 4Hp types) at 03 crushing and screening complexes and 01 water reservoir with volume of 4,500m^3 - Planting 1,000 trees and 520 trees respectively at the processing area and office area - Arrange tank truck (3m^3) for watering to reduce dust along transport road. Noise: Frequently maintain and repair the screening and crushing system, truck's engine to reduce noise. Blasting safety: - Blasting Licence no. 104/GP-SCT dated 17 August, 2015by Department of Trade

		- Explosive materials must be approved by authorities before using. Occupational safety: - Setup regulations of occupational safety at office. - Equip labour protective equipment such as protective clothing, hats, gloves, masks,… - Workers directly operating construction machines must be trained and practice the operation properly in case of incidents likely occurring and must always be present at their working places for technically proper operation and inspection. Solid waste: Arrange a disposal area (3,000 m^2) to contain solid waste generated from removing topsoil Domestic waste: Set up 4 dustbins (100litre/dustbin) to contain domestic waste generated from workers' daily activities. These dustbins then would be transported to landfill at Nha Ho landfill for treatment (frequency: every one week) Monitoring activities: Periodically monitor environmental quality at the quarry area and report to Ninh Son District PC.
4	Hazardous waste	Volume: 300 litres of oil for engines, gear boxes and lubrication per year (Code: 17 02 03) Collection and treatment unit: re-use for machine lubrication
5	Deposit at Environmental Protection Fund	Duration: 15 years Amount: 3,762,242,628 VND, completed prior to31 January. Implementation option/responsibility: The scheme of environmental rehabilitation and expansion of mining capacity of Hòn Giài quarry was approved by Ninh Thuan PPC's Chairman according to Decision no.2429/QD-UBND dated 28 November, 2013
6	Blasting	Licensing authority: Ninh Thuan Industry and Trade Department Information disclosure method for communities:: - Setting up boundary warning signs at blasting area - Informing blasting signals: red flags, siren blasts + Charging explosives: Put red flags at the highest position + Preparing for blasting: 3 long siren blasts + Blasting: 2 long siren blasts + All-clear signal: 1 long siren blast - Blasting time: + Morning: 11h00 - 13h30 + Afternoon: 16h00 - 17h30
7	Workers and heath	Number of workers: 30 persons Labour protective equipment: Protective clothing, shoes, hats, gloves, masks, goggles, welding masks, earplugs Periodical medical checkup: Once a year at the Healthcare Centre of Ninh Thuan Province Periodical labour safety training: twice a year. Trainer: Labour Sanitation and Safety Board of the Company. HIV/AIDS awareness enhancement: once a year, propagated with periodical medical checkup.
8	EIA report, scheme of environmental rehabilitation	Approved by Ninh Thuan PPC's Chairman according to no. no.2429/QD-UBND dated 28 November, 2013

 Office area	 Hazardous warehouse
 Reservoir	 Stone crushing area
 Quarry area	

2. Nha Ho Sand Pit

Address: Nha Hố 3 hamlet, Nhơn Sơn commune, Ninh Sơn district, Ninh Thuận province

Person in charge of: Nguyễn Viết Minh Mobile: 0912690408

No	Main content	Description
1	General Information	Time put into operation: October, 2014 Total mining area: 4.56 ha Mining capacity: 10,000 m^3/year Mining depth: From 1.3m to 2m Documents licensed by the State: Mining license, Decision of environmental approval… (attached with file) Mining technology: Using excavator to load sand directly onto transport trucks
2	Main environmental issues	Dust: Generated from transport activities of trucks. Noise: Generated from excavator and transport trucks Blasting safety: None Occupation safety: possibly occurring due to incompliance with technical and labour safety procedure.

		Distance to residential area: at least 500m. Trees: Grow naturally. Solid waste: Generated from activities of trucks. Domestic waste: Arrange 03 dustbins (20 litre/dustbin) to contain domestic waste and transported by local environmental sanitation for treatment.
	Main equipment/ machine	Number of machines: 07 Type of machine: 0.7-09-m^3 excavator; 6 or 10-tons trucks
3	Pollution control measures	Dust: Use 3m^3tank truck for watering to reduce dust along transport route; Hire workers for cleaning up transport route. Noise: frequently maintaining the engines and truck engines to reduce noise. Blasting safety: none. Occupation safety: - Set up occupation safety regulations at office area. - Information disclosure and occupational safety knowledge to workers. - Equip labour protective equipment: protective clothing… - Workers directly operating construction machines must be trained and practice the operation properly. Solid waste: collected and treated. Domestic waste: collected and treated. Monitoring activities: Periodically monitor environmental quality at the sand mine and report to Ninh Son District PC
4	Hazardous waste	Volume: 50 litres of grease for engines, gear boxes and combined lubrication per year. Collection and treatment unit: re-use for machine lubrication of the excavator.
6	Blasting	None
7	Workers	Number of workers: 07 persons Labour protective equipment: Protective clothing, shoes, hats, gloves, masks, goggles, welding masks, earplugs Periodical medical checkup: Once a year at the Healthcare Centre of Ninh Thuan Province Periodical labour safety training: twice a year. Trainer: Labour Sanitation and Safety Board of the Company. HIV/AIDS awareness enhancement: once a year, propagated with periodical medical checkup. Auxiliary works: construct workers' camps at construction site
8	EIA report, scheme of environmental rehabilitation	- Commitment document of environmental protection approved by Ninh Son District PC according to Notice no.103/TB-UBND dated 22 April, 2014 - Scheme of environmental rehabilitation approved by DONRE according to Decision no. 2204/QD-STNMT dated 9 July 2014

3. Chà Bang Borrow Pit –VẠN PHÚ LỘC Company Ltd

Address: Phước Ninh commune, Thuận Nam district, Ninh Thuận province.

Person in charge of: Phạm Thúy Triều Mobile: 0949.700.799

No	Main content	Description
1	General Information	Legal documents: Permission of exploitation No. 45/GP-UBND date 30/06/2014; The pit reserve certificate No. 368/QĐ-UBND date 30/06/2014; EIA approval and environmental recovery project No. 1856/QĐ-UBND date 27/08/2015 of the Ninh Thuan PPC. Time put into operation: not yet Total mining area: 33.4 ha Mining capacity: 200,000 m^3/year Mining depth: From FL +64.4m to FL +95.77m Documents licensed by the State: Mining license no.45/GP-UBND dated 30 June, 2014; Decision of volume approval no. 368/QD-UBND dated 30 June, 2014; Decision of approval of EIA report and scheme of environmental rehabilitation no.27 August, 2015 of Ninh Thuan PPC Mining technology: based on terrain condition and design technology, the project would select the exploitation system appropriately
2	Main environmental issues	Dust: has not generated Noise: has not generated Blasting safety: None Occupation safety: None Distance to residential area: over4km. Trees: not yet. Solid waste: has not generated. Domestic waste: has not generated

	Main equipment/ machine	Number of machines: not yet. Type of machine:
3	Pollution control measures(expected)	Dust: Frequently spray water and plant trees to reduce dust. Noise: do not use old machines and limit mining activities in daytime. Blasting safety: none. Occupation safety: none Solid waste: none. Domestic waste: - Set up dustbins and classify waste into + Recyclable waste: nylon, plastic bags, cans + Non-recyclable waste: type of remaining wastes would be collected and transported by specialized unit Monitoring activities: Periodically monitor environmental quality at the soil mine and report to DONRE
4	Hazardous waste	Volume of hazardous waste: has not generated Collection and treatment unit:
5	Deposit at Environmental Protection Fund	Duration: 10 years. Amount: 782,773,000 VND. Implementation option/responsibility: complies with mitigation measures of EIA report and Scheme of environmental rehabilitation, which have been approved
6	Blasting	None
7	Workers	Number of workers: 10 persons Labour protective equipment: Protective clothing, shoes, hats, gloves, masks, goggles, welding masks, earplugs Periodical medical checkup: Once a year at the Healthcare Centre of Ninh Thuan Province Periodical labour safety training: twice a year. Trainer: Labour Sanitation and Safety Board of the Company. HIV/AIDS awareness enhancement: once a year, propagated with periodical medical checkup. Auxiliary works: construct workers' camps at construction site
8	EIA report, scheme of environmental rehabilitation	Approved from 27 August, /2015

Current status of soil mine

Trees planted to prevent erosion

ANNEX 2- CCSEP PHAN RANG DREDGED MATERIALS MANAGEMENT PLAN

1. Location of Dredging, Volume and Characteristics of Dredged Materials

The Project proposed to rehabilitate and expand the existing canals including Tan Tai, Cha La, Dong Nam, Nhi Phuoc, TH5 canals and the Dong Hai lake. The contractors will carry out both dredging of the parts underwater and excavation of the soil, including top soil, on the embankments.

It is estimated that approximately 170,000 m^3 of dredged materials will be generated during the implementation of Phan Rang CCSEP Sub-project. The estimated volume of dredged and excavated materials of each item are listed in the Table 1 below.

Table 1 –Volume of Dredged Materials

Item	Top soil	Dredging materials	Excavation	As contents exceed standard*	Saline
Tan Tai Canal	0	21,545	362,427		
TT1		14,427		14,427	-
TT2		-		-	-
TT3		4,147		-	-
TT4		1,264		-	-
TT5		726		-	-
TT6		982		-	-
HTK road	3,452	4,320	9,362		
Lane 150	3,490	8,117	8,291		
Resettlement site	403	36,084	924		
Đông Nam canal	1,288	-	41,607		
Chà Là canal	7,224	35,314	240,838		
CL2		3,366			
CL3		929			
CL4		8,170			
CL5		9,415			
CL6		13,415			13,415
Nhị Phước canal	0	1,538	62,105		
NP1		84			
NP2		637			
NP3		439			
NP4		378			

TH5 canal	178	662	3210		
Đông Hải lake	0	3,089	59,658		62,731
Total	16035	169048	788422	14,427,	76,146
*QCVN03-MT:2015/BTNMT for agricultural soil, allowable limit is 15 mg/kg, tested results was 18 mg/kg					

According to baseline data provided in Chapter 2 of the ESIA, the sludge in the Tan Tai and Cha La has been sediment and contaminated. Particularly, in the Tan Tai canal, the sediment layer is 70-80 cm thick. Tested coliforms concentrations in the Tan Tai canal was from 46,000 to 460,000,000 MPN/100 ml, 4,600 in Dong Hai lake (allowable limit is 75,000). The sediments and sludge at the two sections of the Cha La canal, the CL5 and CL6, and the Dong Hai lake is saline with test results shown in Chapter 2 of ESIA as below

Table 2 –Volume of Dredged Materials

Location	Soil Salinity (mg/kg)	Water Salinity (‰)
Dong Hai Lake	3986	24.7
End section of the Cha la	2500	Not measured
Middle section of the Cha La (end of CL3)	65.7	0.29

2. Final Disposal Site

As canal and lake dredging is combined with embankment lining and road side construction, the data in table 1 also indicate the volumes of top soil and excavated materials, which is 16,000 m3, and which is approximately 788,400 m^3. It is noted that among the dredged materials, 14,427m3 from the first section of the Tan Tai canal may have As content exceeding QCVN 03 (one sample tested, at 17.7 mg/kg), and 76,146 m^3 is saline.

According to the feasibility study, 15,877 m^3 of saline dredged materials will be reused for backfilling on-site. Therefore, the total amount of saline materials from Dong Hai lake that will be disposed off at disposal site will be 62,731 – 15,877 = 46,854 m^3. Together with 13,415 m^3 of saline sludge from Section 6 of the Cha La canal, the total amount of saline materials to be disposed off is 60,269 m^3.

At the meetings at the meeting between CCSEP PMU with DONRE, DARD, DOC, CPC, Dong Hai CPC, Nam Thanh and Thanh Dong companies (urban developer), which was concluded that that all top soil, and materials that is saline or having arsenic contents exceeding standards for agricultural land will be disposed off in Nam Thanh. The representative of Nam Thanh also have confirmed that they can accept unlimited amount of top soil.

The excavated materials will be finally disposed off at sites and with conditions described below:

- All neutral dredged materials will be disposed off at the planned Northeast and Northwest Urban area in Phan Rang city, which are up to 10 km from the construction sites
- All top soils, dredged materials that is saline of having arsenic contents exceeding standard will be disposed off at the Nam Thanh landfill. Materials will be finally reused for mixing with composted materials
- Disposal of saline materials or materials having arsenic contents exceeding standards at the Nam Thanh landfill will follow the applied conditions:

+ Saline materials is isolated from surface water runoff in the catchment to avoid adverse impacts on the existing irrigation canal which is 100 m away from the complex, or on the grassland where surface runoff is finally led to for infiltration into the sand

+ Dredged materials from Tan Tai canal (tested As contents at 18 mg/kg, which is 3 mg/kg or 20% higher than standard for agricultural land) must be loaded separately and the use must be monitored and recorded to ensure that the final composted product must meet QCVN 03 standard. This requirement is under control because the tested As contents in the soil at Nam Thanh was 2.31 mg/kg (Table 2.13, Chapter 2 of the ESIA), when mixing the soil at rate 80% from Tan Tai and 20% from Nam Hai, the composition will have As contents at 15 mg/kg, at standard. However the rate of the soil from Tan Tai should be lower taking into account safety factor

Although a separate management plan is prepared for the excavated materials ò the entire project, disposals of the excavated materials will also follow the above principles. Particularly for the top soil from the Central lake where arsenic content is similar to Tan Tai canal. During construction phase additional tests for deeper layer will also be carried out by the contractors.

3. Contractor's Dredging Management Plan

The Contractor is required to prepare a Contractor's Dredging Management Plan (CDMP) and submitted to the Environmental Consultant of the Construction Supervision team and the PMU Environmental Officer for review and approval. The CDMP will include, but not limited to the followings:

1. The Scope of Works in the Contract package, construction method and schedule
2. Volume and quality of water quality and sediment quality in the dredging area covered by the contract
3. Water users that may be affected by the dredging and embankment lining
4. Materials uploading and transportation method: indicate proposed route of the transport from the dredged site to the disposal area, time of operation, type of vehicles/trucks and proposed measures to reduce the leakage of the dredged materials from the transport trucks,
5. Contractors must prepare a response plan for polluted dredged materials transportation in case leakage of toxic sludge to the environment. The contractors are also responsible for providing fully necessary equipment/tools such brooms, showels... and training their staffs to respond to such incidents of toxic sludge leakage, if any.
6. Schedule to inform the nearby communities about the project, disclosure of name and contact number for possible complaints.
7. Potential social and environmental impacts, including the site-specific impacts and risks
8. Mitigation measures to address the potential impacts and risks. The mitigation measures should be proposed based on ESIA/ECOP, ESMP, SEMP, the potential impacts and mitigation measures presented in Section 4 and 5 of this Plan and the following requirements:
9. Environmental Quality Monitoring plan carried out by the contractor (particularly pH, DO, TSS, BOD, salinity etc. for water and heavy metals including pH, Hg, As, Cd, Cu, Pb, Zn and Cr, Organic Materials and Mineral Oils for sediments and soil
10. for soil and sediment). The number of samples taken will follow the following guidelines

Table3 . The number of Sediment samples

Volume of dredged (m3)	No of Sediment Samples
Up to 25,000	3
25,000 to 100,000	4-6

At least one water, soil and sediment sample must be taken for each contract package

- Consultation with affected community about the draft CDMP
- Excavated soil are separated from dredged materials from source. Excavated soils will be reused on-site and off-site as much as possible and transported to the nearest disposal site appraised under ESIA, or identified and approved during detail engineering design or construction phase;
- The mitigation measures are adequate to address the potential social and environmental impacts associated with various steps and activities, areas of influence and receptors of dredging, temporary storage, transportation and final disposal of the dredged materials.
- Field survey are carried out by the Contractor during the preparation of the CDMP in order to identify if there are additional sensitive receptors not identified previously under CCSEP and proposed additional site-specific mitigation measures accordingly.
- Contractor's environmental monitoring plan are included
- Commitments to carry out corrective actions when excessive pollution is determined, or when there are complaints about environmental pollution, social impacts from any stake holders.

11. Potential Impacts and Mitigation Measures for Dredging and Embankment lining

According to the annual canals maintenance and dredging plan from the Irrigation Works Operation Company Ltd, dredging of the canal system is conducted annually in period from April to May just after having harvested the Winter-Spring crop. This time period has the lowest demand of water for irrigation during the year, thus the dredging would have less impacts on the agricultural production. Therefore, canals dredging of the project is recommended to be carried out during April and May annually, if possible.

Impacts and Description	Mitigation Measures
AT DREDGING and TEMPORARY LOADING AREAS	
Interruption to drainage and irrigation service As the canals in the Project area irrigates over 1,000 ha of paddy rice, blocking of irrigation canals would seriously affect the farmers, their jobs, incomes and livelihood.	- Divert flow if successive construction method is applied - Carry out construction half of the canal width each time so as flow can be maintained - If the canal is widened significantly, carry out the works on the ground and existing embankment first, then move to the part underwater to ensure that flow is maintain all the time
Odour and air pollution, nuisance Decomposition of organic matters under anaerobic conditions generates strong odour-generated gases such as SO2, H2S, VOC etc.	- Inform the community at least one week before dredging is started - Minimise the duration of temporary loading of dredged materials on-site - temporary loading materials must be transported to the disposal site within 48 hours

Impacts and Description	Mitigation Measures
When the muds are disturbed and excavated, these gases are released much faster into the air. Exposure to odour pollution affect the health of workers, local residents and cause public nuisance	- Load the materials on-site tidily - Do not load the materials temporarily outside the construction corridor determined for each canal section - Avoid loading the sludge in populated residential areas or near public buildings such as kindergarten. Load the sludge as far from the houses and buildings as far as possible - Cover the temporary sludge loads when loading near sensitive receptors or longer than 48 hours unavoidable
Dust and nuisance Temporary loading of sludge at the construction site cause nuisance to the public Dry and wet mud may be dropped along the dredging area and on transportation route causing nuisance to the public and traffic safety risks	- Avoid temporary loading of dredged materials on-site - Dredged materials must be transported to the final disposal sites earliest possible and no later than 48 hours from dredging. - Use truck with water-tight tank to transport wet/damp dredged materials; - All trucks must be covered tightly before leaving construction site to minimise dust and mud dispersion along the road
Traffic Disturbance The placement and operation of dredging equipment and construction plants on the ground, temporary loading of the dredged materials may obstruct or disturb traffic and cause safety risks for the people travelling on the canal-side road, particularly on canal-crossing bridges which are usually very narrow	- Arrange worker to observe and direct excavators driver when traffic is busy - Avoid loading materials and equipment on bridges crossing canals that may disturb or block traffic
Damages to existing infrastructure and related services Existing irrigation ditch, intake, sluices, drainage pipes, sewers etc., power lines, cables etc. may be demolished or affected during canal expansion and embankment lining	- Rebuild the affected irrigation ditch, intake, sluices affected by the canal dredging and embankment lining - Coordinate with relevant authority for repair and connection of the disrupted service
Social Disturbance Concentration of workers and equipment, construction plants, temporary loading of materials and wastes, traffic disturbance, dusts and odour pollution etc. will disturb daily activities and the lives of local residents Conflicts may also be arisen if workers, waste, materials, equipment etc. are present outside the construction corridor	- Optimise construction duration schedule to maintain irrigation and drainage function but also minimising the impacts on the residents living along the canals - Inform the community at least one week before construction is started - Monitor to ensure that physical disturbances are within the construction corridors only - Contractor recruit local labours for simple works, brief them about project environmental and safety requirements before started working - Contractor register the list of workers who come from other localities to the commune at the construction site - Led the water leaked from wet/damp dredged materials going back to the canal, not to affect garden or agricultural land - Keep the areas to be disturb minimal

Impacts and Description	Mitigation Measures
	- Enforce workers to comply with codes of conducts
Landslide and soil subsiding risks at dredging area Relative deep excavation or cut and fills on the embankments that create slopes may lead to landslide and soil subsiding at the slops or excavated areas, particularly in rainy weather Deep excavation also cause risks to the existing buildings nearby, particularly the weak structures or located too close to the deep excavation area.	- During field survey for the preparation of CDMP, the contractor in coordination with the Environmental Officer of PMU and the Environmental Consultant of the CES identify weak structures that may be at risk and determine appropriate mitigation measures accordingly - Consider and select appropriate dredging method that allow minimising soil subsiding risks, for example carry out stepped excavation, stabilise slops in parallel to dredging - Apply protective measures such as sheet piles at risky locations
Water Quality Degradation Turbidity in water will be increased when the mud is disturbed; Water leaked from dredged material and suface runoff through disturbed ground also contain high solid contents. Muddy water entering irrigation ditch will cause sedimentation. Aquatic livest in the canal would also be affected by turbid water.	- Build coffer dams surrounding the dredging area and pump the water out before starting dredging - If dredging is carried out directly onto the water, dredge at intervals to allow suspended materials to resettle before continuing. Observe water colour at 20 m upstream of the nearest irrigation water intake and stop dredging when water colour there started to change
Increased Safety risk for the Public	- Place stable barriers along the construction corridor boundary to separate the site with nearby structures - Place warning signs and reflective barriers along the construction area, at dangerous locations and within sensitive receptors - Ensure adequate lighting at
Health and Safety risk to the workers The health of workers may be affected due to exposure to odour and other contaminants from sludge When working in or near relative deep and wide canal, there is a risk of being drown -	- Within two weeks before dredging is started, the contractor will coordinate with local authority to identify good swimmers or those who can dive in the locality, and hire at least one of them at each canal construction site deeper than 3 m and there are workers working on or near water surface. - Provide and enforce the workers to use masks. If and when working in the water, protective cloths, rubber boots, gloves and hats must be wore.
Others	- Other relevant measures specified in ECOP or proposed by the contractors as necessary
MATERIAL LOADING AND TRANSPORTATION	
Dust and nuisance, traffic safety risks Dust or wet materials may be dropped along the transportation route	- Use water-tight tank trucks for transporting wet/dam materials - Cover the materials tightly before leaving the construction site - Do no overload material on the trucks
AT FINAL DISPOSAL SITE	-
Landslide and soil subsiding risks at final Disposal site	- Level the materials after being disposed off - Slopes of the dumps will not be steeper than 45o - Build/create the walls to protect slopes

Impacts and Description	Mitigation Measures
Landslide and subsiding risk may happen on slopes created at the final disposal site of dredged materials if the slopes created are too high, steep or unstable	- Create and maintain drainage at the foot of each dump higher than 2 m
Disturbance to existing drainage Unloaded dredged and excavated materials may disturbed, damage or block the existing drains causing localised flooding	- Dispose off the materials at designated areas only - Clean up or repair existing drains if blockage or damages are the contractors' faults. Clean up and repair will be at cost of the contractors
Soil and Water Quality Pollution Saline dredged materials will be disposed off at the Nam Thanh Landfill. Currently there is an irrigation canal 100 m from the site, and rainwater over there is led to the grassland at the front yards. There is not groundwater available at the site. If storm water passing saline materials before entering the irrigation canal or the grassland, irrigated crops would be affected or grass would be death.	- The excavated materials will be finally disposed off at sites and with conditions described below: - All neutral top soil, excavated dredged materials will be disposed off at the planned Northeast and Northwest Urban area in Phan Rang city, which are up to 10 km from the construction sites - all top soils, dredged materials that is saline of having arsenic contents exceeding standard will be disposed off at the Nam Thanh landfill - Apply measures that ensure rainwater onto the saline materials is not mix with the surface runoff from the surrounding to overflow uncontrolled at the site; rainwater will be infiltrated onto the ground on-site. This can be done by the following mitigation measures: + Build drainage ditches surrounding the designated disposal area + Use impermeable materials to cover the walls surrounding the materials to isolate it with the surrounding + Other measures proposed by the contractors to meet pollution control targets + Dredged materials from Tan Tai canal (tested As contents at 18 mg/kg, which is 3 mg/kg or 20% higher than standard for agricultural land) must be loaded separately by the contractor so as Nam Thanh will take over the monitoring of the final use of the materials

1. Specific Guidance for Dredging at the Dong Hai Lake

The lake comprises of series of abandoned aquaculture ponds, currently surround be residential houses and it is not accessible by motorbike or car. A new access road will be built before dredging takes place. The status and water level in the lake varies significantly in dry and rainy weather as shown in the picture. PMU and the Contractors should take into considerations these characters when scheduling dredging and preparation of the Contractor's dredging plan. Particularly, dredging should be carried out in stages, pond by pond to minimise the potential impacts.

The CDMP prepared for the Dong Hai lake should also comprises of the following:

- Plan for managing the disposal areas including: (a) plan for reducing the drainage, (b) construction of the perimeter dykes, (c) construction of sub-containment area, including the use of existing compartments at the lake, (d) planned thickness of the dredged materials (typically less than 1.5 meters), (e) measures to protect ground water and soils (e.g., installation of PVC membrane).
- Designing the Draining for Disposal lands. As the dredged materials are in the state of mud at first and soil particles are suspended for 24 to 48 hours. All drainage water from disposal land shall be driven to the drains and discharged back to the lake. In order to limit the negative impacts of mud (produced by dredging) on the environment as well as the water quality of the canals, the dredged sediment will be transported to a containing area which is appropriately located and properly design with an adequate size. The dredged spoil will be pumped to the designated disposal are and then overflow to a settlement pond, where turbidity and total suspended solids are settled. After some time, effluent is returned to the lake. A typical design of the dike around each disposal may be as follows: Height: 2m, Footing width: 5 m, and Surface width: 1m. The plan should set out a basic layout.

ANNEX 3- DUE DILIGENCE AT DISPROPOSAL SITES

1. Due Diligence Nam Thanh Solid Waste Treatment Complex

Background

The solid waste collection and treatment services in Phan Rang have been operated by the Nam Thanh Construction, Trade and Services Company Limited referred to as Nam Thanh Company). The areas covered by solid waste collection service including all wards and commune in Phan Rang, Khanh Hai and Phuoc Dan district towns, some communes in Ninh Hai and Ninh Phuoc districts, and all communes in Ninh Son district. The Nam Thanh Solid Waste Treatment Complex was put into operation in 2002, upgraded in 2007.

Environmental documents prepared

- Environmental Protection Commitment (EPC) approved by DOSTE on 15 May 2002 for treatment capacity at 100 T/d
- Registration to meet Environmental Standard certified by DONRE on 2 November 2004 for capacity upgraded to 150 T/d
- Environmental monitoring has been carried out during operation phase of the complex. To date, no fine has been applied to the complex.
- Environmental Protection Plan (EPP) prepared for treatment capacity at 240 T/d and submitted to DONRE for appraisal. During the appraisal meeting, it was reported that a new disposal cell has been planned, DONRE advised the Project to prepare EIA for the entire complex to replace the EPP. EIA has been submitted to DONRE in October 2016 and being reviewed and expected to be approved in November 2016.

Below are the key findings and recommendations of EIA submitted to DONRE

Location and operational history

The complex is located in Loi Hai commune, Ham Thuan Bac district of Ninh Thuan province. It has a total land area of 12.3 ha. It is 90 m from the Chua mountain in the north, an existing road to the west, vacant land including a pond in the south, and with agricultural land in the north. The surroundings of the complex is mostly vacant land with bush, biodiversity is low. There are five households living within 500 m from the west and the south of the complex. Within one kilometer diameter, existing landuse is mostly agricultural land. The nearest residential areas are 1 km to the south and the west, and there is an industrial park at 1 km from the east. Piped water and power supply is available. Within two kilometers from the boundaries of the complex, there is no protected areas such as national park, natural reserve or natural protected sites.

There is no river or stream within 1 km from the complex, there is an existing irrigation canal which is 100 m to the west of the complex. There is a 1 ha dug pond at 100 m from the south. Groundwater is not available in the area.

Currently the complex has treatment capacity at 240T/d, comprising of:

- Solid waste disposal are: total land area is 7 ha, including a 2.7 ha solid waste disposal cell was full and closed. A 4.3 ha new cell has been being planned to receive 16.6 T/d in 12 years. It is expected that prepatory work will be completed in October 2016, final closure of the old cell and construction of the new cell will be completed in QII 2017. The cells will be operated from 2017-2029, close in 2030.
- Stores: 936 m2 for products, 480 m^2 for raw materials, 480 m^2 for fuel, 60 m^2 for waste, 15 m^2 for hazardous waste; Five workshops: i) garbage and separation houses; ii) granual plastic production unit; iii) packaging material production unit; iv) final composting plant;

and v) mechanical workshop. Each workshop has compacted soil ground, metal roof and brick walls; waste drying yard, 1,922 m^2; A mechanical workshop and a vehicle maintenance workshop (build in 2010, operating); car park: 1050 m2. The total land area of these facilities is 6300m^2

- Ancillary structures including office, canteen, accommodation, toilets, car park, and a clean water reservoir in a total land area of 1762 m^2. These were built in 2010 and working
- -> approximately 0.8 ha of land used for production and management

Environmental Measures being implemented

- Dry the waste to reduce moisture in the waste to reduce leachate generation; cover the waste when rain is coming; the drying yard is divided into cells for easier impact control, drainage installed on the lower side of the yard and connected to the complex's stormwater drainage. rainwater is discharged to grassland in front of the gate for infiltration into the soil
- Domestic wastewater is collected to a sedimentation tank with garbage screen, then pumped into the filtration tank. from there wastewater will run into storage tank, biochemical is applied for treatment of organics and odour. treated water is used for tree watering
- Production wastewater is collected through concrete collection channels to the intake/sedimentation tank where screen are installed. Wastewater is pumped into filtration tank. then water is led to the storage. biochemical is applied at all treatment units for BOD removal. Then treated wastewater is pumped to the waste just before fermentation stage.
- Adequate protective cloths were provided to the workers
- Trees were planted within the complex
- Clean up working area regularly
- Workshops are ventilated
- Hazardous waste are stored separately
- Biochemical has been applied regularly for odour and vermin control

Proposed Investments

- Improve the existing facilities: Build two new manholes in the existing drainage system, improve hazardous waste storage area, Improve the old dump for proper closure: add 0.5 m soil cover on top, plant grass on top, Build drainage channels to collect rainwater from the mountain side and embankment to prevent rainwater from coming into the complex (the site is not subjected to flood season), build fence and plant 116 trees behind the fence , install signboard with information about the complex
- Build new disposal cell 4.3 ha, 7m deep, 12 years operation. the bottom and surrounding walls are protected with compacted foundation, compacted clay and HDPE membrane; leachate is collected and led to the existing leachate treatment unit
- Construction will include the following steps: i)excavation at the cell; ii) transport the excavated materials to the temporary storage area for covering the waste during operation phase; iii) compact and strengthen the bottom and the wall.

Impact Assessment

The following key potential impacts were identified and assessed in detail:

Construction phase:

- Generation of domestic wastewater from daily activities of workers, leachate from waste, production wastewater from plastic bag and car washing, from workshops and composting plant. Designed stormwater runoff within the plant: 416 l/s); odour, noise
- Generation of solid waste and hazardous waste
- Gas emission CH_4, CO_2, SO_2, H_2S, NH_3,... from production units, dust from construction activities at the new disposal cell
- Spillage risk from wastewater treatment unit and leachate treatment unit
- Accident risks to the workers from construction plants, truck movements, loading and unloading of materials, landslide from high loads of soils, lightening in rainy weather ;
- Fire and explosion risks from oxygen bottles in the mechanical workshop
- Soil subsident if r compaction does not meet requirement

Operation phase:

- Gas emission from trucks coming in and going out, from garbage levelling and soil covering, from waste decomposition
- Provide job opportunity for local people

Closure phase:

- Gas and dust emission from soil covering

Mitigation Measures

- The mitigation measures already been in place will continued be implemented
- Install signboards
- Use registered trucks within load limits,
- Provide protective cloths for the workers
- Excavated materials will be loaded at a temporary storage area, 0.7 ha, for covering the waste during operation phase. The temporary dump will not be steeper than 45^o, the height will not be higher than the reachable distance of the excavator buck
- Avoid construction in rainy weather

Operation phase:

- Waste will be disposed off in dry weather only (Phan Rang has least rainfall).
- Build embankments and drainage before disposal activity is started so as rainwater from the surroundings do not run into the disposal cell; rainwater within the cell will be pumped out, some would be evaporated
- Garbage are disposed off to 2 m high in an area of $12.5m^2$ each day. Soil cover will be applied at the end of the day to prevent rainwater from entering the soil.
- Rainwater drainage will be built for the old cell during the reclamation process
- To the production wastewater treatment unit (the fermentation tanks at the composting are closed and water-proofed, there are drainage at the surrounding).
- Waste disposal sequence: Each day use $12.5m^2$, apply 0.2 m of soil on top of 2 m thick garbage. after being compacted, the first garbage layer with soil covered (from bottom to top) will be 60 cm thick, the second layer will be 50 cm thick

Comments:

The EIA of Nam Thanh solid waste treatment complex covers adequately the key potential environmental impacts and proposed appropriate mitigation measures for both the existing operations and the proposed investments.

The total land area of the complex is 12.3 ha, in which 7 has are for solid waste disposal, 0.8 ha used for constructed works. The remaining land area is 4.5 ha including internal roads and space between units and buildings.

The EIA did not calculated in detail the volume of the excavated materials, which is 4.2 ha x 7m = 294,000 m^3 including the top soil which is used to mix into the final composting product. As the needs for filling materials in the city is very high and excavation at the landfill site has already been started, the levelling of the Northeast urban area has been on-going, the 294,000 m^3 of excavated materials will be used for ground levelling at the new urban area. Soil samples at the Nam Thanh landfill tested during the preparation of Phan Rang CCSEP indicated that the contents of all heavy metal in the soil are under allowable limits.

At the meeting between CCSEP PMU with DONRE, DARD, DOC, CPC, Dong Hai CPC, Nam Thanh and Thanh Dong companies, it was agreed that 284,000$m^3$of excavated materials mostly from the Central lake will be disposed off in Nam Thanh. The representative of Nam Thanh also mentioned that they would accept unlimited amount of top soil.

2. Due Diligence review of Dong Bac New Urban area

EIA report has been approved by PPC at decision 254/QD-UBND dated 26/01/2011.

Quarterly Environmental Monitoring Report prepared by Project Owner, Thanh Dong Co Ltd submitted to DONRE on 29 June 2016:

Construction Progress by 30 June 2016: + Zone A: Completed ground levelling, construction of road, drain and sewers in the resettlement site; + Zone B: completed the construction of access road including tree planting, lighting and footpaths; continue construction of internal roads including water and power supply, drainage and sewers; construction of Resettlement Site #4.

Equipment and Workers mobilised: Rollers: 4, trucks: 10, concrete mixer: 7, other construction plants: 7. Total 250 people working on the site, among which 50 people reside on-site.

Construction Impacts and Mitigation measures applied: About 5.1 m3 of wastewater is generated each day, 2 mobile toilets were placed at construction site for the workers to use. About 20 kg of solid wastes is generated each day, 4 garbage bins (capacity 200 L each) were placed at the camp and construction site. There is a signboard listing Workers' Codes of Conducts at the construction site. Nam Thanh Company was contracted to collect the waste daily and transport to Nam Thanh Solid Waste Complex for treatment/final disposal.

Result of Environmental Sampling: Water quality tested at two locations shows that at in Cha La river, pH, DO, BOD5, TSS are under allowable limits, Ammonia and coliforms were 6 and 12 times higher than allowable limits, respectively. Air quality at the construction site has TSP, N02, S02 and CO meets Workplace Sanitation Standard 3733:2002/QD-BYT. TSP and noise level measures at 3 locations in nearest residential houses are within allowable limits. Dust level at 2 other locations (down wind direction, measured during high wind velocity) exceeds standards about 1.5 times, and noise level at one level exceeds standard 8dB. Reasons were due to demolition/construction of some private houses were on-going on.

Photos of existing conditions

ANNEX 4- DUE DILIGENCE LINKAGE PROJECT

Due Diligence Review – Construction of the Wastewater Collection, Treatment and Reuse for Phan Rang – Thap Cham City"

Background. The Project 'Construction of the Wastewater Collection, Treatment and Reuse for Phan Rang – Thap Cham City Project" (hereinafter referred to as 'the Project" financed by the Netherland Goverment has been being implemented from 2016-2020. The budget is approximately 17 millions EUR. The Environmental Assessment Report EIA of the Project were prepared in accordance with MONRE Circular no. 26/2011/BTNMT dated 18/07/2011 and been approved by DONRE in 2015. Below are the key findings and recommendations of the EIA:

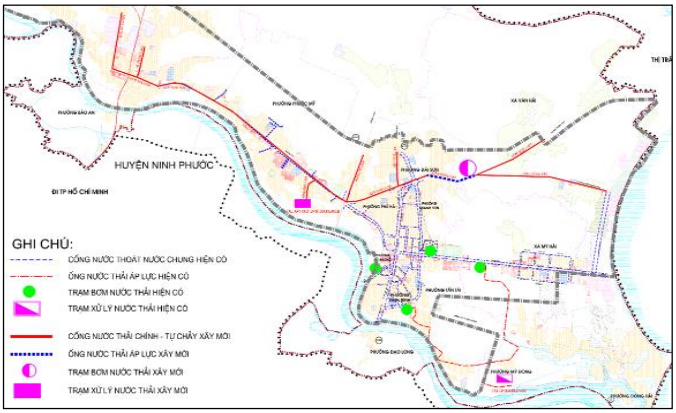
Scope of Works. The Project includes two components:

i) Construction of wastewater collection, treatment and reuse system. Civil works included the construction of 13.25 km of HDPE D280-560 HDPE interceptors and secondary sewers, 372 manholes, one secondary pumping stations, 84 km of tertiary serwers and connections to 14,200 HH, a treated wastewater pumping station capacity 10,000 cmd a new wastewater treatment plant capacity 10,000 cmd with treated water meet QCVN 39" 2011/BTNMT applicable for irrigation water. The serviced area will cover at least seven wards of Phan Rang. The treated wastewater will be used for irrigation water in dry season and discharged to the Dinh river in the rainy season

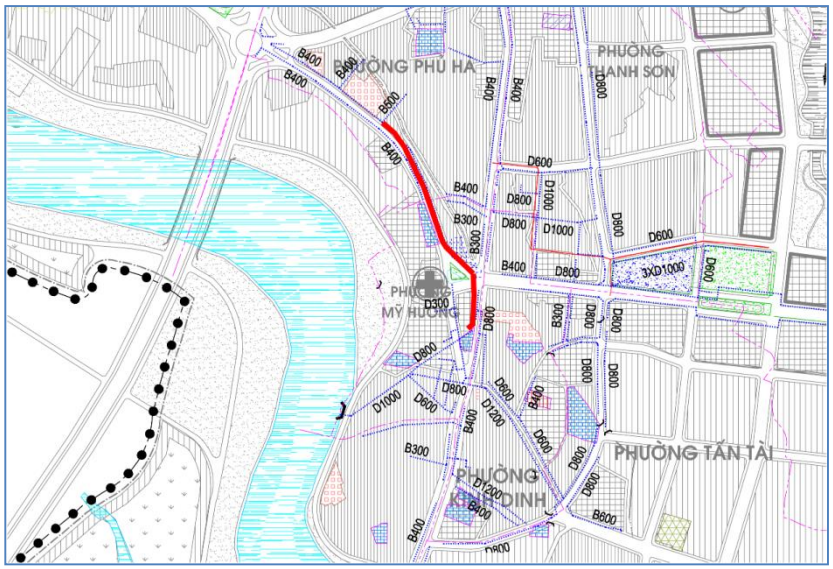
ii) Construction of 857 m D800 drainage to address flooding issue for the provincial Children's Culture Center in Phu Ha ward.

Key Project Areas: the following areas/streets will be disturbed/served by the Project:

- Pham Ngu Lao street in Phuoc My ward (where the WWTP is located)
- Seven serviced wards: Đô Vinh, Bảo An, Phước Mỹ, Đài Sơn, Phủ Hà, Mỹ Bình, Văn Hải
- 21/8 street where the main sewers will be laid, the Tháp Chàm catchment;
- Trần Phú and Nguyễn Văn Cừ streets, the catchement in the north of the city.
- Le Quy Don street, where the sewers from two routes will be joined before coming into the WWTP
- The D800 drain will be installed along the 21/8 street to the Hùng Vương street, connected to the existing drainage then discharge into the Kinh Dinh lake



Location Map of Project Area – Component 1



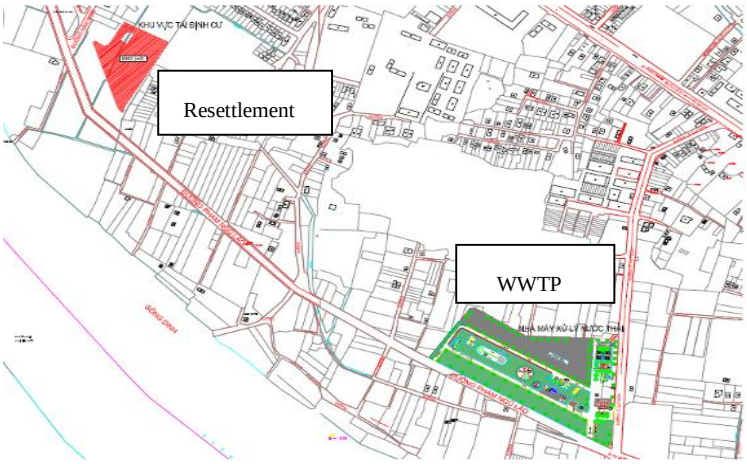
Location Map of Project Area – Component 2

Potential Social and Environmental Impacts and Mitigation Measures relevant to CCSEP

The potential impacts identified in the EIA that are relevant to CCSEP includes

Positive impacts: wastewater reuse supports the irrigation of approximately 180 ha of agricultural land in dry season.

Negative impacts and risks:3.4 ha agricultural and garden land would be acquired, 55 households affected, in which 24 HH have to be resettled at the resettlement site in Phuoc My ward:



Construction impacts:

- Dust and gases from transportation activities
- Generation of excavated materials and domestic wastes: 6,917 m3 or 9684 T of solid waste will be disposed off. each truck would consum 0.0025-0.003 T of fuel, thus total amount of oil consumed would be 1,61-1,94 T (10km).
- Traffic disturbance, traffic safety risks, damages to the existing roads. 646 trips of 15T trucks will be needed to transport the waste to the disposal sites which are within 10 km, 4.793 trips of trucks will be needed to transport 51.356 m3 or 71.898 T of filling materials to the construction sites.The roads where traffic would be affected the most are 21/8, Trần

Phú, the road along the sewers in Đô Vinh, Bảo An, Phước Mỹ, Đài Sơn, Phủ Hà, Mỹ Bình, Văn Hải.

- The impacts of construction activities onto the quality of the water in the Tan Tai canal is negligible
- Health and safety of workers and the public
- Disturbance to daily activities of community
- Conflict between local people and the workers
- Small impacts on the water quality in Tan Tai canal

Operation:

- Wastewater not treated or only partly treated by the WWTP when treatment system failed
- Wastewater leaked from the joints and the sewers/drainage

The EA proposed a set of comprehensive mitigation measures to mitigate the identified potential impacts and risks. The measures to manage the potential impacts of land acquistions include the application of appropriate compensation policy, minimise land acquisition through engineering design, provide special support to vulnerable groups, inform communities about construction progress, develop and implement livelihood stabilisation plan for the affected households etc. The measures to mitigate common construction impacts are similar to ECOP of the Worlbank, such as setting up signing boards and fence, protect construction site, construction materials and wastes, divert traffic, use sheet piles for slop protection, covering the trucks and watering the sites, levelling the disturbed ground, cleaning up the sites regularly, use registers trucks only and maintain regularly, provide safety gears for the workers and training on environmental and health, provide adequate accomodation together with first aid kits, develop emergency preparedness procedures, reinstate the sites after construction.

For operation phase, the mitigation measures were proposed for with investments on an odour treatment unit, standby generators and SCADA system for minimising system failure risk at the WWTP. The sludge from the WWTP will be transported to the Nam Thanh waste treatment complex, periodical environmental monitoring will be carried out regularly.

Institutional Arrangements

The Capacity Building Board of Phan Rang, the same PMU of CCSEP will manage this Project on behalf of CPC and PPC. This Project requires PMU to appoint an enviornmental officer to manage enviornmental aspects of the Project. The Construction Management Contractor, the Contractor, the independent monitoring consultant and communities will participate in environmental compliance monitoring. The estimated budget for independent environmental monitoring is 629 millions VND.

Comments:

The mitigation measures proposed under this EIA are in line with those proposed in ESIA and no conflicts with CCSEP ESIA were determined. Training activities were proposed as part of the EMP however the trainees have not been identified so whether that training would be beneficial for CCSEP is unknown. There will be a laboratory in the proposed WWTP, that would be beneficial for the monitoring activities of CCSEP in the last years althoug a automatic water quality monitoring system will be installed at the WWTP to be upgraded under CCSEP

The same PMU would manage both projects, that would facilitate the coordination for implementation of safeguard management in both projects.