

THANH HOA PROVINCIAL PEOPLE'S COMMITTEE
NGHI SON ECONOMIC ZONE AND THANH HOA INDUSTRIAL PARKS
CONSTRUCTION PROJECT MANAGEMENT UNIT

DYNAMIC CITIES INTEGRATED DEVELOPMENT PROJECT
TINH GIA SUBPROJECT – THANH HOA PROVINCE

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
(ESIA)
Final Report**



THANH HOA – March 2018

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**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
(ESIA)**

PROJECT OWNER

PROJECT MANAGEMENT UNIT FOR
NGHI SON EZ AND THANH HOA
INDUSTRIAL ZONE

CONSULTING UNIT

Joint Venture between VINCEN (Vietnam
Construction and Environment., Jsc) and
HA THANH (Ha Thanh Land and
Environmental Engineering Co., Ltd)

THANH HOA – March 2018

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ABBREVIATIONS AND ACRONYMS

Ahs	Affected Households
CC	Climate change
AC	Asphalt concrete
CeC	Cement concrete
CMC	Construction monitoring consultant
DED	Detailed engineering design
DOC	Department of Construction
DOF	Department of Finance
DONRE	Department of Natural Resources and Environment
DOT	Department of Transport
DPI	Department of Planning and Investment
EIA	Environmental impact assessment
ESIA	Environment and Social Impact Assessment
ECOP	Environmental Code of Practice
EMC	External Monitoring Consultant
EMP	Environmental Management Plan
EMS	Environmental monitoring system
FS	Feasibility study
IEMC	Independent Environmental Monitoring Consultant
MOC	Ministry of Construction
ODA	Ministry of Construction
PMU/BQLDA	People’s Committee
PSC	Project Steering Committee
P/CPC	Provincial/City People’s Committee
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
RP	Resettlement Plan
UBND	People’s Committee
URENCO	Urban Environment Company
WB	World Bank

EXECUTIVE SUMMARY

Project Background and Proposals. The Dynamic City Integrated Development Project (DCIDP) has been proposed to “increase access to improve urban technical infrastructure and capacity building for urban planning and management in the cities of the Project” which is in line with the Vietnam Masterplan for Urban Development (approved by the Prime Minister in 2009). The DCIDP covers five cities and towns including Tinh Gia Town (Thanh Hoa province), Hai Duong, Ky Anh, Thai Nguyen and Yen Bai.

The Tinh Gia subproject is comprised of two components, including:

Component 1: Construction of Technical Infrastructure and Roads. Under this Component, construction and rehabilitation of the following infrastructure has been proposed:

- (i) Construction of a new asphalt concrete road from Ninh Hai to Lach Bang 2 Bridge along the coastal line. The length is $L = 9.8$ km, $B = 27$ to 36 m, design speed is at 60 km/h. Drainage, lighting, infrastructure channel is included. There is one bridge named Son Hai bridge on this road, $L = 50.15$ m, $B = 29$ m.
- (ii) Construction of new asphalt concrete road from Binh Minh to Sao Vang road; $L = 2.1$ km, $B = 26.5$ m. Design speed $V = 60$ km/h. Drainage, lighting, infrastructure channel is included.
- (iii) Demolition of the existing Do Be bridge and rebuild a new Do Be bridge ($L = 70$ m, $B = 20$ m) at the same location, improving the existing 490 m of Do Bo access roads at two ends of the bridge;
- (iv) Construction of the new road from NH1A to Ninh Hai beach; $L = 815$ m, $B = 27$ m, Design speed $V = 60$ km/h. Drainage, lighting, infrastructure channel is included.
- (v) Dredging and embankment lining of the Cau Trang canal, $L = 5.7$ km, $B = 3$ to 9 m;
- (vi) Dredging and embankment lining of the Than canal, $L = 5$ km, $B = 25.5$ m
- (vii) Construction of the wastewater collection and treatment system, including a wastewater treatment plant capacity $2,000$ m³/d using biological technology, and a sewer system;
- (viii) Construction of infrastructure for 5 small resettlement sites with total land area of 4.5 ha with 138 land slots (80 - 150 m² each). The proposed works include ground levelling, construction of internal roads, drainage, water supply, power supply and lighting system.

Component 2: Technical Assistance and Implementation Support

An Environmental and Social Impact Assessment and an Environmental and Social Management Plan (ESIA/ESMP, this document) has been prepared to meet the requirements of the World Bank’s Safeguard Policies. Public consultations were carried out during the preparation of the draft ESIA. The Project will also comply with applicable Vietnamese environmental legislations. The draft ESIA/ESMP has been disclosed locally in Project area at the end of November 2017 and on the Bank website on 28 November 2017. The main contents of the ESIA/ESMP includes:

Chapter 1: Project Description

Chapter 2: Socio-economic and Environmental Baseline Conditions

Chapter 3: Environmental and social Impacts Assessment

Chapter 4: Analysis of Alternatives

Chapter 5: Environmental and Social Management Plan

Chapter 6: Public Consultations and Information Disclosure

Conclusions and Recommendations

The Tinh Gia Project is scheduled to be implemented from 2018 to 2023, with a total investment cost of approximately 79.63 million USD.

Baseline Conditions. The Tinh Gia subproject area is located in the northern central region of Vietnam. Existing internal road system has been limited. Existing drainage system is incomplete, and wastewater has not been collected but being discharged into the environment without being treated. The Cau Trang canal of which the main function is drainage has been polluted by domestic wastewater. The Than canal has been the main irrigation canal of the town, the flow in the canal has been control with a sluice to prevent saline water from the sea from entering the canal. Sampling result shows that salinity in the sediment taken from the Than canal is about 5‰, which is slightly above tolerance range of some agricultural crop trees.

Potential Social and Environmental Impacts and Risks.

The Project has been classified as Environmental Category B by the World Bank. The social and environmental potential impacts and risks have been identified and assessed in Chapter 3 of the ESIA. Overall, the subproject would bring about significant social and environmental impacts during operation phase. The new and improved infrastructure would help to improve living condition of the local people, contribute to promote sustainable socio-economic development in the area. The new wastewater collection and treatment system, dredging and embankment lining at the Than and Cau Trang canals would help to improve urban landscape and environmental sanitation conditions in the subproject area. Accessibility within various parts of the project area and with the surrounding area would be enhanced through the three new roads and the new Do Be bridge.

Beside the significant positive impacts, the ESIA assessed that there would be also some negative impacts and risks during the pre-construction, construction and operations of the infrastructure provided under the subproject.

Pre-construction Impacts and Risks. In terms of land acquisition and resettlement, the Project would acquire 55.3 ha of land including approximately 45.2 ha of agricultural land and 7.5 ha of residential land and some cemetery land. Total 1,354 households (HH) will be affected by the Project, in which 225 HH will have to be relocated, 89 HH are vulnerable and 526 HH are severely affected by agricultural land acquisition; 243 graves will be relocated. As the subproject area was subjected to civil wars in the past, there would be the risks that some UXO (unexploded materials) have been left underground in the subproject area.

Construction Impacts and Risks. Most of common construction impacts would be localised, at low to moderate levels, including: increased dust, noise and vibration levels, solid waste and wastewater generation, surfacewater quality reduction, localized flooding issues, sedimentation, landslide and erosion risks, health and safety of the workers and communities, negative impacts on urban landscape, traffic disturbance and increased traffic safety risks, damages to existing infrastructure (power/water supply, irrigation, roads etc.) and disruptions of related services. Total 1.1 million m³ of construction solid wastes will be generated, including 350,363 m³ of materials from demolition of existing structures for site clearance, 112,110 m³ of dredged materials from Than and Cau Trang canals, and 642,919 m³ of excavated materials. The risks related to labour influx, child labor and STD transmissions related to the Project have also been considered as low under the subproject. The ESMP also have identified site-specific impacts and risks of each work item where sensitive receptors (such as kindergarten, temple, residential clusters, production forests etc.) are located, or water quality reduction related to salinity of dredged materials.

Operation Impacts and Risks. The main social and environmental risks during the operation of the proposed roads and bridges are traffic safety risks on the road/bridge, particularly at the junctions between the new roads and the existing roads. In addition, the new roads may also cause localized flooding risks and reduced accessibility between the two side of the new roads, which is mostly agricultural land. With the Than and Cau Trang canal rehabilitation, traffic safety risks at the roads running along the canals and reduced green landscape would be the main concern during operation phase of canal dredging and embankment lining works, particularly along the Than canal when soft earthen low embankments become steeper hard steeper embankments. Odors, health and safety of the workers and the public would be the issues that should be considered during the operation phase of the wastewater treatment plant, including wastewater pumping stations.

Mitigation Measures.

To address the identified and assessed potential impacts and risks identified in Chapter 3, mitigation measures have been proposed and presented under the Environmental and Social Management Plan (ESMP) presented in Chapter 5.

At Feasibility Study and Engineering stages, engineering and greening solutions were proposed for incorporation into the technical design to address some impacts during operation phase, for examples: combinations between engineering with greening solutions for slop protection at the new road shoulders and canal, design of the intersections includes measures to reduce traffic safety risks, staircases are built at intervals to maintain safe and convenience access to water surface for local communities. The WWTP has been design with adequate buffer zone and space for tree planting to reduce odour and other operational concerns etc.

For pre-construction impacts and risks, a budget estimated at approximately USD 250,000 has been proposed for UXO clearance. A Resettlement Action Plan (RAP) has been prepared to address land acquisition impacts of the subproject. An estimated budget at approximately 224 billion VND (about 9.9 million USD) for land acquisition and compensation, and for livelihood compensation program (detail see RAP).

Table 1. Cost for Implementation of RAP

No.	Contents	Cost estimate (‘000 VND)
I	Compensation and support	
1	Coastal road from Ninh Hai – Lach Bang 2	49,990,134
2	Road from Binh Minh to Sao Vang – Nghi Son economic zone	80,895,148
3	Upgrade, rehabilitate Do Be bridge and approach roads	12,254,730
4	Construct road from NH1A to Ninh Hai beach	23,645,502
5	Upgrade, rehabilitate Than canal	3,425,200
6	Upgrade, rehabilitate Cau Trang canal	36,209,752
7	Resettlement site	5,000,000
II	Other costs	
1	Appreciation for site handover	450,000
2	Support for housing repair and relocation	4,414,000
3	Cost for site clearance (2% of total compensation and support)	4,345,689
4	Survey of replacement cost	300,000
5	Income/live-hood restoration program	3,094,500
6	Independent monitoring	450,000
III	Total	224,474,655

The mitigation measures for common construction impacts have been proposed under the form of Environmental Codes of Practices (ECOP, Table 5.2 in the main report) for incorporation into construction bidding documents. For example, the contractors are required to inform local communities at least two weeks before construction commencement. They must ensure that the trucks must be covered during transportation of construction materials, or drainage and sedimentation traps must be installed to prevent sedimentation in surfacewater sources, ground area to be disturbed must be kept minimal, site protection measures must be applied to manage safety risks for both the workers and local communities, adequate protective cloths and camp facilities must be provided for the workers to use to protect occupational health etc. In addition, site-specific mitigation measures such as installation of sheet piles at deep excavation to prevent land slide risks were also proposed, such measures were presented in the form ready for inclusion into bidding documents. The site-specific mitigation measures at sensitive-receptors are presented below:

Table 2. Site-specific Mitigation Measures

Sensitive Receptors	Description	Site-specific Impacts	Mitigation Measures
 <p>Le Van ancestral temple (Km 0+500)</p>	<p>The Le Van temple is located at about 50m from construction area.</p>	<ul style="list-style-type: none"> - Dust may affect the temple structure - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping on 1st and 15th lunar month - Unsuitable language/behaviour may be offensive to the relic keeper and visitors 	<ul style="list-style-type: none"> - Do not load materials and waste within 20 m from the temple - Water areas located within 100 m from the temple in hot, dry day - Minimise materials and wastes loaded and activities that generate noise in the 1st and 15th of lunar month - Enforce compliance to the codes of conduct particularly with regards to language and behaviours when present in the area near the temple
 <p>Km 1+150: Ninh Hai Kindergarten</p>	<p>This kindergarten is located at 200 m from construction site.</p>	<ul style="list-style-type: none"> - Traffic safety risk on the access road during peak hours: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 	<ul style="list-style-type: none"> - Minimise the number of trucks leaving construction sites during the peak hours - Arrange staff to direct traffic on this section on peak hours during peak construction period
 <p>Km 1+300: General Truong Cong Xuan relic</p>	<p>50 m from construction site.</p>	<ul style="list-style-type: none"> - Dust may affect the structure, - Noise may disturb worshipping activities on 1st and 15th lunar month - Material and wastes may affect landscape and hinder access, - Unsuitable language or 	<ul style="list-style-type: none"> - Do not load materials, waste within 20 m from the relic - Water the construction areas located within 100 m from the relic in hot, dry day - Minimise the volume of materials and wastes temporarily loaded in the area and the activities that generate noise in the 1st and 15th of lunar month

Sensitive Receptors	Description	Site-specific Impacts	Mitigation Measures
		<ul style="list-style-type: none"> behaviours may be offensive - Risks of traffic disturbance, accidents and safety on access road 	<ul style="list-style-type: none"> - Enforce compliance to the workers of conduct particularly with regards to language and behaviours when working near the temple - Do not load construction materials and wastes within 10 from access road during 1st and 15th lunar month
 <p>General Pham Van Doan relic (Km 1+500)</p>	<ul style="list-style-type: none"> - 50 m from construction site 	<ul style="list-style-type: none"> - Traffic disturbance on access road - Material and wastes may affect landscape and hinder access. - Dust may affect the structure - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language or behaviours may be offensive 	<ul style="list-style-type: none"> - Minimise the volume of materials and wastes loaded in the area and the activities that generate noise in the 1st and 15th of lunar month - Enforce compliance to the codes of conduct particularly with regards to language and behaviours when present in the area near the temple - Do not load construction materials and wastes within 10 from access road during 1st and 15th Lunar month.
 <p>Khanh Pagoda (Km 7+900)</p>	<p>Khanh pagoda is 50m from construction area.</p>	<ul style="list-style-type: none"> - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language/behaviours of workers may be offensive to the relic keeper and visitors 	<ul style="list-style-type: none"> - Do not load materials, waste within 20 m from the temple - Water the construction areas located within 100 m from the temple in hot, dry day - Minimise the volume of materials and wastes temporarily loaded in the area and the activities that generate noise in the 1st and 15th of Lunar month - Enforce compliance to the codes of conduct particularly with regards to language/behaviours when present near the temple
Binh Minh road			
 <p>Cemetery (Km 1+000 to 1+080)</p>	<p>about 20 graves will be relocated. The remaining graves are not affected by land acquisition</p>	<ul style="list-style-type: none"> - Disturb access to graves and worshipping activities, particularly on 1st and 15th of lunar month - Insects may attack the workers 	<ul style="list-style-type: none"> - Mark construction area, minimise disturbed area - Do not let materials, waste block access to graves - Minimise construction activities during 1st, 15th of lunar month or when there are events at the cemetery

Sensitive Receptors	Description	Site-specific Impacts	Mitigation Measures
	The ground is well-vegetated		<ul style="list-style-type: none"> - Provide protective clothes particularly boots and gloves and enforce the use - When insects, reptile are found, drive them away or release them, do not kill them.
Road from NH1A to Ninh Hai beach			
 <p style="text-align: center;">Cemetery area (Km 0+100 to 0+200)</p>	73 graves will be relocated, the remaining graves remained at the same location. The ground is well-vegetated	Disturb access to graves and worshipping activities, particularly on 1 st and 15 th of lunar month Insects may attack the workers	<ul style="list-style-type: none"> - Mark construction area, minimise disturbed - Do not let materials and waste block access to graves - Minimise construction activities during 1st, 15th of Lunar month or when there are events at the cemetery - Provide protective clothes particularly boots, gloves and enforce the use - When insects, reptile are found, drive them away or release them . Do not kill them
Cau Trang canal			
 <p style="text-align: center;">A kindergarten at Km 2+900</p>	50m from the construction area.	<ul style="list-style-type: none"> - Public nuisance due to odour, wastewater leakage and dredged materials odor from dredged material may affect the children - Increased safety and traffic safety along the canal, particularly during peak hours - Bad odor affect teaching, learning and relaxing activities, particularly affect children 	<ul style="list-style-type: none"> - Inform local authorities before dredging takes place - Place warning signs and reflective bands surrounding dredging area. - Provide adequate lighting at night time - Avoid temporary loading, use watertight tank trucks to transport the damp dredged materials to the final disposal site if possible. - Monitor, apply pollution control measures related to leaked water from dredged materials - Transport dry dredged materials to final disposal site as soon as possible - Avoid dredging and transportation activities near the kindergarten during peak hours - Cover or contain tightly dredged materials if temporarily loaded within 50 m from business houses

As baseline data indicated that the sediments at the Than canal has salinity at around 5‰, which is slightly above the tolerance range of some crop trees such as rice, the ESMP proposed that dredged materials will be temporarily loaded in abandoned existing ponds along the canal before being transported to final disposal site where existing saline sediment and soil already exist. At the temporary loading sites along the Than canal, taurine impermeable materials will be used to line the bottom and the embankments of the ponds, wastewater leaked from the sediments will be led to run back to the canals.

Dredging and Dredgate Management Plan (DDMP) was prepared to address site-specific impacts and risks related to dredging activities, the mitigation measures proposed included: (i) Avoid dredging in the rainy season, from May to September, in order to maintain drainage function of the canals; (ii) Cofferdams are built before dredging to separate the construction site with the remaining sections of the Than and Cau Trang canals; (iii) Before storing the dredged sediment, the Contractor shall dry the pond by pumping the water into the canals, and create path for leakage water to go back to the Than and Cau Trang canals. After 3-5 days in the ponds, dredged sediment will be transported to the final disposal sites; (iv) Saline dredged materials and soil will be disposed of in a separate area at the disposal sites; the bottom and the surroundings of the disposal areas shall be lined with impermeable materials, surface runoff is led to the existing drains so as it can be diluted before entering waterbodies; (v) When salinity in the dredged materials (at 30 cm deep) is reduced to below 2‰ (at which most plants can tolerate), apply top soil at least 30 cm thick and plant trees on the top; (vi) The contractor must dig and retain the existing grass to cover the surface of the dredged material after completion at the final disposal sites. Estimated cost for tarpauline for temporary disposal cells along Than and Cau Trang canal is 375 million VND (equal 16,667 USD).

The Workers Code of Conducts were also developed as part of ECOP to address the concerns that may be arisen from labour influx (although quite small). In addition, the ESMP also proposed that training on HIV/AIDs awareness for the workers and construction supervision teams will also be provided during the implementation of this subproject. The estimated cost for this training is 210 million VND (equal to 8,889 USD).

Environmental and Social Management Plan (ESMP).

The ESMP proposed an institutional arrangement and identified responsibilities for the implementation of the stakeholders, as below.

Table 3. Responsibilities for the Implementation of the Stakeholders

Stakeholder	Responsibilities
PPC	Overall responsible for environmental safeguard compliance of the Project
PMU	Be responsible for monitoring the overall subproject implementation, including environmental compliance. PMU will be responsible for ESMP implementation and environmental performance of the subproject during the construction and operational phases: <ul style="list-style-type: none"> (i) closely coordinate with local authorities in the participation of the community during subproject implementation; (ii) Ensure that the detailed design include all environment mitigation measures proposed in the ESMP; (iii) monitor and supervise to ensure adequate contents of ESMP are incorporated into bidding and contractual documents; (iv) ensure that an environmental management system is set up and functions properly; (v) Report on ESMP implementation to DONRE and the WB.

Stakeholder	Responsibilities
	PMU will assign Environmental Staff(s) (ES) to oversee and coordinate environmental aspects of the subproject.
PMU Environmental and Social Staff(s) (ES)	<p>Beresponsible for monitoring the implementation of the subproject ESMP. Specifically, ES will be responsible for:</p> <ul style="list-style-type: none"> (vi) Monitor the incorporation of ESMP into the detailed technical designs and civil works bidding and contractual documents; (vii) Monitor the incorporation of ESMP and RAP monitoring and supervision into the TORs, bidding and contractual documents for the Construction Supervision Consultant (CSC) and other safeguard consultant (IEMC); (viii) provide inputs to the consultant selection process; (ix) review reports submitted by the CSC and safeguard consultants; (x) conducting periodic site checks; (xi) propose solutions to handle social and resettlement issues of the subproject; and (xii) prepare environmental and social performance section on the progress and review reports to be submitted to the DONRE and the World Bank.
Contractor	<ul style="list-style-type: none"> - Assign Enviromental, Social Health and Safety (EHS) staff to monitor contractor’s compliance to ESIA/ESMP. - Prepare Contractor ESMP (CESMP) for each construction site area, submit to PMU and CSC for review and approval before commencement of construction. - Obtain all permissions for construction (traffic control and diversion, excavation, labor safety, etc. before civil works) following current regulations. - Implement the mitigation measures specified in the ESMP, CESMP, bidding documents etc. - Actively communicate with local residents and authorities and take actions to address their ESHS concerns during construction. - Ensure that all staff and workers understand the procedure and their tasks in the environmental management program. - Report to the PMU and CSC on any difficulties and their solutions. - Report to PMU and CSC if environmental accidents occur and coordinate with agencies and keys stakeholders to resolve these issues.
Construction Supervision Consultant (CSC)	<ul style="list-style-type: none"> - Assign qualified Environmental and Social Staff(s) to supervise the implementation of ESMP and ensure compliance - Be responsible for routine environmental supervision and reporting during construction phase. - Assist the PMU in reporting and maintaining close coordination with the local community. - Arrange, implement training on HIV/AIDs awareness raising for all workers, CSC team and PMU staff. The cost for this training included in the consulting service contract. - Carry out the periodical environmental quality monitoring during construction period and first-year-operation, prepare periodical environmental monitoring and supervision reports for submission to Vietnamese authorities.
Independent Enviromental Monitoring	<ul style="list-style-type: none"> - Provide support to PMU to establish and operate an environmental management system, coordinate with the CSC team to provide trainings to the Contractors on project environmental management requirements

Stakeholder	Responsibilities
Consultants (IEMC)	- Provide trainings, implement capacity building activities for relevant agencies during subproject implementation, carry out random field visits to certify compliance or recommend corrective/improvement actions . - Prepare monitoring reports after each visit.
Local community	- Participate in volunteer community environmental and social monitoring.
DONRE	Monitoring compliance with the Government environmental requirements.

In addition, the ESMP also have proposed an environmental monitoring and supervision program as well as reporting requirements, capacity building training plan, compliance framework and penalty system as detail in Chapter 5. The total estimated costs for ESMP implementation are summarized below.

Table 4. Total Estimated Costs for ESMP Implementation

Content	Items of Tinh Gia sub-project (USD)
(a) Mitigation during construction	As a part of the contract
(b) Monitoring safeguard compliance during construction	As a part of the cost for Construction Supervision Consulting (CSC)
(c) Running cost of PMU social and environmental units	As part of the costs for the PMU
(d) Environmental quality monitoring (done by CSC)	36,666
(e) Independent environmental monitoring consulting (IEMC)	59,111
(f) Safeguard Capacity building programs (done by IEMC)	9,333
(g) HIV /Aids Training (done by CSC)	8,889

Conclusions and Recommendations.

The proposed subproject is expected to bring about significant positive impacts such as improving urban environmental sanitation and landscape, enhancing access for the project area thus contributing to sustainable socioeconomic development in the subproject area. Most of these positive impacts are expected to be achieved during the operation phase of the subproject.

On the other hand, some potential negative environmental and social impacts and risks may also happen during the construction and operation of the facilities provided under the subproject. These include increased dust, noise and gas emission, vibrations, generation of solid wastes and wastewater, surface water quality reduction, traffic disturbance and increased traffic safety risks, damages to existing infrastructure (power/water supply, irrigation etc.) and disruption of related services increased localized flooding/sedimentation and erosion risks, health and safety issues for the public and the workers etc. These impacts are predicted to be at low to moderate level, and manageable through the environmental and social management plan proposed for this subproject. Therefore, the subproject should be implemented.

INTRODUCTION

1. PROJECT BACKGROUND

Viet Nam has set the goal to have urban development together with complete, modern and environmental-friendly technical infrastructure system. The Prime Minister has approved many important orientations to promote cities development following plans, such as the Masterplan for Vietnam’s Urban Development under Decision No.445/QD-TTg dated 07/04/2009, the National Urban Upgrading Program for the period 2009 to 2020 under Decision No. 758/QD-TTg dated 08/06/2009, the National Urban Upgrading Program for the period 2012-2020 under Decision No. 1659/QD-TTg dated 07/11/2012. These are the basis for formation of the country’s large urban areas with socio-economic development.

Over the past years, Government of Vietnam with the assistance of the World Bank has implemented many urban development projects such as the Vietnam Scaling-up Urban Upgrading project, Medium Cities Development Project...which are bringing great benefits with positive changes in urban landscapes and people’s awareness about urban and project management in the participating cities.

In order to continue following Government’s urban masterplan and development orientation, the Dynamic Cities Integrated Development Project has been proposed to include five cities namely Hai Duong (Hai Duong province), Tinh Gia (Thanh Hoa Province), Yen Bai city (Yen Bai Province), Thai Nguyen (Thai Nguyen Province) and Ky Anh town (Ha Tinh province).



Figure 0.1. Location Map of DCIDP Towns and Cities

Tinh Gia has very important location in economic development. It is a political, economic, cultural, scientific, technological and service center and a hub for transport and trading inside and outside the province; it is also the development center in the southern area of Thanh Hoa

province and South Thanh Hoa – North Nghe An region. Tinh Gia is comprised of the existing Nghi Son Economic Zone (12 communes) and the central area of Tinh Gia District (Tinh Gia township and 6 communes). Thus, the investment in construction and development of Tinh Gia will be very necessary and in line with the approved master plan.

Tinh Gia subproject – Thanh Hoa province consists of 2 components:

- Component 1: Construction of technical infrastructure and roads
- Component 2: Technical assistance and implementation support.

2. RELATED PROJECTS AND DEVELOPMENT PLANS

This project will follow related development plans, including:

- The National Urban Development Program for the period 2012-2020 approved by Prime Minister under the Decision No. 1659/QĐ-TTg dated 07/11/2012;

Following the modification of the master plan for development of Vietnam's urban system up to 2025 with a vision to 2050 which has been approved by the Prime Minister under Decision No. 445/QĐ-TTg dated 07 April 2009, Government of Viet Nam as well as Thanh Hoa province have concentrated many resources for construction and development of Nghi Son Economic Zone. Road system in the economic zone has been invested, facilitating transportation of goods. However, connectivity between the Economic zone with urban areas (residential areas...) is not properly invested. To solve this problem, Thanh Hoa Provincial People's Committee has been mobilizing many resources to implement the planning orientation, specifically:

- Revised construction plans for South Thanh Hoa - North Nghe An in accordance with the Prime Minister's Decision No. 1447/QĐ-TTg dated 16/09/2009.
- Master Plan of Nghi Son Economic Zone approved by the Prime Minister under Decision No. 1364/QĐ-TTg dated October 10, 2007.
- Scheme on expansion of Nghi Son economic zone (Decision No. 18/2015/QĐ-TTg dated 12/06/2015 by the Prime Minister).
- Revised master plan for development of Thanh Hoa urban system (Decision 3975/QĐ-UBND dated 18/11/2014 by Thanh Hoa provincial People's Committee).
- Master plan for the Central area of Tinh Gia district (Decision 2499/QĐ-UBND dated 07/08/2014 by Thanh Hoa Provincial People's Committee).
- The master plan for Tinh Gia district's Central area also stresses the urban development in the existing Nghi Son Economic Zone and the expanded Tinh Gia district (with future wards) of which the district's central urban area will serve as a logistics hub for the economic zone.
- Coastal road project has been approved for planning by the Prime Minister in the Decision No.129/QĐ-TTg dated 18/01/2010 and approval of adjustment of the route direction at the Document No. 2409/TTg-KTN dated 31/12/2015, in which section crossing Nghi Son has been invested (section in line with the North South 2 road and the North South 1B road, provincial road 513 and Nghi Son-Bai Tranh road).

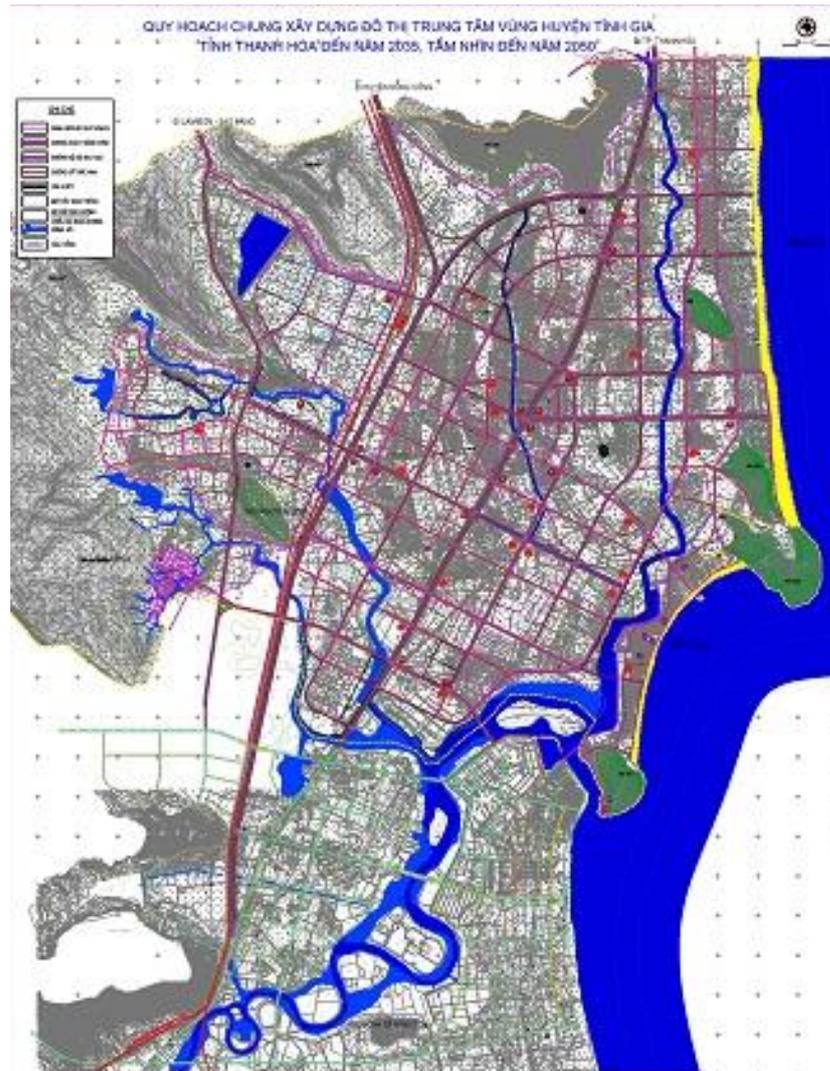


Figure 0.2. Land Use Master plan of Tinh Gia District

3. LEGAL FRAMEWORK

3.1. National Regulations and Technical Basics

- The Law on Environmental Protection No. 55/2014/QH13 passed by the 13th National Assembly on 23 June 2014 and took effect since 01 January 2015;
- 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.
- Construction Law No. 50/2014/QH13 adopted by the 13th National Assembly of the Socialist Republic of Vietnam dated 18 June 2014 and took effect since 01 January 2015;
- Land Law No. 45/2013/QH13 passed by the 13th National Assembly of the Socialist Republic of Vietnam dated 29 November 2013 and took effect since 01 July 2014
- Law on Water Resources No. 17/2012/QH13 passed by the 13th National Assembly of the Socialist Republic of Vietnam, session 3 on 21 June 2012;
- Labour Law No. 10/2012/QH13 passed by the 13th National Assembly of the Socialist Republic of Vietnam on 18/06/2012
- Urban Planning Law No. 30/2009/QH12 passed by the 12th National Assembly of the Socialist Republic of Vietnam on 17/06/2009
- Biodiversity Law No. 20/2008/QH12 passed by the 12th National Assembly of the Socialist Republic of Vietnam on 13/11/2008;
- Law on amendment and supplementation of some articles of Law on Fire Prevention and Fighting No. 40/2013/QH13 dopted by the 13th National Assembly of the Socialist Republic of Vietnam on 22/11/2013
- Law on People’s Health No. 21/LCT/HĐNN8 adopted by the 13th National Assembly of the Socialist Republic of Vietnam on 30/06/1989.
- Decree No. 18/2015/NĐ-CP dated 14 February 2015 of the Government on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plans
- Decree No. 19/2015/NĐ-CP dated 14 February 2015 of the Government detailing the implementation of a number of articles of the law on environmental protection;
- Decree No. 59/2015/NĐ-CP dated 18/06/2015 of the Government on management of construction investment project;
- Decree No. 16/2016/NĐ-CP dated 16/03/2016 of the Government on management and use of official development assistance (ODA) and concessional loans provided by foreign donors;
- Decree No. 201/2013/NĐ-CP dated 27/11/2013 of the Government detailing some articles of Law on Water Resources;

- Decree No. 140/2006/NĐ-CP dated 22/11/2006 of the Government providing for the environmental protection at stages of elaboration, evaluation, approval and implementation of development strategies, planning, plans, programs and projects;
- Decree No. 59/2007/NĐ-CP dated 09/4/2007 of the Government on the management of solid waste;
- Decree No. 38/2015/NĐ-CP dated 24/4/2015 of the government on management of waste and discarded materials.
- Decree No. 80/2014/NĐ-CP dated 06/8/2014 of the Government on drainage and wastewater treatment;
- Decree No.155/2016/NĐ-CP dated 18 November 2016 of the Government on the sanction of administrative violations in the domain of environmental protection;
- Circular No. 27/2015/TT-BTNMT dated 29 May 2015 of Ministry of Natural Resources and Environment on strategic environmental impact assessment, environmental impact assessment and environmental protection plan;
- Circular No. 36/2015/TT-BTNMT dated 30/6/2015 of Ministry of Natural Resources and Environment on hazardous waste management;
- Circular No. 28/2011/TT-BTNMT dated 01/8/2011 of Ministry of Natural Resources and Environment on regulating technical process on environmental monitoring of ambient air and noise;
- Circular No. 29/2011/TT-BTNMT dated 01/8/2011 of Ministry of Natural Resources and Environment regulating the technical process on inland surface water monitoring;
- Circular No. 30/2011/TT-BTNMT dated 01/8/2011 of Ministry of Natural Resources and Environment regulating the technical process on underground monitoring.
- Circular No. 19/2011/TT - BYT dated 06 June 2011 of Ministry of Health guiding the management of labor hygiene, laborers' health and occupational diseases;
- Circular No. 22/2010/TT-BXD dated 03/12/2010 of Ministry of construction providing labor safety in construction.

Legal Documents Related to The Project:

- Decision No. 1364 / QĐ-TTG dated October 10, 2007 by the Prime Minister approving the master plan for construction of Nghi Son economic zone, Thanh Hoa province.
- Document No. 2269 / TTg-KTN, dated November 13, 2014 by the Prime Minister on the adjustment of development planning of industrial zones in Thanh Hoa province by 2020.
- Decision No. 18/2015 / QĐ-TTg, dated 12/6/2015 of the Prime Minister amending and supplementing a number of articles of the Regulation on operation of Nghi Son economic zone, Thanh Hoa province, issued together with Decision Decree No. 28/2010 / QĐ-TTg dated 03/3/2010 of the Prime Minister.
- Decision No.2499/QĐ-UBND dated August 07, 2014 of Thanh Hoa provincial People's Committee approving the masterplan of the central area of Tinh Gia district.
- Decision No.2021/TTg-KTTH dated November 09, 2015 of the Prime Minister selecting some coastal economic zones to focus on the development from the state budget in the period 2016-2020, in which Nghi Son economic zone is one of 8 coastal economic area be selected.
- Decision No.9301/VPCP-KTN dated October 31, 2016 of the Office of Government recognizing Tinh Gia extended district, Thanh Hoa province meeting class III city standard.

Official Letter No. 2318 / VPCP-QHQT dated 14/03/2017 of the Government Office approving the proposal of the project: " Dynamic Cities Integrated Development ", WB loan

3.2. Applicable Vietnam's Technical Standards and Regulations

The ESIA assessment makes reference to the following technical standards and norms:

 Water quality:

- QCVN 01:2009/BYT– National technical regulation on drinking water quality;
- QCVN 02:2009/BYT– National technical regulation on domestic water quality;
- QCVN 08-MT:2015/BTNMT– National technical regulation on surface water quality;
- QCVN 09-MT 2015/BTNMT– National technical regulation on ground water quality.;
- QCVN 14:2008/BTNMT – National technical regulation on domestic wastewater;
- QCVN 40:2011/BTNMT – National technical regulation on industrial wastewater;

 Air quality:

- QCVN 05:2013/BTNMT– National Technical Regulation on Ambient Air Quality;
- QCVN 06:2009/BTNMT– National technical regulation on hazardous substances in ambient air;
- TCVN 6438:2005 - Road vehicles –Maximum allowable limits of gas emission.

 Soil and sediment quality:

- QCVN 03-MT:2015/BTNTM - National technical regulation on the allowable limits of heavy metals in the soils;
- QCVN 15:2008/BTNMT – Soil quality - National technical regulation on the pesticide residues in the soils.
- QCVN 43:2012/BTNTM- National technical regulation on sediment quality;

 Noise and vibration:

- QCVN 26:2010/BTNMT - National Technical Regulation on Noise;
- QCVN 27:2010/BTNMT – National Technical Regulation on Vibration.;

 Solid waste:

- TCVN 6705:2009 – Normal solid waste. Classification;
- TCVN 6706:2009 – Hazardous waste. Classification;

 Drainage and construction works:

- TCVN 7957:2008 - Drainage and sewerage - External Networks and Facilities - Design Standard.
- TCXDVN 33:2006 – Water supply – Pipeline distribution System and Facilities.
- QCVN 07:2016/BXD: National technical regulation “infrastructure works”.
- QCXD VN 01:2008/BXD – National construction regulation – construction planning;
- QCVN 04-05:2012/BNNPTNT – National technical regulation – Irrigation works – Main Regulations on design.

 Labor safety and health:

- Decision No. 3733/2002/QĐ-BYT dated 10/10/2002 promulgating 21 labor hygiene standards, 05 principles and 07 labor hygiene measurements.
- QCVN 18:2014/BXD – National Technical regulation on safety in construction.

3.3. World Bank’s Environmental and Social safeguard policies

In addition to environmental regulations and safeguard instrument required by the Government of Viet Nam, the preparation of Tinh Gia Sub-project must also follow World Bank's social and environmental safeguard policies.

The DCIDP project has been classified as environmental category B by the World Bank. The following Operation Policy are triggered:

Environment Assessment (OP/BP 4.01). The construction and operation of the civil works proposed under the subproject has the potential to cause some potential environmental and social impacts and risks, most of these would be at low or moderate level, and manageable. The investor has prepared an Environmental and Social Impact Assessment (ESIA) to predict, assess the potential negative impacts and risks of the subproject which will be addressed through the Environmental and Social Management Plan (ESMP). The ESMP is an integral part of ESIA and includes mitigation measures, monitoring and supervision plans, capacity building, and cost estimations.

For Tinh Gia subproject, following World Bank's safeguard policies will be triggered:

*Natural Habitats (OP/BP 4.04)*¹;

The subproject will be implemented in urban areas and will not involve significant conversion or degradation of critical natural habitats or other natural habitats. However, some dredging works will be implemented on existing canals and some bridges will be built on the rivers thus causing loss of benthic habitats and disturbance of benthic organisms. The potential impacts and their associated mitigation measures have been identified and addressed in the subproject ESIA and ESMP.

Public consultation will be conducted during the preparation of the ESIA/ESMP and other safeguard instruments of the subproject. The final draft of the safeguard instruments will be disclosed locally in the project areas and the World Bank InfoShop before project appraisal.

*Physical cultural resources (OP/BP 4.11)*²

The subproject does not acquire any land within the boundary of any known existing Physical Cultural Resources (PCRs). However, the proposed civil works would involve significant amount of excavation during which artefacts may expose. The subproject also requires the relocation of 245 graves. Mitigation measures for the relocation of graves have been included in the subproject Resettlement Action Plan (RAP) and ESMP. A chance finds procedure has also been included in the subproject ESMP.

*Resettlement (OP/BP 4.12)*³

Screening of the proposed subproject shows that it would affect 1,354 households (HHs) including 225 HHs who have to be relocated. These impacts will cause significant social impacts such as loss of income and livelihood of the affected households. The potential impacts and risks could be predicable and mitigatable. The subproject has prepared a Resettlement Action Plan (RAP) to address the potential impacts related to land acquisition.

The subproject will also conform to the World Bank's *Environmental, Health, and Safety Guidelines* (EHS) Guidelines and industry specific EHS Guidelines on Water and Sanitation.

¹ OP/BP 4.11 is accessible at

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

¹ Detail of OP/BP 4.12 is available at

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

¹ OP/BP 4.36 is described in detail at

<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543943~menuPK:1286597~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html>

4. ESIA IMPLEMENTATION ARRANGEMENTS

The subProject Owner – the Nghi Son Economic Zone and Thanh Hoa Industrial Parks Construction Project Management Unit has contracted the Joint Venture between VINCEN (Vietnam Construction and Environment., Jsc) and HA THANH (Ha Thanh Land and Environmental Engineering Co., Ltd) consulting firms to prepare the Environmental and Social Impact Assessment report for Tinh Gia subproject. The ESIA team members are presented in Table 1 as follows.

Table 1- List of ESIA Team Members

No.	Full name	Educational background	Involvement in ESIA preparation
I	PMU		
1	Nguyen Minh Hoang	Director of PMU	Responsible for organizing the implementation of ESIA
2	Nguyen Manh Tuan	Officer of PMU	To support the implementation of ESIA
II	Consultant		
1	Ho Thi Huong	Master of Environmental Science	Team leader
2	Le Dao Dai	Master of Environmental Science	Solid waste impact assessment and mitigation measures
3	Dinh Tien Dung	Master of Environmental Science	Wastewater impact assessment and mitigation measures
4	Tran Thi Thuy Trang	Master of Sociology	Social impact assessment and mitigation measures
5	Le Gia Tien	Master of Environmental Science	Propose environmental management and monitoring program
6	Nguyen Thi Thuy	Master of Environmental Science	Ecological impact assessment and mitigation measures
7	Vu Ngoc Chau	Environmental Engineer	Field survey, public consultation
8	Le Tuan Anh	Environmental Engineer	Field survey, public consultation
9	Tran Thu Giang	Bachelor of Foreign Languages	Secretary / Translator

5. ESIA METHODOLOGY

The Social Assessment (SA) which is implemented concurrently with the subproject's environmental assessment has two objectives. The first is to review the potential positive and negative impacts of the subproject based on the project implementation plan. Secondly, findings during the assessment process will help the design to address potential negative impacts and propose community development activities that are relevant to the project's development objectives. For unavoidable negative impacts, consultation with local people, government agencies and project stakeholders, etc. will be carried out to ensure that affected people are compensated and supported in a timely manner so that at least their socio-economic activities are restored to pre-project levels, and in the long run, their livelihoods will not be worse due to the impact of the subproject. The social assessment and preparation of social safeguards for the project during the preparation phase ensures that interventions related to social issues are consistent and complied with GoV's regulations and WB's safeguard polices.

To ensure that all potential impacts can be identified during project preparation, SA has been conducted through a series of consultations with various stakeholders involved in the project. The special assessment focused on the project's affected households (both positive and negative). The research methodologies used for preparation of this SA include 1) secondary research, 2) site survey, 3) focus group discussions, 4) in-depth interviews, and 5) household surveys (see Annex on sampling). 225 people have participated in the survey to assess the social impact of this subproject, of which 120 people joined in the household survey (quantitative), and 115 participants in the focus group discussion, public meetings and in-depth interviews (qualitative).

a. Objective of Environmental Impact Assessment

The objectives of environmental and social impact assessment include:

- Assess environmental and social impacts of proposed investments
- Develop an environmental and social management plan (ESMP) including mitigation measures, monitoring, supervising program, reporting, capacity building, cost estimating, etc.
- Create communication channels that allow local communities to participate in decision-making.

b. Scope of Environmental Impact Assessment

Scope of the assessment bases on scope of affection (divided into 2 areas): (i) Project construction area: canals, road etc., the wastewater treatment plant and pipelines etc. (ii) project's benefited or affected area such as transportation route, borrow pits, disposal sites etc...

Scope of assessment over time: The report will review the environmental and social impacts of the project throughout its implementation from pre-construction to the construction and Operation phase

c. Subjective of the Assessment

Environmental and social components and factors to be assessed are: Natural environment (climate, water, soil, minerals, ecosystems), socio-economic and socio-cultural environment.

The impact assessment should cover: a) physical environment (water source, hydrology, air/water/soil pollution, erosion and sedimentation, drainage, safety for stakeholders and existing infrastructure, taking into account basic conditions such as climate, geography, terrain, air quality), b) historical, cultural and archaeological issues; c) biological systems such as flora and fauna, natural habitats, fisheries, etc., and d) (socio-economic and social-cultural environment such as health and employment, income, gender, social security and life-sustainability, access to basic services such as water, energy, health and education, etc.).

d. Methodology

The ESIA should be combined with the project's analysis on economic, financial, institutional, social and technical condition to ensure that environmental and social considerations are properly addressed in the selection of project investment, location and decisions related to technology solutions.

Quantitatively forecasts and assess those impacts likely to occur.

Distinguish between positive - negative, direct-indirect, cumulative, mid-term and long-term effects. Identify potential occurable impacts, unavoidable and irreversible impacts during the construction phase

e. Environmental Impact Assessment Methodology

Field survey methods: to observe and investigate existing status of environmental resources, sample and rapidly assess some quality parameters of on-site water samples in order to update and supplement the latest documents on project area.

Sociological survey: to interview 225 households (directly, indirectly affected people and beneficiaries), and leadership of relevant departments at provincial, district and communal levels.

Statistical methods: to collect, process and analyse meteorological, hydrological, environmental and socio-economic data.

Expert method: to consult experts through meetings and discussions for proposal of mitigation measures for negative impacts of the project

Summarizing and analyzing method: to summarize and analyze the project's impacts on the natural and socio-economic environment in the project area.

Rapid assessment method: to use the World Health Organization (WHO) pollution coefficients to estimate emissions and to predict pollution.

Comparative method: to assess impacts by comparing with current regulations and norms on land and water quality, water, noise, air and other relevant environmental standards and regulations.

Matrix method: to match each project activity with each environmental or social parameter (air, water, health, economic condition, etc.) to assess the cause and effect relationship of subproject implementation

f. Public Consultation

Public consultation meetings in the project wards/communes are organized with the participation of the following stakeholders:

- Representatives of local authorities from the project wards/communes;
- Mass organizations: Fatherland Front, Women's Union, Youth Union, Farmers' Association, Veteran's Association of project wards/communes. Representatives of households in the project area include households potentially losing land, beneficiaries, especially vulnerable households and households with disabled people.

Issues to be discussed by the Consultant include: (i) Introduction on the project components and work items; (ii) Overview on local socio-economic condition; (iii) Proposed work items; (iv) potential impact and social, environmental risks during construction and operation of the proposed work items. Consulted people were invited to leave comments. Details on information dissemination, consultation and participation are covered in the public consultation section of this document.

CHAPTER 1 - PROJECT DESCRIPTIONS

1.1 GENERAL INFORMATION

Project name: Dynamic Cities Integrated Development Project (DCIDP) - Tinh Gia Subproject, Thanh Hoa province

Executive agency: Thanh Hoa Provincial People's Committee

Project Owner: Nghi Son Economic Zone and Thanh Hoa Industrial Parks Construction Project Management Unit

Address: Floor 4 – Headquarter of Nghi Son Economic Zone and Thanh Hoa Industrial Parks Construction Project Management Unit (Truc Lam commune, Tinh Gia district).

Email: Banqldakv.thanhhoa@gmail.com

The Tinh Gia subproject of the Dynamic Cities Integrated Development Project includes two components:

- **Component 1 – Structural Solution – Construction of Technical Infrastructure and Urban Road.** This component consists of 8 work items in technical infrastructure like road, water drainage, wastewater collection and treatment and the resettlement sites.
- **Component 2 – Non-structural Solution – Technical Assistance and Implementation Support.** This component supports for development of policies and institutional solution in urban asset management for management authorities and public services as well as suggests strategies for tourism and industrial development, job creation and improvement of urban competitiveness.

1.2 SUBPROJECT'S OBJECTIVES

- **General Objectives**

- To increase access to improved urban technical infrastructure and capacity building for urban planning and management in the cities of the project.

- **Specific Objectives**

- Enhance competitiveness of Tinh Gia town in meeting the demand for infrastructure for labour force working in the economic zone;
- Mitigate damages caused by inundation thanks to improving and maintaining existing urban drainage capacity and ensure the capacity in the future, when the urbanization according to planning is approved;
- Promote economic development in Tinh Gia town;
- Minimize traffic jams through developing connection transport corridor;
- Improve urban development management with control thanks to software of urban and climate change management;
- Gradually implement adopted plans;
- Strengthen urban planning and planning management capacity.

1.3 SUBPROJECT AREA

The proposed work items covered by Tinh Gia Subproject will be implemented in Tinh Gia township and seven communes namely Binh Minh, Hai Thanh, Hai Hoa, Nguyen Binh, Hai Nhan, Ninh Hai and Xuan Lam. The locations of subproject areas are shown in Figure 1.1.



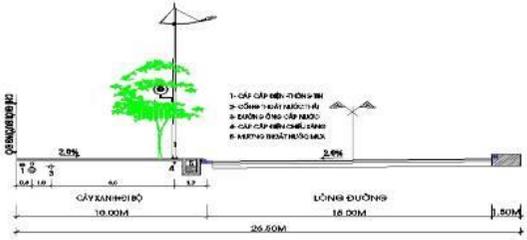
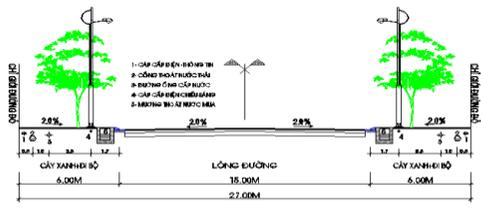
Figure Error! No text of specified style in document..1: Locations of Tinh Gia Subproject’s Work Items

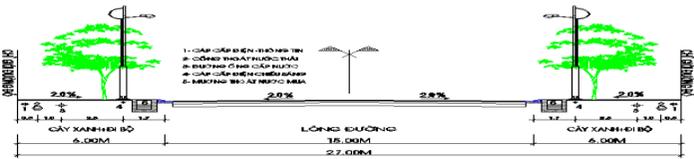
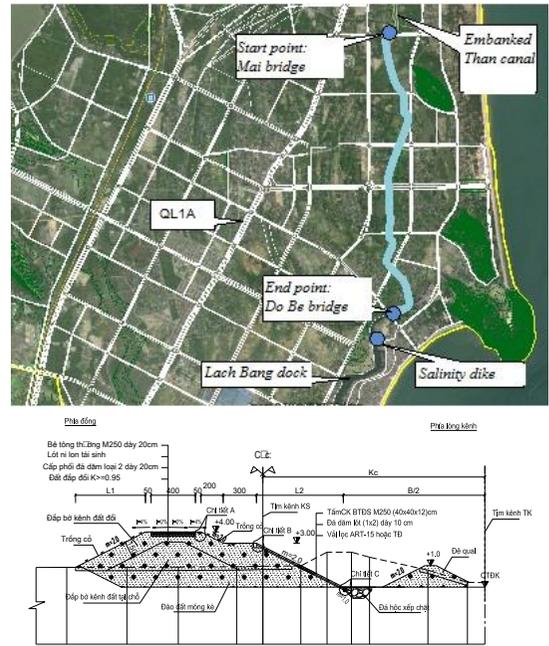
1.4 SCOPE OF INVESTMENTS

Work items for infrastructure improvement proposed in Component 1 of Tinh Gia subproject include:

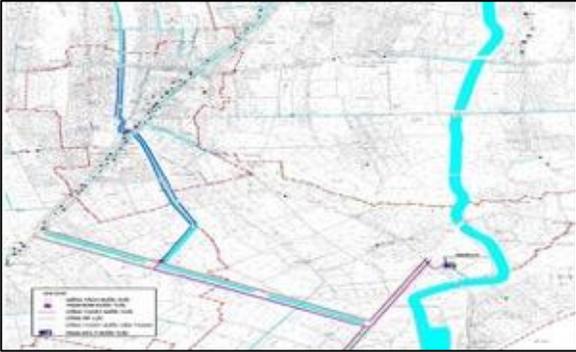
1. Construction of a new asphalt concrete road from Ninh Hai to Lach Bang 2 Bridge along the coastal line. The length is $L = 9.8$ km, $B = 27$ to 36 m, design speed is at 60 km/h. Drainage, lighting, infrastructure channel is included. There is one bridge named Son Hai bridge on this road, $L = 50.15$ m, $B = 29$ m.
2. Construction of new asphalt concrete road from Binh Minh to Sao Vang road; $L = 2.1$ km, $B = 26.5$ m. Design speed $V = 60$ km/h. Drainage, lighting, infrastructure channel is included.
3. Demolition of the existing Do Be bridge and rebuild a new Do Be bridge ($L = 70$ m, $B = 20$ m) at the same location, improving the existing 490 m of Do Bo access roads at two ends of the bridge;
4. Construction of the new road from NH1A to Ninh Hai beach; $L = 815$ m, $B = 27$ m, Design speed $V = 60$ km/h. Drainage, lighting, infrastructure channel is included.
5. Dredging and embankment lining of the Cau Trang canal, $L = 5.7$ km, $B = 3$ to 9 m;
6. Dredging and embankment lining of the Than canal, $L = 5$ km, $B = 25.5$ m
7. Construction of the wastewater collection and treatment system, including a wastewater treatment plant capacity $2,000$ m³/d using biological technology, and a sewer system;
8. Construction of infrastructure for 5 small resettlement sites with total land area of 4.5 ha with 138 land slots (80 - 150 m² each). The proposed works include ground levelling, construction of internal roads, drainage, water supply, power supply and lighting system.

Details on these proposed work items are presented in Table 1.1:

Work Item	Location	Proposed Investments	Figure
<p>(2) Binh Minh road to Sao Vang – Nghi Son EZ</p>	<p>Beginning point: intersecting with NH1. End point: intersecting with the coastal road The road passes through Binh Minh and Nguyen Binh communes</p>	<p>Build new asphalt concrete road, L=2.08 km. B = 26.5m, sidewalk 11.5m. Design speed V = 60 km/h. Side drainage, lighting, power line, trees, cable line are included.</p>  <p>The diagram shows a cross-section of a road with a total width of 26.50m. It includes a 10.00m wide sidewalk on the left, a 16.00m wide main road, and a 0.50m wide sidewalk on the right. The road has a 2.0% slope on both sides. It features a central tree, streetlights, and utility poles. A legend lists: 1- CẤP CÁP ĐIỆN (POWER CABLE), 2- CẤP CÁP THÔNG TIN (INFORMATION CABLE), 3- CẤP CÁP CÁP (CABLE), 4- CẤP CÁP CÁP (CABLE), 5- CẤP CÁP CÁP (CABLE).</p> <p><i>Typical cross section of Binh Minh road to Sao Vang – Nghi Son EZ</i></p>	<p>Figure</p>  <p>The map shows the proposed road route (red dashed line) starting from the intersection of NH1 and the current road, passing through Binh Minh and Nguyen Binh communes, and ending at the intersection with the coastal road. Key features include the current road, coastal road, Do Be bridge, and the start and end points.</p>
<p>(3) Upgrading and rehabilitation of Do Be bridge and its approach roads</p>	<p>Beginning point: intersecting with the coastal road. End point: To Hai Thanh beach, intersecting with the existing road. The road passes through Binh Minh and Hai Thanh communes</p>	<p>Build new asphalt concrete road, L=491 m, B = 27m, sidewalks 2x6m = 12 m. Rebuild Do Be reinforced concrete bridge, B=20m, L=70m.</p>  <p>The diagram shows a cross-section of a road with a total width of 27.00m. It includes a 6.00m wide sidewalk on the left, a 15.00m wide main road, and a 6.00m wide sidewalk on the right. The road has a 2.0% slope on both sides. It features a central tree, streetlights, and utility poles. A legend lists: 1- CẤP CÁP ĐIỆN (POWER CABLE), 2- CẤP CÁP THÔNG TIN (INFORMATION CABLE), 3- CẤP CÁP CÁP (CABLE), 4- CẤP CÁP CÁP (CABLE), 5- CẤP CÁP CÁP (CABLE).</p> <p><i>Typical cross section of the Do Be bridge approach road</i></p>	 <p>The map shows the proposed road route (red dashed line) starting from the intersection of NH1 and the current road, passing through Binh Minh and Hai Thanh communes, and ending at the intersection with the existing road. Key features include the current road, coastal road, Do Be bridge, and the start and end points.</p>

Work Item	Location	Proposed Investments	Figure
<p>(4) Road from NH1A to Ninh Bien beach</p>	<ul style="list-style-type: none"> - Beginning point: intersecting with NH1A, end point at Ninh Hai beach - The road is within area of Ninh Hai commune 	<p>Build new asphalt concrete road, L=0.815 km. B Roadbase = 27m, B = 15m, sidewalk 2x6m = 12 m. Side drains, tree, lighting system, technical tunnels are included. Design speed $V = 60 \text{ km/h}$.</p>  <p><i>Typical cross section of the NH1A road section to Ninh Hai beach</i></p>	<p>Figure</p> 
<p>(5) Upgrading and rehabilitating Than canal</p>	<ul style="list-style-type: none"> - The section starts from Mai bridge to Do Be bridge - The section is located on 3 communes namely Ninh Hai, Hai Hoa and Binh Minh. 	<p>Dredging canal bed and lining the embankment, build operation roads on the canal's two banks.</p> <ul style="list-style-type: none"> • Dredging: $B_{\text{bed}}=25.5\text{m}$, L=5 km. Dredging depth: -0.9m to - 1.39m; Maximum water level is $H = 2.84\text{m}$ • Lining embankment L=5km, elevation (+3.0), width $B_{\text{shoulder}}=3,0\text{m}$. Build concrete steps on the embankment at sections running through residential area. • Stone embankment, slope is reinforced precast concrete, casted in-situ. The bottom is lined with crushed stone 10cm thick and geotextile. Top of the embankment are planted with grass erosion prevention. Operation road: cement concrete operation road, 5m wide at each side. • Replace 18 reinforced concrete box culvert drainage culverts. Culvert foundation is bamboo piled, diameter 6~8, L = 2.5m, structure:. • Rehabilitate the salinity control sluice: some mansoney and machelical works 	 <p><i>Typical cross section at the half of Than canal</i></p>

Work Item	Location	Proposed Investments	Figure
<p>(6) Upgrading and rehabilitating Cau Trang canal</p>	<p>Beginning point: intersecting with NH1A bypass. End point: intersecting with the Than canal. The work item will be done at: Hai Nhan, Nguyen Binh, Binh Minh communes and Tinh Gia township.</p>	<p>Cau Trang dredging and canal embankment lining L = 5.7 km, including: - K0+000 ~ K0+280: dredge and construct culvert, L = 280m; - K0+280 ~ K1+480: dredging, L = 1,200m, B = 9.0m, embankment elevation: (+3,00). - K1+480 ~ K2+719 and K4+884 ~ K5+700: L=2,350.8m, B canal = (3,0~5,0)m. - K2+719 ~ K4+884: length L = 1,613m, B = (4.0~5.0)m, Depth: Zbed = 0.75~1.93 m, embankment elevation: Zbed = 3.00~3.94 m - Embankment structure: cast-in-situ concrete grade M250 structure, slope m=2.0. The foot is stone 30cm thick in hexagonal shape. The top has slope m=1.5m, reinforced by hexagonal cells 10cm planted with grass for erosion prevention. - Work on the canal: Build 5 new reinforced concrete bridges on the canal (at the junction with local roads): B = (5.0-6.0m), - Replace 20 drainage culverts</p> <div> </div> <p><i>Typical cross section of the underground sewer (K0+00 ~ K0+280)</i></p>	<p style="text-align: center;">Figure</p> <div> </div> <div> </div> <p><i>Typical cross section of the canal section from K0+280 ~ K1+480</i></p>

Work Item	Location	Proposed Investments	Figure
<p>(7) Construction of wastewater collection system and treatment plant (WWTP)</p>	<p>The WWTP will be constructed on the land area near the road to Hai Thanh commune, 150m from Than canal, in Dong Tien hamlet, Binh Minh commune</p>	<p>* WWTP capacity: 500m³/day. Treatment technology: biological pond * Treated Wastewater quality meets column B, QCVN 14-2008/BTNMT, discharged into Than canal, 150m from the WWTP. Build 8 CSO (combined sewer overflows), 4,000 m interceptor HDPE D200 – D300. 2 pumping stations: PS 1: near Cong bridge, 4m². PS 2: at the junction between Binh Minh-Sao Vang road and Cau Trang canal, about 10m². H = 2.5 - 4 m.</p> 	<p>Figure</p> 
<p>(8) Construction of Resettlement site)</p>	<p>5 Resettlement sites</p> <ul style="list-style-type: none"> - 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha - 2: Ron field- Hai Hoa 0.5 ha - 3: Cao Thang 3 - Nguyen Binh 0.5 ha - 4: Ray Kenh - Binh Minh 1.5 ha - 5: Van Xuan 8 - Binh Minh 0.5 ha. 	<p>Total land area of 5 resettlement sites is 4.5ha. Work item includes: Leveling, construct road, drainage system, water supply system, lighting system, tree.</p> <p>Infrastructure construction rate is 40%, there are about 138 land plots (for 83 relocated households who wish to resettle in the resettlement site, and for back up). Area of each land plot from 80 m² - 150 m².</p>  <p style="text-align: center;"><i>Resettlement sites 1, 2 and 3</i></p>	 <p style="text-align: center;"><i>Resettlement sites 4 and 5</i></p>

1.5 CONSTRUCTION METHODS

1.5.1 Road and Bridge

Road construction methods (for (1) Coastal road from Ninh Hai –Lach Bang 2 Bridge; (2) Construct road from Binh Minh to Sao Vang road –Nghi Son EZ and (4) Construct Road from NH1A to Ninh Hai beach) includes the following steps:

1. Preparation

- Positioning and localizing works;
- Preparing construction site and workers camps;
- Mobilizing machineries and equipment.

2. Construction of asphalt concrete layer

- Step 1: Digging and dredging organic soil
- Step 2: Cover ground to standard rigidity in each design layers
- Step 3: Digging the road mold following the width of each segment
- Step 4: Spreading and compacting each soil layer, ballast type 2 and type 1 (within the road) to standard rigidity in design layers.
- Step 5: Drawing formwork → completed.

Bridge construction methods (for Do Be bridge, Son Hai bridge) includes the following steps:

- Step 1: Installing temporary bridges (such as wooden bridges or pontoon bridges) at convenient locations to ensure the accessibility of people and vehicles involved in traffic.
- Step 2: Demolition of existing Do Be bridge and Son Hai bridge;
- Step 3: Drilling foundation (pile driving in accordance with scope and geological condition at the construction site)
- Step 4: Constructing abutment/pillar
- Step 5: Installing formwork for cement concrete girder or using crane to mobilizing precast concrete pallets.
- Step 6: Removing formwork → completing the construction

1.5.2 Dredging, Embankment Lining for Than Canal and Cau Trang Canal

The embankment construction will include works as site preparation, excavation/dredging canal banks, embankment and other works behind the dyke. The construction measures for these works are presented as follows:

- Positioning and localizing works;
- Preparing construction site and workers' camps and site office;
- Mobilizing machinery and equipment;
- Locating temporary area at site to gather dredged material.
- Use specialized equipment combined with manual labor to dry dredge canal to the designed elevation;
- Dredged material will be direct transported by truck to landfill/ disposal site. The excavated soil are used for ground levelling, or dumped at disposal site (see 1.5.2 below).
- Construction of embankment as designed.
- Construction of embankment and auxiliary works

Notes: Dredging activities will not be conducted in flood season, during extreme weather events (heavy rains, floods, cyclones, etc).

1.6 LABOUR, MACHINERY AND EQUIPMENT FOR CONSTRUCTION

List of main machinery and equipment for basic construction is presented in Table 1.2 below.

Table Error! No text of specified style in document..2. List of Main Machinery and Equipment for Basic Construction and Labour

Machines and equipment	1. Coastal road from Ninh Hai – Lach Bang 2 Bridge	2. Binh Minh to Sao Vang road	3. Do Be bridge and approach roads	4. Road from NHA to Ninh Hai beach	5. Dredge, embankment lining Than Canal	6. Rehabilitate Cau Trang Canal	7. Construction of WTP and pipe line system	8. resettlement site
Excavator with one bucket, 0.8m ³	6	1	1	1	6	4	2	2
1.6 m ³ excavator	10	1	1	1				
108 CV bulldozers	12	2	1	1	6	4		2
108 CV plate machine	2	1	1	1				1
10T vibratory roller	6	2	1	2	2	2		1
16T Mini Wheel Loader	8	2	1	2	2	2		2
25T vibratory roller	8	2	1	1	1	1		1
10T automobile crane	6	2	2	2				
Cars watering 5m ³	4	2	2	2	2	1		1
Automobile watering plastic 7T	4	1	1	1				1
Mortar mixer	8	4	2	2			1	2
Concrete mixers	10	4	2	2	10	8	2	2
Water pumps	6							2
Plastic asphalt carpet machine	3	1	1	1				1
Pile machine	2		2					
Automobiles dump	20	8	8	8	6	4	1	8
Steel bending machine	6	2	2	2	4	3	13	2
Electric welding machines	20	8	8	8	8	6	2	4
Shredder	20	6	6	6	8	6	2	4
Labour (pers)	100	50	30	50	80	80	50	50

1.7 MATERIALS DEMAND AND WASTE

1.7.1 Excavation, Backfill Volume and Main Construction Material

The road's elevation will be increased so there will be great demand for backfilled material. Besides, to ensure road base structure, existing organic matter and weak soil at some sections will be excavated and replaced by other bearing sand and soil. There is also dumping demand for sludge dredged from canals. Excavation and backfilling volumes are presented in Table 1.3 below.

Table Error! No text of specified style in document..3. Volume of Materials

Work items	Volume								
	Cement	Sand	Macadam	Concrete rock	Asphalt	Construction stone, paving embankment	Steel	Backfilling	Total
	(ton)	(m ³)	(m ³)	m ³	(ton)	(m ³)	(ton)	(m ³)	(m ³)
1. Coastal road	16,293	162,680	3,815	53,301	2,285	2,513	4,317	330,354	330,354
2. Road from Binh Minh to Sao Vang	1,946	8,165	22,506	7,579	492	92	384	55,089	55,089
3.Reconstruction of Do Be bridge	1,678	3,611	5,577	4,639	113	165	548	9,577	9,577
4. Road from NH1A to Ninh Hai beach	1,263	4,082	8,933	4,336	190	27	342	10,163	10,163
5. Dredge, embank Than Canal	2,670	4,708	450	13,389	4	111,628	425	660,168	660,168
6. Rehabilitate Cau Trang Canal	2,403	4,237	383	12,050	4	55,814	362	561,143	561,143
7. WWTP, PSs, Sewers	121	2,600	-	230	2	-	30	64,500	29,400
8. Resettlement site	629	50,661	5,715	1,602	125	23	39	29,400	64,500
Total	27,003	240,744	43,379	97,126	3,215	170,262	6,591	1,720,394	1,720,394

Table Error! No text of specified style in document..4. Volume of Demolition, Dredged Material and Excavation Activities

Work items	Volume of demolition (m ³)	Volume of dredged material (m ³)	Volume of excavation (m ³)	Total (m ³)
1. Coastal road	81,001		522,861	603,862
2. Road from Binh Minh to Sao Vang	133,593		16,150	149,743
3.Reconstruction of Do Be bridge	8,092		3090	11,182
4. Road from NH1A to Ninh Hai beach	64,260		6,177	70,437
5. Dredge, embank Than Canal		68,630	59,357	127,987
6. Rehabilitate Cau Trang Canal	24,631	43,480	9,520	77,631
7. WWTP, PSs, Sewers	11,250		4,164	15,414
8. Resettlement sites	27,536		21,000	48,536
Total	350,363	112,110	642,319	1,104,792

1.7.2 Material Source and Disposal Site

Sand, stone, soil for construction/filling will be purchased from local borrow pits and quarries transported to the project sites by roadways. Locations of potential sources, capacities and operation permits are discussed below.

a. Borrow pit: The licensed borrow pit is located in Phu Lam commune – Tinh Gia district under management and exploitation of Duc Minh private company. Its current reserve is about

1,300,000 m³. Distance to project area is about 10.5km. Due diligence review of the borrow pit is presented in Annex 1.

b. Sand mine: The licensed Ham Rong sand mine which is under management and exploitation of Thuy Son Trading Service Joint-stock company. Distance to project area is 35 Km along NH1A.

c. Quarry: The Licensed Truong Lam quarry which is being managed by Tan Thanh 6 company will be used for the subProject. The nearest distance to the project area is 8.7km along NH1A.

d. Asphalt concrete mixing plant: The asphalt concrete mixer is located in Truong Lam commune, Tinh Gia district. Nearest distance is 6.9km. Transportation route along NH1A.

e. Other materials (steel, iron, cement, block bricks...) are purchased from agents in Tinh Gia district under inter-department Price Statement of Finance Department and Construction Department. The nearest distance for transportation of steel and cement is about 7 km.

f. Disposal sites: Waste generated during the construction of the road will be disposed in communes where there is demand of leveling work in Table 1.5 as follows:

Table Error! No text of specified style in document..5. Locations of Disposal Sites

Disposal Site	Picture	Description
For Excavation:		
1. The dump site is located in Xuan Lam commune, Tinh Gia district		<ul style="list-style-type: none"> - The dump site is in front of the headquarter of Xuan Lam Communal People's Committee - Distance: 10 - 15 Km. - Transport route: Along NH1A - The storage capacity is about 300,000 m3. - This is currently a vacant land, 200m from the nearest residential house, 500m from the nearest National Highway 1A; Currently the site needs leveling.
2. The dump site is located in Tuong Son commune, Tinh Gia district		<ul style="list-style-type: none"> - The dump site is in next to the provincial road DT512, 12 to 15 km far from the construction sites. - Transport route: Along NH1A - The storage capacity is about 250,000 m3. - This is currently a vacant land, need of leveling, more than 500m from the nearest residential house.

Disposal Site	Picture	Description
<p>3. The dump site is located in Mai Lam commune, Tinh Gia district</p>		<ul style="list-style-type: none"> - The dump site is in next to Bach Lang bridge with distance of 3km. - Distance: 10 - 15 Km. - Transport route: North - South No.2 road --> NH1A - The storage capacity is about 20,000 m3. - This is currently a small pond land, need of leveling, more than 100m from the nearest residential house.
For Dredged Material:		
<p>(1) The disposal site under the salinity control sluice (Ben Ngao sluice)</p>		<p>(1) The disposal site is near the salinity control sluice (Ben Ngao sluice) – at the Lach Bang river mouth– Binh Minh commune. This is the disposal site of Lach Bang port project with area of about 3.7ha.</p> <ul style="list-style-type: none"> - Distance from the disposal site to the canal dredging area is 3 - 8 km; The main transportation route is Binh Minh inter-communal road. - Capacity of about 100,000 m3 - The disposal site is near the Lach Bang River which was saline as reflected in the monitoring results of Thanh Hoa DoNRE with a salinity of about 25-28‰.
<p>(2) The disposal site near Do Be bridge</p>		<p>(2) The disposal site near Do Be bridge with area of about available 4.5ha of abandoned land. The distance from the disposal site to the dredging area of Than and Cau Trang canals is 0.5 - 5 km.</p> <p>The main transportation route is Binh Minh inter-communal road. The disposal site's capacity is about 67,500 m³ (corresponding to the discharge height of about 1.5 m).</p>
For domestic and hazardous waste		
<p>Domestic solid waste / sludge</p>		<ul style="list-style-type: none"> - Landfill/waste treatment plant for waste and hazardous waste of Nghi Son Environment JSC in Truong Lam commune, Tinh Gia district. - Average distance to project areas: 20 km. Total land area for disposal is 30 ha.

1.8 IMPLEMENTATION SCHEDULE

The subproject implementation schedule is presented in Table 1.6 below.

Table Error! No text of specified style in document..6 Project Implementation Schedule

NO	Content	By when
1	Approval of Project proposal	3/2017
2	Approval of Pre-FS report	01/2018
3	Approval of FS report	03/2018
5	Signing loan agreement	5/2018
6	Signing contracts with construction contractors for phase 1 (30% work volume)	10/2018
8	Commencing construction for phase 1 (Expected work items: Than canal, Cau Trang canal, Binh Minh road to Sao Vang road – Nghi Son EZ)	From 11/2018 to 11/2020
9	Completing construction and bringing into use	11/2020
10	Signing contracts with construction contractors for phase 2 (70% work volume)	10/2020
11	Commencing construction for phase 2 (70% work volume). Expected work items: Coastal road from Ninh Hai to Bach Lang 2 bridge; Upgrade Do Be bridge and approach roads; Road from NH1A to Ninh Hai beach; Construct wastewater treatment plant capacity 500m ³ /day.	From 11/2020 to 11/2023
12	Completing construction and bringing into use	11/2023

1.9 BUDGET

Total estimated budget for the subproject is: 1,791,692,000,000 VND, equivalent to 79.63 million USD (Exchange rate: 1 USD = 22,500 VND).

CHAPTER 2 - ENVIRONMENTAL, SOCIO-ECONOMIC BASELINE

2.1 NATURAL CONDITIONS

2.1.1 Geography

Thanh Hoa is the northernmost province in Central Vietnam and is a large province in both area and population. The province borders 3 provinces of Son La, Hoa Binh and Ninh Binh to the north, Nghe An province to the south and southwest, Hua Phan province (Laos Republic) to the west and the East sea to the east with 102 km coastline.

The expanded Tinh Gia township borders the East sea to the East, Phu Lam, Phu Son communes (Tinh Gia district) to the west, Quynh Luu district (Nghe An province) to the South and Dinh Hai, Hai Linh communes (Tinh Gia district) to the North. Tinh Gia township after being expanded covers 12 communes of Nghi Son Economic Zone namely Xuan Lam, Truc Lam, Hai Binh, Tung Lam, Mai Lam, Vinh Hai, Hai Yen, Tan Truong, Nghi Son, Hai Ha, Truong Lam, Hai Thuong and 6 communes and 1 township in the central area of Tinh Gia district, namely Tinh Gia township, Binh Minh, Hai Thanh, Hai Hoa, Nguyen Binh, Hai Nhan and Ninh Hai.

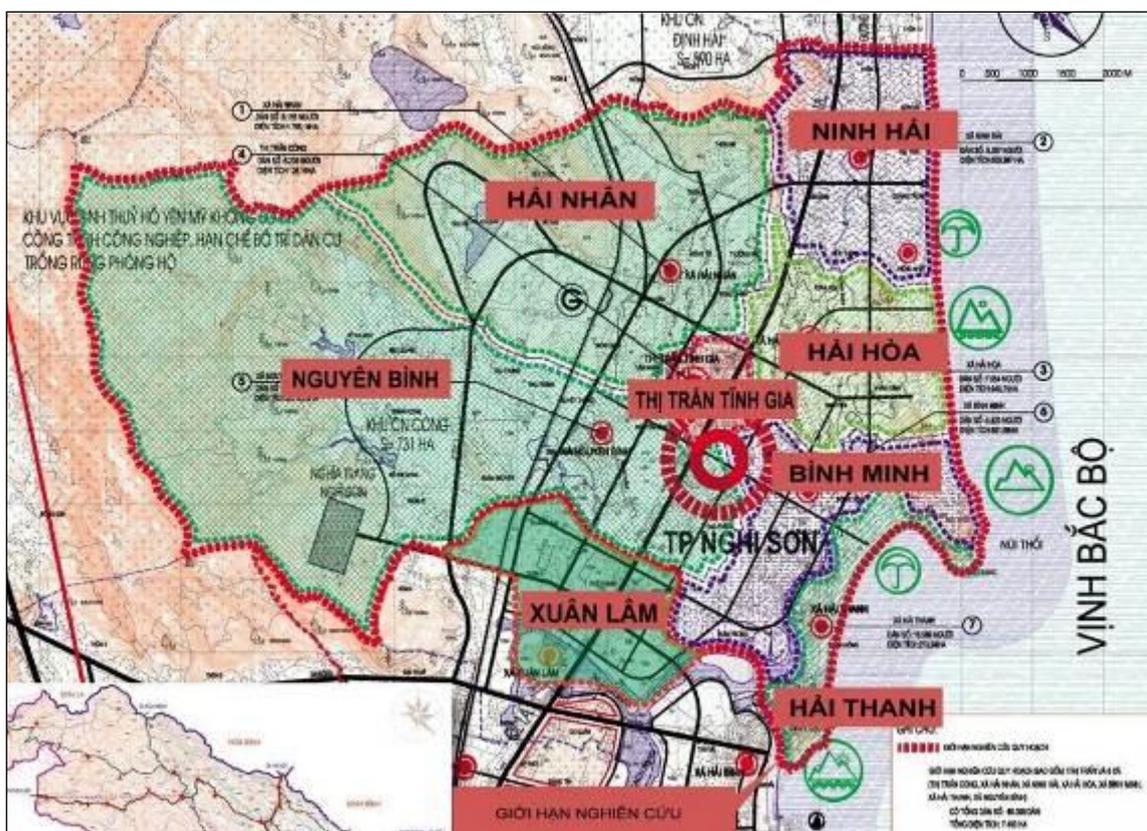


Figure Error! No text of specified style in document..2: Tinh Gia’s Location and Planning

2.1.2 Topography

Topography of Tinh Gia district is relatively complex and diverse. The province is divided into three topographical areas: The southwest topography is relatively high surrounded by series of along mountain to create a semi-mountainous topography. Mountainous and semi-mountainous areas cover the area of about 13 communes, of which 6 mountainous terrain communes are: Tung Lam, Phu Lam, Phu Son, Dinh Hai, Tan Truong, Truong Lam and 7 communes with

semi-mountainous topography is: Hai Nhan, Nguyen Binh, Cac Son, Anh Son, Hung Son, Mai Lam, Truc Lam. The topographical area with semi-mountain allows Tinh Gia to use for development of feature economies such as: forestry, animal husbandry, exploitation of natural resources, soil. Mountainous areas, high peaks of 100 - 250 m are less favorable for construction development, especially the need for concentrated construction. However, this is the watershed area, the green lung of the whole region on tourism and irrigation.

Elevation of the district tends to be low gradually toward the north east. Here, topography is fairly flat and forms a delta area with many rivers and canals across, suitable for the rice growing and floods as well as industrial trees and fruit trees and cattles and livestock. The terrain area includes the area of some communes bordering with semi-mountains with development ability of short-time industrial trees such as Hai Ninh, Trieu Duong, Ngoc Linh, Hai Hoa, etc. Other communes depend on the north of district such as: Cac Son, Anh Son, Thanh Son, Hung Son, Thanh Thuy. The midland has relatively flat terrain, good geology capable of meeting the needs of concentrated construction with the potential of planting industrial crops such as rubber, sugarcane, cassava, etc, is grown on centralized type.

The east area of the district includes about 15 coastal communes in which some communes have canals to create a completely different shape with two above areas, at low elevation and tends to incline to the sea. It will create ability to form and develop marine economic areas for aquaculture as well as fishing far and near shore. However, beside the potential of the sea are the difficulties caused by typhoons and sea invasions.

2.1.3 Meteorology

Average annual rainfall in Tinh Gia district is 1,600-1,900mm. Rainy season lasts from May to September with rainfall accounting for 85% of total annual rainfall. Heavy rains and narrow river beds are potential reason of serious flooding and inundation.

Average monthly temperature in Thanh Hoa province in the year 2015 was 24.4°C, of which in the hot months from May to August, province's temperature was 29°C while Tinh Gia's temperature was 31°C. According to statistical data from 2000 up to now, Tinh Gia's average temperature in hot months tends to increase at an average annual rate of 0.3°C and even hot days up to 41°C. The hot season in Tinh Gia usually lasts longer with severe Laos winds. Tinh Gia borders the sea in the East, so it is at high risk of facing with storms which usually last longer and more serious than other areas in the province.

2.1.4 Hydrology

Rivers and streams in the area are short and sloping, derived from the west and run into the sea but most of them are blocked by sand dunes which run along the coastal line. Therefore, water in flooding season is difficult to drain and usually causes localized inundation for coastal communes. River system in the project area includes:

Lach Bang estuary is connected to the sea in the direction of North West-South East. The estuary is shielded by Mui Tron mountain (Dragon's Nose mountain) in the North and faces a vacant sand area in the South. The terrain is rather flat and shallow, evenly distributed with natural depth ranging from -1.85 ÷ -4.8m (State elevation system). The further area from Lach Bang estuary is relatively flat, with deep creeks running toward Hai Thanh beach (at the old port). The natural depth in the whole area varies from -1.85m to 3.85m and even up to -4.8m at some places. Lach Bang river section is naturally deeper, with depth varying from -1.85 m to -2.85 m.

The Than canal section is relatively shallow, the depth toward the river is shallower than estuary area (-0.85m compared with -1.85m at estuary area). The Cau Trang canal section is relatively shallow, the depth toward the river is shallower than estuary area (-0.85m compared with -1.6m at estuary area).



Figure Error! No text of specified style in document..3: Rivers and Canals in Project Area

2.1.5 Hydrogeology

Tinh Gia district is a area subjected to frequent flooding annually at coastal communes. Streams and rivers system in the area are relatively short and steep flowing from the West to the East sea. At river sections near the sea, there are sand-bank running parallel with the coast obstructing flows and cause to flood for the coastal communes.

In general, groundwater reserve is small and not in good quality. Surface water in the coastal area is mostly salty. Most of Tinh Gia district are mountainous areas which are developed on different original rocks. In the western area, groundwater mainly belongs to cliff water. The thickness of aquifer (fracture zone and karst thickness) is from 30 to about 100m. Water quality is good, total mineralization is 0.1-0.5g/l with a homogeneous component of calcium bicarbonate. In general, the aquifer is very heterogeneous, water storage depends on the degree of karst, but generally, water supply cannot be centralized.

Toward the East, because geological characteristics and hydrological conditions are so complex, and objects with water storage are mostly poor and uneven, they change both reserve and volume in short distance. Therefore, reserve of underground water in general is limited and has poor quality. Groundwater in the coastal communes are mostly salted and affected by tidal impacts.

2.1.6 Geotechnology

Results of geological survey and tests on geotechnical condition of road and work on the route show that, soil layers downwardly in the surveyed area are as follows:

- Layer Kc – Old road base course: This is the layer of the old road base course on road section 3 and Do Be bridge area. Thickness is from 25-30cm.
- Layer D – Filled material layer of the old sub-base: the sub-base layer of the old road on section 3 and Do Be bridge area and sections crossing with local roads. The subgrade structure is combination of gray yellow clay with gravels and cobbles, running through layer of the old road with thickness of 0.8-1.5m.
- Layer Hc – Subgrade layer: sand and organic matters, this is heterogeneous material and needs to be stripped off before construction. The thickness is from 0.5-0.8m.
- Layer 1 – Sandy clay, grey yellow (SC): this is popular terrain layer on the area where the roads run through. This is alluvium sandy clay where most of drilling depths are from 4.0m to 5.0m. The layer is sandy clay with grey yellow color with loose to medium dense.
- Layer 2 – Silty sand, grey blue color (SM), loose to medium dense structure: the silty sand with grey blue color, loose to medium dense structure and is alluvium layer. This layer is popular in the area where the roads run through and is under Layer 1. Drilling depths to this layer are from 7.6 to 8.0m.
- Layer 3 – Lean clay (clay with low plasticity -CL), brown grey, plastic-liquid state: This layer is lean clay with brown grey color at plastic-liquid state. This is diluvium layer under layer 2 and is encountered when drilling at Son Hai bridge and Do Be bridge with thickness of 1.9 – 3.0m. This layer can also be found under the drilling depth of 12.8m at road section from Km 8+600 – Km 9+100.
- Layer 4 - Lean clay (clay with low plasticity –CL), brown grey, at quasi-plastic state: Lean clay (clay with low plasticity –CL), brown grey, at quasi-plastic state is diluvium layer under layer 3, found at the section 1 from Km8+600 – Km9+100 at undefined depth of borehole LK1.9 and at drilling depth from 3.0-4.5m at Son Hai and Do Be bridges.
- Layer 5 – Lean clay with grits (CL), brown grey or grey yellow color at semi-stiff state: Lean clay with grits (CL) having brown grey or grey yellow color at semi-stiff state is under layer 4, which is found locally within the surveyed area of Do Be and Son Hai bridges. It is found at the boreholes for bridge surveying and has undefined thickness. This layer is alluvium and can bear load for bridge abutment foundation.
- Layer 6 – Lean clay with grits (CL) having brown grey or grey yellow color, at semi-stiff state: This layer is under layer Hc and is found locally within the surveyed area of section 1 which runs through hillsides with great gradient (Km3+160 – Km+520). Layer thickness is around 10m as in the geological survey result and it is originated from weathered sand stone, with main composition of lean clay and grits.
- Layer 7 – Highly weathered sand stone (grade 4 stone): layer of highly weathered silty stone is under layer 6, locally found within the surveyed area from section 1 to the hillside with great gradient (Km 3+160 – Km 3+520). Layer thickness is about 15m as in the geological survey result.
- Layer 8 – Stiff silt stone (grade 3 stone): layer of stiff silt stone is under layer 7, locally distributed within the surveyed area of the road section 1 which runs through hillside with great gradient (Km3+160 – Km3+520).

2.2 ENVIRONMENTAL QUALITY

In order to have quantitative assessment on the local baseline environmental parameters, the Consultant has prepared and implemented an environmental quality monitoring program during 20 - 22/10/2017. The monitoring parameters are shown in Table 2.1 below.

Table Error! No text of specified style in document..7. Environmental Quality Monitoring Parameters

No	SAMPLE	NOs of SAMPLE	PARAMETER
1	Air	20	Dust, noise, vibration, NH ₃ , H ₂ S, CO, NO ₂ , SO ₂ .
2	Surface water	14	pH, turbidity, TSS, DO, COD, BOD ₅ , NO ₃ , Cu, Pb, Zn, Fe, oil and grease, total Coliform
3	Groundwater	10	pH, hardness (by CaCO ₃), COD, chloride (Cl ⁻), Nitrate (NO ₃ ⁻), Pb, Zn, Fe, Total Coliform
4	Wastewater	10	pH, salinity, BOD ₅ , TSS, TDS, H ₂ S, amonium, Nitrate (NO ₃ ⁻) by N, oil and grease, total surfactants, phosphate (PO ₄ ³⁻) (by P), total Coliforms
5	Soil	10	Cu, Zn, Cd, Pb
6	Sediment	4	Cu, Zn, Cd, Pb, salinity

2.2.1 Air Quality, Noise and Vibration

Air quality was monitored on 20th and 22nd October 2017 in sunny weather, moderate wind, temperature 27-30^oC, humidity 60-80%. The results of sampling are listed in Table 2.2 below.

Table Error! No text of specified style in document..8. Air Quality, Noise and Vibration

No	Parameter	Unit	Result										QCVN 05:2013/B	QCVN 27:2010/	QCVN 26:2010/
			K1	K2	K3	K4	K5	K6	K7	K8	K9	K10			
1	Temperature	°C	27.5	28.2	27.2	27.6	28.1	28.7	27.0	27.5	28.0	28.4	-	-	-
2	Humidity	%	79.1	68.1	80.1	81.0	68.7	71.8	80.2	78.1	69.2	70.2	-	-	-
3	Wind speed	m/s	1.2	0.9	1.0	1.4	0.8	1.1	1.2	0.9	1.2	1.2	-	-	-
4	TSP	µg/m	190.9	180.7	110.8	110.1	120.9	165.0	177.5	150.8	169.7	150.4	300	-	-
5	NH ₃ *	µg/m	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	-	-
6	NO ₂ *	µg/m	134.7	134.0	123.5	126.5	164.6	163.6	121.5	125.6	120.5	124.5	200	-	-
7	CO*	µg/m	2560	2550	2542	2539	2530	2540	2526	2630	2620	2650	30,000	-	-
8	SO ₂	µg/m	12.1	12.6	17.5	17.2	15.8	15.7	17.2	17.8	17.8	17.6	350	-	-
9	Noise	dBA	56.8	58.0	55.4	56.0	57.9	59.0	56.2	56.2	59.0	59.3	-	-	70
10	Vibration	(m/s ²)	32.4	33.8	32.2	34.8	36.5	37.8	35.1	35.6	37.4	38.0	-	55	-
No	Parameter	Unit	Result										QCVN 05:2013/B	QCVN 27:2010/	QCVN 26:2010/
			K11	K12	K13	K14	K15	K16	K17	K18	K19	K20			
1	Temperature	°C	27.7	28.1	27.4	27.2	28.2	29.1	28.7	29.0	27.9	29.4	-	-	-
2	Humidity	%	74.1	69.2	75.3	76.0	70.7	68.8	69.2	68.4	77.2	67.6	-	-	-
3	Wind speed	m/s	1.3	0.9	1.1	1.4	1.2	0.8	0.8	0.9	1.1	1.1	-	-	-
4	Dust TSP	µg/m	183.9	125.7	176.8	161.1	152.9	149.4	137.5	160.8	139.9	151.4	300	-	-
5	NH ₃ *	µg/m	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	-	-
6	NO ₂ *	µg/m	142.7	143.0	132.5	134.5	151.7	163.7	133.5	145.5	136.5	142.5	200	-	-
7	CO*	µg/m	2570	2565	2572	2531	2620	2532	2537	2533	2580	2575	30,000	-	-
8	SO ₂	µg/m	13.2	12.46	14.5	17.6	15.8	14.7	17.4	16.8	17.1	16.7	350	-	-
9	Noise	dBA	57.8	56.0	58.4	56.4	56.9	58.0	59.2	57.2	58.0	58.7	-	-	70
10	Vibration	(m/s ²)	35.7	33.5	36.7	33.8	34.1	37.2	38.1	35.5	36.0	36.8	-	55	-

Sample	Coordinate system 2000		Location	Sample	Coordinate system 2000		Location
	X	Y			X	Y	
K1	2155 096	583 436	At the junction between the new road with NH1A in Ninh Hai commune	K11	2147 961	582 771	At the junction between the coastal road with the road passing Quy Vinh hamlet residential area in Binh Minh commune

Sample	Coordinate system 2000		Location	Sample	Coordinate system 2000		Location
	X	Y			X	Y	
K2	2155 045	584 129	At the junction between the inter-communal road passing through Ninh Hai, near the tentative resettlement area	K12	2149 275	581 114	At the junction between Binh Minh-Sao Vang road with NH1A, at hamlet 5 of Nguyen Binh commune
K3	2147 041	581 309	At the end point of the new road, 300m from Hai Thanh beach	K13	2147 555	582 376	At the junction between the coastal road with the road passing Thanh Khanh hamlet residential area in Binh Minh commune
K4	2154 532	584 168	At the junction between the coastal road with the road passing through Son Hai hamlet residential area in Ninh Hai commune	K14	2148 985	582 963	At the junction between the coastal road and the road passing Thanh Dong hamlet residential area in Binh Minh commune
K5	2154 292	584 197	At the junction between the coastal road with the road passing through Dai Tien hamlet residential area in Ninh Hai commune	K15	2147 378	581 527	At the junction between the coastal road with the road passing hamlet 7 residential area in Xuan Lam commune
K6	2153 479	584 185	At the junction between the coastal road and the road passing Thong Nhat hamlet residential area in Ninh Hai commune	K16	2151 927	581 621	At the junction between Cau Trang canal and the road passing Thuong Bac hamlet residential area in Hai Nhan commune
K7	2151 410	584 319	At the junction between the coastal road with the road passing through Nhan Hung hamlet residential area in Hai Hao commune	K17	2150 854	581 652	At the junction between the Cau Trang and with the road passing through residential area 1 of Tinh Gia township
K8	2149 112	583 737	At the junction between the coastal road with the construction area of Than canal dredging work and Son Hai bridge in Binh Minh commune	K18	2150 529	581 581	At the junction between Cau Trang canal with the road passing residential area 1 of Tinh Gia township, near Tinh Gia primary school
K9	2148 795	583 491	At the junction between the coastal road with the construction area of the item: upgrading and rehabilitation of Do Be bridge in Binh Minh commune	K19	2151 024	583 708	At the junction between the Than canal and the road passing Thong Nhat hamlet residential area in Hai Hoa commune (on the bridge)
K10	2148 777	583 509	At the junction between dredging work of Than canal and the work of upgrading and rehabilitation of Do Be bridge, Binh Minh commune, at the side to Hai Thanh commune	K20	2150 306	581 664	At the junction between the work item of Cau Trang canal with NH1A (near Cong bridge in Tinh Gia township)

Analysing results on air quality, noise and vibration in the project area show that most environmental parameters of samples taken in the project area are within allowable limits specified by National regulations QCVN 05: 2013/BTNMT, QCVN 06: 2009/BTNMT and QCVN 26: 2010/BTNM.

2.2.2 Surface Water Quality

The results of surface water quality analysis presented in Table 2.3 show that the majority of parameters are within allowable limits compared to QCVN 08: 2015/BTNMT, column B1. BOD₅ are within allowable limits in all sampling locations. However, TSS exceeds the allowable limit in QCVN 08-MT: 2015/BTNMT from 1.52 to 1.84 times on Than and Cau Trang canals and the Lach Bang river. The main causes are supposed to be the discharge of waste water from households and enterprises along canals, especially Cau Trang canal at the section of Tinh Gia township.

Table Error! No text of specified style in document..9. Surface Water Quality

No	Parameter	Unit	Result							QCVN 08-MT: 2015/ BTNMT (Column B1)
			M1	M2	M3	M4	M5	M6	M7	
1	pH	-	7.16	7.18	7.11	7.09	7.15	7.15	7.12	5.5– 9
3	TSS	mg/l	64.6	76.4	84.2	74.3	86.7	92.4	69.8	50
4	DO	mg/l	4.2	4.3	4.5	4.3	4.6	4.6	4.3	≥4
5	BOD ₅ (20 ⁰ C)	mg/l	9.2	8.2	12.4	12.4	13.6	13.6	9.2	15
6	COD	mg/l	14.8	13.8	15.2	14.2	18.8	17.8	16.8	30
7	Nitrate (by N)	mg/l	2.2	1.3	1.6	1.5	1.7	1.3	1.9	10
8	PO ₄ ³⁻	mg/l	0.26	0.24	0.19	0.21	0.22	0.18	0.18	0.3
9	Cl-	µg/l	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	350
10	Surfactant	mg/l	0.06	0.05	0.04	0.04	0.02	0.02	0.06	0.4
11	Zn	mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	1.5
12	Total Coliform	mg/l	3,500	3,200	3,100	2,900	2,700	2,300	2,500	7,500
13	E.Coli	MPN/ 100ml	13	13	24	24	23	23	13	100
No	Parameter	Unit	M8	M9	M10	M11	M12	M13	M14	
1	pH	-	6.81	7.15	7.18	6.77	6.91	7.0	7.16	5.5– 9
3	TSS	mg/l	67.5	74.0	75.0	66.0	71.5	62.0	67.5	50
4	DO	mg/l	4.2	4.3	4.5	4.3	4.6	4.6	4.3	≥4
5	BOD ₅ (20 ⁰ C)	mg/l	5	9	7	7	8	7	5	15
6	COD	mg/l	15.2	19.6	17.4	18.2	18.2	17.4	15.2	30
7	Nitrate (by N)	mg/l	2.8	4.0	3.4	3.6	3.5	2.3	2.7	10
8	PO ₄ ³⁻	mg/l	0.18	0.22	0.24	0.18	0.16	0.26	0.18	0.3
9	Cl-	µg/l	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	350
10	Surfactant	mg/l	0.02	0.04	0.04	0.06	0.01	0.05	0.07	0.4
11	Zn	mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	1.5
12	Total Coliform	mg/l	1,200	1,800	2,100	1,600	2,000	7,870	10,200	7,500

No	Parameter	Unit	Result							QCVN 08-MT: 2015/ BTNMT (Column B1)
			M1	M2	M3	M4	M5	M6	M7	
13	E.Coli	MPN/ 100ml	16	21	24	26	28	31	32	100
Sample	Vietnam Coordinate system 2000		Location							
	X	Y								
M1	2151 550	583 640	The beginning point of Than canal, at the bridge crossing Than canal in Duc Thanh hamlet, Hai Hoa commune							
M2	2151 024	583 708	Than canal section passing through Dong Hai hamlet in Hai Hoa commune, where there is agricultural land of the commune							
M3	2150 553	583 475	Than canal section passing through Chay bridge in Hai Hoa commune							
M4	2149 398	583 573	Than canal section passing through Son Hai bridge in Binh Minh commune							
M5	2148 773	583 474	Than canal section passing through Do Be bridge in Binh Minh commune							
M6	2148 427	583 276	Than canal section in front of the saline controlled sluice which passes through Giai Kenh bridge in Binh Minh commune (construction area of the WWTP and dredging work of Than canal)							
M7	2146 874	581 439	Lach Bang river at the end point of the coastal road near hamlet 7 in Xuan Lam commune (high tide).							
M8	2146 874	581 439	Lach Bang river at the end point of the coastal road near hamlet 7 in Xuan Lam commune (low tide).							
M9	2146 682	582 529	Lach Bang river section near trade village in Hai Thanh commune and near construction are of the coastal road in Binh Minh commune (high tide)							
M10	2146 682	582 529	Lach Bang river section near trade village in Hai Thanh commune and near construction are of the coastal road in Binh Minh commune (low tide)							
M11	2146 476	582 319	Lach Bang river estuary to the East Sea (high tide)							
M12	2146 476	582 319	Lach Bang river estuary to the East Sea (low tide)							
M13	2151 943	581 489	Cau Trang canal section crossing with the access road to Hai Nhan communal People's committee headquarter							
M14	2151 844	581 538	Sampling at Cau Trang canal section near the Cultural house of Dong Tam hamlet, Hai Nhan commune							

2.2.3 Groundwater Quality

Analyzing results on groundwater quality in Table 2.4 show that parameters in groundwater samples taken in the project area are within allowable limits in QCVN 09: 2015/BTNMT.

Table Error! No text of specified style in document..10. Groundwater Quality

No	Parameter	Unit	Result										QCVN 09-MT: 2015/ BTNMT
			NN ₁	NN ₂	NN ₃	NN ₄	NN ₅	NN ₆	NN ₇	NN ₈	NN ₉	NN ₁₀	
1.	pH	-	7.40	7.42	7.41	7.48	7.42	7.49	7.40	7.46	7.45	7.40	5.5-8.5
2.	Temporary Hardness	mg/l	81.7	85.5	84.2	87.1	83.4	80.9	86.3	88.2	80.7	89.1	500
3.	TSS	mg/l	165.5	170.0	166.5	168.0	171.5	169.5	170.5	168.5	166.0	165.5	-
4.	COD	mg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	-
5.	Nitrite (NO ³⁻)	mg/l	0.21	0.23	0.18	0.18	0.22	0.23	0.28	0.17	0.21	0.25	1
6.	CN ⁻	mg/l	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.01
7.	Cadmium (Cd)	mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.005
8.	Mangan	mg/l	0.12	0.15	<0.1	<0.1	0.19	0.17	0.15	<0.1	0.17	0.19	0.5
9.	Chloride	mg/l	19.8	17.9	18.8	18.2	18.6	18.5	19.0	18.9	19.1	18.7	250
10.	Ferrous	mg/l	1.20	1.21	1.26	1.25	1.17	1.01	1.19	1.11	1.25	1.31	5
11.	E.Coli	MPN/ 100ml	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH
Sample	Coordinate system 2000		Location										
	X	Y											
N1	2154 519	584 210	Dug well water of household near the road to Ninh Hai beach and area for construction of tentative resettlement area in Son Hai hamlet, Ninh Hai commune										
N2	2154 438	584 223	Dug well water of household near the coastal road, Son Hai hamlet, Ninh Hai commune										
N3	2154 391	584 265	Dug well water of household near the coastal road, Thong Nhat hamlet, Ninh Hai commune										
N4	2151 434	584 412	Drilled well water of household near the coastal road, Dong Hai hamlet, Hai Hoa commune										
N5	2150 906	584 396	Drilled well water of household near the coastal road, Dong Trung hamlet, Hai Hoa commune										
N6	2149 067	583 355	Drilled well water of household near the coastal road, Dong Tien hamlet, Binh Minh commune										
N7	2147 852	582 690	Drilled well water of household near the coastal road, Quy Vinh hamlet, Binh Minh commune										
N8	2147 5531	582 299	Drilled well water of household near the coastal road, Thanh Khanh hamlet, Binh Minh commune										
N9	2148 085	582 377	Drilled well water of household near the coastal road in Thanh Dong hamlet, Binh Minh commune										
N10	2147 302	581 566	Drilled well water of household near the coastal road in hamlet 7, Xuan Lam commune										

2.2.4 Wastewater Quality

Analyzing results of wastewater samples are presented in Table 2.5 show that most of parameters are within allowable limits in QCVN 14:2008/BTNMT, column B. However, concentration of BOD₅ exceeds the standard from 3.8 to 4.4 times; TSS exceeds the standard from 1.71 to 2.5 times; Sulfur hydrogen (H₂S) exceeds the standard from 2.05 to 3.1 times and Coliform exceeds the allowable limits from 1.9 to 2.9 times. These are due to discharge of wastewater from households and enterprises along Cau Trang canal before treatment or non-standard treatment.

Table Error! No text of specified style in document..11. Wastewater Quality

No	Parameter	Unit	Result				QCVN 14: 2008/ BTNMT (Column B)
			NT1	NT2	NT3	NT4	
1	Ph	-	6.67	6.73	6.86	6.74	5.5– 9
3	BOD ₅ (20 ⁰ C)	mg/l	210	220	200	190	50
4	TSS	mg/l	250	278	235	171	100
5	TDS	mg/l	365	372	313	268	1,000
6	Sulfur (by H ₂ S)	mg/l	9.2	8.2	12.4	12.4	4
7	NH ₄ ⁺	mg/l	2.3	1.4	1.4	2.7	10
8	Nitrate (NO ₃) ⁻	mg/l	15.1	11.4	11.0	13.2	50
9	Oil and grease	µg/l	1.26	1.00	0.72	1.18	20
10	Surfactant	mg/l	0.06	0.05	0.04	0.04	10
11	PO ₄ ³⁻	mg/l	3.5	2.3	2.0	3.8	10
12	Total Coliform	mg/l	12,700	13,100	13,600	9,780	5,000
Sample	Coordinate system 2000		Location				
	X	Y					
NT1	2151 019	581 595	The discharge point of Hung Phat restaurant to Cau Trang canal in Tinh Gia township				
NT2	2150 671	581 601	The discharge point of Thang Ai restaurant to Cau Trang canal in Tinh Gia township				
NT3	2150 478	581 587	The discharge point to Cau Trang canal, near primary school in Tinh Gia township				
NT4	2150 261	581 702	Discharge point of Nguyen Hung restaurant to Cau Trang canal in Tinh Gia township				

2.2.5 Soil and Sediment Quality

Soil quality data in the project area show that all samples have heavy metal contents are within allowable limits specified by National regulations QCVN 03-MT:2015/BTNMT.

Table Error! No text of specified style in document..12. Soil Quality

No	Parameter	Result											QCVN 03-MT:2015/BTNMT
		Unit	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	
1	Cd	mg/kg	1.25	1.30	1.21	1.28	1.24	1.25	1.31	1.23	1.33	1.35	1.5
2	Cu	mg/kg	62.1	62.9	61.8	63.5	64.7	64.1	62.3	63.4	64.2	62.9	100
3	Pb	mg/kg	7.7	7.5	7.3	8.1	8.3	7.8	6.9	7.5	7.6	7.3	70
4	Zn	mg/kg	50.1	49.8	50.5	49.9	49.7	48.9	50.2	51.0	50.8	49.7	200
Sample	Vietnam Coordinate system 2000		Location										
	X	Y											
D1	2155 047	584 094	Sampling at the construction site near the road to Ninh Hai beach near Hai Thanh sea										
D2	2154 500	584 136	Sampling at the construction site of the coastal road in Son Hai hamlet, Ninh Hai commune										
D3	2151 336	584 233	Sampling at the construction site of resettlement area in Ninh Hai commune										
D4	2148 981	583 483	Sampling at the construction site of the WWTP in Binh Minh commune										
D5	2148 930	582 299	Sampling at the construction site of the road connecting Binh Minh –Sao Vang in Binh Minh commune										
D6	2147 240	581 492	Sampling at the construction site of the coastal road in hamlet 7, Xuan Lam commune										
D7	2146 754	579 628	Sampling at the construction site in Xuan Lam commune										
D8	2147 707	581 982	Sampling at the construction site near the coastal road to Ninh Hai beach, near Hai Thanh sea										
D9	2146 813	581 152	Sampling at the construction site of the coastal road in Son Hai hamlet, Ninh Hai commune										
D10	2148 131	582 714	Sampling at the construction site of the resettlement area in Binh Minh commune										

Analyzing results on environmental parameters of sediment in Table 2.7 show that content of heavy metals like Cu, Zn, Pb and Cd in the sediment samples (for brackish water) is lower than the allowable limit in QCVN 43: 2012/BTNMT (National Technical Regulation on sediment quality, applied for saline and brackish water sediment). However, salinity in the sediment from the Than canal and Lach Bang are at around 5‰.

Table Error! No text of specified style in document..13. Sediment Quality

No	Parameter	Unit	Result										QCVN 43:2012/ BTNMT	QCVN 07:2009/B TNMT Ctc (mg/l)
			T1	T2	T3	T4	T5	T6	T7	T8	T9	T10		
1	Salinity	‰	4.90	5.13	5.26	5.42	5.12	0.71	0.62	1.15	3.81	5.92	-	-
2	Cd	mg/kg	3.12	2.09	1.80	2.18	1.14	2.05	2.11	3.13	2.60	1.15	4.2	5
3	Copper (Cu)	mg/kg	60.7	62.3	60.9	64.5	64.1	63.8	61.7	61.5	62.9	62.2	108	-
4	Lead (Pb)	mg/kg	8.7	5.5	6.3	8.1	8.3	6.8	5.9	7.5	6.6	7.3	112	15
5	Zinc (Zn)	mg/kg	68.5	69.0	69.5	58.9	67.7	56.9	69.2	59.0	68.8	49.1	271	250
Sample	Coordinate system 2000		Location											
	X	Y												
T1	2151 024	583 708	Than canal at the section passing Dong Hai hamlet, Hai Hoa commune, on the agricultural land near sampling location of NM2											
T2	2149 398	583 573	Sampling at Than canal section at Son Hai bridge in Binh Minh commune near sampling location of NM4											
T3	2148 773	583 474	Sampling at Than canal section at Do Be bridge in Binh Minh commune near the sampling location of NM5											
T4	2151 024	583 708	Sampling at Than canal section at Do Be bridge in Binh Minh commune at the construction site of the WWTP											
T5	2149 398	583 573	Than canal section crossing with the access road to Hai Nhan communal People's Committee headquarter and near NM13											
T6	2148 773	583 474	Sampling at Cau Trang canal at the section passing through residential area KP 1 of Tinh Gia township											
T7	2148 794	583 518	Cau Trang canal at the section passing through residential area KP1 of Tinh Gia township, crossing with the access road to Tinh Gia district People's committee headquarter											
T8	2151 943	581 489	Sampling at Cau Trang canal section near Cong bridge, Tinh Gia township											
T9	2150 793	581 607	Sampling at Cau Trang canal section crossing with Than canal in Binh Minh commune, near the sampling location of NM17											
T10	2150 459	581 619	Sampling at Lach Bang river section crossing with Than canal											

2.3 BIOLOGICAL RESOURCES

2.3.1 Terrestrial Biological Resources

Thanh Hoa province has some forests and nature reserves located about more than 30 km from the suburban areas of the Tinh Gia sub-project. These includes the Ben En National Park (16,000 ha in Nhu Xuan, Nhu Thanh districts), Cuc Phuong National Park (the part in Thach Lam and Thanh My communes, Thach Thanh district), about 300 ha conservation area of Lauan meranti in Tam Quy commune, Ha Trung district, Pu Luong Nature Reserve, Xuan Nha. In addition, there are genetic conservation areas associated with historical-cultural relics such as Lam Kinh (Ironwood Forest Conservation), Ba Trieu Temple with pine trees (Trieu Loc commune, Hau Loc district), Ham Rong forest garden, botanical garden of Sam Son town. Thanh Hoa forests are mainly broad-leaved, evergreen trees, diversified in family and species, etc. There are rare timber trees like Chukrasia, Fokienia, agarwood. Group II trees are Cunninghamia, Erythrophleum fordii, Vatica, Madhuca pasquieri. Group III and IV trees are Magnolia dandyi, Menghundur, Pyinkado, White Meranti, etc. There are also trees like bamboo, Phyllostachys, Schizostachyum aciculare etc. in the forests and Daemonorops, Calamus, herbs and lacca etc. These forests and natural reserve areas are located over 30 km away from the areas of Tinh Gia Sub-project.

In addition, in Tinh Gia district, there is Lam Dong mountain protection forest located in Truc Lam, Phu Lam and Phu Son communes, about 10 km west of the subproject area, which is over 5 thousand ha with low coverage of canopy.

a. Flora in Tinh Gia District

The majority of vegetation cover in the subproject areas (Tinh Gia district) is from garden and agricultural land. The garden has plant species such as jackfruit, longan, pomelo, banana, and some shady trees such as eucalyptus, casuarinas etc. Agricultural vegetation includes maize, peanut, sweet potato etc.. Along the construction area of the proposed Coast Road (Km 0 + 700 to Km 1 + 200) and at the end of the proposed Road from NH1A to Ninh Hai beach there are some production forest land most of which are Casuarina and acacia trees planted for timber under the management of local households. Tree density in this area is moderate, tree trunk about 3-4m high, diameter from 10-15cm and are harvested periodically for timber production.

b. Fauna in Tinh Gia district

There is no known rare, endangered or vulnerable species in the project area. There are diverse amphibians and reptiles in the area. There is only Rodentia species such as Muscaroli, Rattus argentiventer; Carnivora such as Suncus murinus and Chiroptera and birds. - There are also cattle (buffalo, cows, pigs, goats, etc.), poultry (chickens, ducks, etc.) fed by households.

2.3.2 Aquatic Biological Resources

Phytoplankton are available in the river area and aquaculture ponds. The composition of phytoplankton is mainly: diatoms, cyanobacteria and algae. The project area is found to have richer algae than aquaculture ponds. The composition of the zooplankton consists of the following groups: protozoa, Copepoda, Cladocera, Rotatoria, Ostracoda and insect larvae. Among of which, the Rotatoria has a higher number of species and then the groups of Ostracoda and Cladocera.

Other aquatic animals such as: shrimp, sardines, dDecapterus macrosoma and Ilisha elongata also exist in subProject area. According to the result report on the survey and assessment of coastal mangroves to serve the sustainable development strategy of Thanh Hoa province up to 2020, headed by Prof. Pham Ngoc Ho, Director of Environmental Monitoring and Modeling

Research Center – Vietnam National University, phytoplankton and zoobenthos at Lach Bang river estuary in Table 2.8. :

Table Error! No text of specified style in document..14. Phytoplankton and Zoobenthic at Lach Bang River Estuary

Phylum	Species	Unit	Số lượng
Algae	Bacillario phyta	103 cells/litre	74
	Dino phyta		36
	Chloro phyta		8
	Cyano bacteria		0
	Eugleno phyta		0
	Chryso phyta		0
	Total		118
Zoobenthos	Naplius	individual/m3	15,000
	Copepoda		57,500
	Rotatoria		7,500
	Total		48,750
Poisonous algae	Dinophysis caudata	Cell/litre	100
	Prorocentrum micans		150

In 2016, Environmental Technology Research and Transfer Center - Vietnam Association for Conservation of Nature and Environment took samples for quantitative analysis of zooplankton, phytoplankton and benthos at Bang river estuary, the results are in Table 2.9 as follows:

Table Error! No text of specified style in document..15. Zooplankton at Lach Bang River Estuary

No	Zooplankton	Result (individual/m ³)		
		M ₁	M ₂	M ₃
	Rotatoria			
	Monogononta			
1	Ploimida	132,100	196,100	254,100
	Arthropoda			
	Crútacea			
2	Cladocera	261,100	285,100	103,100
3	Copepoda	428,100	389,100	295,100
	Total	821,100	870,100	652,100

(Source: Environmental Technology Research and Transfer Center- Vietnam Association for Conservation of Nature and Environment - October 2016)

Through the survey, it was found that zoobenthos are generally concentrated at Bang river estuary and the coastal tidal areas, the density tends to decrease gradually from the shore, with diversity of Bivalvia and Polychaetes, providing an abundant source of shellfish species for aquaculture and a valuable food source for many other aquatic species.

2.4 SOCIO-ECONOMIC CONDITIONS

2.4.1 Land Use

Total natural land area of Tinh Gia is about 459 km², agricultural land accounts for large part as detailed in Table 2.10:

Table Error! No text of specified style in document..16. Land Use in Tinh Gia District

No.	Type of land	Area (ha)
	Natural area	45,829
1	Agricultural land	26,016
2	Non- Agricultural land	12,165
3	Unused land	7,648

Agricultural land area accounts for about 68% of total land area, in which:

- Land for agricultural production mainly focuses in communes of Cac Son, Anh Son, Hung Son, Thanh Son, Thanh Thuy, Ngoc Linh, Truc Lam, Hai Nhan, Dinh Hai, Nguyen Binh. It will create advantages of centralized rice planning in the district and investment in technical infrastructure serving for rice regional development to ensure food security for the entire district and serving for development of processing industry and cattle-breeding. Land for crops mainly focuses on the area of some communes in Hai Ninh, Trieu Duong, Ngoc Linh, Hai Nhan, Nguyen Binh, Xuan Lam, Tung Lam, An Hai, Tan Dan, Hai Binh, Ninh Hai, Hai Hoa, Binh Minh, Tinh Hai, Hai Yen, Mai Lam, Phu Lam, Phu Son. The characteristics of land is suitable for main planting of peanuts, sesame seeds, sesame seeds, potatoes, soybeans, melons, sweet potatoes and fresh vegetables.
- Land for ponds and aquaculture mainly focuses on the coastal communes. The land type is currently used for shrimp farming in the industrial and semi-industrial form.
- Forestry land mainly focuses on the area of 13 communes: Tung Lam, Phu Lam, Phu Son, Dinh Hai, Tan Truong, Truong Lam, Hai Nhan, Nguyen Binh, Cac Son, Anh Son, Hung Son, Mai Lam, Truc Lam. The forestry land resource has been continuously helping Tinh Gia form paper industry of the province and cultivated area for fruit trees, cane material, combined with the development of raising cattle and poultry.
- Non-agricultural land is mainly traffic road and irrigation work.

Tinh Gia has two zones: The Northern zone with total 7,400 ha is urban, administrative, tourism, trading and service area and the Southern zone is the existing Nghi Son economic zone with an area of 18,600 ha, with key industrial sectors such as oil refinery, metallurgy, cement, seaport

2.4.2 Labor and Employment

There are 250,784 people, belonging to the Kinh people and Thai ethnic groups, the Thai ethnic group is 1049 people, accounting for 4.01%.

The number of people aged 15 and over is 133,740, accounting for over 60% of the total local population, which is the main income earner for the city. The structure of labor has changed toward industry and service, increased 4.25% compared to 2010. In 2014, 101,806 people are working in enterprises and factories with increasing rate of trained labor. 78.91% labor are working in non-agricultural sectors, accounting for over 60% of the total labor force in the district. The poverty rate of Tinh Gia district in 2016 was 13.34%.

Poor household⁴ accounts for 13.34% in Tinh Gia district in 2016 Hai Hoa and Nguyen Binh are two communes in project area has percentage of poor households higher than that of the remaining communes, at 18% and 13.9%, respectively. Hai Thanh is the commune with the highest population density, even higher than Tinh Gia township.

Table Error! No text of specified style in document..17. Household and Poverty Rate

No	Location	Unit	Number of HH	Poor HH	Poverty rate (%)	Population growth rate
1	Nguyen Binh	9,048	2,262	314	13.9	0.65%
2	Hai Hoa	8,996	2,181	392	18%	1%
3	Binh Minh	6,616	1,480	133	9%	0.10%
4	Xuan Lam	8,705	1,741	264	13%	0.80%
5	Hai Thanh	18,252	3,650	447	0.122	1.20%
6	Ninh Hai	7,345	1,469	192	1.30%	1%
7	Tinh Gia township	6,690	1,338	54	3.80%	0.70%

(Source: Draft of RP report, August 2017)

2.4.3 Economic Structure and Income

The growth rate of district's production value reaches 6.9% and 39% (including Nghi Son economic zone), of which agriculture, forestry and fishery increases 7.7%, industry - construction increases 48.8%, service increases 10%. The structure of agriculture, forestry and fisheries accounts for 7.5%; industry - construction accounts for 82.5%; services account for 10%. Compared with the whole province, Tinh Gia district has a higher proportion of industry-construction and lower proportion of agriculture, forestry and fishery. The specific comparison is shown in Table 2.12.

Table Error! No text of specified style in document..18. Economic Condition of Thanh Hoa Province and Tinh Gia District

Comparing parameter	Tinh Gia district	Thanh Hoa province
Development rate	6.9%	9.05%
Economic structure		
Agriculture – Forestry – Fishery	7.5%	16.49%
Industry – Construction	82.5%;	41.9%
Service	10%	37.12%

Although the agro-forestry-fishery only contributes 7.5% to the local economy, this sector has the highest percentage of working labor, accounts for about 57% of local laborforce in Tinh Gia district's communes. In some communes such as Nguyen Binh, Binh Minh, Xuan Lam, Ninh Hai and Hai Nhan, agriculture and fishery is the main economic section with about 76% of the labor force.

Some communes, such as Hai Thanh and Hai Binh, have fisheries and seafood processing and production as the main sectors, and a small proportion of the population working in tourism. Hai Hoa commune has Hai Hoa beach - the famous tourist place of Tinh Gia district; At present,

⁴ Multi-dimensional poverty criteria

the number of tourists increases every year. Hai Hoa's tourism revenue is estimated at 20% of the total revenue of the commune.

People’s living standard has improved significantly over the years. This is reflected in the annual per capita income index.

Table Error! No text of specified style in document..19. Tinh Gia District’s Annual Income Per Capita

Year	Annual income per capita (thousand VND)
2013	17,320
2014	19,420
2015	25,870
2016	28,798

People in the project area have rather stable occupation with 20% are freelance with seasonal jobs, 41% are farmers, 17% are factory workers, 11% living on traditional fishery and the rest are living on employee, trading and service. Households doing business concentrate mostly in Hai Thanh and Hai Hoa communes (Figure 2.3).

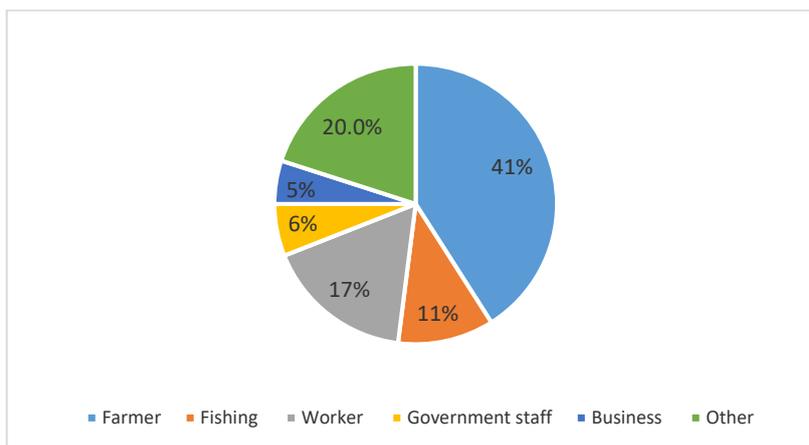


Figure Error! No text of specified style in document..4: Occupational Structure of Affected Households

Notably, the rate of female workers is higher than male worker, accounts for 67% and 23%, respectively. The reason is the existing garment and footwear factories in the project area attracts female workers.

The rate of students is quite high, accounts for 30% of the town’s population, and about 1% are elderly and dependent children. This is one of the reasons that lead to unstable balance between household income and expenditure as discussed below.

Socio-economic Survey Results on Household Income and Expenditure of Affected Households at The Project Area:

Almost 60% of households have income sources from wages, which indicates that all households which have member at the working age are working in the paid labor market to be workers, hired labors, civil servants. However, the average number of person in each household with income from wages is small, only 0.81 person per household. The remaining members of households have unstable income from livestock, farming, fishery or opening small shops in local markets.

The average income of surveyed households is about 121 million VND/household/year, The prevailing income level is around 68 million per year per household, much lower than average income. The average expenditure of surveyed households is about 87 million VND per household.

2.4.4 Housing Condition

By end of 2015, permanent and semi-permanent in Tinh Gia district accounted for 71.3% of total houses. Average accommodation area for each person is 16.13 m²/person. Socio-economic survey shows that most of the project's affected households are living in permanent houses, and there is no temporary houses /grade 4 house.

2.4.5 Healthcare

At present, 19/19 communes have medical stations equipped with basic facilities. In addition, many private healthcare facilities are also invested. In 2014 only, there were 85 facilities registered to operate. With modern equipment and skilled medical staffs, they have ensured to meet the health care needs of district's people, reduce number of patients going to higher level treatment facilities and reduce other social costs. In Tinh Gia district, there is a 200-bed general hospital (serving 265 beds in practice) which serves the needs of medical examination and treatment and health care for local people as well as patients from neighboring areas.

Currently, the 500-bed Nghi Son General Hospital project is being invested and its completion will ensure to meet the city's and region's increasing demand for high-quality medical care, meeting the higher-level urban standards. According to statistics of the health department, in 2015, Tinh Gia district served 459 beds with an average of 2.02 beds per 1000 people. In general, people in the subproject area has quite convenience to access to medical services. Average distance to commune/township health centers is nearly 1-2 km and district hospital about 4-6 km. The system of private clinics and pharmacies also increase access to health care for the affected community.

According to the report of the health sector in Tinh Gia district, preventive medicine is assured, the plans for prevention of seasonal diseases such as measles, cholera, hand - foot - mouth, dengue fever, zika ...have been developed and implemented. There was no major disease outbreaking in the year. 44 cases of foot-and-mouth disease, 2 cases of measles, 09 cases of chickenpox and 08 cases of dengue fever were recorded. Surveyed households also showed no cases of environmental-borne infectious diseases.

2.4.6 Cultural and Sport

There are 03 urban stadiums, a gymnasium, 08 tennis courts, 7 badminton courts at cultural houses and mixed pitches in the area of the expanded Tinh Gia township. Most of the communes have volleyball and soccer fields and 02 clubs.

There are 31 national monuments (Dao Duy Tu Temple, Duke Le Dinh Chau Temple, Ngoc Linh Commune ...) and 28 provincial relics, 25 historical and cultural relics, 3 monuments (Truong Lam cave, Bien Son scenic complex, Quang Trung- Lach Bang scenic complex), 01 revolutionary relics (Tan Dan) and 2 architectural relics (Le Dinh Chau relic in Ngoc Linh commune, sculpture stone in Phuc Long pagoda, Hai Ninh commune).

Destinations such as Quang Trung - Lach Bang (Hai Thanh) scenic area, Bien Son (Nghi Son) relic complex, Truong Lam cave...are attracting more and more visitors. Some relics have been attractive destinations for local people and visitors for spiritual life, such as Am Cac pagoda (Dinh Hai); Khanh Trach Temple - Thien Vuong pagoda (Binh Minh); Da Ngang Stone Temple; Dac Tien Pagoda (Hai Thanh). These historical and cultural sites are located about 2km far from project areas.

2.4.7 Education and Training

There is one vocational college, 1 centre for continuing education, 4 schools (1 primary school and 3 high schools), 20 primary schools, 19 kindergartens and private-owned kindergartens, 1 political nourishing centre available in Tinh Gia.

2.4.8 Trade, Service and Tourism

There are markets and shopping malls like Hai Binh, Thuong Hai markets in Hai Thanh commune, township market and 1 supermarket. These markets and malls are over 1km from project construction area. By the end of 2014, there were 37 hotels and motels, tourism season is from May to September annually.

2.4.9 Transport

External transport: The subproject area has 9.6 km of National Highway 1A (NH1A) runs North-South. It is 14 m wide asphalted road. The road of Cong town to Hai Hoa beach is 3 km long, 5.5-7.0m wide. The Nghi Son to Bai Tranh road with 56 Km long. In addition, the project area also has a road running along the coastal line connecting road 513 to Nghe An, the road from Nghi Son EZ linking to Tho Xuan airport. The national railway crosses over extended Tinh Gia town with 03 stations, in which Khoa Tuong station is expected to expand to be the central station. Waterway: breakwater in Nghi Son Port has been built; Port No.1; 2; 3; 4; 5. Construct fishing ports, Lach Bang storm harbor; Build port for Nghi Son thermal power plant and dredge lane for 50.000 DWT ships and boats to Nghi Son port.

Projects are continued to construction: upgrade and expand road 513: North South 2 road; North south 1B; East-West 4 road (section from NH1A to the North-South route); road entering into the waste landfill; road entering into Tinh Gia district; East-West 4 road (section from 513 road to Nghi Son Port) and West-East 1 road (stage 1).

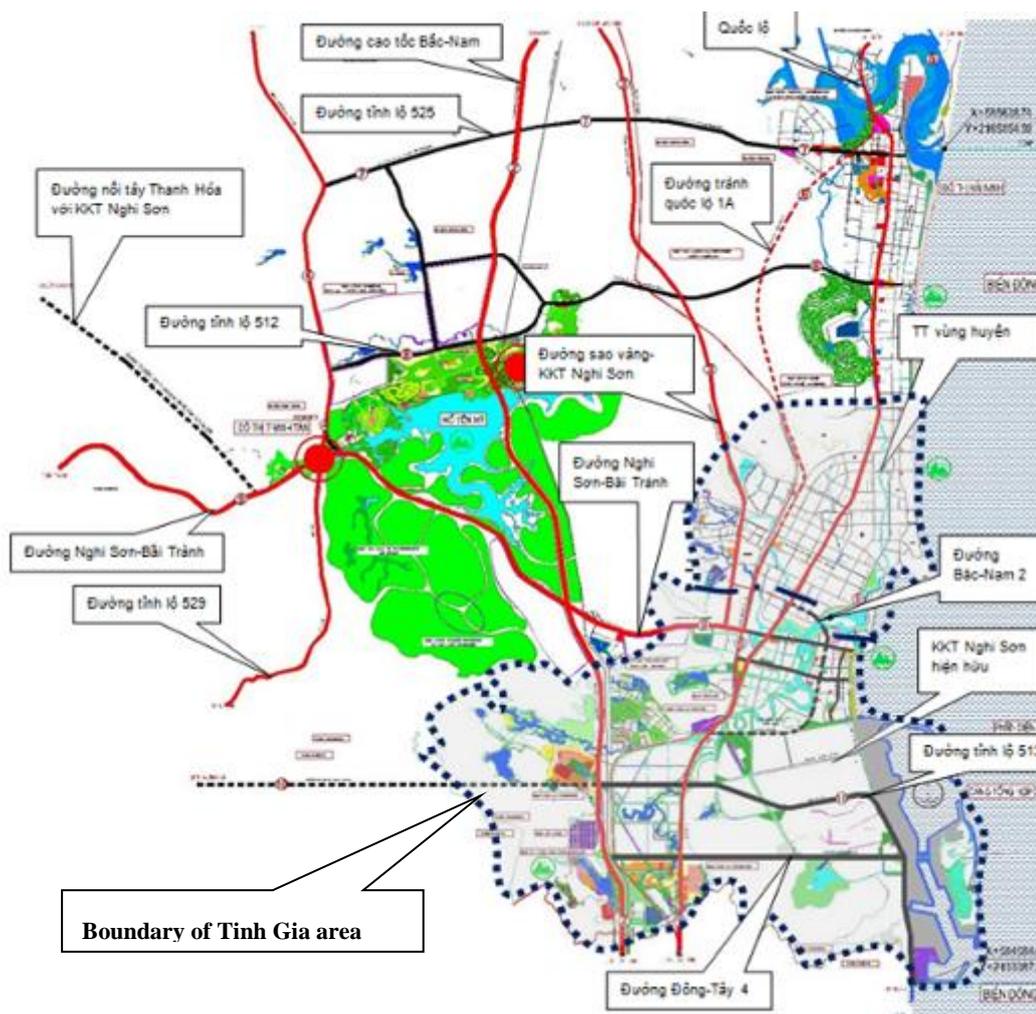


Figure Error! No text of specified style in document..5: Transport System in the Project Area

2.4.10 Water Supply

There are several water supply plants in Tinh Gia district including The plant that takes raw water from Yen My lake then to Dong Chua lake, the Binh Minh water supply plant with capacity of 35,000m³/day, the Long Hai water supply with capacity of 1,500 m³/day and the Nguyen Binh water supply plant capacity of 2,800m³/day. These plants mainly supply water for Nghi Son Economic Zone and some central areas of Tinh Gia town.

For the remaining project area (seven communes), surveyed results show that, most of households have dug wells; In recent years, households have begun to use bored wells. Very few households use rainwater because dug wells and bored wells already meet the household's water needs. Some households living adjacent to NH1A, Tinh Gia township, tourism areas and densely populated areas have been connected to tap water, however, the rate is not high (about 4% of the overall project site).

2.4.11 Drainage

Drainage in the area is mainly gravitational natural drainage flowing from the west to the east. In the urban center, there are three main canals for the drainage including Than, Cau Trang and Cau Hung canals.

Than River (or Than canal) is a man-made river in the Le dynasty (in the 17th century), it is the North-South waterway (from Yen River to Lach Bang River) and serves for irrigation of a half

of Tinh Gia district, including 14 communes (inclusive of 03 communes in the district central area: Ninh Hai, Hai Hoa, Binh Minh), the East of the city with 6.691ha basin. The proposed dredging section of Than canal is 5km, from Mai bridge to Do Be bridge. There are agricultural land and abandoned ponds with bushes, grass along two banks of Than canal. The Than canal intersects with Lach Bang river at Ben Ngao salinity control sluice gate, 2 km from Do Be bridge toward the downstream (the ending point of the dredging and embankment of the sub project).



Than canal (Hang bridge)



Than canal (Do Be bridge)

The Cau Trang canal is a dead-end canal originating from Hai Nhan Commune, the last intersection with the Than Canal. Cau Trang Canal is 6 km long, crossing central area of the city is the main irrigation canal for Cong town and part of Hai Nhan, Nguyen Binh, Binh Minh commune; the drainage canal for entire the Western part of the city, collecting water from flooding-preventing ditches on the foot of Am mountain. The drainage in areas along canal sides is poor because there are many broken parts on canal banks, grasses and water hyacinth on the canal bed, inhibiting the flow; about 70% of canal bed is clay-sand-soil content which is prone to be deposited and slide; some bridge made by the local residents narrow down the cross section for flooding drainage; some sections have been leveling into canal bed to plant trees; irrigation culverts along the canal is damaged and deteriorated concrete-round culvert, box culvert, brick arch culvert and RC capped stone.

The Cau Hung canal (or Cau Hung stream) is originated from Yen My lake and Lam Dong protection forest in Truc Lam, Phu Lam and Phu Son communes, Tinh Gia district. It is far from about 10 km of the subproject area.



Cau Trang canal (across the town)



Cau Trang canal (through agricultural land)

The drainage basin in the central area of Tinh Gia is shown in Figure 2.4: Basin 1: Covering 3,669.4 ha of the entire western part of the North-South railway. Rainwater is stored in Ao Quan lake, Khe Mieu reservoir, Khe Chan lake, Khe Dau lakes and drains via streams such as Cau Hung, Khe Chan and Khe Dau streams to discharge to Bang river. Basin 2: Covering 960 ha, including Hai Nhan commune, Tinh Gia township, Nguyen Binh, Binh Minh and an eastern part of the North South railway and NH1A. Rainwater is discharged via Cau Trang canal to

Than canal and toward Bang river. Basin 3: Covering 1,118.1 ha, including Ninh Hai, Hai Hoa and Binh Minh communes. Rainwater drains via Than canal and discharges to Bang river.

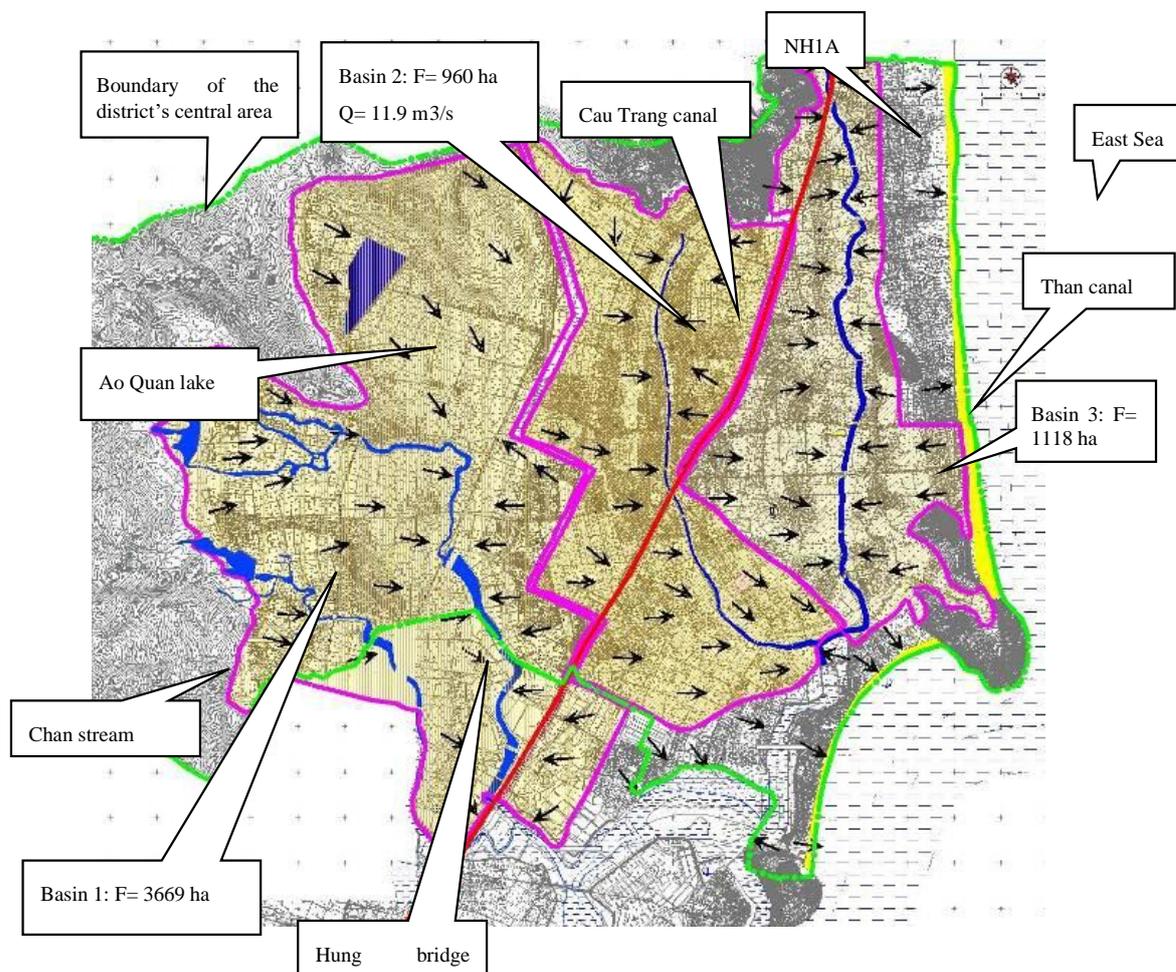


Figure Error! No text of specified style in document..6: Drainage basin in central area of Tinh Gia district

2.4.12 Environmental Sanitation

Solid waste collection and treatment: The waste treatment plant with capacity of 250 tons/day in Truong Lam commune has been operating, meeting the demands on solid waste treatment and serving for the demands of extended Tinh Gia town. However, the domestic collection waste service remains inadequate. Rapid urban development and people’s limited awareness contribute to limitations in environmental sanitation conditions.

Wastewater collection and treatment: In Hai Hoa, residential areas are scatterly distributed and there are some hotels (about 7 hotels with 15-20 rooms on average), and some small restaurants (mostly located at wrong place) so the volume of waste water is not large; Majority of the wastewater is treated by septic tank and natural drainage. Planning for this area has been under preparation. Hai Thanh area has a large population, waste water is treated through septic tanks and self-draining. On the other hand, there is no household infrastructure so it is difficult to construct centralized wastewater collection system. Nguyen Binh residential area is a resettlement site for the Nghi Son EZ project, so wastewater collection and treatment system for this area is studied and invested by Nghi Son EZ. The center of Tinh Gia township has population of over 6,000 people, waste water in this area is collected in the combined sewers

and discharged to Cau Trang canal, causing environmental pollution, affecting the lives of people along the canal banks.

Cemetery: Tinh Gia district’s cemetery project (stage 1) and other cemeteries for communes are completed and put into operation.

2.5 SITE-SPECIFIC BASELINE CONDITIONS

2.5.1 Coastal Road from Ninh Hai Beach to Lach Bang 2 Bridge

The proposed new road has L = 10km, B= 27m. The route passes four communes including Ninh Hai, Hai Hoa, Binh Minh and Xuan Lam. Some notable characteristics on current status along the road alignment are presented in Table 2.14:

Table Error! No text of specified style in document..20. Site-Specific Conditions Along the Coastal Road

Location	Picture	Description
<p>Section 1: Start point intersecting with the planned coastal road (Km 0+00)</p>		<p>The start point of the road is cultivation land of Ninh Hai commune.</p> <p>The left-hand side of the road start-point is adjacent to production forest of Ninh Hai commune.</p>
<p>Le Van ancestral temple (Km 0+500)</p>		<p>About 50m from construction area</p> <p>This is the temple for worshipping Le Van’s ancestry. Worshipping activities happen particularly on the first day and 15th day of every solar month.</p>
<p>Agricultural land area (Km 0+100 to Km 0+600)</p>		<p>Land for cultivation of rice and crops (corn, peanut) of Ninh Hai commune</p>
<p>Residential area along the road, Ninh Hai commune (Km 0+600 Km 1+100)</p>		<p>There are about 50 households, belonging to Ninh Hai commune.</p> <p>10 - 100 m from the construction area.</p>
<p>Kindergarten Ninh Hai commune (Km 1+150)</p>		<p>This kindergarten belongs to Ninh Hai commune including 20 classrooms, guard house, yard and fence with total area of 500 m². There are 30 teachers and 400 pupils.</p> <p>School time is 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 every weekday.</p> <p>At about 200 m from the construction area.</p>

Location	Picture	Description
Residential area (Km 1+150 to Km 1+300)		Residential area of about 200 households. Distance from construction area: 10 - 100 m
General Truong Cong Xuan relic (Km 1+300)		- Provincial historical relic, for worshipping family's members. Distance from construction area: 50 m
General Pham Van Doan relic (Km 1+500)		- Provincial historical relic, for worshipping family's members. - Distance from construction area: 50 m
Agricultural land area (Km 1+300 to Km 1+700)		Land for cultivation of rice and crops (corn, peanut...) of Ninh Hai commune, Tinh Gia district.
Residential area (Km 1+700 to Km 1+900)		It is the living area of about 100 households. Distance from construction area: 10 - 100 m
Agricultural land area (Km 1+900 to Km 2+400)		Land for cultivation of rice and crops (corn, peanut...) of Ninh Hai commune, Tinh Gia district.
Residential area (Km 2+400 to Km 2+900)		It is the living area of about 200 households. Distance from construction area: 10 - 100 m.
Agricultural land area (Km 2+900 to Km 3+500)		Land for cultivation of rice and crops (corn, peanut...) of Ninh Hai and Hai Hoa communes, Tinh Gia district.

Location	Picture	Description
Residential area (Km 3+500 to Km 2+700)		It is the living area of about 50 Hai Hoa commune's households Distance from construction area: 10 - 100 m
Agricultural land area (Km 3+900 to Km 4+600)		Land for cultivation of rice and crops (corn, peanut...) of Hai Hoa commune, Tinh Gia district.
Residential area (Km 4+600 to Km 4+900)		It is the living area of about 60 households of Hai Hoa, Binh Minh communes. Distance from construction area: 10 - 100 m
Agricultural land area (Km 5+00 to Km 5+600)		Land for cultivation of rice and crops (corn, peanut...) of Binh Minh commune, Tinh Gia district.
Son Hai bridge: reinforced concrete bridge, B=21m, L=90m. (Km 5+300)		Construct Son Hai bridge crossing Than canal in Binh Minh commune, Tinh Gia district
End point section 1: connecting with the Start point of Do Be bridge (Km 5+640)		Intersecting with the Start point of Do Be bridge, Binh Minh commune, Tinh Gia district
Start point Section 2: Start point of Do Be bridge (Km 5+640)		Intersecting with the Start point of Do Be bridge, Binh Minh commune, Tinh Gia district
Residential area (Km 5+640 to Km 6+00)		It is living area of about 30 households of Binh Minh commune. Distance from construction area: 10 - 100 m

Location	Picture	Description
Agricultural land area along the route (Km 6+00 to Km 7+600)		Land for cultivation of rice and crops (corn, peanut...) of Binh Minh commune, Tinh Gia district.
Khanh Pagoda (Km 7+900)		Khanh pagoda is located in Binh Minh commune, Tinh Gia district. This is a Buddhist pagoda where local people come to organize worshiping activities, particularly on the first day and 15 th day of every solar month. Distance from construction area: 30m.
Agricultural land area along the route (Km 7+900 to Km 9+700)		Land for cultivation of rice and crops (corn, peanut...) of Binh Minh commune, Tinh Gia district.
Residential area (Km 9+700 to Km 10+00)		Is living area of nearly 30 households in Xuan Lam commune. Distance from construction area: 10 - 100 m
End point Section 2: Start point Lach Bang 2 bridge (Km 5+640)		Intersecting with the start point of Lach Bang 2 bridge, Xuan Lam commune, Tinh Gia district. Lach Bang 2 bridge is under the construction phase.

2.5.2 Binh Minh Road to Sao Vang Road – Nghi Son Economic Zone

The proposed road has L = 2.08km, B= 26.5 m passes two communes namely Binh Minh and Nguyen Binh. Some notable characteristics on current status along the road alignment are presented in Table 2.15.

Table Error! No text of specified style in document..21. Site-Specific Conditions along Binh Minh Road to Sao Vang Road

Location	Picture	Description
Start point intersecting with NH 1A (Km 0+00)		Is the intersection of NH1A with the planned road. Traffic density on NH1A is rather high.

Location	Picture	Description
Nguyen Binh Petroleum station (Km 0+050)		Nguyen Binh petroleum station is under management of Thanh Hoa Petroleum Company, serving about 200 vehicles/days. Distance from construction area: 30 m
Agricultural land area (Km 0+050 to Km 1+000)		At present, this land is rice field and crops filed of people in Nguyen Binh commune, Tinh Gia district.
Cemetery (Km 1+000 to 1+080)		There are about 20 graves of Binh Minh commune's people. Distance from construction area: 50 m
Residential area (Km 1+080 to Km 1+200)		This is living area of about 20 households in Binh Minh commune, Tinh Gia district Distance from construction area: 50 - 200 m
Agricultural land area (Km 1+200 to Km 2+080)		At present, this land is rice field and crops filed of people in Binh Minh commune, Tinh Gia district.
End point intersecting with Ninh Hai road to Lach Bang 2 bridge (Km 2+080)		End point intersecting with Ninh Hai road to Lach Bang 2 bridge

2.5.3 Do Be Bridge and Approach Roads

Currently, the existing approach roads has a total length $L = 491$ m, $B = 27$ m. The bridge has $B = 15$ m, $L = 70$ m. The road and approach roads are narrow, degraded and the bridge to Hai Thanh commune is degraded, not safe for use. The route passes two communes of Hai Thanh and Binh Minh. Some notable characteristics on current status of the construction area are presented in Table 2.16.

Table Error! No text of specified style in document..22. Existing Lan Use Along Do Be Bridge and Approach Roads

Location	Picture	Description
Start point intersecting with the coastal road, section from Ninh Hai-Lach Bang 2 bridge		The road connects with inter-communal Binh Minh – Hai Thanh road, Tinh Gia district

Location	Picture	Description
Residential area		There are 20 households living along 2 sides of road and bridge side in Hai Thanh and Binh Minh communes. Distance from nearest resident's house to construction site is 10 m.
Thuong Hai Petroleum station		Thuong Hai petroleum station is located in Hai Thanh commune, serving about 100 vehicles/day. 30m from construction site
Start point intersecting with Hai Thanh inter-communal road		The intersection between the approach road and Hai Thanh inter-communal road.

2.5.4 The Road from NH1A to Ninh Hai Beach

The route has L = 815 m, B= 27 m, passes two communes namely Ninh Hai and Hai Hoa. Some notable characteristics on current status along the road alignment are presented in Table 2.17.

Table Error! No text of specified style in document..23. Site-Specific Conditions along NH1A to Ninh Hai Beach Road

Location	Picture	Description
Intersection with NH 1A (Km 0+00)		The start point of the route is intersection with NH1A, which has rather high traffic density.
Residential area (Km 0+000 to 0+100)		This residential area is within Ninh Hai and Binh Minh communes, with about 10 households. Nearest distance from resident's house to the construction site is 10 m.
Cemetery (Km 0+100 to 0+200)		There are about 50 graves of Binh Minh commune's residents, about 50m from construction site

Location	Picture	Description
Agricultural land area (Km 0+200 to Km 0+700)		This is agricultural land for rice and crops of Ninh Hai residents.
End of the route (Km 1+200)		The end point intersecting with Ninh Hai beach. About 50 - 100m far from the construction site is some production forest which has been allocated to people's management.

2.5.5 The Than Canal

At present, the Than canal section proposed for being dredged has earth embankment thus the canal has been sedimented and subject to landslide on the embankment. The canal section to be rehabilitated (L = 5 km, B = 25.5m) passes three communes including Ninh Hai, Hai Hoa and Binh Minh. Some notable current areas are presented in Table 2.18:

Table Error! No text of specified style in document..24. Site-Specific Conditions along Than Canal

Location	Picture	Description
Start at Mai bridge (Km 0+00)		The intersection with the canal at Ninh Hai commune has been concretize, Than canal route will connect with this completed canal section.
Agricultural land (rice, crops) (Km 0+00 to Km 5+00)		At present this is land for cultivation of rice and crops of residents in Ninh Hai, Hai Hoa, Binh Minh communes, Tinh Gia district.
End point intersecting with Do Be bridge		Is the end point of the planned route to Do Be bridge in Binh Minh commune, Tinh Gia district.

2.2.6 Cau Trang Canal

The existing canal has L = 5.7 km, B = 3 to 6m. There are some bridges constructed by local people on some canal sections. The canal passes four communes of Hai Nhan, Nguyen Binh, Binh Minh and Tinh Gia township. Some notable features are presented in Table 2.19:

Table Error! No text of specified style in document..25. Site-Specific Conditions along Cau Trang Canal

Location	Picture	Description
Start point: intersecting with NH1A planned bypass in Hai Nhan commune (Km 0+00)		At present, the beginning area of the route is agricultural land for rice and crops in Hai Nhan commune, Tinh Gia district - About 50m from the construction area
Agricultural land area (Km 0+000 to Km 2+000)		Agricultural land area along the canal in Hai Nhan commune, Tinh Gia district.
Tinh Gia township residential area (Km 2+00 to Km 3+00)		There are about 100 households living in the residential areas along 2 canal banks. The bridge crossing the canal is located within the residential area. -About 30 - 100 m from the construction area.
Township kindergarten (Km 2+900)		This is the kindergarten of Tinh Gia township. Daily school time is: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on week days. The kindergarten is about 50m from the construction area.
Tinh Gia township residential area (Km 3+00 to Km 3+500)		The residential area along 2 canal banks, with about 30 households, 30 - 100 m distanced from the construction site.
Intersection with NH1A at Cong bridge (Km 3+100)		Intersecting of the NH1A with the planned road. Traffic density is rather high.

Location	Picture	Description
Agricultural land area (Km 3+500 to Km 6+720)		Agricultural land area along the canal banks, belonging to Tinh Gia township and Binh Minh commune, Tinh Gia district.
End point of the route (Km 6+720)		End point intersecting with Than canal, Binh Minh commune, Tinh Gia district.

2.2.7 Wastewater Treatment Plant

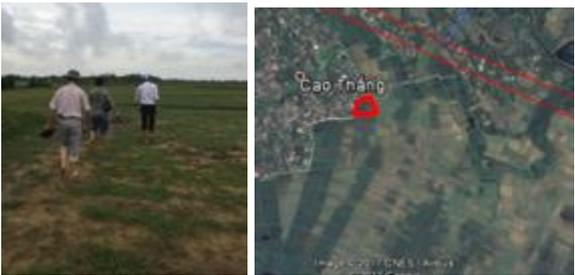
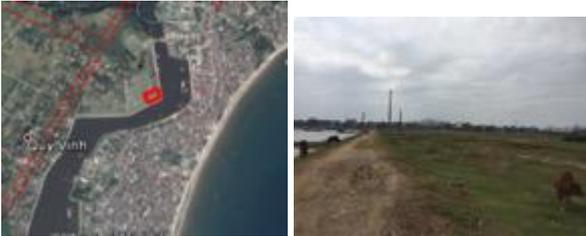
The proposed wastewater treatment plant is located in Nguyen Binh commune, Tinh Gia district. The site is currently agricultural land, far from residential area. Some notable features of the current status are presented in Table 2.20:

Table Error! No text of specified style in document..26. Site-Specific Conditions at the Wastewater Treatment Plant

Location	Picture	Description
The land area for construction of the treatment plant		Agricultural land (for rice and crops) in Binh Minh commune, Tinh Gia district.
Construction of booster pumping station 26m ³ /h		Location: Cong bridge on Cau Trang canal bank
Construction of booster pumping station 50m ³ /h		Location: intersection between Binh Minh – Sao Vang route and Cau Trang canal
Effluent receiving point		The receiving body of effluent after treatment is Than Canal section near Do Be bridge/ before the salinity sewer.

2.2.8 Resettlement Sites

Table Error! No text of specified style in document..27. Site-Specific Conditions at the Resettlement Sites

Location	Picture	Description
Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha		<p>The rice-field and crop land area (peanut, corn...) in Ninh Hai commune.</p> <p>About 100-150m from Ninh Hai commune residential area</p>
Resettlement site 2: Ron field- Hai Hoa 0.5 ha		<p>A vacant land area which has been leveled and is under management of Hai Hoa communal people’s committee.</p> <p>About 50-100m from residential area</p>
Resettlement site 3: Cao Thang 3 - Nguyen Binh 0.5 ha		<p>Agricultural land of some households in Cao Thang 3 hamlet, Nguyen Binh commune.</p> <p>About 100m from the residential area</p>
Resettlement site 4: Ray Kenh - Binh Minh 1.5 ha		<p>A vacant land area in Binh Minh commune with majority of vegetation as weeds and bushes. This is husbandry grazing area (buffalo, cow) of local people.</p> <p>About 150-200m distanced from Than canal and residential area</p>
Resettlement site 5: Van Xuan 8 - Binh Minh 0.5 ha.		<p>Watershed area of Van Xuan 8 hamlet, under management of Xuan Lam communal People’s Committee.</p> <p>It is adjoining North-South 2 road (Bac Nam 2) which has been completed. This location is very convenient for transportation of material during operation and construction process.</p> <p>It is about 100m distanced from the nearest residential area</p>

2.2.9 Borrow Pits and Quarries

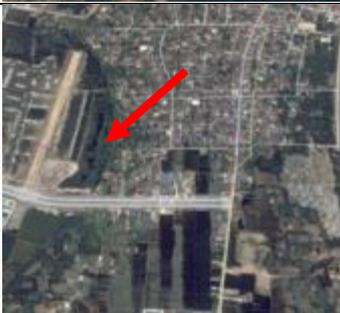
Table Error! No text of specified style in document..28. Current Status of some Existing Quarries

Location	Picture	Description
Truong Lam quarry, Tinh Gia district		<ul style="list-style-type: none"> - The quarry is located in Truong Lam commune, managed and operated by Tan Thanh 6 Company. The company has permit No. 440/GP-UBND issued by Thanh Hoa PPC on 28/11/2014. - The quarry meets the environmental requirements (see annex on due diligence review). - Reserve: 2,414,452 m³, located at 600 m to the east of NH 1A, 10 km away from the nearest project site.
Phu Lam borrow pit, Tinh Gia district		<ul style="list-style-type: none"> - The pit is owned and managed by Duc Minh Company. - The mine operation meets the environmental requirements (see annex on due diligence review). - The borrow pit has Permit No. 140/GP-UBND on exploitation and land rental issued by Thanh Hoa PPC on 17/4/2014. - Reserve: 1,200,000 m³, the pit is 5 km far from the NH1A to the East, material is transported along Xuan Lam - Phu Son interprovincial road, 10.5 km from the project site.
Ham Rong sand mine, Ham Rong ward, Thanh Hoa city		<ul style="list-style-type: none"> - The sand mine is managed and operated by Thuy Son Trading and Service JSC. - The mine operation meets the environmental requirements. - The mine has Permit No. 3350/QD-UBND on approval the planning on exploration and use of sand and gravel resources on the rivers of Thanh Hoa province, issued by Thanh Hoa PPC on 5/11/2007. - Reserve: 2,000,000 m³, The mine is 5 km from NH 1A, 35 km from the project site along NH1A, thus the supply and transportation of stone for construction is ensured.

2.2.10 Disposal Sites

Table Error! No text of specified style in document..29. Existing Conditions at Disposal Sites

Disposal site	Picture	Description
For Excavated Materials		
1. The disposal site is located in Xuan Lam commune, Tinh Gia district		<ul style="list-style-type: none"> - The disposal site is in front of the headquarter of Xuan Lam Communal People's Committee - Distance: 10 - 15 Km. - Transport route: Along NH1A - The storage capacity is about 300,000 m³. - This is currently vacant land, 200m from the nearest residential house, 500m from NH1A; Currently the site is in need of leveling.

Disposal site	Picture	Description
		
<p>2. The disposal site is located in Tuong Son commune, Tinh Gia district</p>		<ul style="list-style-type: none"> - The disposal site is in next to the provincial road DT512, 12 to 15 km from the construction sites. - Transport route: Along NH1A - The storage capacity is about 250,000 m³. - This is currently vacant land, need of leveling, more than 500m from the nearest residential house.
<p>3. The disposal site is located in Mai Lam commune, Tinh Gia district</p>		<ul style="list-style-type: none"> - The disposal site is in next to Bach Lang bridge with distance of 3km. - Distance: 10 - 15 Km. - Transport route: North - South No.2 road --> NH1A - The storage capacity is about 20,000 m³. - This is currently a small pond, need of leveling, more than 100m from the nearest residential house.
Disposal Site for Dredged Material from Than and Cau Trang canals:		
<p>(1) The disposal site under the salinity control sluice (Ben Ngao sluice)</p>		<ul style="list-style-type: none"> - The disposal site is near the salinity control sluice (Ben Ngao sluice) – at the estuary area of Lach Bang river – Binh Minh commune. This is the disposal site of Lach Bang port project with area of about 3.7ha. - Distance from the disposal site to the canal dredging area is 3 - 8 km; The main transportation route is Binh Minh inter-communal road. - Capacity of about 100,000 m³ - The disposal site is near the Lach Bang River which was saline as reflected in the monitoring results of Thanh Hoa DoNRE with a salinity on surface water of about 25-28‰.
<p>(2) The disposal site, 100m from Do Be bridge</p>		<ul style="list-style-type: none"> - The disposal site is 100m from Do Be bridge with area of about 4.5ha of abandoned land. The distance from the disposal site to the dredging area of Than and Cau Trang canals is 0.5 - 5 km. - The main transportation route is Binh Minh inter-communal road. The disposal site's capacity is about 67,500 m³ (corresponding to the discharge height of about 1.5 m).
Disposal Site for Domestic solid waste and hazardous wastes:		

Disposal site	Picture	Description
Domestic solid waste / sludge		<ul style="list-style-type: none">- Landfill/waste treatment plant for waste and hazardous waste of Nghi Son Environment JSC in Truong Lam commune, Tinh Gia district.- Average distance to project areas: 20 km. Total land area available for disposal: 30 ha

CHAPTER 3 -ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

The Tinh Gia Subproject consists of two main components:

- b) Component 1: Improvement and Construction of Urban Technical Infrastructure; and
- c) Component 2: Technical Assistance

Component 1 involves some civil works as shown in Figure 3.1 while Component 2 only involves technical assistance.

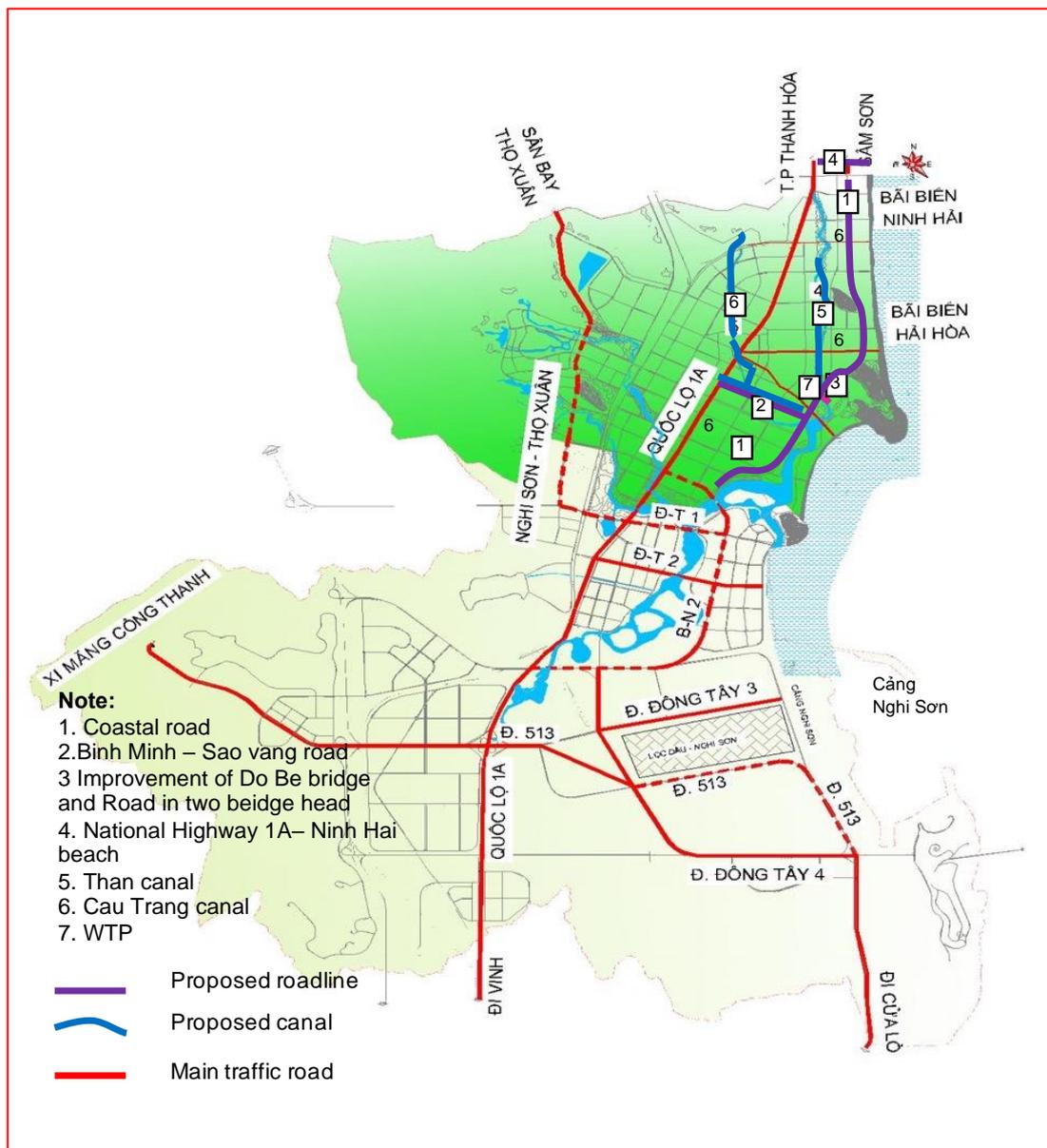


Figure Error! No text of specified style in document..7: Proposed Activities of Tinh Gia Sub-project

Under Component 1, the main civil work to be provided/rehabilitated includes:

- (i) Construction of 9.8 km new coastal road from Ninh Hai – Lach Bang 2;
- (ii) Construction of 2 km new road from Binh Minh road to Sao Vang-Nghi Son economic zone;

- (iii) Rehabilitation and upgradation of the Do Be bridge and access roads;
- (iv) Construction of 815m new road from NH1A to Ninh Hai beach;
- (v) Dredging and rehabilitation of 5 km of the Than canal;
- (vi) Dredging and Rehabilitation of 5.7 km of the Cau Trang canal; and
- (vii) Construction of a wastewater collection and treatment system capacity 500 m³/day; and
- (viii) Construction of infrastructure for total 4.5 ha resettlement areas (5 RSs).

3.1 POSITIVE IMPACTS

Overall, the subproject would bring about significant positive socio-environmental impacts. Construction contracts would help to create casual short term job and additional incomes for local people during construction phase.

Once the subproject is completed and the listed facilities are put into operation, the subproject area would be benefited greatly. The new and improved infrastructure and services would help to improve living conditions of local people, contribute to promote sustainable socio-economic development in the area. Environmental sanitation conditions would be significantly improved after the existing polluted canals are dredged, domestic wastewater are collected and treated before being discharged into the environment. Therefore, public health risks related to water-borne diseases would be reduced. Public nuisance related to the polluted canals or untreated domestic wastewater would be addressed, the town's landscape would be improved, these would contribute to improvement of people's living standard. Dredging of canals would help to improve drainage capacity, reducing flooding risks and related public health and safety issues. The subproject would also be an opportunity to raise local people's awareness on environmental protection by the new or improved facilities combined with environmental communication campaigns.

Investments on urban transport infrastructure will strengthen the connectivity among areas in the town. The new roads in urban areas will facilitate transportation of goods, save transportation time, reduce traffic pressure thus reducing emissions from vehicles in the urban areas.

In addition, the implementation of the project helps to achieve the outputs as follows:

- Reduce economic losses on the basis of reduced area of flooding and inundation time.
- Reduce traffic jams and traffic accident risks.
- Increase urban competitiveness when urban environment is improved: investing in wastewater collection and treatment system helps improve urban environment and public health.
- Increase the land value with synchronous infrastructure system.
- Increase production efficiency thanks to favorable infrastructure; reduce travel time between production and residential areas. Attract skillful workers from other provinces.
- Respond to climate change, natural disasters, storms, floods.

In brief, with synchronous investment of the project, Tinh Gia district will receive positive changes and more beautiful urban landscape; sustainable environment; convenient movement between the area and surrounding areas; contribute to promote trade-services, create stable environment for attracting domestic and foreign investment, thereby creating drive for comprehensive development from economics, culture to education. Living conditions of people are enhanced leading to significant improvement of economic, increasing GDP.

3.2 CLASSIFICATION OF NEGATIVE IMPACTS AND RISKS

There will be some potential negative environmental and social impacts and risks during the pre-construction, construction and operation of the facilities provided under Component 1.

These potential negative impacts and risks are classified as below:

Significant Impacts (S)

- Impacts on large land areas, important areas, or changes in environmental conditions in a period of more than two years;
- Impacts exceeding permitted standards and regulations. Long-term and large-scale impacts;
- Changes in ecological systems, impacts on ecological systems of large areas, or medium impacts (lasting for more than two years) yet required recovery period of the affected ecological systems is ten years;
- Impacts on health of people;
- 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 six months to two years;
- Changes in ecological systems or ecological functions at the localities in a short time and recovery capacity is good. The impact levels are similar to current changes yet such impacts can have a cumulative effect;
- Impacts might (or might not) affect people's health, causing impacts on persons in the surrounding 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 in less than six months or medium changes for a period of less than two years;
- Impacts are within permitted standards and regulations, causing minor changes at 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 cannot be identified yet such impacts can also be caused by daily activities;
- No social and environmental impacts. Types and scope of negative potential environmental impacts and risks are classified in Table 3.1

Table Error! No text of specified style in document..30. Level of Negative Impacts of Tinh Gia Subproject

Component	Physical aspects			Biological aspects		Soci aspects				Others	
	Air, noise, vibration	Soil, water	Solid waste, dredged material	Forest, natural ecosystem	Fish, aquatic species	Land acquisition and resettlement	Indigenous people	Physical cultural resources	Livelihood, community disturbance	Local flooding, traffic, safety	Off-site impacts
Sub-Component 1.1. Coastal road from Ninh Hai –Lach Bang 2 Bridge: L = 9.8 km, B = 27 to 36 m, design speed V = 60 km/h. Drainage, lighting, infrastructure channel is included. Son Hai bridge will be built on this road, L = 50.15m, B = 29m.											
Pre-construction	N	N	N	N	N	M	N	N	L	N	L
Construction	S	M	M	N	L	N	N	N	M	S	L
Operation	L	N	L	N	N	N	N	N	N	L	L
Remark	381 PAHs, of which 85 PAHs have to relocate; 15,7078m ² agricultural land and 18,180m ² residential land would be acquired. Impacts on PCR; Impact on agricultural land.										
Sub-component 1.2. Construct road from Binh Minh to Sao Vang road –Nghi Son EZ: Construction of new asphalt concrete road; L = 2.1 km, B = 26.5 m. Design speed V = 60km/h. Drainage, lighting, infrastructure channel is included.											
Pre-construction	N	N	N	N	N	L	N	L	N	N	N
Construction	L	L	M	N	L	N	N	L	L	L	L
Operation	L	N	L	N	N	N	N	N	L	L	L
Remark	387 PAHs, of which 30 PAHs have to relocate; 89,843m ² agricultural land and 38,870m ² residential land are acquired. Impact on transportation of QL1A; Impact on local people' business; Impact on agricultural land; Impact on local cemetery										
Sub-component 1.3. Rebuild a new Do Be bridge and access roads: Demolition of the existing Do Be bridge and rebuild a new Do Be bridge (L = 70m, B = 20m) at the same location, improving the existing 490 m of Do Bo access roads at two ends of the bridge											
Pre-construction	N	N	N	N	N	L	N	N	L	N	L
Construction	M	M	M	N	L	N	N	M	M	S	L
Operation	L	N	N	N	N	N	N	L	L	L	L
Remark	25 APHs, of which 17 APHs relocated, affected agricultural land 7876m ² ; Impact on business; Impact on transportation; Cause of land subsidence at the beginning and the end of the bridge; Impact on agricultural land; Impact on the quality water of Than canal										
Sub-component 1.4. Construct Road from NH1A to Ninh Hai beach: L = 815m, B = 27 m, V = 60km/h. Drainage, lighting, infrastructure channel included											
Pre-construction	N	N	N	L	N	L	N	N	L	N	L
Construction	M	M	M	L	L	N	N	M	M	L	L
Operation	L	N	N	N	N	N	N	L	L	L	L
Remark	105 PAHs, of which 31 PAHs have to relocate; 31933m ² agricultural land and 6310m ² residential land would be acquired; Impact on agricultural land; Impact on cemetery.										

Component	Physical aspects			Biological aspects		Soci aspects				Others	
	Air, noise, vibration	Soil, water	Solid waste, dredged material	Forest, natural ecosystem	Fish, aquatic species	Land acquisition and resettlement	Indigenous people	Physical cultural resources	Livelihood, community disturbance	Local flooding, traffic, safety	Off-site impacts
Sub-component 1.5: Dredging and embankment of Than canal: Dredging and embankment lining of Than canal, L = 5km, B = 25.5 m											
Pre-construction	M	M	M	N	M	L	N	L	L	L	L
Construction	M	M	M	N	M	L	N	N	M	M	M
Operation	M	N	L	N	N	N	N	N	L	L	L
Remark	Increase land subsidence risks along both sides of river bank; Impact on agricultural land; Bad smell from dredging the Than canal.										
Sub-component 1.6: Dredging and embankment of Cau Trang canal: Dredging and embankment lining of the Cau Trang canal, L = 5.7km, B = 3 to 9 m											
Pre-construction	M	M	M	N	M	L	N	L	L	L	L
Construction	M	M	M	N	M	L	N	N	M	S	M
Operation	M	N	L	N	N	N	N	N	L	L	L
Remark	Increase soil subsidence risks along river bank; Impact on agricultural land; Bad smell generated from dredging the Cau Trang canal.										
Sub-component 1.7: Construction of wastewater collection and treatment system: Construction of a wastewater treatment plant capacity 2,000 m ³ /d using biological technology, and a sewer system, 2 PSs.											
Pre-construction	M	M	M	N	L	M	N	L	L	L	L
Construction	M	M	M	N	L	L	N	L	L	M	M
Operation	M	L	M	N	L	N	N	N	M	L	L
Remark	10,000 m ² agricultural land is acquired; The plant is located 300 m from the nearest residential area; people live along the sewer pipe system (Cau Trang canal). Impact on local people living along with Cau Trang canal during construction. Bad smell, quality of wastewater after treatment discharged to the host system (Than canal); Management and Operation the station.										
Sub-component 1.8: Construction of the infrastructures in resettlement sites: 5 small resettlement sites, total land area of 4.5 ha with 138 land slots (80-150 m ² each). The proposed works include ground levelling, construction of internal roads, drainage, water supply, power supply and lighting system.											
Pre-construction	N	N	N	N	N	M	N	N	N	N	N
Construction	M	M	M	N	N	N	N	N	L	L	L
Operation	L	L	L	N	N	N	N	N	N	L	N
Remark	Land acquisition and resettlement: 45,000m ² agricultural land Community disturbance; demolition of structure and disposal of waste; Potential flooding impacts due to poor O&M; Road safety concerns on operation phase										

3.3 POTENTIAL NEGATIVE IMPACTS & RISKS DURING PRE-CONSTRUCTION

Pre-construction impacts and risks during pre-construction phase include (1) Land acquisition; and (2) Safety risks related to unexploded ordnances (UXO).

3.3.1 Land Acquisition

Total land area to be acquired permanently is **553,336 m²**, of which 75,235m² is residential land; **452,656 m²** of annual land (include 1,152m² public land), 22,305m² of perennial land and; and 3,140 m² cemetery land. The land to be acquired is mostly agricultural land with 452,656 m².

The item that requires the most agricultural land acquisition is the coastal road, with 198,268 m²; this item that also requires the most residential land acquisition, 50,140 m². The Table 3.2 below shows the land areas to be acquired by types of land use and work item.

Table Error! No text of specified style in document..31. Scope of Affected Land by Tinh Gia Subproject

No.	Items	Residential land (m ²)	Agricultural land		Cemetery Land (m ²)	Total (m ²)
			Annual land (m ²)	Perennial land (m ²)		
1	Coastal road from Ninh Hai – Lach Bang 2 bridge	50,140	175,963	22,305	700	249,108
2	Binh Minh road to Sao Vang – Nghi Son economic zone	6,960	48,653	0	2,440	58,053
3	Do Be bridge and approach roads	2,820	0	0	0	2,820
4	Road from NH1A to Ninh Hai beach	9,005	31,933	0	0	40,938
5	Than canal	0	68,959	0	0	68,959
6	Cau Trang canal	6,310	72,148	0	0	78,458
7	Wastewater treatment plant	0	10,000	0	0	10,000
8	Resettlement sites	0	45,000	0	0	45,000
Total		75,235	75,235	452,656	3,140	553,336

(Source: RP report, 10/2017)

Total Project's the affected households (PAH) is 1,354AHs. There are 350 AHs whose houses are affected, of which 225 HHs have to relocate; 89 AHs are vulnerable (50 social policy HHs; 39 poor HHs and 3 single female headed households with dependents); 526 AHs are severely affected by losing agricultural land.

Survey shows that 22/1144 PAHs whose business will be affected, of which 2 PAHs are affected by the construction of the road from NH1A to Ninh Hai beach, 9 PAHs affected by the Rehabilitation of the Cau Trang Canal, and 11 PAHs are affected by the Upgrading of the Do Be bridge and approach roads. There is no affected ethnic minority household in project area.

Table Error! No text of specified style in document..32. Classification of affected households

No	Item	Total AHs	Number of Vulnerable households	Number of Resettlement HHs	Severely Affected HHs	Number of affected businesses
1	Coastal road from Ninh Hai – Lach Bang 2 bridge	594	60	135	252	0
2	Binh Minh road to Sao Vang – Nghi Son economic zone	174	12	36	59	0
3	Do Be bridge and road approaches	28	1	13	0	11
4	Road from NH1A to Ninh Hai beach	105	13	41	46	2
5	Than canal	156	3	0	82	0
6	Cau Trang canal	157	0	0	87	9
7	Wastewater treatment plant	43	0	0	0	0
8	Resettlement sites	97	0	0	0	0
Total		1,354	89	225	526	22

(Source: RP report, 10/2017)

Land acquisition, relocation and resettlement have potential to impact the affected households physically and psychologically, these may result in social problems and even litigation. Relocating to a new place may cause disturbances and disruptions to the livelihood, business, income, accessibility to existing infrastructures and services of affected households.

Socio-economic surveyed results on affected households⁵ show that, 20% of affected people (AP) are seasonally hired-worker; 41% are farmers; 17% are factory workers; 11% are traditional fishermen/fisherwomen; and the rest are state servants, traders or service providers. Business/service households are mostly in Hai Thanh and Hai Hoa communes. 745 households (HH) are severely affected⁶ (accounting for about 65% total PAH), of which 520 HHs are severely affected due to acquisition of agricultural land and 225 HHs have houses and shops/business establishments to be displaced.

Average income of affected household is about 121 million VND/year/HH. Popular income level is about 68 million VND/year/HH, much lower than the average income.

Incomes HHs affected with partly agricultural land acquisition would not be affected significantly as the remaining agricultural land area will be still sufficient for agricultural production. Moreover, HH income from agriculture accounts for parts of total HH income as number of young household members are workers instead of farmer. Income of 25 business/trading and 17 HHs doing fishery will be affected. These are people who will bear the most severe impact from land acquisition because they will permanently lose production area/workshop area or be interrupted in practice. These are also very high-income people with

⁵ - RP report, October 2017

⁶ Severely affected households include those who lose over 20% existing agricultural land area (or over 10% existing agricultural land area for households in vulnerable group) and those who have shop/business displaced.

around 22 million/grown-up person/month on average. People working in other sectors seem not affected significantly except for initial adaptation to new changes in movement/location. In addition, with average distance of 0.5-1km from people’s old place to the un-centralized resettlement area in the village/commune, affected households will not encounter big challenge to access to education, transport and medical service.

There are 68 vulnerable households⁷ (only account for nearly 6% of total project affected households). In term of income restoration, these households will get lower pace than other households due to limitation in internal resources (finance, labor, knowledge or skill), which require more special behavior. However, there will be typical policies to support these households to ensure that their income will be restored and they will have better life than pre-project condition. These typical activities will be considered during the formulation of livelihood restoration program and Resettlement plan for the project.

In general, land acquisition are unavoidable and the impacts on relocated households would be long term and significant. The subproject has prepared a Resettlement Action Plan to address the impacts related to land acquisition.

3.3.2 Affected Buildings/Structures

The houses and ancillary works of 350 PAHs would be affected, of which 225 households are losing entire house. Total area of affected houses is 49,645 m². Other impacts include: breeding facilities (23,495 m²), shop, factory (1,460 m²), yard (20,650 m²), fence (35,821 m²), well (389 pcs), grave (243 pcs). Detail of affected building/structure is shown in Table 3.4:

Table Error! No text of specified style in document..33. Affected Buildings/Structures

No.	Items	House (m2)	Breeding facilities (m2)	Shop, factory (m2)	Yard (m2)	Fence (m2)	Well (pcs)	Grave (pcs)
1	Coastal road	30,550						
2	Binh Minh to Sao Vang road	5,990	3,750	230	3,110	4,510	59	-
3	Do Be bridge and approach roads	3,150	880	-	1,400	470	4	-
4	NH1A - Ninh Hai beach Road	4,825	2,452	-	1,320	3,789	41	73
5	Than Canal	-	0	0	0	0	0	0
6	Cau Trang Canal	5,130	690	570	1905	2390	16	0
7	WWTP, sewers, PSs	-	-	-	-	-	-	-
8	Resettlement site	-	-	-	-	-	-	-
Total		49,645	23,495	1,460	20,650	35,821	389	243

⁷ **Vulnerable group:** are special people likely to suffer from disproportionate impacts or at risk of further impoverishment under the impact of resettlement, include: (i) Household-headed women (single, widow or disabled) with dependents, (ii) people with disabilities (not able to work), elderly people with no support, (iii) people meeting criteria for the poor as stipulated by MoLISA (with poor household certification), (iv) landless people, (v) isolated ethnic minority groups, and (vi) policy households such as martyr/veteran’s family, Vietnam Heroic Mother, contributor families....

3.3.3 Affected Graves

243 graves will be relocated. Of which: (1) Coastal road from Ninh Hai –Lach Bang 2 Bridge affect 4 graves; (2) Binh Minh to Sao Vang road affect 166 graves; (3) Road from NH1A to Ninh Hai beach affect 73 graves. To Vietnamese, graves are belief and spiritual matter which should be respected carefully. Relocation of graves will affect household’s spiritual and psychological life. In addition, physical removal of the grave will require customary or religious worshipping procedure. 243 graves all belong to Buddhism people so they share the same spiritual procedures for relocation. Consultation with the households affected by grave relocation shows that people are willing to move the graves to another location to give land for construction if the subproject owner provide adequate supports to cover the cost of grave relocation. Thus, the impacts on graves is at moderate level and can be mitigated.

3.3.4 Impacts on Trees and Crops

Project will affect 37,996 fruit trees, 34,819 wood trees, 9,728 ornamental plants/bonsai trees, 44,665 m² of vegetable and 262,460 m² of rice. The Table 3.5 below presents the detail of impact on trees.

Table Error! No text of specified style in document..34. Impact on Trees and Crops

No	Items	Fruit tree (tree)	Wood trees (tree)	Bonsai trees (tree)	Vegetable (m2)	Rice (m2)
1	Coastal road	27,358	13,245	7,631	32,375	155,040
2	Binh Minh to Sao Vang road	4,707	2,155	874	6,745	16,303
3	Do Be bridge and approach roads	55	15	20	-	-
4	Road NH1A to Ninh Hai beach	4,424	18,451	588	4,605	3,030
5	Than Canal	0	0	0	0	68,959
6	Cau Trang Canal	1452	953	615	940	6128
7	WWTP, sewers, PSs				10,000	
8	Coastal road				32,000	13,000
	Total	37,996	34,819	9,728	86,665	262,460

Cutting down of tree and vegetation will affect households economically, cause the loss of shadow and change greenery landscape. This impact during construction of these work items is unavoidable but can be minimized.

3.3.5 Impact on Business

The business of 22 households will be affected. They are located in road from NH1A to Ninh Hai beach item (2 households), Cau Trang Canal (9 households) and Do Be bridge and approach roads (11 HHs). Of which, two business households in NH1A to Ninh Hai beach item will be permanently displaced, 20 other business households will be temporarily interrupted during the construction period, leading to reduction of household income. Construction will hinder access to shops and generate dust affecting sanitation condition of catering services (for 9 business households in Cau Trang Canal, at Cong township and 11 seafood processing/trading households near Do Be bridge),... These impacts will reduce number of customers, leading to income reduction for the affected households. However, construction time is medium, 3-6 months in Cau Trang canal section and about 10 months in Do Be bridge, so with proper mitigation measurements, the impacts on these households can be mitigated. Therefore, the impact level is assessed to be medium.

3.3.6 Temporary Land Acquisition

During construction, about 35,850 m² annual land will be acquired temporarily for worker camp, disposal sites, quaires . Detail of temporarily acquire land is shown in Table 3.6 below.

Table Error! No text of specified style in document..35: Temporarily Acquire Land

Item	Area (m2)
Coastal road from Ninh Hai – Lach Bang 2 bridge	9,000
Construct Binh Minh road to Sao Vang – Nghi Son economic zone	3,500
Upgrade, rehabilitate Do Be bridge and road approaches	3,350
Construct road from NH1A to Ninh Hai beach	3,000
Upgrade, rehabilitate Than canal	6,000
Upgrade, rehabilitate Cau Trang canal	6,000
Construct wastewater treatment plant	2,500
Resettlement site	2,500
Total	35,850

3.3.7 Safety Risks due to Unexploded Ordnance (UXO)

Before 1975, Vietnam underwent two wars and Tinh Gia town was also suffered from being bombed during the war. The subproject areashave been greatly disturbed by human activities including extensive cultivation and urban development, UXOs have already been cleared in some parts. However, some UXOs may still be remained underground in the subproject area. As the subproject involves civil works with excavation, there are risks that UXOs may expose or even cause injuries, losses of human lives and assets in the subproject areas. Therefore, UXO detection and clearance will carried out before commencement of any construction work with more details provided in the ESMP.

3.4 POTENTIAL ADVERSE IMPACTS DURING CONSTRUCTION

3.4.1 Common Construction Impacts

The investments under Component 1 includes: (1) Coastal road from Ninh Hai –Lach Bang 2 Bridge; (2) Construct road from Binh Minh to Sao Vang road –Nghi Son EZ; (3) Upgrade, rehabilitate Do Be bridge and approach roads; (4) Construct Road from NH1A to Ninh Hai beach; (5) Dredging of 5 km and lining the embankments of the Than river; (6) Rehabilitate Cau Trang Canal; (7) Construction of wastewater collection and treatment system capacity 500 m3/day; (8) Construction of infrastructure for 4.5 ha resettlement site.

Activities to be performed during the construction of work items under Tinh Gia subproject include:

- Leveling of the site and constructing worker camps and site office
- Machinery’s operation and workers’ activities.
- Transportation and temporary storage of material and fuel
- Installing retaining wall, dredging, gathering wastes along Than and Cau Trang canals
- Excavating, backfilling, forming foundation for roads and drainage works, electric line, lining embankment...
- Boring pile for pier and abutment of Do Be and Son Hai bridges; Driving pile/casting pile for reinforcement of Than and Cau Trang canal revetment.
- Backfilling and restoring the site, lining the embankment for Than and Cau Trang canals
- Laying aggregate stone and asphalt for roads

- Transporting waste material to disposal site

Sources and scale of impacts in the main affected area under construction activities are listed in following Table 3.7.

Table Error! No text of specified style in document..36. Sources and Scale of Impacts in Construction Phase

No	Impacts/Risks	Sources of Impact	Main Receptors	Impact level	Duration
1	Air Quality Reduction: increased levels of dusts and exhaust gas, odor, noises, vibration.	<ul style="list-style-type: none"> - Dust from excavation, loading/ unloading and transportation of construction materials. - gas emitted from exhausts of cars, trucks, excavators, cranes etc. - Bad odor from materials dredged up from Cau Trang and Than canals. - Noise from pile driving; sheet piles installation, operations of construction plants, unloading rocks and soil on temporary material yards, - Vibration due to pile driving at bridges, road compaction. 	<ul style="list-style-type: none"> - People living around the construction areas and material transport routes (Ngo Chau Luu road lead to Hai Hoa beach; Luong Van Yen road lead to Hai Hoa beach; Luong Chi road lead to Bach Lang bridge). - Workers on sites; - Infrastructure and landscape around the construction areas and material transport routes. 	Medium to Significant	Medium to Long-term
2	Waste water generation	<ul style="list-style-type: none"> - Stormwater runoff through construction sites; - Domestic wastewater from workers' camp; - Construction Wastewater. 	Land and surface water sources in the project areas, especially Cau Trang and Than canal	Medium	Medium
3	Solid wastes generation	<ul style="list-style-type: none"> - Wastes from demolition of the existing Do Be bridge; - Excavated soil - dredged materials from Than and Cau Trang canals - Domestic waste from workers' accommodation; - Construction solid waste; - Hazardous materials/wastes such as wasted oil, materials contaminated with oil. 	Residents along the pipelines, near the PSs, Do Be bridge, and the workers' camps; Soil, water, terrestrial/aquatic vegetation around the temporary and permanent disposal sites of dredged materials .	Medium	Medium
4	Surface Water quality reduction	<ul style="list-style-type: none"> - Dredging disturb muds from bottom of cannals - Soil and water leaked from dredged materials of Cau Trang and Than canals. - Storm water runoff from the construction sites; - Wastewater from workers' camps and construction sites 	Surface water in Cau Trang and Than canal Water bodies near construction sites and workers' camps	Medium	Medium

No	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
5	Impacts on Biological Resources	<ul style="list-style-type: none"> - Site clearance - Dredging 	Trees, vegetation, some terrestrial species in project area	Medium	Short
6	Impacts on Urban landscape	<ul style="list-style-type: none"> - Temporary loading of construction materials and waste, dredged materials. 	Residents, travelers passing construction sites along pipelines, pumping stations, Than and Cau Trang canals	Significant	Medium
7	Increased erosion and landslide risks	<ul style="list-style-type: none"> - Land slide risks at deep excavations for construction of sewers, pumping stations, materials dredged from Cau Trang and Than canals, Do Be and Son Hai bridges, - Landslide risks at Barren slopes created for embankment lining of Cau Trang and Than canals; Increased erosion risks from material/waste loads and at disposal site 	<p>People living in areas along the banks of Cau Trang and Than canals, the road embankment, near the excavated pits along pipeline, pumping station and treatment plant, around the disposal site</p> <p>Workers working in the WWTP</p>		
8	Increased flooding, sedimentation, risks	<ul style="list-style-type: none"> - Cofferdams in canals narrow down the flow, lead to increased flooding risks. - Leaked wastewater from dredged material may cause flooding if drainage is inadequate. - Material and waste blocks drains causing flooding at surrounding areas. - Rain water run-off at construction material yards may cause sediment in the nearby drains. - New road disrupt existing drainage pattern - Muds in wastewater from construction site deposits in drains leading to localized inundation 	<p>Fields along the coastal road, NH1A connecting Ninh Hai beach, Binh Minh road to Sao Vang.</p> <p>Culvert area along Cau Trang canal</p> <p>Area around the WWTP, resettlement area</p>	Medium	Short
9	Traffic Disturbance and Increased traffic safety risks	<ul style="list-style-type: none"> - Road excavation, parking of construction plants or loading of materials and wastes may obstruct, disturb or interrupt traffic in roads. - Road surface partially occupied by materials, open trenches, construction plants 	<p>Traffic means and drivers, pedestrians</p> <p>Local residents at the intersections between the construction area and NH1A, Ngo Van Luu, Luong</p>	Significant	Short

No	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
		and wastes during construction phase will lead to increased traffic risks	Van Yen, Luong Chi, the road along Cau Trang canal, Do Be bridge.		
10	Damages to existing infrastructure and or disruptions to related services	<ul style="list-style-type: none"> - Affect irrigation function of Than canal. - Power lines may be affected by cranes, bulldozers - Existing underground infrastructure may be affected by excavation - Deep excavation may cause cracks/damages to existing weak structures 	Roads, existing houses, powerlines, irrigation canal along the construction routes and the related services these infrastructures provide	Medium	Short
11	Social impacts: disturbance to businesses and daily activities of local people	<ul style="list-style-type: none"> - construction activities may disturb/disrupt accessibility to roadside houses, business, offices that may lead to social conflicts - Dust, noise, waste and wastewater may affect daily lives of HHs and business in project area; - Social conflicts, local security may be affected; 	People living along the construction sites; near workers' camps Workers	Medium	Short
12	Impacts on cultural, historical resources	<ul style="list-style-type: none"> - Some PCRs located may be affected by dust, noise, traffic disturbance. - Accessibility to cemeteries may be disturbed 	People visit the temples and cemeteries.	Low	Short
13	Community Safety and Health	<ul style="list-style-type: none"> - Traffic safety risks increases at construction areas and transportation routes. - Disturbed ground, open channels, bulky dumps may cause accidents; - The use of electricity, gas, oil may cause safety risks to local communities - Dust and emissions, noise from construction sites may affect people's health. 	People living along the road;	Medium	Short
14	Health and safety of workers	All construction activities impose safety risks to the workers due to falling into deep excavated holes, electrical shocks, being injured by materials mixed with sediments in dredged materials, fall into water from bridge and drowned,	the workers	Medium	Short

No	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
		bitten by insects etc.			

Detailed assessment on the potential adverse impacts during construction of investments under Component 1 are described below.

3.4.1.1 Air Quality Reduction

During construction phase, air quality would be affected by increased level of dusts and gas emission, noise and vibration.

Dust is generated from demolition of existing structures for site clearance, from excavation, leveling, transportation and unloading of material. Gas emissions including CO, SO₂, NO₂, hydrocarbonate... are generated from operation of construction machinery and equipment (bulldozer, excavator...), mainly from vehicles for transportation of material and wastes. Impact of dust and gas emissions are analyzed in details as follows:

➤ Dust Generated from The Demolition of Existing Houses and Structures

Total volumes of the waste generated from houses and structures demolition is estimated at 350,363 m³. These are mainly masonry and brick and some steel. Demolition of these materials will generate dust. The volume of dust emitted from the demolition is calculated below:

$$W = E \times Q \times d \quad [1]$$

In which: *W*: The average dust emissions (kg);
E: Particulate Emission factor (kg dust/ton);
Q: Emission volume (m³);
d: Specific weight of debris $d = 1,8 \text{ ton/m}^3$ (according to document No. 1784/BXD-VP of the Ministry of Construction publishing the norm of construction materials).

Dust emission coefficient is determined in accordance with the guidelines on Environmental Assessment Sourcebook (World Bank, 1991) and AP 42 for Stationary Point and Area Sources (US EPA, 1995) as follows:

$$E = k \times 0.0016 \times (U/2.2)^{1.3} \div (M/2)^{1.4}, \text{ kg/ton} \quad [2]$$

In which: *E* - Emission coefficient (kg/ton); *k* - Particle structure with average value ($k = 0.2$ with particle size structure table (*k*) page 13.2.4-4 AP 42 (US EPA, 1995); *U* - average wind speed (m/s) (selected speed is 3 m/s); *M* - The average moisture content of debris (%) (Selected average moisture is 11% - Table 13.2.4-1 AP 42, US EPA, 1995).
 $\rightarrow E_d = 0.02742 \text{ kg/ton}$

Based on pollution coefficient *E* and compliance with the subproject work progress, the loads of dust dispersed from demolition is calculated and provided in Table 3.8

Table Error! No text of specified style in document..37. Forecasts on Dust from Demolition

Work items	Volume of demolition (m ³)	Dust emission (kg)	Duration (month)	Dust load (kg/day)	Dust concentration (mg/m ³)	QCVN 05:2013 (mg/m ³)
(1) Coastal road	81,001	1,359	4	9.44	1.6	0.3
(2) Binh Minh to Sao Vang road	133,593	2,498	5	13.88	12.6	0.3
(3) Do Be bridge and approach roads	8,092	166	1	4.62	5	0.3
(4) Road from NH1A to Ninh Hai beach	64,260	1,996	4	13.86	17	0.3
(5) Than Canal	-	-	0	0	0	0.3

Work items	Volume of demolition (m3)	Dust emission (kg)	Duration (month)	Dust load (kg/day)	Dust concentration (mg/m3)	QCVN 05:2013 (mg/m3)
(6) Cau Trang Canal	24,631	358	2	0.94	5	0.3
(7) WWTP, sewers, PSs	11,250	555.26	1	0.64	1.5	0.3
(8) Resettlement site	27,536	1,359	2	1.07	5.1	0.3

Remark: The following assumptions are made (i) a working day of 8 hours; (ii) Dispersion height $h = 10$ m and (iii) Dry season's meteorological data are used

The amount of dust generated from demolition depends on many factors such as the material and the size of the works to be demolished, weather conditions (humidity and especially, dry or rainy). The results calculated above for dry season show that the amount of dust generated from demolition operations would exceed the allowable limits set in QCVN 05:2013/BTNMT 5.4 from 5 to 57 times. The highest calculated dust levels would be along the road from NH1A to Ninh Hai beach (57 times above limits), Binh Minh to Sao Vang road (exceed allowable limit 42 times); the Do Be bridge and approach road, and the Cau Trang canal; and the resettlement area (exceed limits 17 times).

Dust from demolition mainly caused by relative coarse particulate matters thus usually deposit quickly and exist in a relative short time. The demolition lasts in 2-4 weeks in each area so that the impacts of dusts caused by demolition activities are relative short term, temporary and can be minimized.

Dust emission from excavation and filling activities

Based on equation [2] the particle emission factor applied for the construction phase under component 1 is $E = 0.02742$ kg/tons. Thus, dust emission at each work item is calculated and summarized in Table 3.9.

Table Error! No text of specified style in document..38. Estimation of dust emission from the excavation and backfilling

Work items	Volume of earthworks (m3)	Dust emission (kg)	Construction Duration (month)	Dust load (kg/day)	Dust concentration (mg/m3)	QCVN 05:2013 (mg/m3)
(1) Coastal road	522,861	40,756	36	37.737	1.5	0.3
(2) Binh Minh to Sao Vang road	16,150	2,965	15	6.589	1.5	0.3
(3) Do Be bridge and approach roads	3,090	538	10	1.793	0.8	0.3
(4) Road from NH1A to Ninh Hai beach	6,177	902	15	2.003	0.8	0.3
(5) Than canal	59,357	41,084	24	57.06	7.1	0.3
(6) Cau Trang Canal	9,520	34,225	24	47.535	9	0.3
(7) WWTP, sewers, PSs	4,164	171.3	12	0.476	0.15	0.3
(8) Resettlement site	21,000	2,073	6	11.516	1.6	0.3

Remark: The following assumptions are made (i) a working day of 8 hours; (ii) Dispersion height $h = 10$ m and (iii) Dry season's meteorological data are used.

The results in Table 3.9 show that dust concentration generated from excavation exceeds allowable limit set in QCVN 05:2013/BTNMT from 2.5 - 30 times. Excavation would last 4-8 weeks at each construction site along the road, bridges and canals. Dust from excavations would be generated the most from Than and Cau Trang canal construction sites. Some areas have high population density such as Tinh Gia township residential area (Km 2+00 to Km 3+00) of what and on Cau Trang canal Resident area near the end section of Than canal will be affected by dust. As “successive construction method” is used so the impacts be at MEDIUM to HIGH level and can be mitigated.

➤ **Dust and Emission Generated from The Transportation**

According to the standards established by the World Health Organization (WHO)⁸, 15-ton diesel vehicles will generate loads of dust and exhausted CO, SO₂, NO₂, and HC as follows: dust: at 1.6 g/km/vehicle; CO gas: 3.7 g/km/vehicle; SO₂: 7.43S g/km/vehicle; NO_x: 24.1 g/km/vehicle and HC: 3 g/km/vehicle (diesel of 0.05% S). The subproject will use 15-ton trucks for transporting. The average transport distance is 8 - 10 km (10km for the areas providing construction materials and adjacent to Tinh Gia district and 8 km for the dumping site in front of People’s Committee of Xuan Lam commune – Tinh Gia district). The total passages of trucks and the generated dust loads in the process of transportation are calculated as follows:

Table Error! No text of specified style in document..39. Number of Truck Passages in Constructing Items

Work items	Volume of material (m3)	Transport time (months)	Number of Trips (trip/d)	Volume of waste (m3)	Transport time (months)	Number of Trips (trip/d)	Total Trips (trips/d)
Coastal road	575,558	36	72	603,862	36	60	132
Binh Minh to Sao Vang road	96,253	15	7	149,743	15	11	18
Do Be bridge and approach roads	25,908	10	4	11,182	10	3	7
Road from NH1A to Ninh Hai beach	29,336	15	4	70,437	15	3	7
Than Canal	793,442	24	1	127,987	24	92	93
Cau Trang Canal	636,396	24	1	77,631	24	77	78
WWTP, sewers, PSs	67,483	12	1	15,414	12	1	2
Resettlement sites	88,194	6	31	48,536	6	19	50

Concentration of dust is quantified using Sutton’s atmospheric dispersion model as follows:

$$C = \frac{0,8E \cdot \left\{ \exp \left[\frac{-(z+h)^2}{2\sigma_z^2} \right] + \exp \left[\frac{-(z-h)^2}{2\sigma_z^2} \right] \right\}}{\sigma_z \cdot u} \text{ (mg/m}^3\text{)} \quad [3]$$

- In which
- (C): concentration of air particles (mg/m³);
 - (E) – Emission load (mg/m.s);
 - (z): height (m);
 - σ_z– dispersion coefficient (m) as a function of distance and wind direction σ_z = 0.53×x^{0.73};
 - (u) – mean wind speed (m/s), u = 3m/s;
 - (h) road height from base elevation (m), h = 0.5m.

⁸) (Assessment of Sources of Air, Water and Land Pollution –Part 1: Rapid Inventory Techniques in Environmental Pollution, WHO, 1993),

Assuming wind speed at 3.0 m/s, the concentration of dust generated from transportation vehicles at distance of 10-20 m from sources is calculated as follows:

Table Error! No text of specified style in document..40. Dust Emission Concentration from Transportation of Demolition Wastes

Work items	W (m)	Dust concentration (mg/m ³)				QCVN 05:2013/BTNMT (mg/m ³)
		H=1.5	H=2	H=3	H=4	
(1) Coastal road	10	0.1932	0.1864	0.1703	0.1545	0.3
	20	0.1699	0.1682	0.1635	0.1578	
(2) Binh Minh to Sao Vang road	10	0.2489	0.2185	0.1658	0.1479	
	20	0.2192	0.2095	0.1867	0.1633	
(3) Do Be bridge and approach roads	10	0.2099	0.1999	0.1827	0.1769	
	20	0.2002	0.197	0.1895	0.1821	
(4) Road from NH1A to Ninh Hai beach	10	0.2699	0.2395	0.1868	0.1843	
	20	0.2402	0.2305	0.2077	0.1843	
(5) Cau Trang Canal	10	0.1621	0.1515	0.1334	0.1273	
	20	0.1518	0.1528	0.1406	0.1329	
(6) WWTP, sewers, PSs	10	0.1518	0.1484	0.1406	0.1328	
	20	0.1511	0.1499	0.1465	0.1424	
(7) Resettlement site	10	0.1448	0.1414	0.1336	0.1258	
	20	0.1441	0.1429	0.1395	0.1354	

Remarks: These results included the base environmental quality condition

The concentration of dust generated from transportation of demolition wastes is below allowable limits of QCVN 05:2013/BTNMT - National technical regulations on the quality of ambient air. Similarly, concentration of dusts from transportation of materials, excavation and backfilling is presented in the Table 3.12 below:

Table Error! No text of specified style in document..41. Dust Emission from Transportation of Materials and Wastes

Work items	W (m)	Dust concentration (mg/m ³)				QCVN 05:2013/BTNMT (mg/m ³)
		H=1.5	H=3	H=5	H=10	
(1) Coastal road	10	0.0349	0.3272	0.2748	0.2482	0.3
	20	0.2736	0.2679	0.2528	0.2343	
(2) Binh Minh to Sao Vang road	10	0.1597	0.1558	0.1468	0.1423	
	20	0.1466	0.1456	0.1431	0.1415	
(3) Do Be bridge and approach roads	10	0.1808	0.1796	0.1767	0.1751	
	20	0.1765	0.1762	0.1754	0.1749	
(4) Road NH1A to Ninh Hai beach	10	0.1548	0.1536	0.1507	0.1491	
	20	0.1505	0.1502	0.1494	0.1489	
(5) Than Canal	10	0.5103	0.3614	0.2116	0.119	
	20	0.3663	0.3259	0.2638	0.254	
	50	0.1978	0.1947	0.1878	0.1629	
(6) Cau Trang Canal	10	0.4172	0.3889	0.3226	0.289	
	20	0.3212	0.314	0.2949	0.2835	
	50	0.1821	0.1801	0.1758	0.1602	
(7) WWTP, sewers, PSs	10	0.1142	0.1139	0.1131	0.113	
	20	0.1131	0.1131	0.1128	0.1127	

Work items	W (m)	Dust concentration (mg/m ³)				QCVN 05:2013/BTNMT (mg/m ³)
		H=1.5	H=3	H=5	H=10	
(8) Resettlement site	10	0.2252	0.2184	0.2023	0.1941	
	20	0.2019	0.1981	0.1955	0.1928	

Remarks: These results included the base environmental quality condition

The concentration of dust generated from the transportation of materials and excavated soil of construction items is within the allowable limits of QCVN 05:2013/BTNMT - National Technical Regulations on the quality of ambient air. Except, for Than and Cau Trang canals items, the dust concentration exceeds 1.7 times and 1.3 times compared with the allowable limits. Main routes for transportation of material and wastes will be most affected by dust, including: (i) Ngo Chau Luu road, from NH1A to Hai Hoa beach, accessible to the construction site at the beginning section of Than canal, section 1 of the coastal road; (ii) Luong Van Yen road, from NH1A to Hai Hoa beach,; (iii) Luong Chi road, the section from NH1A to Binh Minh commune.

Locations of the main transportation routes are presented in following Figure 3.2:



Figure Error! No text of specified style in document..8: Locations of The Main Transportation Routes for Material and Wastes

Table Error! No text of specified style in document..42. Dust Sensitive Receptors

Main transportation routes	Sensitive receptors
(1) Ngo Chan Luu road lead to Hai Hoa beach, in Tinh Gia district (about 3 km length)	- Residential areas along two sides of road, distance from the road is 10 - 200 m - About 5 bussiness households, distance from the road is 10 - 50 m
(2) Luong Van Yen road lead to Hai Hoa beach, in Tinh Gia district (about 3 km length)	- Residential areas along two sides of road, distance from the road is 10 - 100 m - About 7 bussiness households, distance from the road is 10 - 30 m - Cultural house in Le hamlet (far from 50m)
(3) Luong Chi road lead to Bach Lang bridge in Binh Minh commune	- Residential areas along two sides of road, distance from the road is 10 - 100 m - About 10 bussiness households, distance from the road is 10 - 50m

➤ **Dust from The Material Loading and Unloading**

The unloading and loading materials are mainly gravel, sand and cement. the dust emission loads from the material unloading and loading activities can be calculated as below⁹

Table Error! No text of specified style in document..43. Dust Emission Concentration due to Loading and Unloading

Work items	W (m)	Dust concentration (mg/m ³)				QCVN 05:2013/BTNMT
		H=1.5	H=5	H=10	H=15	(mg/m ³)
(1) Coastal road	10	1.661	1.629	0.865	0.432	0.3
	50	0.526	0.228	0.164	0.128	
	150	0.156	0.117	0.108	0.104	
(2) Binh Minh to Sao Vang road	10	1.497	0.799	0.449	0.333	
	50	0.217	0.158	0.129	0.119	
	150	0.115	0.108	0.104	0.103	
(3) Do Be bridge and approach roads	10	1.427	0.498	0.299	0.187	
	50	0.211	0.133	0.117	0.107	
	150	0.115	0.104	0.102	0.101	
(4) Road from NH1A to Ninh Hai beach	10	1.146	0.414	0.257	0.168	
	50	0.187	0.126	0.113	0.106	
	150	0.111	0.106	0.103	0.102	
(5) Than canal	10	1.048	0.384	0.242	0.195	
	50	0.179	0.124	0.112	0.108	
	150	0.110	0.103	0.102	0.101	
(6) Cau Trang Canal	10	0.950	0.355	0.227	0.155	
	50	0.171	0.121	0.111	0.105	
	150	0.109	0.103	0.101	0.101	
(7) WWTP, sewers, PSs	10	0.191	0.127	0.114	0.106	
	50	0.108	0.102	0.101	0.100	
	150	0.101	0.101	0.1	0.1	
(8) Resettlement site	10	1.413	0.494	0.297	0.186	
	50	0.21	0.133	0.116	0.107	
	150	0.114	0.104	0.102	0.101	

Remarks: These results included the base environmental quality condition

The concentrations of dust generated from gathering, loading and unloading of construction materials at distance of 10 km at the height from 1.5 to 5 m exceed allowable limits set in QCVN 05:2013/BTNMT from 1.1 to 5.4 times; At a distance greater than 50m, dust concentrations reach allowable limits. Of which, the construction of the coastal road and Binh Minh road to Sao Vang generates the largest volume of dust. Along these two roads, the dust concentration is highest at distance of 10m from the construction site, which exceeds the allowable limits from 4.9 to 5.5 times (at the height of 1.5m); at distance of 50m for work item of the coastal road, the dust concentration is 1.75 times higher than the allowable limit (at the height of 1.5 m). As described in Chapter 2, the coastal road will be newly constructed mainly

⁹ Based on document AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Tran Ngoc Chan, 1999, Air pollutant and waste gas treatment (Volume 1), Ha Noi Science and Technology Publishing House

on field land or vacant land, most of which are distanced from residential areas and only some short sections passing through residential area will be most affected by dust generated from gathering, loading and unloading of construction materials. The item of Binh Minh road to Sao Vang is also a new road which will be constructed on field land and vacant land areas 50m distanced from the residential areas so the dust impact will be lower than the coastal road item. Sensitive receptors suffering from the dust generated from gathering, loading and unloading of construction materials when constructing the coastal road and Binh Minh road to Sao Vang include:

- (1) Coastal road: Construction workers; PCRs: Le Van ancestral temple (at Km 0+500)-General Truong Cong Xuan relic (at Km 1+300), General Pham Van Doan relic (at Km 1+500), Khanh Pagoda (at Km 7+900); Residential area along the road in Ninh Hai commune (Km 0+600 Km 1+100; Residential areas at Km 1+150 to Km 1+300, Km 1+700 to Km 1+900, Km 2+400 to Km 2+900), Km 3+500 to Km 2+700), Km 4+600 to Km 4+900, Km 5+640 to Km 6+00, Km 9+700 to Km 10+00);
- (2) Binh Minh to Sao Vang road: Construction workers, Nguyen Binh Petroleum station (Km 0+050) on NH1A.

Dust and gas emissions generated from construction activities and on the main transportation routes: Dust will hinder the view of road users, posing the high risk for traffic safety. Dust affect visions and sanitation of restaurants and service facilities. Dust can retain in people's external respiratory organs, leading to short-term health issues because construction dust is usually large granular type. Dust will also reduce photosynthesis capacity of surrounding vegetation and trees when the dust covers the tree's leaf surface.

Although the construction period of each work item is quite long (6 - 36 months), successive construction method is used so the impacts caused by dust generated from the handling of construction materials is LOW TO MEDIUM level and can be minimized.

➤ ***Exhaust Gas Emission due to Activities of Transportation Means***

Transportation of construction materials or waste by 15-ton trucks will result in the emission of exhaust of gas such as NO₂, SO₂, CO, VOC, affecting the ambient air quality. Pollutant load depends on the numbers of trucks travel and types of fuel used. Diesel Oil (DO) with sulphur content smaller than 0.25% so the concentration of SO₂, NO₂ in the exhaust gases significantly limited. Moreover, emission source is the mobile source so the waste gas concentration is not focused but dispersed on whole road line. The people on the transportation routes and workers may be affected by vehicle gas emissions. The box below shows the potential health impacts of some gases emitted from vehicles.

Potential health impacts of some gases emitted from vehicles

- CO enters the bloodstream, reacting with hemoglobin (found in red blood cells) to become a sustainable structure but cannot afford to load oxygen, this cause the body asphyxia. If getting a large amount of CO, people will feel headache, dizziness, and fatigue. Too much CO can lead to unconscious or suffocated status quickly. When oxidized, CO turns into carbon dioxide (CO₂), CO₂ also causes asphyxiation but not so poisoning as CO.
- SO₂ can penetrate into the human body through the respiratory system, trespassing into the circulatory system. When exposed for long periods, it can create small acid particles which can penetrate into the blood vessels if their size is < 2-3 μm. SO₂ can trespass into the human body through the skin and cause chemical conversion, leading to reduced alkaline level of blood. Ammonia can leak through urine and affects the salivary gland. Bigger concentration will cause increasing mucous secretion of trachea. This gas exposing to the eyes can form acid.
- NO₂ concentration in the air with 5 ppm will have negative impacts on the lungs. Being exposed to the air for several hours with NO₂ concentration of 15-20 parts per million can cause damage to lung, heart and liver;

NO₂ concentration in the air of 1% can be fatal in a few minute. NO₂ oxidized under sunlight can create ozone gas causing tear and skin rashes. NO₂ also contributes to asthma, even lung cancer, tracheal damage.

VOCs is the common name of liquid or solid substances containing volatile organic carbon. Some common substances as acetone, ethylaxetat, buthylaxetat ... They are less chronic toxicity. The main toxicity can include dizziness, drunken vomiting, swollen eyes, twitching, pneumonia. Only a few substances with chronic toxicity will cause blood cancer, and neurological diseases¹⁰.

Rapid assessment method of WHO is used to evaluate the impacts.

Table Error! No text of specified style in document..44. Emission Coefficient of all Air Pollutants from Trucks

No	Type of car	Unit (U)	SO ₂ kg/U	NO _x kg/U	CO kg/U	VOC kg/U
1	Petrol-run lorry (> 3,5 tons)	1000 km	4.50*S	4.50	70	7
		Fuel ton	20*S	20	300	30
2	Oil-run lorry DO (< 3,5 tons)	1000 km	1.16*S	0.70	1	0.15
		Fuel ton	20*S	12	18	2.60
3	Oil-run lorry DO (3,5 - 16 tons)	1000 km	4.29*S	11.80	6	2.60
		Fuel ton	20*S	55	28	12
4	Oil-run lorry DO (>16 tons)	1000 km	7.26*S	18.20	7.30	5.80
		Fuel ton	20*S	50	20	16

Remark: S is the concentration of sulfur in diesel (S = 0.25%)

Assumptions: Truck load is 15 tons, average speed is 10 km/h, and the average transportation distance is 1 km, pollutant load generated from one vehicle is: Dust: 0.90 g/km; SO₂: 4.29*S g/km; NO_x: 11.80 g/km; CO: 6.00 g/km; VOC: 2.60 g/km, wind speed of 3.0 m/s, the truck would consume 0.4 liters of oil/car.km (1 liter of DO weights 0.832 kg). Emission loads are calculated for the distance of 5-20 m from sources by applying Sutton model are presented in Table 3.16 below.

Table Error! No text of specified style in document..45. Exhaust Emission From Vehicles

Work items	Duration (month)	Trips (trip/)	Distance (km)	Fuel consumption (kg/day)	SO ₂ load (mg/m.s)	NO ₂ load (mg/m.s)	CO load (mg/m.s)
(1) Coastal road	36	132	10	439.30	0.0109	0.0282	0.0152
(2) Binh Minh to Sao Vang road	15	18	10	59.90	0.0014	0.0038	0.0021
(3) Do Be bridge and approach roads	10	7	10	23.30	0.0005	0.0015	0.0008
(4) NH1A - Ninh Hai beach road	15	7	10	23.30	0.0005	0.0015	0.0008
(5) Than canal	24	93	10	309.5	0.0078	0.0211	0.0104
(6) Cau Trang Canal	24	78	10	259.58	0.0064	0.0167	0.009
(7) WWTP, sewers, PSs	12	2	10	6.66	0.0001	0.0004	0.0002

¹⁰ <http://tnmtvinhphuc.gov.vn/index.php/vi/news/Moi-truong/Tac-dong-cua-mot-so-khi-doc-den-suc-khoe-con-nguoi-71/>

Work items	Duration (month)	Trips (trip/)	Distance (km)	Fuel consumption (kg/day)	SO ₂ load (mg/m.s)	NO ₂ load (mg/m.s)	CO load (mg/m.s)
(8) Resettlement site	6	50	10	166.4	0.0041	0.0106	0.0058

Data in the above Table 3.16 shows that the concentration of exhaust gases generated from transport activities meets QCVN 05:2013/BTNMT - National technical regulation on ambient air quality. Thus, level of impact is low. If a vehicle stops without its engine turned off, exhaust gas would affect localised air quality. However, exhaust gas emission is considered to be small and the gases usually disperse quickly into the surrounding environment thus concentration would be reduced quickly. The effect of exhaust gas emission is small but mitigation measures are required to control the impacts on people's health.

➤ **Exhaust Emitted from The Operation of Construction Machines and Equipment**

The amount of all construction machines and fuel demand are presented in the following Table 3.17 (Source: WHO, 1993).

Table Error! No text of specified style in document..46. DO Fuel Demand for Construction Machines and Equipments

Equipment, machines	Quantity (set)/Work items								Fuel consumption ship (diesel liter)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Vibration roller 25T	1532	33	7.2	18.8	53	39.8	-	8	40.32
Grader 110 CV	42	9	1.9	5.1			-	1.8	38.88
Excavator ≤ 0,8 m ³	998	45.4	65	69	1911	1337.7	4	51.1	64.8
Steel wheel compactor 8,5T	1782	250	45	114	106	79.5	-	236	24
Bulldozer ≤110 CV	2530	163	37	70	1368	957.6	-	126	54.6
Car 15 T (tank transport)	132	18	7	7	93	78	2	50	31
Asphalt truck 7 T	277	60	13.3	33.8			-	12	25.5
Water truck 5 m ³	154	33.2	7.2	18.8	53	39.8	-	8	22.5
Total DO oil used (liter/hour)	37.45	6.21	2.97	3.74	15.53	25.32	0.11	10.79	
Highest DO oil used (kg/h) (D _{DO} =0,85kg/liter)	31.83	5.28	3.49	3.18	13.19	21.51	0.09	12.69	

Based on the frequency of the machine activities, the constructional area and a working day of 8 hours, the emission load and emission concentration from Diesel oil combustion process are calculated as follows:

Table Error! No text of specified style in document..47. Emission Coefficient and Emission Load due to DO Combustion Engines

Load of exhaust gas (g/s)	Pollutant load coefficient (g/kg DO)	(1) Coastal road	(2) Binh Minh to Sao Vang road	(3) Do Be bridge and approach roads	(4) NH1A - o Ninh Hai beach Road	(5) Than canal	(6) Cau Trang Canal	(7) WWTP, sewers, PSs	(8) RSs

SO₂	20*S	0.4421	0.0733	0.0485	0.0442	0.1832	0.2988	0.0013	0.1763
NO₂	2.84	0.0628	0.0104	0.0069	0.0063	0.0260	0.0424	0.0002	0.0250
CO	0.71	0.0157	0.0026	0.0017	0.0016	0.0065	0.0106	0.00004	0.0063
Dust	0.28	0.0062	0.0733	0.0485	0.0442	0.1832	0.2988	0.0013	0.1763
VOC	0.035	0.0008	0.0733	0.0485	0.0442	0.1832	0.2988	0.0013	0.1763

In which: S is the concentration of sulfur in the fuel (0.25%).

From the above pollution loads from exhaust gases, by applying Sutton model with a wind speed of 3.0 m/s, and a distance of 5-10 m from generating sources. The concentration of exhaust gases generated from construction machines and equipments meets QCVN 05:2013/BTNMT - National technical regulation on ambient air quality.

In summary, the sensitive receptors affected by dust, exhaust gases during construction phase in the project areas and the main transportation routes are listed in Table 3.19 below:

Table Error! No text of specified style in document..48. Sensitive Receptors Affected by Dust during Construction Phase

Work items	Sensitive receptors affected by dust	Distance to construction Site
(1) Coastal road	<ul style="list-style-type: none"> - Construction workers - PCRs: Le Van ancestral temple (at Km 0+500)- General Truong Cong Xuan relic (at Km 1+300) , - General Pham Van Doan relic (at Km 1+500) - Khanh Pagoda (at Km 7+900); Kindergarten Ninh Hai commune (at Km 1+150) - Residential area along the road in Ninh Hai commune (Km 0+600 Km 1+100 - Residential area (Km 1+150 to Km 1+300) - Residential area (Km 1+700 to Km 1+900); - Residential area (Km 2+400 to Km 2+900); - Residential area (Km 3+500 to Km 2+700) - Residential area (Km 4+600 to Km 4+900); - Residential area (Km 5+640 to Km 6+00); Residential area (Km 9+700 to Km 10+00); 	<ul style="list-style-type: none"> 50m 50m 50m 30m 200m 10 -100m 10-100m 10-100m 10-100m 10-100m 10-100m
(2) Binh Minh to Sao Vang road	<ul style="list-style-type: none"> - Construction workers - Nguyen Binh Petroleum station (Km 0+050); - Cemetery area (Km 1+000 to 1+080 - Residential area (Km 1+080 to Km 1+200 	<ul style="list-style-type: none"> 30m 50m 50 – 200m
(3) Do Be bridge and approach roads	<ul style="list-style-type: none"> - Construction workers - Residential area - 11 bussiness households - Thuong Hai Petroleum station 	<ul style="list-style-type: none"> 10m 30 -100m 30m
(4) Road from NH1A to Ninh Hai beach	<ul style="list-style-type: none"> - Construction workers - Residential area (Km 0+000 to 0+100), - Cemetery area (Km 0+100 to 0+200), - Production forest (Km 0+700 to Km 1+200) 	<ul style="list-style-type: none"> 10m 50m
(5) Than cannal	<ul style="list-style-type: none"> - Construction workers - Resident area near the end section of Than canal 	<ul style="list-style-type: none"> 10 m 50 - 200m
(6) Cau Trang Canal	<ul style="list-style-type: none"> - Construction workers - Tinh Gia township residential area (Km 2+00 to Km 3+00), - - Township kindergarten (Km 2+900. - Tinh Gia township residential area (Km 3+00 to Km 3+500), 	<ul style="list-style-type: none"> 30-100m 50m 100m

Work items	Sensitive receptors affected by dust	Distance to construction Site
	- 09 bussiness households	10m
(7) WWTP, sewers, PSs	- Construction workers - Tinh Gia township residential area (Km 2+00 to Km 3+00), - - Township kindergarten (Km 2+900), - Tinh Gia township residential area (Km 3+00 to Km 3+500), - 09 bussiness households	30 -100m 50m 100m 10m
(8) Resettlement site	- Construction workers - RS1: Ninh Hai commune residential area - RS2: About from Hai Hoa commune residential area - RS3: Nguyen Binh commune residential area - RS4: Binh Minh commune residential area - RS5: Xuan Lam commune residential area	100-150m 50-100m 100m 150-200m 100m
The main transportation routes	(1) Ngo Chan Luu road lead to Hai Hoa beach, in Tinh Gia district (about 3 km length): - Residential areas along two sides of road - About 5 bussiness households	10 - 200 m 10 - 50 m
	(2) Luong Van Yen road lead to Hai Hoa beach, in Tinh Gia district (about 3 km length): - Residential areas along two sides of road - About 7 bussiness households - Cultural house in Le hamlet	10 - 100 m 10 - 30 m 50m
	(3) Luong Chi road lead to Bach Lang bridge: - Residential areas along two sides of road - About 10 bussiness households	10 - 100 m 10 - 50 m

The level of impact by dust and exhaust gas is MEDIUM to HIGH and can be minimized.

➤ **Odor**

Dredging and embankment lining of Cau Trang and Than canals will include excavation of soil and bottom sediment. There are gases such as H₂S, CH₄, amine, organic acid, and volatile organic compounds (VOCs) accumulated in these soil and dredged materials from anaerobic decomposition of organic matters. When soil and sediment structures are disturbed and broken by physical interventions from excavation and dredging, these gases will be released into the air and cause odor. The characters and typical health effects of some gases are indicated in the Box below.

Health Impacts of some gases:

- H₂S has rotten egg smell and be easily identifiable. If inhaled, victims may have asphyxiation, conjunctivitis because H₂S effects on the eyes, then the respiratory system will be irritated strongly due to oxygen deprivation, then it can cause short of breath and stopped breathing. H₂S at high concentration can cause respiratory paralysis and suffocate.

- Alkaline NH₃ can cause skin irritation and corrosion, absorbing water in the skin organization then makes protein denatured, fat decomposed and membrane structure destroyed. If inhaled, ammonia in the lung easily goes through the alveoli into the bloodstream, combined with hemoglobin, to sabotage the oxygen transportation function. If inhaled at high dose, ammonia may cause sore throat, tearing, cough, bloody sputum, chest pain, difficult breathing along with headache, vertigo, nausea, vomiting, exhaustion, especially pulmonary edema or respiratory synthesis in adults, and can rise to symptoms of respiratory stimulant.

According to research of Cambridge Environmental Research Organization on odor perception

based on perception intensity: Odor Detection 1 Ou/m^3 , light 5 Ou/m^3 , specific odor 10 Ou/m^3 and according to the soil characteristic of the dredging and excavating areas of the project, odor is forecast at $8.42 \text{ Ou odor/s.m}^2$. Impacts of odor from dredging operations are shown in Figure 3.3.

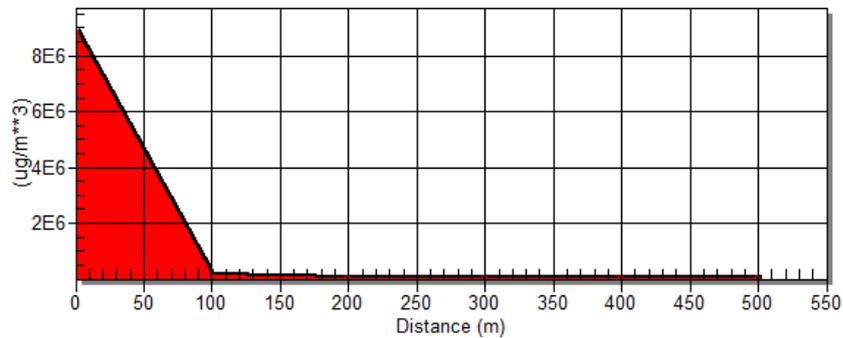


Figure Error! No text of specified style in document..9: Impacts of Odors Generated During Dredging and Excavation

According to the above chart, the biggest impact of odor is 0-20 m from the external emission source, but by a distance of 100 m the impact has dropped considerably.

For the section of Cau Trang canal which passes through center of Cong township, in addition to construction workers, residents living along the canal banks (30-100m distance) will also be affected by the bad odor during the dredging of canal bed. For the Than canal, because the nearest HHs are 200 - 500 m from the dredging area, the potential impact of odor on local residents will be minimal and the odor generated will mainly affect the workers.

Thus, impacts of odors on the surrounding air environment are small and manageable.

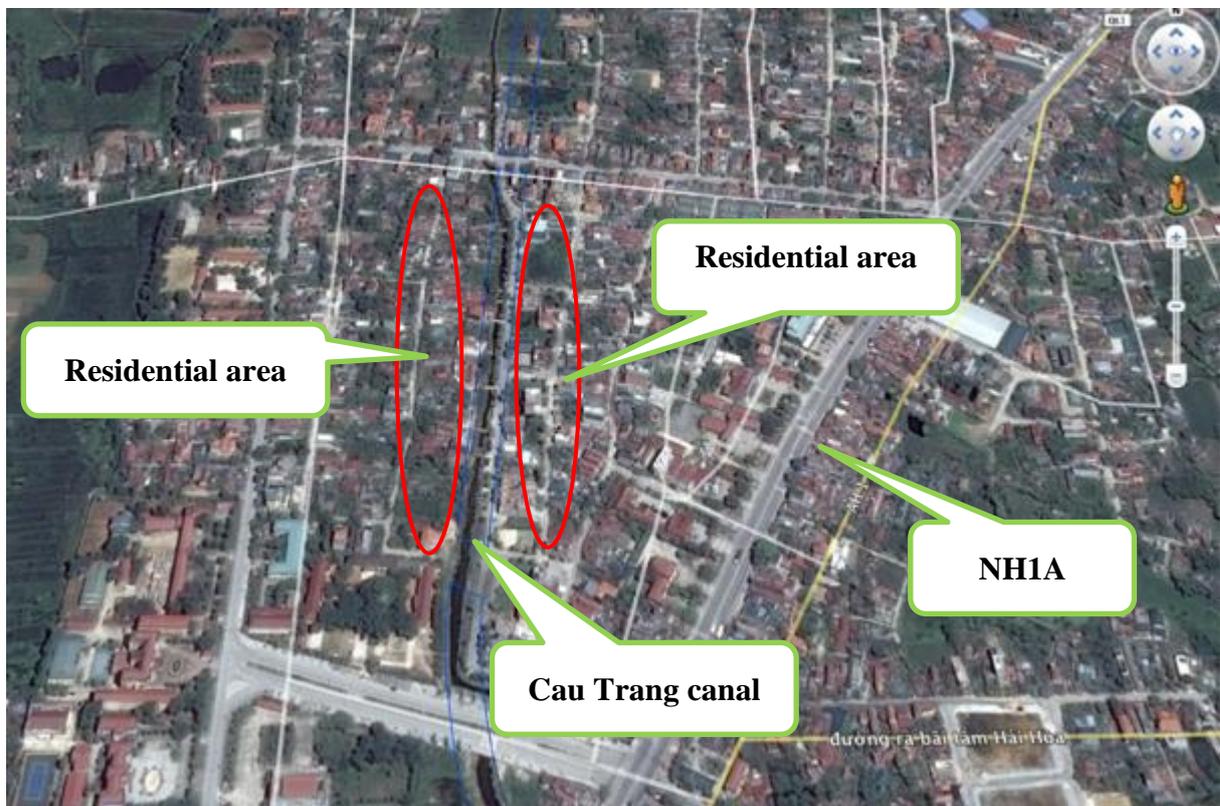


Figure Error! No text of specified style in document..10: Residential houses along Cau Trang canal in areas Cong township

3.4.1.2 Increased Level of Noise and Vibration

➤ **Noise**

The noise generated during the construction phase is mainly from three sources: (i) demolition of existing structures, particularly the Do Be bridge; (ii) from vehicle movements; (iii) the operation of concrete/ asphalt drilling-cutting machines, and piling machines, dredging. Lower levels of noise are generated from construction plants, engines of vehicles, and materials loading/unloading particularly stone unloading.

Noise during demolition of the existing Do Be Bridge will be mainly be generated from the operation of the concrete bombardment hammer. Demolition will take 10-15 days; the noise level generated from pile-driving during the construction of the new Do Be Bridge will be limited as a bored piling method has been proposed. During the construction of the new bridge, the maximum level of noise generated from pile driving would be 78 dBA at 100 m from source. Noise level would be within allowable limit at distance 200 m from source. Noises from other activities during bridge construction will be only at a small level. However, since the construction site is near from residential areas, noise impact of bridge construction will be medium and might be mitigated.

Noises level along the transportation routes including Ngo Chan Luu road, Luong Van Yen road and Luong Chi road will be mainly generated by operation of the trucks (15 ton). According to Table 3.20, at distance of 150 m or further, the noise level will be within allowable limits of standard QCVN 26:2010/BTNMT. However, at distance of 30 - 100m within the houses located from noise sources will be affected. These impacts will be medium and might be mitigated.

Noise levels generated from the construction plants are estimated by the following equation¹¹:

$$L_i = L_p - \Delta L_d - \Delta L_c \text{ (dBA)} \quad [4]$$

In which: L_i – Noise level at site with a distance d (m) from the source; L_p – Noise level measured at source (from a distance of 1.5m); ΔL_d – Noise level as a function of distance d and at frequency i ;

$$\Delta L_d = 20 \lg \left[\left(\frac{r_1}{r_2} \right)^{1+a} \right] \quad [5]$$

In which: r_1 - Distance to the noise source corresponding to L_p (m); r_2 - Distance corresponding to the noise L_i (m); a - Specific absorption coefficient of noise with the land surface topography ($a = 0.1$); ΔL_c - Decrement Noise level through the obstacle. The construction area with all buildings and obstacle brick wall, thus, $\Delta L_c = 1,2$;

Noise level by the distance of machines in this period is calculated as in the Table 3.20 below

Table Error! No text of specified style in document..49. Noise level by the distance of machine of work items

Items	Construction machine	Distance to the noise source (m)									
		15	30	60	100	120	150	180	200	250	300
(1) Coastal road	Combined noise level	99	93	87	83	81	79	77	76	74	72
	Excavator 0,8m ³	89	83	77	73	71	69	67	66	64	62
	Bulldozer ≤ 140CV	90	84	78	74	72	70	68	67	56	41
	Lorry 15T	96	90	84	80	78	76	74	73	71	69

¹¹ by Pham Ngoc Dang 2003. Air environment. Science and technics publishing house 2003

Items	Construction machine	Distance to the noise source (m)									
		15	30	60	100	120	150	180	200	250	300
	Excavator 1.6 m ³	92	86	80	76	74	72	70	69	67	65
Son Hai bridge	Drilling rig	94	88	82	78	76	74	72	71	69	67
(2) Binh Minh to Sao Vang road	Combined noise level	102	96	90	86	84	82	80	79	77	71
	Excavator 0,8m ³	82	76	70	66	64	62	60	59	57	55
	Bulldozer ≤ 140CV	83	77	71	67	65	63	61	60	58	56
	Lorry 15T	102	96	90	86	84	82	80	79	77	75
	Excavator 1.6 m ³	82	76	70	66	64	62	60	59	57	55
(3) Do Be bridge and approach roads	Combined noise level	96	70	84	80	78	76	74	73	70	69
	Excavator 0,8m ³	82	76	70	66	64	62	60	59	57	55
	Bulldozer ≤ 140CV	80	74	68	64	62	60	58	57	55	53
	Lorry 15T	93	87	81	77	75	73	71	70	68	66
	Drilling rig	94	88	82	78	76	74	72	70	69	67
	Excavator 1.6 m ³	82	76	70	66	64	62	60	59	57	55
(4) Road from NH1A to Ninh Hai beach	Combined noise level	100	94	88	84	82	80	78	77	75	73
	Excavator 0,8m ³	82	76	70	66	64	62	60	59	57	55
	Bulldozer ≤ 140CV	80	74	68	64	62	60	58	57	55	53
	Lorry 15T	100	94	88	84	82	80	78	77	75	73
	Excavator 1.6 m ³	82	76	70	66	64	62	60	59	57	55
(5) Than Canal	Combined noise level	97	91	85	81	79	77	75	74	72	70
	Excavator 0,8m ³	89	83	77	71	70	69	67	66	64	62
	Bulldozer ≤ 140CV	87	81	75	71	69	67	65	64	62	60
	Lorry 15T	96	90	84	80	78	76	74	73	71	69
	Excavator 1.6 m ³	82	76	70	66	64	62	60	59	57	55
(6) Cau Trang Canal	Combined noise level	93	87	81	77	75	73	71	70	68	66
	Excavator 0,8m ³	88	82	76	72	70	68	66	65	63	61
	Bulldozer ≤ 140CV	86	80	74	70	68	66	64	63	61	59
	Lorry 15T	90	84	78	74	72	70	68	67	65	63
(7) WWTP, sewers, PSs	Combined noise level	91	85	79	75	73	71	69	68	66	64
	Excavator 0,8m ³	85	79	73	69	67	65	63	62	60	58
	Bulldozer ≤ 140CV	86	80	74	70	68	66	64	63	61	59
	Lorry 15T	90	84	78	74	72	70	68	67	65	63

Items	Construction machine	Distance to the noise source (m)									
		15	30	60	100	120	150	180	200	250	300
(8) Resettlement site	Combined noise level	99	93	87	83	81	79	77	76	74	70
	Excavator 0,8m ³	85	79	73	69	67	65	63	62	60	58
	Bulldozer ≤ 140CV	83	77	71	67	65	63	61	60	58	56
	Lorry 15T	99	93	87	83	81	79	77	76	74	72
QCVN 26:2010/BTNMT (from 6h-21h) – Normal area		70									
QCVN 26:2010/BTNMT (from 21h-6h) – Normal area		55									

Data in the Table 3.20 above shows that noise impacts of construction plants would affect 100 HH (including 9 business HH with restaurant/drinking/recreation) which are located at 30 - 100 m from the construction sites of the sewers and WWTP. The others HH are located at more than 200 m away from the construction sites thus will be less affected

Noise generated from dredging activities is mainly due to operation of 0.8 m³ bucket excavators. According to Table 3.20, at distance of 120 m or further, the noise level will be within allowable limits of standard QCVN 26:2010/BTNMT. The dredging Cau Trang canal site is 30 - 100m from the nearest houses, where the forecast maximum resonating noise is about 81dBA at the distance of 100 m so the noise impact of dredging machines will affect people in the nearest. But, the dredging Than canal site is 200 m or further from the nearest houses so the noise impact of dredging machines will be minor to people in the nearest houses.

The receptors affected by the noise in the project areas include:

Table Error! No text of specified style in document..50. Sensitive receptors affected by Noise

Work items	Sensitive receptors affected by Noise	Distance to const. Site (m)
(1) Coastal road	<ul style="list-style-type: none"> - Construction workers - PCRs: Le Van ancestral temple (at Km 0+500)- General Truong Cong Xuan relic (at Km 1+300), - General Pham Van Doan relic (at Km 1+500) Khanh Pagoda (at Km 7+900) - Kindergarten Ninh Hai commune (at Km 1+150) - Residential area along the road, Ninh Hai commune (Km 0+600 Km 1+100 - Residential area (Km 1+150 to Km 1+300); - Residential area (Km 1+700 to Km 1+900); - Residential area (Km 2+400 to Km 2+900); - Residential area (Km 3+500 to Km 2+700) - Residential area (Km 4+600 to Km 4+900); - Residential area (Km 5+640 to Km 6+00); Residential area (Km 9+700 to Km 10+00); 	<ul style="list-style-type: none"> 50m 50m 50m 30m 200m 10 -100m 10-100m 10-100m 10-100m 10-100m 10-100m
(2) Binh Minh to Sao Vang road	<ul style="list-style-type: none"> - Construction workers - Nguyen Binh Petroleum station (Km 0+050); - Cemetery area (Km 1+000 to 1+080 - Residential area (Km 1+080 to Km 1+200 	<ul style="list-style-type: none"> 30m 50m 50 – 200m

Work items	Sensitive receptors affected by Noise	Distance to const. Site (m)
(3) Do Be bridge and approach roads	- Construction workers - Residential area - 11 bussiness households - Thuong Hai Petroleum station	10m 30 -100m 30m
(4) Road from NH1A to Ninh Hai beach	- Construction workers - Residential area (Km 0+000 to 0+100), - Cemetery area (Km 0+100 to 0+200), - Production forest (Km 0+700 to Km 1+200)	10m 50m
(5) Than cannal	- Construction workers - Resident area near the end section of Than canal	
(6) Cau Trang Canal	- Construction workers - Tinh Gia township residential area (Km 2+00 to Km 3+00), - Township kindergarten (Km 2+900) - Tinh Gia township residential area (Km 3+00 to Km 3+500), - 09 bussiness households	30-100m 50m 100m 10m
(7) WWTP, sewers, PSs	- Construction workers - Tinh Gia township residential area (Km 2+00 to Km 3+00), - Township kindergarten (Km 2+900), - Tinh Gia township residential area (Km 3+00 to Km 3+500), - 09 bussiness households	30 -100m 50m 100m 10m
(8) Resettlement site	- Construction workers - RS1: Ninh Hai commune residential area - RS2: About from Hai Hoa commune residential area - RS3: Nguyen Binh commune residential area - RS4: Binh Minh commune residential area - RS5: Xuan Lam commune residential area	100-150m 50-100m 100m 150-200m 100m

The noise impact will be more severe at night time and meal time for residents and both at night time and day time for businesses in the area. The noise generated at the construction site is intermittent and lasts in a short time but it poses high risk of troubles for community. Therefore, the noise impact is assessed medium and requires suitable mitigation measures.

➤ **Vibration**

Vibration will be mainly caused by construction activities related to bridge construction, piling and road base compaction. Vibration caused by compaction of piped trench will be negligible because the sand will be watered before compaction takes place. Typical vibration levels are specified in the following table:

Table Error! No text of specified style in document..51. Vibration Level of Typical Equipment Within 10m Distance

No.	Equipment	Reference vibration (Vertical direction, dB)
1	Excavator	80
2	Bulldozer	79
3	Truck	74
4	Roller	82
5	Air compressor	81
6	Concrete hammer	97.5

(Source: Transit Noise And Vibration Impact Assessment, FTA, 2006)

Vibration from construction equipment is calculated by vibration attenuation with distance:

$$L = L_0 - 10\lg(r/r_0) - 8,7a (r - r_0)$$

In which:

- L: vibration level in dB at a distance “r” from the source;
- L₀: vibration level in dB at a distance “r₀” from the source. In the project case, r₀ is vibration source and r₀ = 10m;
- a: intrinsic vibration attenuation coefficient at clay foundation, a = 0.5

Predicted results are presented in the following table

Table Error! No text of specified style in document..52. Vibration by Distance During Construction of Do Be Bridge

Items	Max source vibration (r ₀ = 10m) (dB)	Vibration level at a distance (*) (dB)			
		r = 5m	r = 10m	r = 15m	r = 20m
Concrete hammer	106.5	98.5	72.8	54.6	34.2
Bored piles	97.5	92.7	69.4	46.4	23.8
QCVN 27: 2010, allowable level of 75 dB during 6÷21h and base level during 21÷6h					

Comparison of predicted results with QCVN 27:2010/BTNMT, at distances of >10m, vibration will be within allowable limits. The existing civil works and houses are over 30m from the boundary of road construction and 150m away from the bridge construction site so they will not be affected by vibration. Construction workers (particularly workers operating the machinery and vehicles) will be affected by the vibration.

The impacts of vibrations are at SMALL level and can be managed.

3.4.1.3 Wastewater Generation

During the construction phase, there are three main sources of wastewater generation including: (1) Rainwater runoff from construction sites; (2) Wastewater generated from construction workers’s camps; and (3) construction wastewater. The volumes and characteristics of each types of wastewater generated during construction phase are discussed below:

➤ Rainwater runoff

Rainwater is considered clean if it is not exposed to pollution sources such as wastewater, exhaust gas, contaminated with soil/dredged material, etc. During the construction process, when rainwater runoff passing construction sites, it will drag soil, sand, waste discharged by construction workers, debris,... and become polluted.

Flow of Rainfall rate in the construction areas compared with surrounding environment is calculated by the method of limit intensity (according to TCVN 7957: 2008 - Drainage and Sewerage - External networks and facilities – Design Standard).

Rainfall rate Q (m³/s) is calculated by the following formula: Q = q.C.F

Of which:

Q: Calculated flow (m³/s)

q: Rainfall intensity (liter/s.ha).

C: flow coefficient. The flow coefficient C depends on the coverage surface and the repetition cycle of the calculated rain (P), given C= 0.2.

F: Project area (ha)

Rainfall intensity is calculated by following formula:

$$q = \frac{A(1 + C * \lg P)}{(t + b)^n}$$

Of which:

q: calculated rainfall intensity (liter/s.ha)

P: Repetition cycle of the calculated rain (years), given P = 2 years
t: Rain runoff duration in the project area (about 30 minutes).
A, C, b, n: Parameters determined according to local rain conditions.

These parameters depend on local climatic condition. For the area of Tinh Gia district - Thanh Hoa province, A = 3640; C = 0.53; b = 19; n = 0.72. Applying these values in the above formula, we have:

Calculated rainfall intensity at the construction area is: $q = 256.12$ (l/s.ha)

Therefore, the volume of rainwater runoff through the construction sites of Tinh Gia subproject is calculated as follows:

Table Error! No text of specified style in document..53. Flow of Rainwater Runoff During Construction Phase

Work items	Catchment area (m ²)	Flow coefficient	Flow rate (l/s)	Flow rate (m ³ /h)	Runoff Volume at design rainfall (m ³)
Coastal road	309,708	0.2	1,586.5	5,712	8,566.91
Binh Minh to Sao Vang road	55,120	0.2	282.3	1,017	1,524.69
Do Be bridge and approach roads	12,015	0.2	61.5	222	332.35
Road from NH1A to Ninh Hai beach	32,400	0.2	166.0	598	896.22
Than Canal	30,000	0.2	653.1	2,351	3,526.81
Cau Trang Canal	66,140	0.2	338.8	1,220	1,829.52
WWTP	10,000	0.2	51.2	184	276.61
Sewers, PSs	30,000	0.2	153.7	553	829.84
Resettlement sites (RS)	42,400	0.2	282.3	1,016	1,524.69
RS1	15,000	0.2	7.68	28	41.49
RS2	5,000	0.2	2.5	9	13.83
RS3	5,000	0.2	6.14	22	33.19
RS4	12,000	0.2	2.56	9	13.83
RS5	5,400	0.2	7.68	28	41.49

Note: Above results are from calculations with rain duration of 90 minutes)

The main environmental concerns of surface runoff is the large volumes may cause localised flooding, and if it is highly turbid, it may cause sedimentation in existing drains.

For the aligned work items such as the Cau Trang and the Than canals, the sewer pipes, rainwater would flow into the canal/channels nearby thus localised flooding is not likely to occur. For the four roads, the levelled road surface may disrupt or block the existing drains runoff thus may cause localised flooding along the two sides of the road embankments.

As the existing land use at the proposed WWTP is ricefield which is 100 m from the Than river, currently rainwater is drained to the Than river through existing drains. During construction phase of the WWTP, surface runoff may follow existing drains or overflow on the ricefield before finally being drained to the Than canal. According to the basic design, with the calculated rain, current drainage ditches in this field have enough capacity to drain, not causing flooded.

For 5 resettlement sites with land area ranges from 0.5 to 1.5 ha, each the amount of runoff is from 9.22 to 27.66 m³/h. Four out of the five resettlement sites are field or low-lying land (except for resettlement site No. 2 - Dong Ron, Hai Hoa already having land foundation) will have to be filled to increase elevation from 1.5 m to 2.5 m on a area of 0.5 to 1.5 ha. Therefore, if there are no adequate drainage system, there will be risk of localized flooding in the surrounding areas. However, existing natural drainage in these areas is relatively good with two receiving waterbodies namely Cau Trang and Than canals, so the risk of flooding in heavy rain is medium and can be mitigated.

Rainwater runoff will drag a long pollutants such as oil, grease, dust and soil on the construction site surface. According to WHO (1993), content of pollutants in the rainwater runoff is about 0.5 – 1.5 mg N/l, 0.004 – 0.03 mg P/l, 10 - 20 mg COD/l and 10 - 20 mg TSS/l, these parameters are lower the acceptable standard by QCVN 40:2011/BTNMT - National Technical Regulation on Industrial Wastewater. The work item will be constructed in 12 months so construction in rainy season will unavoidable; then, the rainwater runoff will drag stone debris, soil, dirt, oil and types of waste on the construction site surface into the receiving body in the area (Than canal). These pollutants will increase water's turbidity and content of TSS will usually exceed the allowable limit. Without proper management, this will cause bad impact on surface water quality and aquatic life in Than canal.

➤ **Domestic Wastewater generated from worker's camps**

The Project is expected to mobilize about 490 workers, so each work item will require 30-100 workers (the number varies depending on construction time and progress). According to Vietnamese standard QCVN 01: 2008/BXD, the rate of domestic water consumption by the workers is 45 liters/person/day, the amount of wastewater generated is equal to 80% of the supplied water amount. Assuming all the workers would reside in camps then the volume of wastewater generated from each worker's camp is calculated in Table 3.22 below:

Table Error! No text of specified style in document..54. Wastewater generated from Workers' Camps

Work items	Number of workers (persons)	Construction duration (months)	Amount of domestic wastewater (m ³ /day)	Amount of domestic wastewater (m ³ /week)	Amount of domestic wastewater (m ³ /month)	Total of domestic wastewater (m ³)
Coastal road	100	36	3.84	27	115	4,147
Binh Minh to Sao Vang road	50	15	1.92	13	58	864
Do Be bridge and approach roads	30	10	1.15	8	35	346
Road from NH1A to Ninh Hai beach	50	15	1.92	13	58	864
Than canal	80	24	3.07	22	92	2,212
Cau Trang Canal	80	24	3.07	22	92	2,212
WWTP, sewers, PSs	50	12	1.92	13	58	691
Resettlement site	50	6	1.92	13	58	346

Domestic wastewater contains suspended solids, and, some oil and grease, high concentrations of organic matters, nutrients (nitrogen, phosphorus) and microorganisms. The load of pollutants in domestic wastewater at workers camps is provided in Table 3.26.

Table Error! No text of specified style in document..55. Load of Pollutants in Domestic Wastewater

No	Pollutants	Pollution coefficient (g/per/day)		Load of pollutant (kg/day)	
		Min	Max	Min	Max
1	BOD ₅	45	54	2.25– 9	2.7 – 10.8
2	COD	72	102	3.6– 14.4	5.1 – 20.4
3	TSS	70	145	3.5– 14	7.25 – 29
4	T-N	10	30	0.5- 2	1.5 - 6
5	T-P	6	12	0.3– 1.2	0.6 – 2.4
6	Cl ⁻	2.4	4.8	0.12 – 0.48	0.24 – 0.96
7	Ecoli	10 ⁶	10 ⁹	5.10 ⁴ - 2.10 ⁵	5.10 ⁷ – 2.10 ⁸

(Source: WHO, 1993)

Table Error! No text of specified style in document..56. Domestic Wastewater Quality

Pollutants	Concentration in domestic wastewater	QCVN 14:2008/BTNMT (Column B)
pH	5 – 9	5 – 9
BOD ₅	640 – 780	50
TSS	1000 – 1450	100
Nitrate (NO ₃ ⁻)	50 – 100	50
Total coliform	10 ⁶ – 10 ⁹	5,000

The Table 3.26 shows that construction of the coastal road will generate most wastewater, about 3.84 m³/day, equivalent to 27 m³/week, 115 m³/month and the total generated wastewater in 36 construction months will be 4,147 m³. Similarly, over 2,000 m³ of wastewater would also be generated from the camps of the Than and Cau Trang canals. However, the volume of wastewater generated at each camp site usually small than the calculated volumes as each contractor usually use number of teams for aligned works, and each team use separate smaller camp or even hire the house of local people. It is likely that the worker of the WWTP and the resettlement sites will stay at camp on-site. The estimated volumes of wastewater generated from the camps at these sites during construction phase would be approximately 750 m³ at the WWTP (12 months construction contract) and 350 m³ at the resettlement site (6 months construction contract).

With the volume of wastewater and pollutant load forecasted in the Tables 3.26 above, the concentration of some pollutants in untreated wastewater generated from workers' camps may be higher than the standards set in QCVN 14:2008/BTNMT several to many times. Particularly, BOD may exceed standards 13-15 times, TSS may be 10-15 times higher than allowable limits, Nitrate may be up to 10 times higher than standard, and coliform may be 200 - 200,000 times higher than standards. If not managed properly, wastewater from workers camps will become stagnant, forming favorable conditions for water-borne diseases (such as cholera, dysentery, typhoid, dengue fever) vectors to develop. Therefore, wastewater is smelly, can cause nuisance and affect public health. If untreated wastewater enters the Than canal and Cau Trang canal, it would lead to surface water pollution in these canals

➤ Construction Wastewater

Construction wastewater is generated from concrete curing, equipment and material washing. The estimated volumes of such construction wastewater is 2 - 5 m³/day at each site, equivalent to about 20 - 50 m³ out of total construction period at each location. This wastewater contains

high suspended solids contents, some oil and grease. Untreated construction wastewater and may cause increased water turbidity which affect respirations and photosynthesis process of aquatic lives. High solid contents may cause sedimentation, contributing to narrowing down these channels.

Wastewater Leaked from Dredged Materials

During the dredging of Cau Trang canal and Than canal, dredger shall be used for dredging. Wastewater will be drained off from dredged materials during temporary loading before being transported to disposal site. The mud seepage from temporary loading area may enter agricultural land and harm crop trees there. As learnt from similar projects, the mud seepage contains total suspended solids (TSS) of 800-1400 mg/l, F. Colifom from 90-200 MPN/100ml.

Without proper collection and management, the mud seepage may also cause localized flooding surrounding temporary loading site. When flowing into the receiving waterbody, the saline/brackish seepage with high content of solids may cause water's turbidity, affect photosynthesis and respiration of aquatic life as well as cause sedimentation;

At present, Cau Trang canal has been being polluted by domestic wastewater from residential areas in Cong township, so the seepage from this canal's dredged mud will also contain high content of bacteria (Coliform 4200 to 4300 MPN/100 ml).

Salinity in the sediment of the Than canal was measured at 5‰. if not properly managed, saline wastewater from temporary and permanent disposal site may pollute water sources and soil in the surrounding area, negatively affecting the growth or even damaging vegetation cover and trees. However, this risk is at moderate level as the 5‰ salinity is only slightly higher than tolerance range of popular crop trees. On the other hand, the wastewater from dredged materials will be manageable when ponds are used for temporary loading.

3.4.1.4 Solid Waste Generation

Solid waste generated in the construction phase includes 3 main types: (1) Construction waste including demolition materials, excavated and dredged materials and unused/waste construction materials; (2) Domestic solid waste from worker's camps; and (3) hazardous solid waste. The volumes of each types of solid wastes generated volume are presented below.

➤ Construction Waste

The project's construction phase will generate total 1.1 million m³ of construction solid wastes including demolition waste, excavated soil and dredged materials from canals. Of which, 350,363 m³ are waste generated from demolition of existing structures for site clearance, 112,110 m³ are dredged materials from Than and Cau Trang canals and 642,919 m³ are excavated soil from work items under the project. The volume of the construction solid waste generated from each work item is presented in Table 3.28 as follows:

Table Error! No text of specified style in document..57. Volume of construction solid waste during construction phase

Work items	Volume of demolition (m3)	Volume of dredged material - (m3)	Volume of excavated soil (m3)		Total (m3)
			Top soil	Bottom soil	
(1) Coastal road	81,001		104,572	418,289	603,862
(2) Binh Minh to Sao Vang road	133,593		6,460	9,690	149,743
(3) Do Be bridge and approach roads	8,092		1,236	1,854	11,182
(4) Road from NH1A to Ninh Hai beach	64,260		2,471	3,706	70,437

Work items	Volume of demolition (m3)	Volume of dredged material - (m3)	Volume of excavated soil (m3)		Total (m3)
			Top soil	Bottom soil	
(5) Than Canal		68,630	23,743	35,614	127,987
(6) Cau Trang Canal	24,631	43,480	3,808	5,712	77,631
(7) WWTP, sewers, PSs	11,250		1,666	2,498	15,414
(8) Resettlement sites	27,536		8,400	12,600	48,536
Total	350,363	112,110	152,355	489,964	1,104,792

The solid waste generated from demolition. Mainly construction waste, including brick, mortar, broken concrete, tree trunk, weeds... and other material (waste, plastic bags...). Most of solid waste generated from the demolition can reused. Construction waste can reused for leveling low-lying areas if necessary; recyclable materials can be Sold to recycling dealers. The remaining waste which cannot be re-used will be dumped at disposal sites.

Total excavated soil volume from project construction is high, about 642,319 m³, of which, the highest excavated soil volumes is generated from the coastal road (522,861 m³). Rehabilitation of Than canal and rehabilitation of Cau Trang canal would generate 59,357m³ and 9,520m³ of Solid waste, respectively . The rich topsoil on agricultural land or vacant land accounts for 20% - 40% (152,355 m³) of total excavated soil volume. This rich topsoil can be used for plantation purpose while the rest excavated soil can be used for leveling of low-lying areas. Details on the solution for 642,319 m³ of excavated soil will be presented in the Chapter on Environmental Management Plan.

It is estimated that, the dredging of Than and Cau Trang canals will generate about 112,110 m³ of dredged materials, of which about 10% (11,211 m³) are waste and water-fern. Analysis of the sediment samples taken from Than and Cau Trang canals (as presented in Chapter 2) shows that, contents of heavy metal are within the allowable limits in the QCVN 07:2009/BTNMT – National Technical Regulation on Hazardous waste . However, the sediment mud contains high content of organic matters, causing bad odor and bacteria, mud leakage...so it will require specific and effective measures for dredging, loading of mud and treatment prior to transportation to the disposal site as normal solid waste. It is noticeable that the sediment in the Than canal has salinity at 5‰. During temporary and permanent loading, salinity from such dredge materials may be spread around by waste water and rain water running from/through these materials. If entering garden/ agricultural land, water/wastewater from such sites may harm vegetation/ trees. This risk can be controlled as discussed in detail in the DDMP.

Small amount of construction wastes mainly consists of lime, mortar, iron and steel, soil, rock and cement packages, etc. will be generated during construction phase. Such wastes should be collected then transported for disposal at approved sites specified in the Environmental Management Plan.

In general, the total volume of construction waste generated during construction phase is relatively large, requirement considerable land area for temporary and final disposal. Other environmental concerns may also be arisen from temporary and final disposal sites as discussed at the end of this Chapter. Therefore, the potential impacts of solid waste in this Project is considered HIGH.

➤ *Domestic Solid Waste*

Domestic solid waste will be generated from workers' camps during operation phase. The main components in such domestic solid wastes are mainly packaging materials, plastic bags, bottles, waste from food preparation etc. The volume of domestic generated is assessed through the application of rapid assessment method introduced by the World Health Organization, at rate

of 0.5 kg/person/day. The estimated volume of the total solid waste generated daily in the construction process of the work items is calculated and shown in the following Table 3.29:

Table Error! No text of specified style in document..58. Domestic Solid Waste Generated

Item	Nos. of workers (people)	Construction duration (months)	Domestic solid waste (kg/day)	Domestic solid waste (kg/week)	Domestic solid waste (kg/month)	Total of solid waste (ton)
(1) Coastal road	100	36	50	350	1,500	54
(2) Binh Minh to Sao Vang road	50	15	25	175	750	11.25
(3) Do Be bridge and approach roads	30	10	15	105	450	4.5
(4) Road from NH1A to Ninh Hai beach	50	15	25	175	750	11.25
(5) Than canal	80	24	40	280	1,200	18
(6) Cau Trang Canal	80	24	40	280	1,200	18
(7) WWTP, sewers, PSs	50	24	25	175	750	18
(8) Resettlement sites	50	12	25	175	750	9
TOTAL	490	160	245	1,715	7,350	144

The volume of domestic solid waste generated each day at each work item during construction phase is small, from about 15 - 100 kg/day or 750 - 1500 kg/month. Despite of this small generated solid waste volume, without proper collection and treatment measures, this waste can be pollution source with bad odor, place of flies, mosquitoes, rats, bacteria, waste leakage..., directly affecting public and workers' health, and decreasing the area's aesthetics value as well as affecting environmental sanitation of neighboring areas. So, the impact of domestic waste is considered to be medium and can be mitigated.

➤ **Hazardous solid waste:**

A small amount of hazardous waste may be generated during the construction process, including gasoline, waste oil, oily rags, paint containers mainly from repair work, maintenance of vehicles and machinery, construction equipment, etc. If such hazardous waste and materials are not managed properly, environmental and health hazards (spill, fire, explosion, erosion etc.) related to the storage, transportation, storage, handling and disposal may occur.

The risk related to hazardous wastes and materials is assessed to be medium and manageable as detailed in the Environmental and Social Management Plan.

3.4.1.5 Water Quality Reduction

Surface water quality in the project area may be affected with increased total suspended solid (TSS), some oil and grease, BOD, nutrient contents, DO, coliform and salinity.

Primarily, dredging is would be the main cause of surfacewater quality reduction in the Project area. The sources of these pollutants are from surface runoff containing high TSS after passing disturbed/excavated areas or granular material loads, construction wastewater containing high contents of solids, some oil and grease, wastewater from workers' camps containing high BOD, nutrient contents, and coliform. Surfacewater quality would also be affected if construction plants are washed in water sources.

Total suspended solids in surfacewater sources in the project area would be significant increase in rainy season when soil surface in large construction areas such as the WWTP site or the resettlement site, or if many locations in the project area are disturbed at the same time, or when

large amount of excavated/ filling materials are temporarily loaded at one time without adequate mitigation measures are applied. However, in practice, the risks of increased suspended solids and turbidity in water is lower due to the works are divided into construction packages and not all are to be implemented at the same time; Turbidity and total solids in the Cau Trang and Than canals would be highest when dredging taking place. Wastewater drained from dredged materials containing high solid contents may affect the water quality at the receptor surrounding temporary loading areas.

For the Do Be bridge construction, the water quality at the river would be affected with increased turbidity from bentonite used for drilling, with increased oils and grease contents that may be leaked into the river from the barge supporting bridge construction, and with higher solid contents from excavation for pile foundation construction.

Oil and grease plus solid contents in a surfacewater source if oils from containers at construction sites is leaked and enter surface runoff, or if machine and equipment are washed in water bodies. However, the risk is low and manageable. This is because for the pipeline packages (in which pre-casted pipes are installed), most of the works would be done by machines (cranes, bulldozer, excavator etc.). The manual works carried out by the workers would be mostly for finalization and site cleaning (for which mostly shavers and sweepers would be used). Bridge construction and river dredging would follow similar practice. Construction plants such as trucks, vehicles, bulldozers, excavators would not be washed on-site in the city at or nearby construction sites but in other designated areas or workshops where wastewater is not discharged directly into any water bodies. Only in regarding to embankment lining or drains to be built on-site, would some works be done manually by the workers with mason tools. Washing of manual tools depends on availability of water and workers' awareness. Tool washing practice can be monitored and is manageable.

BOD₅, N and P, Coliform are the main pollutants added into to surfacewater by domestic wastewater from worker's camps. At the maximum camp of 100 workers, wastewater was estimated at 3.84 m³ per day (4,147 m³/3years), if untreated but discharged directly into the environment, it can contribute to the deterioration of water quality in the surrounding area. Wastewater from camps can be managed for minimizing its potential impacts onto surfacewater quality.

Salinity in the Than canal water may be affected during construction phase when the saltwater intrusion control gate is open while being repaired. Currently the gate functions to prevent saline water from the sea from coming into the irrigation canal during high tide, keep fresh water for the Than canal for irrigation. In flood season, the gate is opens to drain water from Than canal to Lach Bang river and flows to the sea. Therefore, if the gate is open during repair, saline water from Lach Bang river may enters the Than canal causing water quality reduction the canal. This risk is manageable by construction method described in Section 5.1.5.4.



Figure Error! No text of specified style in document..11: Location for rehabilitation of salinity control gate on Than canal

3.4.1.6 Impact on Biological Resources

Impact on biological resources in the project areas is mainly due to: (i) site clearance which will affect terrestrial species and (ii) dredging of Than and Cau Trang canals which will affect aquatic life.

Impacts on Terrestrial Biology:

The activities for site clearance will affect trees, vegetation and some terrestrial species. Site clearance would remove vegetation cover in 262,460 m² rice field, 86,665 m² vegetable crop land. Total 37,996 fruit trees (such as jackfruit, coconut, banana, etc.) and other wood trees (such as tamarind, eucalyptus, acacia, bamboo, etc.). These vegetation and trees will be permanently cut down. In addition, there are some shrubby plants and trees in the fallow will also be cleared.

Removal of the trees in garden and cultivation land will affect the animals (rat, bat, bird...), insects (bees, butterflies etc.) living in each area. The number and species affected by construction are not large, mainly species such as frogs, snakes, invertebrates, etc. living along canals, rivers and roads and agricultural land and plantation forest affected by the project. These species are not of rare species and when cleared they are able to move to other sites in the area.

As the salinity in dredged materials from the Cau Trang canal is around 3‰, and slightly more than 5‰ in that of the Than canal, if these materials fill up agricultural/garden land, vegetation covers, crop and trees may be affected seriously. On the other hand, if surface runoff passing such dredging materials before entering agricultural/garden land, similar effects may also happen. The impacts of salinity on plants and salinity tolerance ranges of some crops trees are shown in the Box below.

Impacts of Salinity on Plants

Plant species vary in how well they tolerate salt-affected soils. Some plants will tolerate high levels of salinity while others can tolerate little or no salinity. Perennial plants seem to handle salinity better than annual plants. In some cases, salinity also has a toxic effect on plants because of the high concentration of certain salts in the soil. Salinity prevents the plants from taking up the proper balance of nutrients they require for healthy growth[1].

Salinity tolerance ranges of some types trees and plants as shown below[2]:

Fruit Trees: oranges, grape fruit: 2‰, mango: 4‰, sugar canes: 2‰, coconuts: 7‰.

Rice: 2‰, only when young and multiplying. Rice is very sensitive with salinity during flowering.

Corn: 1‰, tomatoes: 2‰, beans: 5‰

[1] *Salt Tolerance of Plants, Alberta Agriculture and Forestry*, [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex3303](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex3303). Accessed 30 November 2017.

[2] *Salinity tolerance of some crops, Vietnam Sugarcane research institute*. <http://www.vienmiaduong.vn/vi/detailkhoa.php?idTin=793>, accessed 30 November 2017.

The potential impacts and risks related to salinity from dredged materials onto vegetation cover/agricultural land would be significant if the materials and surface runoff passing temporary and permanent disposal areas are not managed properly. This impact and risk can be managed by isolating the materials from surrounding soil and water, and control of surface runoff passing disposal sites as discussed in the DDMP.

Impacts on Aquatic Species:

As discussed in Chapter 2, biological values of the ecosystems in the Cau Trang canal and Than canal are very limited due to the following factors:

- The canals are man-made, approximately 5 km long for Than canal and 5.7 km long for Cau Trang, and originated from paddy fields upstream. Only the downstream is connected to the Yen river which is a natural river (farther 20 km from subproject site);
- Along its length, the canal is fed by drainage channels in the catchment but by no natural streams or river;
- The main function of the river is drainage for an urbanised catchment and irrigation canal. The catchment has been largely modified by extensive human activities over a long period;
- Currently Cau Trang canal water is polluted with TSS, Coliform exceeding standards by 1.36 times (Table 2.3, Chapter 2); The remaining sections of Than canal have been modified previously by other provincial-financed projects;
- Although the Than canal is connected to the sea, the interactions between freshwater in the canal with sea water is very limited as the gates are closed most of the time (no running water near the gate) when canal water level is lower than seawater level. It is open mainly for draining flood water.

The above finding has been supported by the site observation, it is poor in both quantity and diversity. The composition of phytoplankton is mainly on Than canal: diatoms, cyanobacteria and algae. The composition of the zooplankton consists of the following groups: protozoa, Copepoda, Cladocera, Rotatoria, Ostracoda and insect larvae. Among of which, the Rotatoria has a higher number of species and then the groups of Ostracoda and Cladocera. Other aquatic animals such as: shrimp, sardines, Decapterus macrosoma and Ilisha elongata also exist in the subproject area. In summary, there is no known rare or endangered species in the project area. Therefore, the small quantity of aquatic organisms living Than canal would be affected seriously by dredging activity. Some aquatic species can go with the pumped water to the neighboring area prior to construction of the retaining dike and will continue living at that area. Some benthos species can die when the mud layer is broken by dredging or they can be taken out of water with the mud.

Aquatic species can also be affected by the pollutants coming into surface water from construction sites. Increased turbidity in water may cause difficulties to their respirations, photosynthesis.... Under water's diluting and self-cleaning capacity and with the fact that the mud can deposit after a certain time period, this impact will be temporary. Photosynthesis and

respiration of many species will be recovered when the pollutant content decreases. The impact levels are low, short-term, local, but it is necessary to apply mitigable measures.

The impacts on biological resources are assessed to be at MEDIUM level and the area of influence is within the land acquisition boundary. Also, these impacts are temporarily happening during construction and they will soon be stabilized once the subproject is in the operation phase.

3.4.1.7 Impacts on Landscape

Landscape in the project area will be affected during construction phase. Green space in the project area will be reduced due to excavation of some existing vegetation areas and due to cutting down of some trees and productive forest for site clearance. The gathering of bulky construction material, heaps of excavated and backfilled material, gathering of construction machinery and construction waste as well as the open channels created during construction of the wastewater collection system and wastewater pumping station will cause negative impacts on the urban landscape.

As mentioned in the section 6 about the impact on biological, site clearance will require excavation of 262,460 m² of rice field and 86,665 m² vegetable crop land. 37,996 fruit trees in garden land and 34,819 m² wooden trees such as tamarind, eucalyptus, acacia, bamboo, etc. together with 9,728 bonsai trees will be removed. With such removal, Landscape will be changed from green land into barren soil during the construction phase (which lasts from 6 to 36 months, variable between the work items). However, as described in Chapter 2, the affected green areas are scatterly distributed so they do not have great contribution in landscape value. Therefore, the impact on landscape due to loss of one part of vegetation and trees is at low level.

Landscape in the project area would also be affected by the construction sites with, fences, bulky materials, excavated soil, open channels under construction, temporary loaded construction materials and wastes. This impact will last from 6-36 months at the construction sites of 4km interceptor, 2 wastewater pumping stations, the centralized WWTP, 10km of new coastal road and the Son Hai bridge on the route, 2km of new Binh Minh road, 1km new road connecting NH1A to Ninh Hai bridge, demolition of the old Do Be bridge and construction of the new Do Be bridge at the same location, dredging and lining embankment for two banks of Than and Cau Trang canals, construction of infrastructure system for the 4.5ha resettlement area. Landscape in the densely populated along Cau Trang canal where there is dredging work and construction of the interceptor (see Figure 3.4) will be most severely affected. Without proper management and mitigation measures, landscape and aesthetics of the area along Than canal and Cau Trang canal will also be affected by bad odor, temporary loaded construction material and mud leakage...Locations and sensitive receptors of the landscape impact during construction phase include:

(1) Than canal: the residential area at the end section of the rehabilitated Than canal (Do Be bridge area) where there are about 100 households including 11 seafood trader households at a distance of 50-200m from Than canal's dredging area and Do Be construction site.

(2) Cau Trang canal: Tinh Gia township residential area (Km 2+00 to Km 3+00), at a distance of 30-100m, of which 9 households are catering service/entertainment service providers; Township kindergarten (Km 2+900) at a distance of 50 m; Tinh Gia township residential area (Km 3+00 to Km 3+500) at a distance of 100 m.

Besides, the temporary storage of waste, parking of truck, gathering of construction machinery such a bulldozer, excavator, roller...and workers' camps on the vacant land areas near the coastal road, Cau Trang, Than canals... will also affect landscape in these areas.

In general, these work items are scattered, mainly along the route at the 7 communes and Tinh Gia township and are implemented in two phases during 4 to 5 years. Therefore, the impact on landscape is only localized at each construction site and it is assessed to be medium and mitigable.

3.4.1.8 Increased Erosion and Landslide Risks

Land slide and erosion risks may also be increased at the disposal sites where the ground would be disturbed, and ground elevation will be changed. The level of risks depends on existing ground conditions and the height of the dumps. With the five proposed disposal sites, the height of the dumps is estimated below:

Table Error! No text of specified style in document..59. Estimated Height of the Dumps

Disposal Site	Land Area (ha)	Existing ground conditions	Volume of Disposal (m3)	Dump Height/ Ground Level after Disposal
Xuan Lam commune	8	Pond, 2.5 m deep	300,000	1.3 m higher than the surroundings
Mai Lam commune	1	0.5 m lower than the surrounding	20,000	1.5 m higher than the surroundings
Tuong Son commune	3	8 m deep pond	250,000	Same level as the surrounding ground
Do Be (dredging materials)	4.5		70,000	1.5 m higher than existing ground level
Lach Bang (dredging materials)	2.5		50,000	2 m higher than existing ground level
Total	19		690,000	

As ground level at four out of five disposal sites will be from 1.3 to 2 m higher than the surround ground level, some slopes will be formed. There will be land slide risks on these slopes if the soil is not compacted, the slopes are not shaped and stabilised properly. The risks would be higher in rainy season than dry season. On the other hand, erosion may also occur on the surface and particularly on slopes of barren dumps in both seasons under the effects of wind and rainwater. Erosion and land slide risks is at moderate level as the height of the dump and land area at each disposal site is limited. The potential impacts and risks can be minimized by levelling the dumped areas regularly.

3.4.1.9 Increased Localised Flooding and Sedimentation Risks

The project’s localized flooding and sedimentation risks can be as follows:

Construction materials, dredged materials and excavated soil can block the existing rain water drainage causing localized flooding. However, the construction of interceptors and wastewater collection sewer is usually conducted by successive method so the localized flooding risk is no very high. The construction site of the wastewater pumping stations (PS1 is near Cong bridge in Tinh Gia township, PS2 is at the junction between Binh Minh-Sao Vang road and Cau Trang canal) are the area bearing the highest risk of localized flooding due to construction activity. Other remaining areas are newly constructed and have good natural drainage system through two main canals namely Than and Cau Trang and mainly vacant land area along the route so the localized flooding risk by the construction activities is low.

Localized flooding can also happen at the area for gathering dredged material from Than and Cau Trang canals.

Heaving for construction of the WWTP and the resettlement area which are currently located on low-lying areas will also reduce rainwater temporary storage capacity in the areas. Then rainwater will run faster to the drainage canals around the resettlement area.

When constructing the new roads, the roadbed will be filled to heave to the design elevation. Then, the new filled road will become a dike disturbing the existing rainwater drainage at the two sides of the road along its entire length. Localized flooding will likely occur if cross culverts are not constructed timely. This risk can be moderated and mitigated by designing solutions and planning to avoid road construction in the rainy season.

3.4.1.10 Traffic Disturbance and Increased Traffic Safety Risks

During construction phase, it was estimated that 132 trips of vehicles will be added to the traffic flow in the project area if all the work items are built at the same time. Most of them are heavy-loaded vehicles, some routes of transportation passing residential areas. The increased number of heavy-loaded vehicles may disturb traffic and cause increased traffic safety risks. The main roads to be affected with traffic disturbance and increased traffic safety risks are the Luong Van Yen road, Luong chi road and Ngo Chau Luu road. However, as the construction will be divided into phases with number of construction packages thus the quantity of vehicles added to traffic flow in the project area is much fewer than the estimated 132 trips per day. The impact is temporary, intermittently but lasts in 3 years.

In addition, traffic disturbances not only occur due to increased traffic density by means of transport, but also due to other causes, such as the road surface is narrowed by pipeline construction, parking of vehicle, unloading/loading of materials and waste occupy the road surface. These lead to increased traffic density and traffic accident risks. Due to the fact that the sewer system will be constructed successively so the traffic disturbance and traffic safety risks will mainly be localized. The risk of traffic accidents will be high during peak hours and at night, around the areas where there is the open ditch under construction. The two most affected areas from traffic disturbance and increased road safety risks are:

(1) Tinh Gia township along Cau Trang canal: Tinh Gia township residential area (Km 2+00 to Km 3+00), Township kindergarten (Km 2+900), Tinh Gia township residential area (Km 3+00 to Km 3+500).

(2) Do Be bridge area: Residential area at the bridge end to Hai Thanh inter-communal road.

People's movement will also be disturbed when construction of sewer system hinders people's access to residential houses and roadside works. Trucks transporting materials when running into some internal roads to access the construction site will also increase the risk of traffic safety on these roads. In particular, the internal roads in the residential areas where the coastal road passes through can also be interrupted, increasing traffic safety risk. The residential areas along the road in Ninh Hai commune at Km 0+600 Km 1+100, the residential areas at Km 1+150 to Km 1+300, Km 1+700 to Km 1+900, Km 2+400 to Km 2+900, Km 3+500 to Km 2+700, Km 4+600 to Km 4+900, Km 5+640 to Km 6+00, Km 9+700 to Km 10+00) will be affected with traffic disturbance and traffic safety;

It should be noted that the existing Do Be bridge will be demolished for completely new construction. Therefore, transport on this bridge will also be interrupted during construction. This effect will be partially mitigated because the contractor usually makes temporary road in parallel to the existing bridge before dismantling to ensure traffic circulation. On the other hand, there are also alternative access to the two ends of the Do Be Bridge by using the nearby bridges/roads such as Binh Minh bridge, Ben Ngao sluice. Traffic disturbance and traffic safety risk at Do Be bridge should be mitigated traffic diversion and applying other mitigation measures described in Chapter 5 – Environmental Management Plan.

Some schools in Tinh Gia township, such as the kindergarten at Km 2 + 900 of the Cau Trang canal are the areas sensitive to traffic disturbance and increased traffic safety risks during school time.

Thus the impact on traffic disturbance and increased traffic safety risk is assessed at a medium level and can be minimized. The impact on traffic will be limited if project owners and contractors have a reasonable construction plan, coordinate with local governments in regulating traffic and having legal and economic sanction in transportation.

3.4.1.11 Damages to Existing Infrastructure and Disruptions to Related Services

Tinh Gia township residential area along Cau Trang canal and other construction sites has many electricity poles, canal bridges and water supply along the canal. The project's construction phase can damage or disrupt these services.

Besides, roads power cables on the major transportation routes will also be at risk of being damaged because the heavy trucks' operation on the road can damage road surface, collapse the culvert and break electrical lines if carrying bulky materials. Ngo Chau Luu, Luong Van Yen and Luong Chi roads are the main roads at this risk.

3.4.1.12 Social Issues, Labour and Influx of Workers

In addition to land acquisition and its related impacts, communities and households not affected by land acquisition in the project areas would also be affected by other social impacts. These may include:

- Reduced incomes of road-side business households due to dusts and limited accessibility to shops
- Community disturbance due to construction impacts (increased dust, noise and traffic traffics, obstruct access to road-side houses etc.)
- Social impacts and issues related to influx of workers

Reducing Incomes Business Households. Along about 1 km at the beginning section of Ngo Chan Luu, Luong Van Yen and Luong Tri there are some shops/small business households. During construction phase, part of the road may be occupied for construction activities, parking machineries or material loading. Such activities may cause or make the local people feel inconvenience to enter shops and road-side business, or customers may feel it is un-hygenic thus they done come to drinking/eating places in dusty area. With less customers, the incomes of these road-side business would be reduced. This potential impacts will be reduced by carrying out construction in stages.

Community Disturbance due to Construction Impacts. Roadside households would be disturbed by dusts, noise, vibration temporary reduced accessibility to their houses which are located along the road. These impacts may make the affected families change/modify their routine activities as studying (of children), cooking, eating and resting, entertainment, etc. On the other hand, traffic disturbance and increased traffic and safety risk or localized flooding may affect travel habits of household members, particularly in temporary flooded/muddy areas. However, that impacts occur only in short, intermittent time and can be minimized if applied appropriate measures.

Social Impacts and Issues Related to Influx of Workers

Community Disturbance due to mobilisation of workers to the Project areas. It is estimated that the subproject will mobilize about 490 workers possibly comes from others localities to live and work in the Project area during construction phase. This number of workers compared to the total population of each ward/commune in the project area (about 250,000 people, including

4% or 1,049 Thai ethnic people) is quite small. Whether living in rented accommodation or in camps set up by the Contractors, there will be some interactions between the workers with local community. Social disturbance or even conflicts may be arisen when the workers are presence in the project area due to:

- The workers come from other places with different income, employment, reputation and expectations etc.
- Language used by the workers, their behaviours or ways of living not suitable to local culture/customs, particularly if they involve in drinking, gambling, sexual harassment or prostitution.
- Construction impacts, particularly waste and wastewater, cause nuisance, disturbance or even disruption to daily activities of local communities.
- Sanitation conditions at workers' living areas/camps is poor, causing environmental pollution which pose health risks for local communities.

In terms of *income level*, nearly 60% households in the subproject area have main income source from wages from their employers. The popular income level is around 5 million dong/month per household. Therefore, there may be some differences in the income levels between the households and the workers and this could be one of the cause to potential social issues.

With regards to *language used and workers' behaviour*, culture and customs, particular attentions should be paid to the 4% of Thai ethnic minority population living in the project area. Social conflicts may happen if the workers use unsuitable language or have behaviours that shows irrespects to the local people. Social conflicts would be serious if the workers harass local women, or involve in drinking, gambling. Particularly, serious long term health impacts if the workers involve in prostitutions as that would be the cause of STD, HIV/AIDs. In reality each construction company usually apply certain rules to manage the workers, prohibiting inappropriate behaviors and enforcing healthy lifestyles. Such regulations would be helpful for managing social impacts. However, current regulations may not be sufficient to manage all social risks/impacts and should be strengthened if a bidder wins the contract in the project.

Related to *construction impacts*, only the Cong town is relative populated, the existing land use in other construction sites are mostly agricultural land. People in the project area have been informed and consulted about the project proposal and related impacts, they should also understand the benefits of the project thus it is likely that local people would be able to sympathy and accept the temporary negative construction impacts. Therefore social conflicts due to construction impacts should be small. Additionally, local authorities in the project area have regulations on the temporary residence, temporary residence for the management of residents and temporary residents in the area. This will contribute to maintaining social security in the project area.

With regards to *camp conditions*, it is likely that some contractors may set up camps for the workers to live in during construction phase, the others could rent houses of local residents to provide accommodation for the workers. In both cases, if localised pollution is caused from the workers' accommodations, nuisance and health impacts on to the nearby households would lead to social conflicts.

It is noticeable that Vietnam Labour Code (article 165) regulates that employers are prohibited to use people under 18 years of age to carry heavy objects, work at construction sites, to carry out works for demolition of structures, or work under water. Therefore, the age of workers hired by the contractors should be monitored during construction phase of the Project to ensure with this regulation.

Generally, the potential social impacts and risks of the subproject would be at low to moderate and manageable by the measures presented in Chapter 5.

3.4.1.13 Impacts on Physical Cultural Resources

The project’s construction phase can affect some PCRs in the project areas. There are no PCRs affected by land acquisition, the impacts of construction in these areas are mainly due to dust, noise, traffic hinderance and aesthetics impact due to construction activities and loading of materials. The impact level is moderate because the construction time can last several days at the areas where successive construction method is applied, or up to 3-6 months at other areas. Religious activities (pagoda visits, festival activities...) can be affected especially on the 15th day and 1st day of Lunar month. The consultation with key people in these religious and belief works which are sensitive to the project impact show that, in great feast-days, there will be large number of Buddhists gathering and joining in the worshipping activities. Construction and gathering of material at this time will cause traffic hinderance, affect the psychology and level of satisfaction of pagoda’s monks and visitors.

Table Error! No text of specified style in document..60. Physical Cultural Resources affected by Construction Impact

Receptors	Picture	Description	Impacts
<i>Section 1: Start point intersecting with the planned coastal road</i>			
Le Van ancestral temple (Km 0+500)		About 50m from construction area This is the temple for worshipping Le Van’s ancestry. Worshipping activities happen particularly on the first day and 15 th day of every solar month.	<ul style="list-style-type: none"> - Dust may affect the temple structure - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors
General Truong Cong Xuan relic (Km 1+300)		- Provincial historical relic, for worshipping family’s members. Distance from construction area: 50 m	<ul style="list-style-type: none"> - Dust may affect the structure, noise may disturb worshipping activities on 1st and 15th lunar month - Material and wastes may affect landscape and hinder access, - Unsuitable language or behaviours of workers may be offensive - Risks of traffic disturbance, accidents and safety on access road
General Pham Van Doan relic (Km 1+500)		- Provincial historical relic, for worshipping family’s members. - Distance from construction area: 50 m	<ul style="list-style-type: none"> - Traffic disturbance on access road - Material and wastes may affect landscape, hinder access.

Receptors	Picture	Description	Impacts
			<ul style="list-style-type: none"> - Dust may affect the structure - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language or behaviours of workers may be offensive Traffic disturbance on access road
Section 2: Start point of Do Be bridge (Km 5+640)			
Khanh Pagoda (Km 7+900)		<p>Khanh pagoda is located in Binh Minh commune.</p> <p>This is a Buddhist pagoda where local people come to worship, particularly on the 1st and 15th of lunar month.</p> <p>Distance from construction area: 30m.</p>	<ul style="list-style-type: none"> - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping activities on 1st and 15th Lunar month - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors
Binh Minh road			
Cemetery (Km 1+000 to 1+080)		<p>There are 20 graves of Binh Minh commune's people.</p> <p>Distance from construction area: 50 m</p>	<ul style="list-style-type: none"> - Disturb access to graves and worshipping activities, particularly on 1st and 15th of lunar month - Insects may attack the workers
Road from NH1A to Ninh Hai beach			
Cemetery area (Km 0+100 to 0+200)		<p>There are about 50 graves of Binh Minh commune's residents, about 50m from construction site</p>	<ul style="list-style-type: none"> - Disturb access to graves and worshipping activities, particularly on 1st and 15th of lunar month - Insects may attack the workers

As the subproject involves relative large quantity of excavation and dredging, there are chances that artifacts may be exposed during the execution of earth works. Therefore, a chance find procedure need to be developed and included in the ESMP.

3.4.1.14 Occupational Health and Safety risks to the Workers

Accident Risks

Accidents may happen at any stage during construction phase, the causes include:

- Workers working on the canal (constructing embankment, constructing canal-cross bridge) are at risk of being drowned due to their carelessness or tiredness or not following

regulations on occupational safety when performing their construction activities at these areas.

- Outdoor workers exposed to hot weather (in summer, temperature can reach 38⁰C - 40⁰C), Extreme weather events such as heavy rain, storms, flash flood, or extreme hot weather.
- Environmental pollution may cause fatigue, dizziness or fainting for workers during their work.
- Operations of machines and equipment used for loading/unloading materials and equipment, dredging, excavation, construction and transport of materials.
- Land slide at deep excavation sites.
- Injuries due to insect bites, broken grass when working in the bush during site clearance,
- Accident risk for the workers when dismantled or broken materials falling during the demolition of the existing Do Be bridge.

Generally, the risk of labor accident on construction sites is minor and can be mitigated by suitable solution such as training on occupational safety before and during the construction process and provision of sufficient protective equipment for workers.

Risks of Fire, explosion and leakage of fuel

Fire and explosion may occur during transport, storage, handling and usage of fuel, or failure in the temporary power supply system. These hazards may cause loss of life and damage to property during the construction phase. The specific causes are identified as follows:

- The temporary fuel and material warehouse (gas, DO oil, FO oil, welding gas, etc.) are the source of chemical leakage, fire and explosion. The occurrence of such incidents may relate to smoking, oil and gas handling/usage practices and can cause serious damage to people, society, economy and the environment.
- Fire risk may happen when operating construction machineries, welding and vehicles using gasoline and diesel without compliance with fire regulations. In addition, there can be forest fire hazard at the construction site of the coastal line crossing the Casuarina forest due to worker's smoking or fire using activities.
- There can also be risks of electric fire, gas tank explosion, particularly mini gas bottles.

In general, for the subproject, the fire and explosion risk are low because construction sites mainly on river/canal, at open space and far from residential areas (50 - 500m). If there is any fire and explosion incidence, it will only affect workers, but this impact is at low level, in small scale and can be mitigable by suitable methods.

3.4.1.15 Health and Safety Risk to the Community

The construction process will cause some health effects and increase the safety risks for local residents living in residential areas and some sensitive works. Health effects are mainly due to environmental impacts during construction such as dust, noise or odor from dredged materials when they are temporarily stored. In addition, without good management, waste and wastewater from construction sites, especially workers' camps, will be a source of health safety risk to the community.

During project construction, the ground surface will be disturbed, no longer flat, some wires or generators, water pipes ... will be temporarily installed, open channels and deep holes will be under construction, new slopes will be formed and bulky materials will be temporarily gathered. These will be the causes for safety risk of pedestrians and vehicles passing through the construction site if appropriate mitigation measures are not fully applied. Pedestrians will encounter the risk of being injured by treading on nails, pieces of iron, pointed wood, ... when passing through the construction site; they can fall when passing through muddy or slippery

areas caused by the mud from the site in rain or they can fall into a deep water hole in rains if there is no proper coverage or warning measure. Accident risk will be higher at relatively high traffic areas or at night. These risks are less likely to occur if there is good warning and coverage measures, but if they occur, they can be life threatening and would require strict compliance with safety measures on site.

The households living to be affected are those located along the transportation route and near construction sites will be affected with health and safety risks. These include:

- (1) The coastal road: Residential areas at Km 1+150 to Km 1+300, Km 1+700 to Km 1+900, Km 2+400 to Km 2+900), Km 3+500 to Km 2+700), Km 4+600 to Km 4+900, Km 5+640 to Km 6+00, Km 9+700 to Km 10+00);
- (2) Cau Trang canal and the wastewater collection sewer: Tinh Gia township residential area (Km 2+00 to Km 3+00).
- (3) Do Be bridge: Residential area at the bridge end to Hai Thanh inter-communal road.
- (4) Residential areas on the transportation routes including: (i) Ngo Chan Luu road to Hai Hoa beach, in Tinh Gia district (3 km long): Residential areas along two sides of road; 5 business households; (i) Luong Van Yen road lead to Hai Hoa beach, in Tinh Gia district (3 km long): Residential areas along two sides of road, About 7 business HH; Cultural house in Le hamlet; (iii) Luong Chi road lead to Bach Lang bridge in Binh Minh commune: Residential areas along two sides of road, About 10 business households.

Other project areas are vacant land or distanced from residential areas, or are thinly populated area so there will be very low health and safety risk to the community.

Therefore, the impact on community health and safety risks during the construction phase can be considered at moderate and can be managed by the measures presented in the ESMP chapter.

3.4.1.16 Impacts of Blasting

During the construction of the coastal road, rock blasting will be conducted to build the section from Km 3+190 to Km 3+500. Expected blasting method used is electric ticking time explosion with a hole diameter of 30-50mm ÷ and 2-2.5m depth Blasting will generate vibration, dust and emissions such as CO, CO₂, SO₂, etc. which are shown in the following table 3.32.

Table Error! No text of specified style in document..61. Emission Level of Blasting

Areas measured	Dust mg/m ³)	Noise (dB)	Emission (mg/m ³)		
			CO	CO ₂	SO ₂
40 min after blasting at distance of 30-40m	500-600	160	1%	2%	-
Rock shoveling after blasting	1,6-5	90-110	1,3-2	0.2	0.73
1Km away downwind	0,4-0,6	75-80	-	-	-

Source: *Urgent issues on labor environment in stone exploitation and processing in Vietnam, 1999.*

According to research results, immediately after blasting there will be a large amount of dust and emissions releasing into the surroundings. However, these emissions have local impacts and the dust concentration arising from the blasting will decline gradually with increasing distance from the epicenter of the explosion. At a distance of 1 km downwind from the epicenter

of the explosion, volume of dust and noise recorded are still higher than permitted limits and ranges from 0.4-0.6 mg/m³ ¹² for dust and from 75-80 dB for noise¹³.

One of the important factor related to environmental impact assessment of blasting is the minimum safety distance (r_{min}) between boundary of the affected area by air wave and location of the technicians.

According to research results of Dong Nai Department of Industry (2006) of the quarry in Dong Nai province, a safe distance calculated for each explosion is.

Table Error! No text of specified style in document..62: Safe Distance

No	Scale of explosion Q (kg)	Safety distance r_{min} (m)
1	100	70
2	200	88
3	300	100
4	400	111
5	500	119
6	1,000	150

Along with that, a safe distance of explosion vibration for houses and building by one exploding is calculated using the formula:

$$r_c = K_c \alpha \sqrt{Q} \quad (m)$$

When: - r_c is safety distance (m);

- K_c is dependent coefficient and ground nature of protected buildings ($K_c=8$)
- α is a coefficient dependent on exploding impact indicator n ($\alpha = 1,2$)

Also according to the research results of Dong Nai Department of Industry (2006), a safe distance is calculated for blasting in the quarries Dong Nai province as follows.

Table Error! No text of specified style in document..63. Calculated Safety Radius by Vibration of Blasting Scale

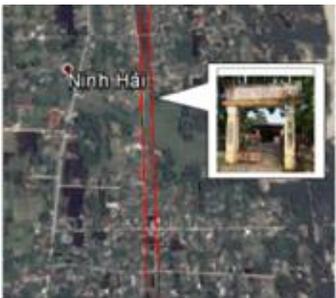
No	Scale of explosion Q (kg)	Safety distance r_c (m)
1	100	96
2	200	136
3	300	166
4	400	192
5	500	215
6	1.000	304

3.4.2 Site-specific Impacts and Risks

In addition to the common construction impacts discussed in detail in the previous section, there will also be site-specific impacts. base on baseline conditions and subproject-proposals. The site-specific impacts are discussed in detail below.

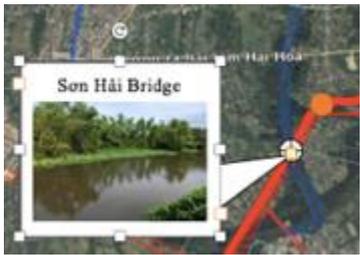
12 QCVN 05:2013/BTNMT-National standards on ambient air quality with dust volume limit per hour of 0,3 mg/³.

13 QCVN 26:2010/BTNMT-National standards on noise limits in normal areas in a day (70dB).

Location	Picture	Description	Impacts/Risks
Km 0+500: Le Van ancestral temple		The Le Van temple is located at about 50m from construction area. The temple is for worshipping Le Van's ancestry. Worshipping activities happen on 1st and 15 th of lunar month.	<ul style="list-style-type: none"> - Dust may affect the temple structure - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language/ behaviours of workers may be offensive to the relic keeper and visitors
Km 0+500 Km 1+100:		The left side at the beginning section is the edge of a scatterly distributed residential cluster, the right side is crop land The end section cut through a populated residential area The alignment cut through three existing local roads	<ul style="list-style-type: none"> - Safety risks to the public in residential areas - Increased level of dust and noise - Construction materials and waste may fill up agricultural land and irrigation ditches - Fragmentation of community at the end section - Localised flooding risks at section passing populated residential clusters - Disturbance on access and daily activities of HHs due to dust, noise, excavation, movement of trucks etc. in populated area - Risks of cracking/damages to existing weak structure, if any traffic disturbance and increased traffic safety risks on existing local roads
Km 1+150: Kindergarten Ninh Hai commune		This kindergarten is 200 m from construction site. It has 20 classrooms, guard house, yard and fence. Area 500 m ² . There are 30 teachers and 400 pupils.	<ul style="list-style-type: none"> - Traffic safety risk on the access road during peak hours: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30
Km 1+150 to Km 1+300: Residential area		The section cut through a populated residential area with 200 households The section cut through two existing local roads	<ul style="list-style-type: none"> - Increased safety risks to the public - Increased level of dust and noise - Fragmentation of community - Localised flooding risks - Disturbance on access and daily activities of households due to dust, noise, excavation, movement of trucks etc. - Risks of cracking/damages to existing weak structure, if any - Traffic disturbance and increased traffic safety risks on existing local roads

Location	Picture	Description	Impacts/Risks
<p>Km 1+300: General Truong Cong Xuan relic</p>		<p>- Cultural relic, for worshipping family's members. 50 m from construction site</p>	<ul style="list-style-type: none"> - Dust may affect the structure - Noise may disturb worshipping activities on 1st and 15th lunar month - Material and wastes may affect landscape and hinder access, - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors - Risks of traffic disturbance, accidents and safety on access road
<p>Km 1+300 to Km 1+700</p>		<p>The alignment cut through crop land intersected with small clusters of bush land Cut through two existing village roads</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads - Disturb, interrupt traffic on the local road
<p>Km 1+500: General Pham Van Doan relic</p>		<p>- Cultural relic, for worshipping family's members. - 50 m from construction site</p>	<ul style="list-style-type: none"> - Traffic disturbance on access road - Material and wastes may affect landscape and hinder access. - Dust may affect the structure - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors - Traffic disturbance on access road
<p>Km 1+700 to Km 1+900:</p>		<p>The alignment cut through a scatterly distributed residential cluster and slots of crop land cut through some small clusters of bush land Cut through two existing village roads</p>	<ul style="list-style-type: none"> - Safety risks to the Public - Traffic disturbance and increased traffic safety risks on village roads - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries

Location	Picture	Description	Impacts/Risks
<p>Km 1+900 to Km 2+400: Agricultural land area along the route</p>		<p>the alignment cut through crop land (first half) and some garden land (second half)</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries
<p>Km 2+400 to Km 2+900:</p>		<p>The section cut through a populated residential area with 200 households The section cut through two existing local roads</p>	<ul style="list-style-type: none"> - Safety risks to the Public - Increased level of dust and noise - Fragmentation of community - Localised flooding - Disturbance on access and daily activities of households due to dust, noise, excavation, movement of trucks etc. - Risks of cracking/damages to existing weak structure, if any - Traffic disturbance and increased traffic safety risks on existing local roads
<p>Km 2+900 to Km 3+500:</p>		<p>the alignment cut through crop land (two ends) and some garden land (middle) The section cut through two existing local roads including the road to Ninh Hoa beach</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads, particularly on the road the beach.
<p>Km 3+500 to 4+900: Residential area, Agricultural land area</p>		<p>The alignment cut through the edges of two populated residential areas (50 households at the beginning section and 60 HH at the end section) The middle part cut through cultivation Land The alignment cut through two existing local roads</p>	<ul style="list-style-type: none"> - Safety risks to the Public - Increased level of dust and noise - Fragmentation of community - Disturbance on access and daily activities of households due to dust, noise, excavation, movement of trucks etc. - Risks of cracking/damages to existing weak structure, if any - Construction materials and waste may fill up agricultural land and irrigation ditches - Disturbance on accessibility to agricultural land - Traffic disturbance and increased traffic safety risks on existing local roads

Location	Picture	Description	Impacts/Risks
Km 5+00 to Km 5+600:		The alignment cut through crop land. A new bridge will be built in the middle of this section The alignment cut through an existing intercommunal road	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Disturb access to crop land - Traffic disturbance and increased traffic safety risks on existing local roads
Km 5+300: Son Hai bridge: B=21m, L=90m. Pile driving: 40 m deep		Construct Son Hai bridge crossing Than canal The nearest house is 200 m from construction site	<ul style="list-style-type: none"> - Risks of Over clearance of trees and vegetation cover at the two ends of the bridge - surface water quality degraded due to construction materials, excavated/ drilling materials, and bentonite - Injury risks for the workers: falling onto the canal, bush insects bite
Km 5+640: Ending point section 1		The alignment cut through crop land. Intersecting with the approach road of Do Be bridge, Binh Minh commune.	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Access to crop land may be disturbed - Traffic disturbance and traffic safety risks on the existing approach road
<i>Section 2: Approach road Do Be bridge (Km 5+640)</i>			
Km 5+640 to Km 6+00:		the alignment cut through the edge of a scatterly distributed residential area, some bush land and garden land - cut through two local roads	<ul style="list-style-type: none"> - Safety risk and disturbance to the residential area - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads,
Km 6+00 to Km 7+600: Agricultural land		the alignment cut through bush land, some ponds, two local road and existing irrigation ditch and sluice	<ul style="list-style-type: none"> - Construction materials and waste may fill up irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries -Traffic disturbance and increased traffic safety risks on existing local roads.

Location	Picture	Description	Impacts/Risks
Km 7+900: Khanh Pagoda		Khanh pagoda is 50m from construction area: worshipping activities mostly take place on the 1st and 15 th day of lunar month.	<ul style="list-style-type: none"> - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors
Km 7+900 to Km 9+700:		The alignment cut through land for cultivation of rice and crops (corn, peanut...)	<ul style="list-style-type: none"> - Disturb access to crop land - Materials and wastes may fill up irrigation ditch
Km 9+700 to Km 10+00: Residential area		the alignment cut through scatterly distributed residential area, garden land, some ponds and two local roads	<ul style="list-style-type: none"> - Increased safety risks and disturbance to local residents - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance, increased traffic safety risks on local roads
Km 10+640: Ending point Section 2	 (approach road of Lach Bang 2 bridge)	Intersecting with the access road of Lach Bang 2 bridge	<ul style="list-style-type: none"> - Access through existing bridge will be disturbed - Traffic disturbance

3.4.2.2 Binh Minh Road to Sao Vang Road – Nghi Son Economic Zone

This road alignment mainly passing rice fields in order to avoid densely populated area. The road is 2.08 km long and 26.5m wide. The Figures 3.7 below shows the objects that may be sensitive to construction impacts of Binh Minh road to Sao Vang road – Nghi Son Economic Zone.

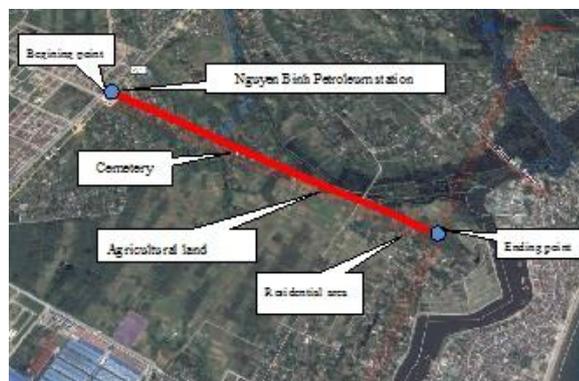


Figure Error! No text of specified style in document..13: Sensitive Receptors along Binh Minh road

Table Error! No text of specified style in document..65. Site-Specific Impacts Along Binh Minh Road

Location	Picture	Description	Impacts
Km 0+00 - Km 0+050:		Intersects with NH1A Traffic density on NH1A is rather high. Nguyen Binh petroleum station (km 0-0+050) located at 30 m from construction site, serving about 200 vehicles/days. Distance from construction area: 30 m	Traffic disturbance and increased traffic safety risks at the intersection with NH1A and near the petrol station
Km 0+050 to Km 1+000:		The alignment cut through the edge of a residential cluster. Some rice field, bushland and	<ul style="list-style-type: none"> - Increased safety risk, disturb local community - Construction materials and waste may fill up irrigation ditches - Accessibility to crop land may be interrupted - Risks of vegetation over clearance - Insects and reptiles may attack the workers
Km 1+000 to 1+080:		about 20 graves will be relocated. The remaining graves are not affected by land acquisition the ground is well-vegetated	<ul style="list-style-type: none"> - Disturb access to graves and worshipping activities, particularly on 1st and 15th of lunar month - Insects may attack the workers
Km 1+080 to Km 1+880:		The alignment cut through agricultural land, an existing commune road. The middle section run parallelly and is very close to the Cau Trang canal	<ul style="list-style-type: none"> - Disturb access to crop land - Materials and wastes may fill up crop land, irrigation ditch - Disturbance and increased traffic safety risks at the intersection with commune road - Risks of materials and wastes fall into the Cau Trang canal
Km 1+880 to Km 2+080: Residential area		The alignment cut through the edge of a residential cluster (in the middle of the section) Agricultural land, An existing commune road	<ul style="list-style-type: none"> - Community disturbance and increased safety risks - Disturb access to crop land - Crop land and irrigation ditch may be filled up - Traffic disturbance and increased traffic safety risks

Location	Picture	Description	Impacts
			at the intersection with commune road
Km 2+080: End point intersecting with coastal road		End point intersecting with coastal road	Traffic disturbance and increased traffic safety risks at the intersection with the coastal road

3.4.2.3 Do Be Bridge and Approach Roads

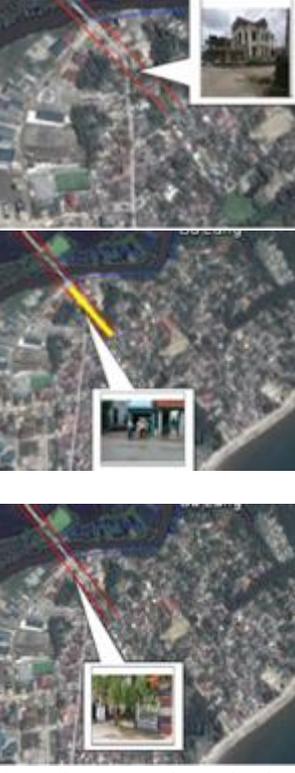
Figure 3.8 shows the sensitive receptors on the approach road of the Do Be bridge. The existing bridge crossing the Than canal is on the main road connecting Hai Thanh commune; When the existing bridge is demolished and the construction of the new bridge is on-going (takes about 10-12 months), traffic on this route will be disturbed or even disrupted. About 100-200 households at each side of the existing bridge will be affected the most by traffic disturbance or disruption at the Do Be bridge site.



Figure Error! No text of specified style in document..14: Locations of Sensitive Receptors Along Do Be Bridge and Approach Roads

There are two inter-communal roads crossing Than canal in the area that can be accessed. So, this impact might be minimized by the construction of a temporary bridges to maintain connectivity between the two ends of the bridge. The impact will end right after completion of the work. Site-specific impacts at Do Be bridge and approach roads are considered in Table 3.37.

Table Error! No text of specified style in document..66. Site-Specific Impacts at Do Be Bridge and Approach Roads

Receptors	Picture	Description	Site-specific Impacts/Risks
<p>Upgrading the western approach road of Do Be bridge (L=220 m):</p>	 <p>The alignment is coincided with the existing road, widen from 9 to 12 m</p>	<p>Agricultural land (at 2 sides of Hai Thanh inter-commune road) The nearest residential house 300m from the beginning point of the access road Roadside is agricultural and bush land Some invasive plants were observed near the bridge</p>	<ul style="list-style-type: none"> - Disturb access to crop land - Crop land and irrigation ditch may be filled up - Risks on Over clearance of vegetation - Insects from bush may attack the workers - Spreading of invasive plants into agricultural land
<p>Do Be bridge over Than canal (L=70 m)</p>	 <p>3 piles will be driven into the rive bed and two abutments will be built</p>	<p>Than canal is the main agricultural and drainage irrigation canal in the area; The existing bridge will be demolished, a new bridge will be built at the same location</p>	<ul style="list-style-type: none"> - Disruptions of traffic on the exiting bridge - Accident risks to the public underneath during bridge demolition - surface water quality degraded due to construction materials, excavated/ drilling materials, and bentonite - Injury risks for the workers: falling onto the canal, bush insects bite
<p>The eastern approach road of Do Be bridge (L=220 m):</p>	 <p>The alignment is coincided with the existing road, widen from 9 to 12 m</p>	<p>There are 20 households living along the road. The distance from nearest resident's house to construction site is 10 m. There are 9 business households located at 30 -100 m from construction site. Thuong Hai petroleum station is located at 30m from construction site, , serving about 100 vehicles/day.</p>	<ul style="list-style-type: none"> - Increased dust and noise level - Traffic disturbance and increased traffic safety risks - Temporarily disrupt business activities

3.4.2.4 The Road from NH1A to Ninh Hai Beach

The road from NH1A to Ninh Hai beach will be built by asphalt concrete with a total length of 1.2 km and 27 m wide. The land along two sides of the road is agricultural land. The Figures 3.9 below shows the objects that may be sensitive to construction impacts of the road from NH1A to Ninh Hai beach.



Figure Error! No text of specified style in document..15: Sensitive Receptors Along the Road from NH1A to Ninh Hai Beach

Some site-specific impacts and sensitive receptors by the construction of this road are considered in Table 3.38. **Table Error! No text of specified style in document..67. Site-Specific Impacts along the Road from NH1A to Ninh Hai Beach**

Location	Picture	Description	Site-specific Impacts/Risks
Km 0+00:		Intersection with NH 1A The start point of the route is intersection with NH1A, which has rather high traffic density.	<ul style="list-style-type: none"> - - Traffic disturbance - - Increased traffic safety risks, particularly at the junction
Km 0+000 to 0+100:		The alignment passes near about 10 scatterly distributed households located at 10 m from construction site. The alignment cut through crop land, some bush/garden land and a local road	<ul style="list-style-type: none"> - Increased dust and noise level at residential area - Increased safety risks at the residential area - Disturb access to crop land - Crop land and irrigation ditch may be filled up - Risks on Over clearance of vegetation - Insects from bush may attack the workers - Traffic disturbance and increased traffic safety on existing local road
Km 0+100 to 0+200: Cemetery area		73 graves will be relocated, the remaining graves remained at the same location The ground is well-vegetated	<ul style="list-style-type: none"> - Disturb access to graves and worshipping activities, particularly on 1st and 15th of lunar month - Insects may attack the workers

Location	Picture	Description	Site-specific Impacts/Risks
Km 0+200 to Km 0+750 (end point):		The alignment cut through crop land, five irrigation ditches, garden land and an existing local road The casuarina plantation is about 50 m from the end of the road.	<ul style="list-style-type: none"> - Disturb access to crop land - Crop land and irrigation ditch may be filled up - Localised flooding risks/risks on disruption of irrigation service - Risks on Over clearance of vegetation - Traffic disturbance and increased traffic safety risks at the intersection with commune road - Insects from bush may attack the workers - Increased fire risks, damages to the trees if the workers enter the plantation area and set fire or cut tree branches for various purposes, particularly in dry season

3.4.2.5 Site-Specific Impacts at Than and Cau Trang canals

The main environmental impacts and risks of canal dredging include:

- Generation of dredged materials (salinity at around 5‰) requires land for temporary and final disposal
- Odour, localized flooding and spreading of salinity from wastewater leaked from wet dredged materials
- Public nuisance if dredging takes place near residential area
- Materials drop on the way of transportation affecting other traffic means and cause public nuisance
- Increased water turbidity, reduced water quality, affecting aquatic lives
- Disturbance or disruptions to irrigation and drainage functions of the canal
- Landslide from embankment
- Accident risks for the workers
- Health risks for the workers when in contact with dredged materials or expose to bad odour from there

The mitigation measures for these specific impacts of canal dredging are presented in the Annex 2 – Dredging and Dredgate Management Plan. The two tables below only present site-specific impacts.

The Than Canal

The Than canal will be dredged and lined with embankment on its both banks with total length of 5km and dredging width of 25.5m, connecting to the existing embanked canal section, starting at Mai bridge (Km 8+893) and ending at Do Be bridge (Km 13+822). Additionally, salinity control sluice will also be rehabilitated at the ending section of Than canal about 2km from Do Be bridge to the junction between Bang river and the East Sea. At present, this canal section usually gets deposited in dry season and eroded in rainy season.

The site-specific impacts and sensitive receptors by the construction of this canal are considered in Table 3.39.

Location	Picture	Description	Impacts/Risks
Km 10 + 71400: Noi bridge crossing Than canal		This is the bridge on the main transportation route (Ngo Chan Luu road) crossing the Than canal to Hai Ha beach, serving local people and tourists	<ul style="list-style-type: none"> - Possible impacts on the bridge abutments if there is no proper dredging and reinforcing method. - Odour and temporary loads of dredged materials along the canal may cause nuisance to the public and affect local people as well as tourists
Km 10+714 to Km 11+251 Rice field and crop land		The two banks are area of bushes and weeds; The land area adjoining the canal banks is rice field, crop land and bushes. There are two ponds with area of ...on the canal left bank and right bank where material can be temporarily stored.	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Risk of filling up, flooding, or even damages crops and vegetation (due to 5% salinity of the dredged materials) in agricultural land when mud dredged materials and/or wastewater leaked from dredged materials in temporary disposal site - Insects, reptiles such as snake may attack workers. - Irrigation/drainage function of the existing ditch may be disturbed
Km 11+250: Chay bridge crossing Than canal on the road to Hai Hoa beach		This is the bridge on the main transportation route (Luong Van Yen road) crossing the Than canal to Hai Ha beach, serving local people and tourists	<ul style="list-style-type: none"> - Dredging activity may affect the stability of the bridge abutment - Odour and temporary loads of dredged materials along the canal may cause nuisance to the public and affect local people as well as tourists
Km 11+250 to Km 12+370: Rice field and crop land	  <p>Ending point is Binh Minh bridge</p>	The two banks are area of bushes and weeds; The land area adjoining the canal banks is rice field, crop land and bushes. Irrigation ditch is at Km 12+224. There are two ponds with area of ...on the canal left bank. The thinly populated residential area is about 40-100m from the canal left bank.	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or even damages crops and vegetation (due to 5% salinity of dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site - Irrigation and drainage function may be affected - Bad Odour and Dredged materials may cause public nuisance

Location	Picture	Description	Impacts/Risks
Km 12+370 to Km 13+320: Rice field and crop land Km 13+822: End point - at Do Be ridge.		The two banks are area of bushes and weeds; The land area adjoining the canal banks is rice field, and crop land. There are two residential areas on the canal left banks and at its ending section. Distance from the nearest house to the canal bank is 30-80m.	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or even damages crops and vegetation (due to 5% salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site - Bad Odour and Dredged materials may cause public nuisance

Cau Trang Canal

The canal cross section is from 3-6 m wide. There are some bridges constructed by local people on some canal sections. This work items will dredge and embankment two sides of Cau Trang canal with L = 5.7 km, B= 4 - 9 m. Figure 3.11 below presents sensitive locations/receptors which can be affected by construction of the road, dredging and lining embankment of Cau Trang canal.

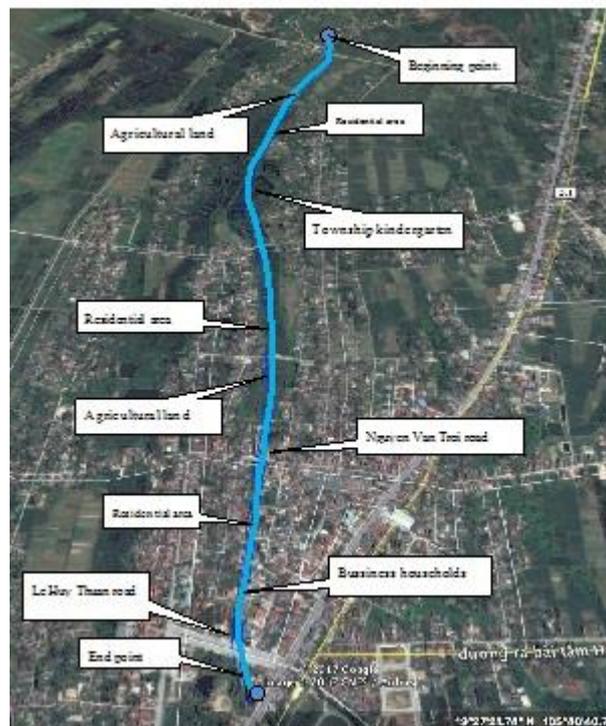
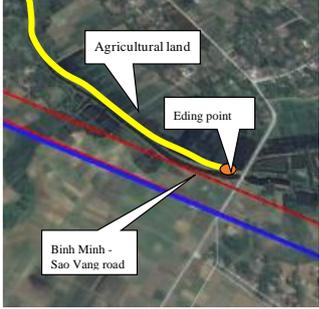


Figure Error! No text of specified style in document..17: Sensitive Receptors Along Cau Trang Canal

Table Error! No text of specified style in document..69. Site-Specific Impacts along Cau Trang Canal

Receptors	Picture	Description	Impacts
<p>Km 0+000 to Km 2+000: Agricultural land area</p>		<p>- The first 800 m of the canal section runs through agricultural land - 1 km ending section runs through area of bushes and weeds - Along 500 m length of the canal section, there are some ponds - Irrigation canal is at Km 0+450 -800 m ending section runs through residential area on its right bank and distance from the bank to the nearest house is 30m</p>	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Water in the ponds may be affected with increased turbidity and salinity from dredged materials/ leaked water - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or damages to crops and vegetation due to 5%o salinity of dredged materials - Drainage/irrigation may be disrupted - Bad odour and dredged materials may cause public nuisance
<p>Km 2+00 to Km 3+500:</p>		<p>This canal section runs through center of Cong township. Its water is seriously polluted due to domestic wastewater and waste discharge, causing bad odor. There are 100 HHs living along 2 canal banks. - About 10 small bridges crossing the canal is located within the residential area. NH1 A and Le Huy Thuan road cut through the canal at that km3+100 and 3+250 150 m on the right is vacant land</p>	<ul style="list-style-type: none"> - Public nuisance, negative impacts on urban landscape from dredged materials - Odour issue - Increased safety risks - Health risks for the workers when exposed to or in contact with contaminated dredged materials - Community disturbance - Traffic disturbance and increased traffic safety risks, particularly on the bridges, NH1A and Le Huy Thuan road section crossing the canal
		<p>- A kindergarten at Km 2+900 50m from the construction area. Transport peak hours near school are: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on week days. - 9 business households located along the canal from km 2 to km 3</p>	<ul style="list-style-type: none"> - Public nuisance due to odour, wastewater leakage and dredged materials odor from dredged material may affect the children - Increased safety and traffic safety along the canal, particularly during peak hours - Bad odor affect teaching, learning and relaxing activities, particularly affect children. - Disturbance to business households

Receptors	Picture	Description	Impacts
Km 3+500 to Km 4+700: Agricultural land area		<ul style="list-style-type: none"> - There are bushes and weeds on the two banks - Agricultural land area along the canal banks - 50 - 200 m - Irrigation canal at Km4+ 200 	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or even damages crops and vegetation (due to 5%o salinity of dredged materials) in agricultural land - Drainage/irrigation may be disrupted
Km 4+700 – km 5+700:		<p>The end section of the rehabilitated canal is near the intersection with Binh Minh to Sao Vang road;</p> <p>At present, this area is agricultural land along the canal banks. There are water intakes of some irrigation canals along this route.</p>	<ul style="list-style-type: none"> - Risk of filling up, flooding, or even damages crops and vegetation (due to 5%o salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site - Irrigation may be disrupted

3.4.2.6 Wastewater Collection and Treatment System

The system includes a wastewater treatment plant with capacity of 500 m³ per day, 8 combined sewer overflows (CSO) and 4km sewer HDPE D200 – D300, pumping stations PS1 and PS2 in 2m x 2m = 4 m², 2.5m - 4m deep land area.

The construction WWTP and PSs areas is currently agricultural land or public land, far from residential area, however the sewers and the CSO will be built along the Cau Trang canal which is a populated residential area, there are existing infrastructure such as power supply and powerlines in this area

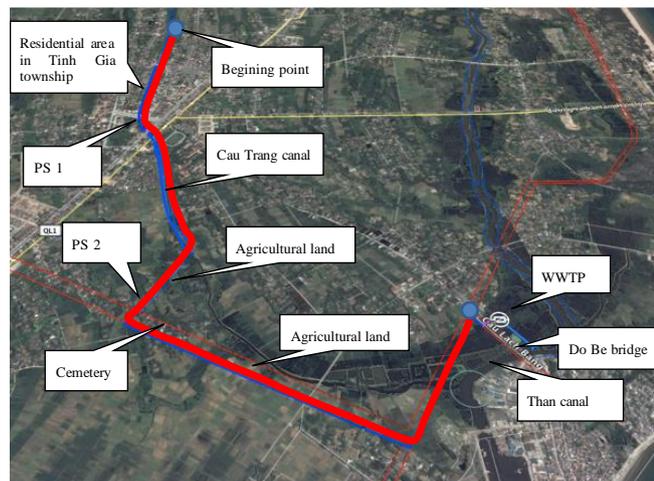


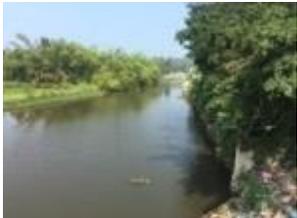
Figure Error! No text of specified style in document..18: Sensitive Receptors Along Sewer, PSs, WWTP

The site-specific impacts and sensitive receptors by the construction of the WWTP are considered in Table 3.41.

Table Error! No text of specified style in document..70. Site-Specific Impacts at the WWTP

Receptors	Picture	Description	Site-specific Impacts/ Risks
Sewer along Cau Trang canal			
Km 2+00 to Km 3+500:		<p>This canal section runs through center of Cong town. Its water is seriously polluted due to domestic wastewater and waste discharge, causing bad odor.</p> <p>There are 100 HHs living along canal banks. - About 10 small bridges crossing the canal is located within the residential area.</p> <p>NH1 A and Le Huy Thuan road cut through the canal at that km3+100 and 3+250</p> <p>150 m on the right is vacant land</p>	<ul style="list-style-type: none"> - Public nuisance, negative impacts on urban landscape from dredged excavation - Increased safety risks - Health risks for the workers when exposed to excavate - Community disturbance - Traffic disturbance and increased traffic safety risks, particularly on the bridges, NH1A and Le Huy Thuan road section crossing the canal
Km 2+900		<ul style="list-style-type: none"> - A kindergarten at Km 2+900 50m from the construction area. Transport peak hours near school are: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on week days. - 9 business HHs are located along the canal, km 2 to km 3 	<ul style="list-style-type: none"> - Increased safety and traffic safety along the canal, particularly during peak hours - Disturbance to business households
Km 3+500 to Km 4+700: Agricultural land area		<ul style="list-style-type: none"> - There are bushes and weeds on the two banks - Agricultural land area along the canal banks - 50 - 200 m - Irrigation canal at Km4+200 	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Drainage/irrigation may be disrupted
Km 4+700 – km 5+700:		<p>The end section of the rehabilitated canal is near the intersection with Binh Minh to Sao Vang road;</p> <p>At present, this area is agricultural land along the canal banks.</p> <p>There are water intakes of some irrigation canals along this route.</p>	<ul style="list-style-type: none"> - Irrigation may be disrupted

Receptors	Picture	Description	Site-specific Impacts/ Risks
PS1, capacity of 26m ³ /h		<ul style="list-style-type: none"> - Cồng bridge crossing the Cau Trang canal. - Some bush and grasses on the land - The pump chamber is 2.5 m deep 	<ul style="list-style-type: none"> - Traffic safety risks when the PS is located near the road - Over clearance of vegetation on the land - Insects may attack the workers - Soil subsident risks as the pump chamber is 2.5 m deep - Safety risks for local community when passing by, particularly at night time.
PS2, capacity of 50m ³ /h		<ul style="list-style-type: none"> - At the intersections between Bình Minh – Sao Vàng road and Cầu Trắng canal, currently is agricultural land - Rain water is drained through existing natural drainage ditches. - The pump chamber is 4 m deep 	<ul style="list-style-type: none"> - Over clearance of crop land risks - Vehicles, construction plants and excavated materials may cause damage to or fill up agricultural land - Soil subsident risks as the pump chamber is 4 m deep
WWTP		<ul style="list-style-type: none"> - Existing land use is agricultural land - Ain water is drained through existing natural drainage ditches. - Access road will be built new 100 m on agricultural land and connected to the intercommunal road Bình Minh - Hải Thanh 	<ul style="list-style-type: none"> - Disrupt access to agricultural land surrounding the WWTP - Construction materials and wastes may overflow onto the surrounding agricultural land - Irrigation ditches in agricultural land around the plant may be filled up and blocked - Surface runoff on elevated ground at the WWTP sites may disturb existing drains and cause more serious localized flooding - Surface runoff passing the WWTP may affect the quality of Than canal - Social disturbance related to concentration of the works to the WWTP area - Environmental pollution due to waste and wastewater from Camps at the WWTP - Safety risks for the workers during the construction of WWTP discharge structure - Safety risks for community

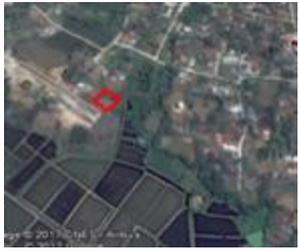
Receptors	Picture	Description	Site-specific Impacts/ Risks
Than canal (to receive wastewater)		<p>Than canal will be the water body receiving wastewater after treatment, at the section near Do Be bridge toward upstream area, about 150m from the location of the WWTP.</p> <p>This is an agricultural irrigation and drainage canal in the area; Water from no canal section is used for domestic purpose.</p> <p>There is no navigation on the canal.</p>	<ul style="list-style-type: none"> - Accident risks for the workers when working on water, safety risks for the community

3.4.2.7 Resettlement Sites

Table Error! No text of specified style in document..71. Site-Specific Impacts at the Resettlement Sites

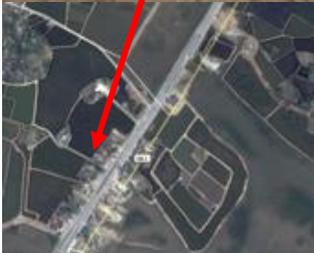
Location	Picture	Description	Impacts/Risks
Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha	 	<p>The rice-field and crop land area (peanut, corn...) in Ninh Hai commune.</p> <p>About 100-150m from Ninh Hai commune residential area</p>	<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land damage crop trees, affect productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust and noise - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc.
Resettlement site 2: Ron field- Hai Hoa 0.5 ha		<p>A vacant land area which has been leveled and is under management of Hai Hoa communal people's committee.</p> <p>About 50-100m from residential area</p>	<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage

Location	Picture	Description	Impacts/Risks
			<ul style="list-style-type: none"> - pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust and noise - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc.
<p>Resettlement site 3: Cao Thang 3 - Nguyen Binh 0.5 ha</p>		<p>Agricultural land of some households in Cao Thang 3 hamlet, Nguyen Binh commune. About 100m from the residential area</p>	<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site - Safety risks for the public - Erosion risks from barren soil surface may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust and noise - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc.
<p>Resettlement site 4: Ray Kenh - Binh Minh 1.5 ha</p>		<p>A vacant land area in Binh Minh commune with majority of vegetation as weeds and bushes. This is husbandry grazing area (buffalo, cow) of local people. About 150-200m distanced from Than canal and residential area</p>	<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust and noise - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc.

Location	Picture	Description	Impacts/Risks
Resettlement site 5: Van Xuan 8 - Binh Minh 0.5 ha.	 	<p>Watershed area of Van Xuan 8 hamlet, under management of Xuan Lam communal People's Committee.</p> <p>It is adjoining North-South 2 road (Bac Nam 2) which has been completed. This location is very convenient for transportation of material during operation and construction process.</p> <p>It is about 100m distanced from the nearest residential area</p>	<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust and noise - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc.

3.4.2.8 Disposal Sites

Table Error! No text of specified style in document..72. Site-Specific Impacts at the Disposal Sites

Disposal Site	Picture	Description	Site-Specific Impacts
For Excavated Materials			
1. The disposal site is located in Xuan Lam commune, Tinh Gia district	 	<ul style="list-style-type: none"> - The disposal site is in front of the headquarter of Xuan Lam Communal People's Committee - Distance: 10 - 15 Km. - Transport route: Along NH1A - Storage capacity is about 300,000 m3. - This is currently vacant land and pond, 200m from the nearest residential house, 500m from NH1A; Currently the site is in need of leveling. 	<ul style="list-style-type: none"> - Disturbance on daily activities of Xuan Lam CPC office due to dust, noise, excavation, movement of trucks etc. - Increased safety and traffic safety at the intersection with NH1A, particularly during peak hours - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause more serious localized flooding - Erosion risks from barren soil surface
2. The disposal site is located in Tuong Son commune, Tinh Gia district		<ul style="list-style-type: none"> - The disposal site is next to the provincial road DT512, 12 to 15 km from the construction sites. - Transport route: along NH1A - Storage capacity is about 250,000 m3. 	<ul style="list-style-type: none"> - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause more serious localized flooding - Erosion risks from barren soil surface

Disposal Site	Picture	Description	Site-Specific Impacts
		<ul style="list-style-type: none"> - This is currently vacant land, need of leveling, more than 500m from the nearest residential house. 	
<p>3. The disposal site is located in Mai Lam commune, Tinh Gia district</p>		<ul style="list-style-type: none"> - The disposal site is in next to Bach Lang bridge with distance of 3km. - Distance: 10 - 15 Km. - Transport route: North - South No.2 road --> NH1A - The storage capacity is about 20,000 m3. - This is currently a small pond, need of leveling, more than 100m from the nearest residential house. 	<ul style="list-style-type: none"> - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause more serious localized flooding - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks - Safety risks for the public - Erosion risks from barren soil surface
For Dredged Material from Than and Cau Trang canals:			
<p>(1) The disposal site under the salinity control sluice (Ben Ngao sluice)</p>		<ul style="list-style-type: none"> - The disposal site is near the salinity control sluice (Ben Ngao sluice) – at the estuary area of Lach Bang river – Binh Minh commune. This is the disposal site of Lach Bang port project with area of about 3.7ha. - Distance from the disposal site to the canal dredging area is 3 - 8 km; The main transportation route is Binh Minh inter-communal road. - Capacity 100,000 m3 - The disposal site is near the Lach Bang River which was saline as reflected in the monitoring results of Thanh Hoa DoNRE with a salinity on surface water of about 25-28‰. 	<ul style="list-style-type: none"> - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials disposal site - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause more serious localized flooding
<p>(2) The disposal site, 100m from Do Be bridge</p>		<p>The disposal site is 100m from Do Be bridge with area of about 4.5ha of abandoned land. The distance from the disposal site to the dredging area of Than and Cau Trang canals is 0.5 - 5 km. The main transportation route is Binh Minh inter-communal road. The</p>	<ul style="list-style-type: none"> - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials

Disposal Site	Picture	Description	Site-Specific Impacts
		disposal site's capacity is about 67,500 m ³ (corresponding to the discharge height of about 1.5 m).	<ul style="list-style-type: none"> - disposal site - Public nuisance due to odour, wastewater leakage and dredged materials odor from dredged material. - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause more serious localized flooding - Safety risks for the public - Erosion risks from barren soil surface
For Domestic solid waste and hazardous wastes:			
Domestic solid waste / sludge		<ul style="list-style-type: none"> - Landfill/waste treatment plant for waste and hazardous waste of Nghi Son Environment JSC in Truong Lam commune, Tinh Gia district. - Average distance to project areas: 20 km 	<ul style="list-style-type: none"> - The risk of erosion and subsidence due to non-compliance with the height regulation (2-3m) - Drainage of waste dumps with a design area of 1-2 ha

3.4.3 POTENTIAL NEGATIVE IMPACTS AND RISKS DURING OPERATION

Beside the potential positive impacts discussed at the beginning of Chapter 3, the construction of the proposed works may also result in the following negative impacts and risks during operation phase:

3.4.3.1 Roads and Bridges

- **Road Safety Risks:** Road safety is likely to be the key impacts during operation of the roads and bridges. Traffic safety risks would be highest at the road junctions and approach road to the bridge. This can be addressed by the engineering solutions applied that the junctions and bridge approach road as presented in Chapter 5.
- **Localised Flooding Risks:** The road surface level after construction will be higher than that of the existing cultivation land. This may lead to localised flooding of the cultivated areas due to embankment effect of the road. This risk can be addressed by inclusion of proper drains in the design of the road.
- **Disrupt Accessibility:** The Coastal road from Ninh Hai –Lach Bang 2 Bridge road will be 2-3 m higher than the existing ground level at some sections, it will be difficult for the farmers to access to their home and farm land from one side of the road to the other. This issue need to be considered during the detail design of the road.

3.4.3.2 Cau Trang and Than Canals

Traffic safety risk. Traffic safety will also be a concern in the operation stage of the roads on both sides of Than canal. Particularly, vehicles or people traveling on the canal's operation road may fall into the water and unable to make their way due to sloping and slippery bank before embankment.

Limitation in access to water, canal. At present, the canal bank is low and is soil bank so the access to the canal water is relatively easy and convenient. After embankment, this can become no longer easy, convenient or safe without the steps.

The above problems can be solved by a design safeguards such as providing steps on the embankment, constructing the bank higher than the road base or arranging chain as presented specifically in Chapter 5.

For the Cau Trang Canal, section at the beginning of Tinh Gia township is densely populated. Without these safeguards, there will be potential incidents of falling into water or drowning, especially for old people and young children.

3.4.3.3 Wastewater Treatment Plant

➤ Impact on Water Quality of Receiving Waters

The collection and treatment of wastewater in the area will help reduce pollutants discharged into Than canal. With a capacity of 500 m³/day and the treated effluent water meeting the Column B (e.g., effluent water meeting the inputs for non-domestic water supply) of the national standard on domestic waste water (QCVN 14: 2008/BTNMT), the specific amounts of pollutants reduced would be as follows: BOD₅: 0.75 tons/day, TSS: 0.67 tons/day, Total N: 0.13 tons/day, Total P: 0.05 tons/day. This will help improve the quality of river or canal water in the subproject area (Than canal, Lach Bang river and so on coastal sea-water at Hai Hoa beach).

However, heavy rains pose a risk that may affect the water quality. As the wastewater collection system is a combined one, heavy rains may cause wastewater to overflow out into the environment or may result in larger amounts of wastewater that exceed the treatment capacity of the WWTP. This would likely lead to input overload of WWTP and damages to the equipment. However, this issue has been studied in designing the collection system. Storm water and wastewater will be collected into sewer, where a constructed 8 combined sewer overflows will separate and take the stormwater, and the remaining wastewater will be transmitted to the WWTP. The collection pipelines would be designed to ensure that the treatment capacity of the WWTP would not be exceeded, and the said impact can be eliminated. So, this impact is controlled.

To evaluate the capacity of the receptor to receive the treated wastewater from Tinh Gia WWTP, the methods provided in Circular No.02/2009/BTNMT have been applied:

Step 1: Preliminary assessment of the receptor, the Than canal

- Water in Than canal is not a source of domestic water supply.
- In Than canal, water does not have black color or a bad smell.
- In Than canal, there are no indications that the lives of aquatic organisms are being threatened, and mass mortalities of aquatic species have not been reported. No algal blooming is reported.
- There are no known documents or data reporting community illnesses caused by exposure to river water.

Step 2: Detailed assessment of receptor's wastewater receiving capacity to receive treated wastewater based on specific parameters:

Data for assessing the wastewater receiving capacity of Than canal are as follows:

- Q_s (m³/s) is the instantaneous flow discharge of Than canal, measured $Q_s \sim 75$ m³/s (in the driest month).
- Q_t (m³/s) is the maximum wastewater discharge $Q_t = 500$ m³/day $\sim Q_t = 0.005$ m³/s
- C_{tc} (mg/L) is the limit value of pollutant concentration under the national technical regulation on surface water quality, QCVN08: 2015/BTNMT level B1.
- C_t (mg/L) is the maximum concentration value of pollutants in wastewater after treatment in Tinh Gia

WWTP

- C_s (mg/L) is the maximum concentration value of pollutants in Than Canal.
- Safety factor F_s : follow the instructions in Circular 02/2009/BTNMT, safety factor F_s has a value range of $0.3 < F_s < 0.7$. Calculating the self-cleaning ability of Than canal, using a safety factor $F_s = 0.4$.

Than canal has been used for irrigation and drainage, and aquaculture purposes, thus permissible values of pollutants in the water source should be applied following Column B1-QCVN 08-MT:2015/BTNMT. Concentrations of some typical pollutants in wastewater generated from Tinh Gia WWTP and Than canal are as follows:

Table Error! No text of specified style in document..73. Concentrations of Some Typical Pollutants

Parameter	Unit	Concentration (mg/l)		
		Than canal	Wastewater from Tinh Gia WWTP	Allowable Values (Column B1-QCVN 08:2015/BTNMT)
BOD ₅	mg/l	50	14	15
COD	mg/l	80	20	30
TSS	mg/l	100	36.50	50
NO ₃ ⁻	mg/l	50	1.24	0.04
PO ₄ ³⁻	mg/l	2	0.28	10
Coliform	MPN/100ml	5000	4200	7500

(Supposed to select the safety factor of 0.4)

Apply formula to calculate the maximum pollutant load:

$$L_{td} = (Q_s + Q_t) * C_{tc} * 86.4$$

In which:

- + L_{td} (kg/day): Maximum pollutant load of the water source for the pollutant in question;
- + Q_s (m³/s): Minimum instantaneous flow discharge in river section under evaluation before receiving wastewater;
- + Q_t (m³/s): Maximum wastewater discharge;
- + C_{tc} (mg/l): Limit values of concentration of the pollutant in question;
- + 86.4: Secondary unit conversion factor from (m³/s)*(mg/l) into (kg/day).

We have the maximum pollution load for Than canal to receive pollutants as follows, respectively:

Table Error! No text of specified style in document..74. Receivable Maximum Pollutant Load by Than canal

Parameter	BOD ₅	COD	TSS	NO ₃ ⁻	PO ₄ ³⁻	Coliform
$(Q_s + Q_t)$ m ³ /s	75.01	75.01	75.01	75.01	75.01	75.01
C_{tc} (mg/l)	15.00	30.00	50.00	10.00	10.00	7500
L_{td} (kg/day)	97,206	194,413	324,022	64,804	64,804	48,603,240

Apply formula to calculate the available pollutant load in the receiving water source:

$$L_n = Q_s * C_s * 86.4$$

In which:

- + L_n (kg/day): The available pollutant load in the receiving water source;
- + Q_s (m³/s): Minimum instantaneous flow discharge in river section under evaluation before receiving wastewater;
- + C_s (mg/l): Maximum concentration value of pollutants in the water source before receiving wastewater;

+ 86.4: Secondary unit conversion factor from (m³/s)*(mg/l) into (kg/day).

We have the load of pollutants in Than canal as follows:

Table Error! No text of specified style in document..75: Load of Pollutants in Than Canal

Parameter	BOD5	COD	TSS	NO ₃ ⁻	PO ₄ ³⁻	Coliform
Qs (m3/s)	75.00	75.00	75.00	75.00	75.00	75.00
Cs (mg/l)	14	20,90	36,50	1,24	0.28	4200
Ln (kg/day)	90,720	135,432	236,520	8,035	1,814	27,216,000

Apply formula to calculate the pollutant load from waste sources to receiving sources:

$$L_t = Q_t * C_t * 86.4$$

In which:

- + L_t (kg/day): Pollutant load in the waste source;
- + Q_t (m³/s): Maximum wastewater discharge;
- + C_t (mg/l): Maximum concentration value of pollutants in wastewater;
- + 86.4: Secondary unit conversion factor from (m³/s)*(mg/l) into (kg/day).

Load of those pollutants from the WWTP to Than canal is as follows, respectively:

Table Error! No text of specified style in document..76: Load of Pollutants Discharged from WWTP into Than Canal

Parameter	BOD ₅	COD	TSS	NO ₃ ⁻	PO ₄ ³⁻	Coliform
Q_t m³/s	0.006	0.006	0.006	0.006	0.006	0.006
C_t mg/l	50.00	80.00	100.00	50.00	2.00	5000
L_t kg/day	25.00	40.00	50.00	25.00	1.00	2500

Apply formula to calculate the ability to receive pollutant load of the water source for a number of specific pollutants:

$$L_{tn} = (L_{td} - L_n - L_t) * F_s$$

In which:

- + L_{tn} (kg/day): Capacity to receive pollutant load of the water source;
- + L_{td} (kg/day): Maximum pollutant load of the water source for the pollutant in question;
- + L_n (kg/day): The available pollutant load in the receiving water source;
- + L_t (kg/day): Pollutant load in the waste source;
- + F_s : Safety factor, take 0.4

Than canal's capacity to receive wastewater from WWTP for specific pollutants is as follows, respectively:

Table Error! No text of specified style in document..77: Receiving Capacity of Than Canal

Parameters	BOD ₅	COD	TSS	NO ₃ ⁻	PO ₄ ³⁻	Coliform
L_{td} -L_n-L_t (kg/day)	6,461	58,941	87,452	56,744	62,989	21,384,740
L_{tn} (kg/day)	2,585	23,576	34,981	22,698	25,196	8,553,896

Conclusion: With the maximum waste discharge rate at 500 m³/day from the Tinh Gia WWTP, the Than canal is capable to receive BOD₅, COD, Coliform, TSS, Nitrite, Phosphorous.

➤ *Offensive Odors*

Odors from the wastewater treatment process are generated mainly from the treatment units where anaerobic decomposition takes place. Aerobic decomposition also generates offensive odors but at lower levels. Those units which possibly generate bad odors include the lagoons.

The main gases generated from anaerobic decomposition consist of H₂S, mercaptans, CO₂, CH₄, of which H₂S and mercaptans, the main factors giving rise to mal odors (Table 3.49).

Table Error! No text of specified style in document..78. Odorous Compounds from Anaerobic Decomposition of Wastewater

Compounds	Formula	Typical odor	Detection threshold (ppm)
Amyl mercaptan	CH ₃ -(CH ₂) ₃ -CH ₂ -SH	Unpleasant, stinking smell	0.0003
Ethyl mercaptan	CH ₃ CH ₂ -SH	Smell of decaying cabbage	0.00019
Hydrogen sulfide	H ₂ S	Smell of rotten eggs	0.00047
Methyl mercaptan	CH ₃ SH	Smell of decaying cabbage	0.0011
Propyl mercaptan	CH ₃ -CH ₂ -CH ₂ -SH	Unpleasant smell	0.000075
Sulfur dioxide	SO ₂	Pungent smell	0,009
Tert-butyl mercaptan	(CH ₃) ₃ C-SH	Unpleasant skunk smell	0.00008

Source: 7th International Conference on Environmental Science and Technology Ermoupolis, Syros Island, Greece – Sep. 2001. Odor emission in a small wastewater treatment plant.

➤ **Impact caused by aerosol emissions from wastewater treatment**

The WWTP would generate biological aerosols that can be dispersed into the atmosphere. Aerosols often contain many kinds of E. coli, enteric bacteria, and fungi which are pathogens or induce allergies through the respiratory system. Therefore, the generation and dispersion of biological aerosols can affect the air quality in the environment within the premises of the WWTP.

Table Error! No text of specified style in document..79. Contents of Bacteria Dispersed from WWTP

Unit: bacteria/m³ of air

Position against wind direction	Distance			
	0 m	50 m	100 m	> 500 m
End of wind direction	100-650	50-200	5-10	-
Beginning of wind direction	100-650	10-20	-	-

Source: 7th International Conference on Environmental Science and Technology Ermoupolis, Syros Island, Greece – Sep. 2001. Bio aerosol formation near wastewater treatment facilities

The components of the WWTP are located fairly distantly from the residence areas (about 300m). In normal operation conditions with a closed treatment technology and a separated buffer zone 250m away in accordance with QCVN 07:2010/BXD standards, offensive odors are not likely to exist. The impact level is assessed to be low to medium.

➤ **Noise from WWTP, Pumping stations (PSs)**

Noise generated from WWTP and submersible pumping stations during operation would be negligible

➤ **Domestic Wastewater**

With about 5 staffs, the estimated domestic water supply per capita for the workers and operators at the WWTP will be 100 lit/person/day. The volume of domestic wastewater is estimated as 100% of this amount water supply demand, resulting in about 0.5 m³/day. In general, this amount of domestic wastewater is low stored/treated by drainage/sewers within the WWTP. The impacts are therefore considered to be negligible.

➤ **Municipal Solid Waste**

It is anticipated that a total of 5 people will be responsible for managing and operating the WWTP. Each person is estimated to generate 0.5 kg of solid waste/day, or 5 kg/day for the whole staff. Waste are collected and dumped together with domestic waste collection system of the city. The impact level is assessed to be low.

➤ **Hazardous Waste**

Hazardous waste generated from the operation of the WWTP and pumping stations is composed mostly of chemical packaging materials used in wastewater treatment, waste grease and oil, oily rags (about 100 kg/year) from maintenance tasks, and broken fluorescent lamps (about 20 kg/year), and Chemical packaging materials (about 50 kg/year) to be discarded. Such waste is a threat to the soil and water environment if dumped into the surrounding. However, such types of waste can be completely controlled during operation by the licensed unit such as Nghi Son Environment Joint Stock Company, so as to mitigate possible impacts.

Besides, chlorine used in wastewater disinfection is also a hazardous gas with any leakage into the environment. Coming into contact with chlorine without protective gear can claim human lives (Continuous contact with chlorine with a concentration of 250 ppm during 30 minutes can cause death to an adult) and cause skin or eye burns. A contact with chlorine at lower concentration will result in chronic diseases like bronchial illnesses, tooth corrosion, breathing difficulties, cough, etc. Therefore, special care must be taken during operation processes when using and handling chlorine.

The impact level is assessed to be medium.

3.4.3.4 Resettlement Sites

➤ **Domestic Wastewater**

With total 621 people (scale: 138 lots x 4.5 person/household = 621 people), the estimated domestic water supply per capita for the workers and operators at five RSs will be 100 lit/person/day. The volume of domestic wastewater is estimated as 80% of this amount water supply demand. Resulting in the Table below.

Table Error! No text of specified style in document..80. The Volume of Domestic Wastewater for RSs

No.	Name of RS	Number of lots	Persons	Total of domestic wastewater (m ³ /day)
1	Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha	50	225	18
2	Resettlement site 2: Ron field- Hai Hoa 0.5 ha	15	68	5
3	Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha	15	68	5
4	Resettlement site 2: Ron field- Hai Hoa 0.5 ha	43	194	15
5	Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha	15	68	5
6	Total	138	621	50

In general, this amount of domestic wastewater is modest. The area will be connected to the Tinh Gia WWTP for wastewater collection and treatment before discharging to surface water source. The impact level is assessed to be medium.

➤ **Solid Waste Generation**

It is anticipated that a total of 621 people lives in the RS of Tinh Gia subproject. Each person is estimated to generate 0.5 kg of solid waste/day, or 300 kg/day (0.3 ton/day) for the whole RSs.

Table Error! No text of specified style in document..81. The Volume of Domestic Wastewater from RSs

No.	Name of RS	Number of lots	Persons	Total domestic solid waste (kg/day)
1	Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha	50	225	113
2	Resettlement site 2: Ron field- Hai Hoa 0.5 ha	15	68	34
3	Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha	15	68	34
4	Resettlement site 2: Ron field- Hai Hoa 0.5 ha	43	194	97
5	Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha	15	68	34
6	Total	138	621	311

Waste are collected and dumped together with domestic waste collection system of the city at Landfill/waste treatment plant for waste and hazardous waste of Nghi Son Environment JSC in Truong Lam commune, Tinh Gia district. So, the impacts level is assessed to be medium.

➤ **Flooding Risk**

Four out of five resettlement sites field land or low-lying land areas (except for Resettlement site 2 - Dong Ron, Hai Hoa which is already available). These sites will have to be elevated from 1.5 m to 2.5 m above ground level on a large area from 0.5 to 1.5 ha. Therefore, if there is no proper calculation for drainage capacity and proper drainage design suitable with local drainage condition, there will be risk of localized inundation for areas surrounding the resettlement sites. However, areas for construction of project’s resettlement sites are having relatively convenient natural drainage system with two receiving waterbodies namely Cau Trang and Than canals. Particularly, upgrading and rehabilitation of these two canals have considered and calculated drainage capacity and flooding scenarios which can happen in the design process, so the impact is considered minor and can be mitigated.

3.5 INDUCED IMPACTS

The design and construction of the roads in the project are in line with the land use planning of Tinh Gia City (approved in Decision 2499/QD-UBND dated 07/08/2014 by Thanh Hoa Provincial People's Committee). Accordingly, the land along the new roads will become residential areas. The main safeguard issues would be access to clean water supply, drainage, sewer, and solid waste collection. While the first three would be included as part of land development in each area, the fourth would be covered by the existing town solid waste collection service. Generally, the induced impacts would be addressed at city plan/development level instead of this subproject level.

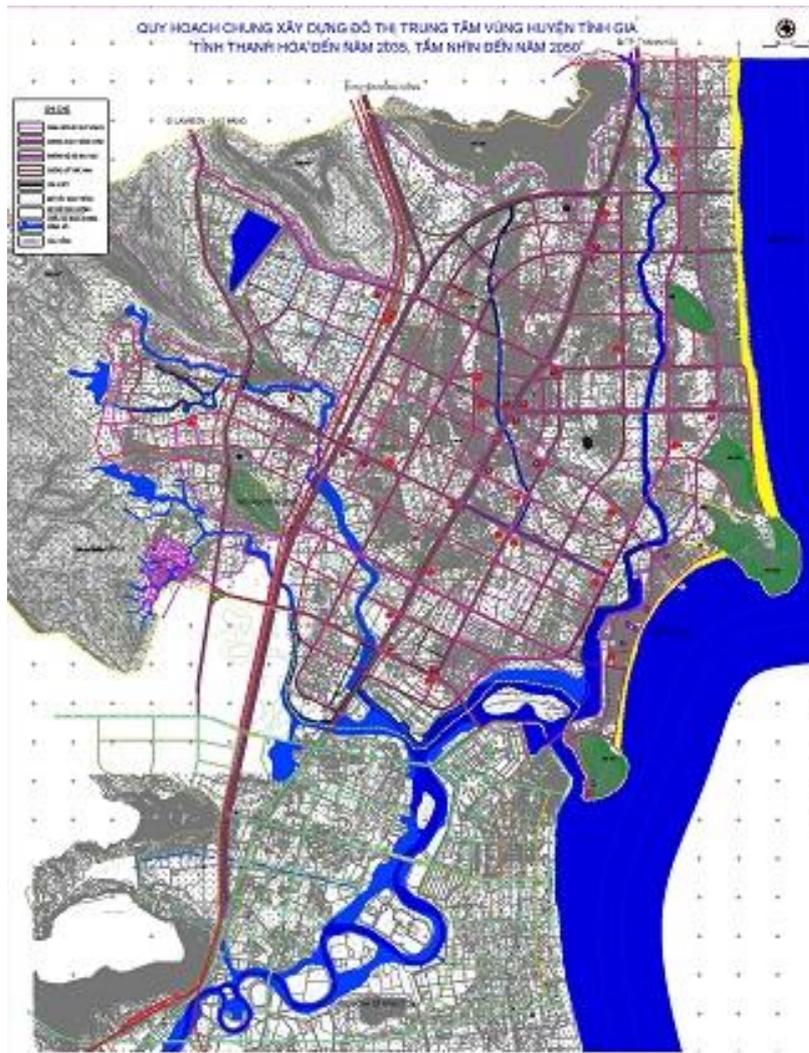


Figure Error! No text of specified style in document..19: Map of Land Use Master Plan

CHAPTER 4 - ANALYSIS OF ALTERNATIVES

Tinh Gia DCIDP is in accordance with: i) Tinh Gia township master plan to 2030 with a vision to 2050; (ii) Orientations for planning of major technical infrastructure system; iii) Transport development plan of Thanh Hoa province up to 2020 with orientation to 2025; iv) Master plan for public transport development in Tinh Gia to 2020, orientation to 2030; v) Development planning of Nghi Son economic zone up to 2020 with orientation to 2030.

4.1 “WITHOUT PROJECT” SCENARIO

Without project, Tinh Gia will continue facing with challenges of lacking of technical infrastructure as other small city. These challenges include:

- Tinh Gia’s urbanization rate is very fast while its drainage system has been overloaded or degraded at some areas. If having no investments as proposed, flooded situation and pollution in these areas will be more and more serious.
- Traffic density on NH1A will be more serious.
- Pollution will become worse. Discharge of untreated wastewater will lead to epidemic and affect public health
- Drainage capacity of Cau Trang and Than canals will not be improved. Flood will continue to happen leading to socio-economic loss and safety risk for local people.
- Tourism will not be effectively exploited (there are great volume of tourist but the revenue from tourism is not high) and potential of a sea tourism city will not be utilized.
- Impacts from climate change and sea level rise will be more serious compared with the case of having the project.

4.2 “WITH PROJECT” SCENARIOS

With the project, it will not only bring benefits to people living in the project area but also contribute to the socio-economic development of Tinh Gia district in particular and Thanh Hoa province in general. The construction of roads for the development of urban transport system, the rehabilitation of the canal system, the construction of wastewater treatment plant and sewerage system ... will bring positive result in reduction of traffic jam, ensuring traffic safety, reducing flood and improving security as well as environmental sanitation, improve living standards of local people. Additionally, there will be benefits for tourism development such as sea tourism, resort tourism in Hai Thanh, Hai Hoa, Ninh Hai...

It is forecasted that there will be 65,000 direct beneficiaries (2023) and there will be about 177,815 indirect beneficiaries under the project.

The project also has a positive impact on local labor and labor structure. Firstly, the project will help create jobs for the local workforce. It is expected that about 300 unskilled and technical workers will be recruited to work in the short term during construction of the project. In addition, the project will significantly promote the development of the labor market, especially the labor market serving the needs of Nghi Son Key economic zone.

Moreover, construction and upgrading of road and bridge will bring economic benefits namely: (1) saving travel time; (2) Minimizing operation cost of means of transport; (3) minimizing damage caused by traffic accidents; (4) Minimizing the impacts of climate change and sea level rise.

In general, “with project” scenario will bring more socio-economic and environmental benefits than the “without project” scenario although the “with project” scenario can bring negative impacts from medium-to-high-level during the construction of works under Component 1. These impacts are mainly potential during construction and will end when the works are completed and they can be minimized when applying technical and monitoring measures properly.

4.2.1 Analysis on Proposed Options

Among the proposed work items of the project, most of the road items have only one option which is assessed to be (i) suitable for the current traffic demand and can meet the city’s development plan by 2035, (ii) in line with the current investment finance plan and socio-economic condition, (iii) suitable for traffic connectivity and in line with the planned alignment; (iv) economically and technically feasible under donor criteria.

Only a few items having options which will need to be considered and compared (locally) prior to official proposal. The options are presented below.

4.2.1.1 The Coastal Road from Ninh Hai to Lach Bang 2 Bridge

This work item consists of road and bridge. The bridge has only one option as presented in Chapter 1. The road has two options as follows:

- Option 1: Road length L= 9.787km
- Option 2: Road length L = 9.845km

Table Error! No text of specified style in document..82. Comparing and Selecting Option for The Coastal Road

Criteria	Option 1 (To be selected)	Option 2:
<i>Description</i>	<ul style="list-style-type: none"> - The road is 9.787 km long, section from Km 3 + 190 to Km 3 + 500 crosses mountain - Design speed: 60km/h 	<ul style="list-style-type: none"> - The road is 9.845km long, not crossing mountain - Design speed: 60km/h
<i>Alignment</i>	 <ul style="list-style-type: none"> - The road starts from Ninh Hai beach as its planned alignment and runs in parallel with the beach at a distance of 500m from the beach. - To Km 4 + 440, the road alignment turns right and crosses with Than river at Km 5 + 960 - The road alignment continues to run along Than river to its end point which crosses 	 <ul style="list-style-type: none"> - The road alignment runs along Than river to its end point which crosses with the North-South 22 road to Nghi Son EZ and in parallel with the beach at a distance of 500m. It continues to run along Than river to the mountain. - The road alignment continues to run along Than canal to its end point

Criteria	Option 1 (To be selected)	Option 2:
	with the North-South 2 road to Nghi Son EZ	
<i>Technical aspect</i>	<ul style="list-style-type: none"> - There are 4 curves on the road. - At the section running across mountain: requiring complex reinforcement for road slope, difficult for construction commencement. 	<p>There are 5 curves on the road Simple construction method</p>
<i>Environmental aspect</i>	<ul style="list-style-type: none"> - Large volume of excavation work (522.861m³) about 50 times higher than Option 2, so it will require larger disposal site for accommodating excavated material. - The road will form a highlighted landscape. - Forest will not be affected. - The road section running across mountain will change local landscape. There will be risk of land erosion leading to accident risk during construction process. - There should be proper measure and cost for protection of the slope - Number of curves is less than Option 2 so traffic operation will be easier than Option 2 	<ul style="list-style-type: none"> - Excavation work volume: 9,863m³ - Not forming highlighted landscape - Requiring acquisition of 2.0ha of Casuarina planted forest . - Avoiding the risk of land erosion and accident because it does not require crossing the mountain - Not requiring measures and cost for slope protection - More curves than Option 1 so traffic operation will not be as easy as Option 1.
<i>Social aspect</i>	<ul style="list-style-type: none"> - Land acquisition area: 381,790.84m² - The road mainly runs through agricultural land and one part of residential area so the impact on community is lower than Option 2 	<ul style="list-style-type: none"> - Land acquisition area: 369,365.32m². - The road mainly runs through densely populated area so the impact of site clearance on community is high
<i>Economic aspect</i>	<ul style="list-style-type: none"> - Construction cost is lower - Site clearance cost is lower 	<ul style="list-style-type: none"> - High construction cost - High site clearance cost
<i>Conclusion</i>	Option 1 have more advantages and more suitable with local traffic condition, so Option 1 will be selected.	

4.2.1.2 Do Be Bridge and Approach Roads

The existing Do Be bridge and its approach roads are narrow, degraded and the road to Hai Thanh commune has degraded, no longer safe for use. The work item consists of road and bridge of which the road will have one option as presented in Chapter 1 and the bridge will choose one among 2 options presented below:

Table Error! No text of specified style in document..83. Comparing and Selecting Option for Upgrading Do Be Bridge

Criteria	Option 1	Option 2 (To be selected)
<i>Description</i>	<ul style="list-style-type: none"> - To keep the existing bridge and construct an additional unit. - Bridge width: B= 22m including 3 reinforced concrete spans. Spans 1 	<ul style="list-style-type: none"> - To demolish the existing Do Be bridge - To construct new Do Be bridge including 2 pre-stressed reinforced concrete spans with L=21m, girder section. Bridge width B =20m in

<i>Criteria</i>	Option 1	Option 2 (To be selected)
	and 3 are 12m long and span 2 is 15m long	form of reinforced concrete abutment sitting on D1200 piled based. Bridge pillar is reinforced concrete sitting on D1200 piled foundation. - The alignment is straight, without curves
<i>Technical aspect</i>	- Simple construction	- Complex construction
<i>Environmental aspect</i>	- Shorter construction time so affecting time on people and environment will be shorter. - Lower aesthetics, normal landscape - Lower traffic disruption than Option 2 because people still have the old bridge to use. - There will be no accident risk for demolition but accident risk for drivers due to their lack of concentration when running on the existing bridge while another new one is under construction. - There will be no impacts related to bridge demolition - Traffic operation will not be as convenient as Option 2	- Longer construction time so affecting time on people and environment will be longer - Higher aesthetics, beautiful urban landscape - Higher traffic disruption than Option 1 when people will have to use bypass road or use temporary bridge - Higher risk of traffic accident during bridge demolition and operation of the temporary bridge - Dust, noise and vibration will be generated from the demolition of the existing bridge - More convenient operation
<i>Social aspect</i>	- Land acquisition area is 2,020m ²	- Land acquisition area is 2,820m ²
<i>Economical aspect</i>	- Lower construction cost	- Higher construction cost
<i>Conclusion</i>	Option 2 will be selected to ensure urban landscape, traffic safety and development objectives of Tinh Gia in the future.	

4.2.1.3 Dredging and Lining Embankment for Than Canal

The work item includes: (i) dredging and lining 5 km embankment for Than canal and (ii) rehabilitation of salinity control sluice. For the rehabilitation of the salinity control sluice, there will be only one option as proposed in Chapter 1. For dredging and lining embankment, there will be two options for embankment as follows:

- Option 1: Slope lining embankment by reinforced concrete and grass planting cells to prevent land erosion.
- Option 2: Ecological embankment lining by sand bags and grass planting.

Table Error! No text of specified style in document..84. Comparing and Selecting Option for Than Canal Embankment

Criteria	Option 1 (To be selected)	Option 2:
<i>Description</i>	To line the embankment with slope m=2 by reinforced concrete: - Embankment foot will be reinforced by stone of 1m thick.	To line the embankment by sand bags and planting grasses: - Embankment foot will be reinforced by bamboo piles

Criteria	Option 1 (To be selected)	Option 2:
	- Embankment will be lined by precast concrete slabs (40x40x12) on cast-in-situ reinforce concrete frame. Embankment top is planted with grass for erosion protection	1. Embankment will be lined by sand bags and grass will be planted for erosion protection
<i>Technical aspect</i>	- Higher structural stability. - Complex construction method, longer construction time because it will require precast reinforced concreting work - Easier operation and maintenance	- Lower structural stability. - Simple construction method, faster construction time. - Complicated and more frequent maintenance
<i>Environmental aspect</i>	- The embankment will be more beautiful at high water level than at low water level. - Construction will cause higher environmental impact because piling work can generate more noise and vibration. - There will be lower risk of land erosion because this is a permanent structure. Disturbance of local people's lives (residential areas on two banks of the canal at Binh Minh and Do Be bridges) will be higher due to dust, noise and vibration generated during construction of embankment foundation and cast-in-situ process.	- The embankment is combination of grass and vegetation planting so it will form a beautiful landscape on the canal banks. - Lower impact during construction because it will use available and environmental-friendly materials. - Land erosion will still happen because this embankment is not permanent. - Lower disturbance on local people's lives Sự xáo trộn đời sống của các khu dân cư lân cận (residential areas on two banks of the canal at Binh Minh and Do Be bridges) because of shorter construction time and use of available material
<i>Social aspect</i>	- Land acquisition area is 68,959 m ²	- Land acquisition area is 86,198.75m ²
<i>Economical aspect</i>	- Higher construction cost	- Lower construction cost
<i>Conclusion</i>	Option 1 will be selected because it can ensure urban aesthetics, structural stability for coastal area and it can bear the impacts due to climate change and sea level rise.	

4.2.1.4 Wastewater Collection and Treatment System

This item includes (i) wastewater collection system (sewer, wastewater pumping station) and (ii) wastewater treatment plant.

➤ Selection of Wastewater Collection System:

For wastewater collection system, there will be 3 options:

- Option 1: Combined drainage system
- Option 2: Separate drainage system
- Option 3: Semi-separate drainage system with sewer overflow and inceptor for collecting wastewater

3 Options for wastewater collection system are analyzed for selection as in Table 4.4 below:

Table Error! No text of specified style in document..85. Comparing and Selecting Option for Wastewater Collection System

Criteria	Option 1 Combined drainage system	Option 2 Separate drainage system	Option 3 (To be selected) Semi-separate drainage system with sewer overflow and inceptor
Description	Rainwater and wastewater are collected by the same system and directly discharged to receiving waterbody (canal, ditch, river ...)	Rainwater and wastewater are collected by separate culverts and are brought to the treatment plant	Sewer overflow will be constructed at the end of the existing combined drainage system before discharge outlet in order to collect wastewater to bring to the treatment plant
Technical aspect	<ul style="list-style-type: none"> - To use the existing drainage culverts - Simple operation and maintenance 	<ul style="list-style-type: none"> - Not make use of the existing drainage culverts - Easy and simple operation and management for environmental pollution control 	<ul style="list-style-type: none"> - To use the existing drainage culverts - Complicated management and operation
Environmental aspect	<ul style="list-style-type: none"> - Not thoroughly solve the environmental pollution - Pollution in dry season will be more serious because there will be no rainwater for diluting the wastewater. - High risk of flooding in rainy season because both rainwater and wastewater run to the culvert system before being discharge to the receiving waterbody - Unstable operation because in the system will be easily deposited or blocked in dry season due to low water speed. Requiring frequent dredging work. - Lower environmental impact during construction process than other options 	<ul style="list-style-type: none"> - Ensure best sanitation. Wastewater will be completely collected and treated. - Convenient for handling with flooding, treating and protecting environment. - Causing greatest environmental impacts during construction among the three options. - Stable operation, lower risk of flooding and pollution than other options 	<ul style="list-style-type: none"> - Low excavation work in center area of Cong township - Rather good sanitation because all wastewater will be cleansed (in dry season and in small rains) or will be diluted by rainwater before discharging to the receiving waterbody, making use of the receiver's self-regulating ability.
Social aspect	<ul style="list-style-type: none"> - No site clearance and resettlement required 	<ul style="list-style-type: none"> - Required largest volume of site clearance and resettlement than other remaining Options. Land acquisition area is 0.4 ha 	<ul style="list-style-type: none"> - Low volume of site clearance and resettlement, lower than Option 2. Land acquisition area is 0.24 ha.
Economical aspect	<ul style="list-style-type: none"> - Lowest cost among three options 	<ul style="list-style-type: none"> - Highest cost among 3 options. - The rainwater drainage system does not work much in dry season so it will be a waste of cost. 	<ul style="list-style-type: none"> - Construction cost is moderate compared with the other two options.

Criteria	Option 1 Combined drainage system	Option 2 Separate drainage system	Option 3 (To be selected) Semi-separate drainage system with sewer overflow and inceptor
Conclusion	Based on: (i) Existing status of the local drainage system; (ii) capital source for project implementation and (iii) environmental efficiency, Option 3 will be selected for the construction of wastewater collection system		

➤ **Wastewater Treatment Plant (WWTP)**

Siting of the WWTP and pumping stations

Construction codes TCVN 7957:2008 (design standard of drainage and sewer – external networks and facilities) has been complied with during the siting of the WWTP and pumping stations. The proposed the wastewater treatment plant (capacity 500 m³/d) is located at 350 m from the nearest households (TCVN 7957 requires 200 m) and the two wastewater pumping stations were sited at 100 m away from the nearest households (TCVN 7957 requires 20 m);

Three options for wastewater treatment technologies will be analyzed in Table 4.5 below:

Table Error! No text of specified style in document..86. Comparing and Selecting Wastewater Treatment Technology

Criteria	Option 1: Biological pond	Option 2: Oxidation ditch	Option 3: MBBR technology
Description	Wastewater pumping station → Garbage trap → Grit chamber → Aeration tank → Facultative tank → Sedimentation tank → Receiving waterbody (Than canal)	Wastewater pumping station → Garbage trap → Standing grit chamber → Oxidation ditch → Secondary sedimentation tank → Discharge pumping station → Receiving waterbody (Than canal)	Wastewater pumping station → Garbage trap → transition pump → MBBR ¹⁴ treatment → Receiving waterbody (Than canal)
Technical aspect	<ul style="list-style-type: none"> - Simple construction 2. Easy operation and management 	<ul style="list-style-type: none"> - Relatively complicated construction, requiring high skill - Suitable with variable quality and flow of influent wastewater by seasons and by time - More complicated operation and management - Suitable for treatment plant with high capacity 	<ul style="list-style-type: none"> - Modulus design so it will be convenient for construction and installation - Simple and compact design, suitable for installation in narrow space
Environmental aspect	<ul style="list-style-type: none"> - Able to cause bad odor especially in summer) - Lower treatment efficiency than the two remaining options. - Low energy consumption 	<ul style="list-style-type: none"> - Not causing much odor - Highest treatment efficiency, meeting standard with strict requirement - Highest energy consumption 	<ul style="list-style-type: none"> - The system operates automatically, generating almost no odor - High treatment efficiency,

¹⁴ MBBR (Moving Bed Biological Reactor) – is the moving biofilm technology using moving biofilm carrier .

Criteria	Option 1: Biological pond	Option 2: Oxidation ditch	Option 3: MBBR technology
			- Moderate energy consumption in operation
Social aspect	- Greatest land acquisition among 3 options. Land acquisition area is 1ha.	- Medium land acquisition, smaller than Option 1. Land acquisition area is 0.8ha	- Smallest land acquisition among 3 options. Land acquisition area is 0.5ha
Economical aspect	- Construction cost: 7,000,000 VND/m ³ - Operation cost: 1,000 VND/1m ³	- Construction cost cao nhất 14,000,000 VND/m ³ - Operation cost: 2,300 VND/1m ³	- Construction cost 12,000,000 VND/m ³ - Operation cost: 1,500 VND/1m ³
Conclusion	From the analysis on technical, environmental and economical aspects as well as total investment and actual conditions in Tinh Gia, it is proposed to select Option 1 - Biological pond technology for the project.		

CHAPTER 5- ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

With the potential impacts and risks identified and assessed in Chapter 3, an Environmental and Social Management Plan (ESMP) has been prepared in this chapter with the aims of impact prevention and mitigation. Procedures for implementation, monitoring, supervision and reporting are also included in this ESMP together with Capacity building program and cost estimation. This ESMP consists of main contents as follows:

- The measures to minimize the potential environmental impacts from Feasibility Study and Detailed Design stage to pre-construction, construction and operation phases together with implementation responsibilities;
- Environmental Monitoring Program;
- The Project Compliance Framework, including environmental and social supervision arrangements, fines applicable to non-compliance;
- Capacity building programs;
- Cost estimation; and
- Grievance Redress mechanism.

5.1 MITIGATION MEASURES

5.1.1 Measures Incorporated into Feasibility Study and Detailed Design

5.1.1.1 Roads and Bridges

The following measures were considered during the preparation of the feasibility study and will be integrated in the detailed designs to mitigate the potential socio-environmental impacts and traffic safety risks during operation phase:

- Minimise site clearance requirements.
- Protect slopes with grass vegetation cover and concrete frames and/or embankments
- Install crossing and longitudinal drains to ensure the stability of the project's new roads and to avoid localised flooding risks along the new roads

The Figures below shows the design of the inter-sections between the project's new roads in which traffic and safety control measures included:

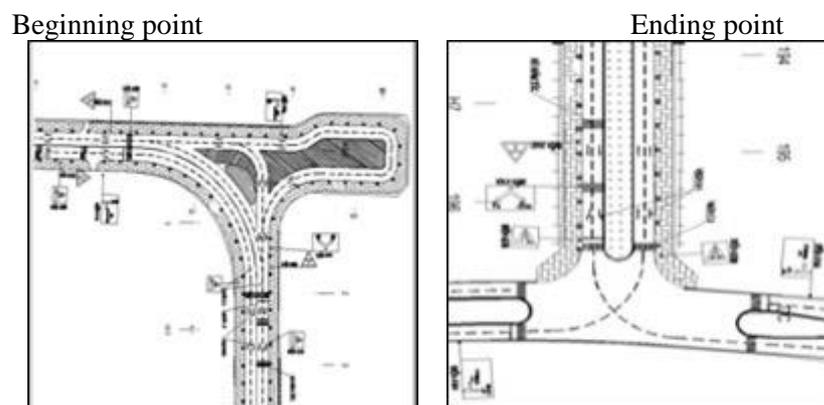


Figure Error! No text of specified style in document..20: Inter-sections at the Coastal Road and the Current Roads

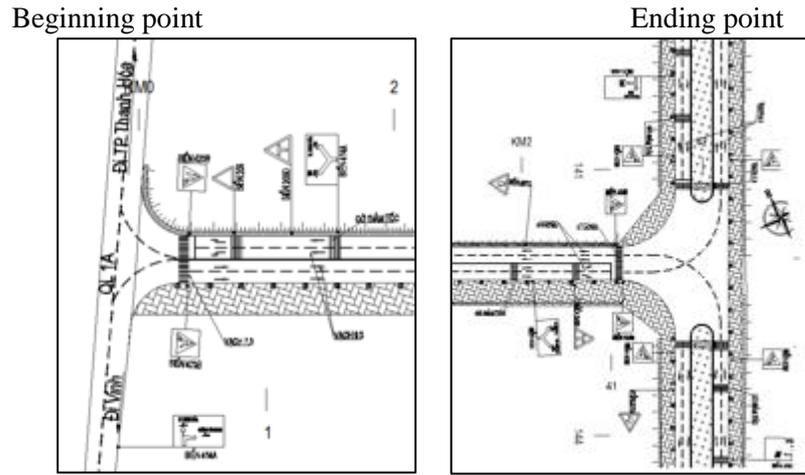


Figure Error! No text of specified style in document..21: Inter-sections at the Binh Minh - Sao Vang Road and Existing Road

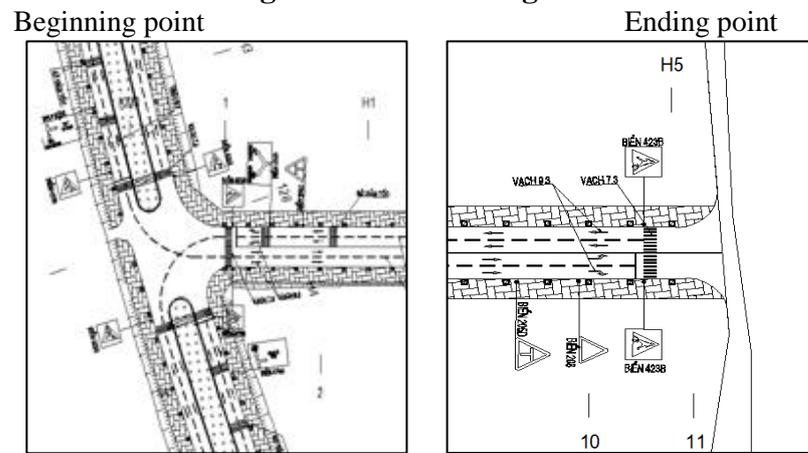


Figure Error! No text of specified style in document..22: Inter-sections at approach Road to Do Be Bridge and existing Roads

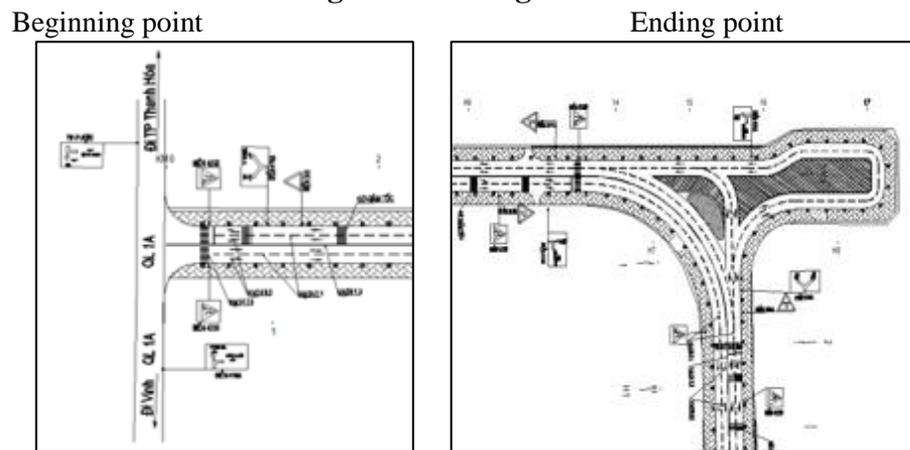


Figure Error! No text of specified style in document..23: Inter-sections at the NH1A - Ninh Hai beach and Existing Roads

5.1.1.2 Embankments

The design of the embankment operational roads along the Than and Cau Trang Canals allowed minimization of site clearance that affect local resident's permanent houses while ensuring straight embankment. Consider the followings:

- (i) there are stair cases and handrails at intervals along the embankments to maintain safe access to water fronts for local communities;

(ii) Trees and grass would be planted along riverbanks of both Than and Cau Trang canals to maintain the green landscape and stabilize the canal-bank.

5.1.1.3 WWTP

To control and minimize the potential impacts of the operational phase of the wastewater treatment plant and promote environmental friendliness of the Project, the following measures have been incorporated into the proposed investment project and will be implemented in the detailed design stage:

- Larsen sheet piles will be applied to reinforce and protect the slopes of pipe trenches to prevent landslide and erosion when excavation depth is 3m or deeper
- The treatment units within the WWTP will be sited in compliance with the Vietnamese National Standard QCVN 01:2008/BXD. This standard requires the WWTP that has biological have a buffer zone of at least 300 m wide. For project, the minimum distance from some treatment units to the nearest residential buildings:

Item	Distance (m)
Pumping station	50 m
Intake	75 m

To meet QCVN 01:2008/BXD requirements, the WWTP will have a buffer zone of at least 300 m (at this time) wide from the nearest residential area in which 5 m wide green corridor will be created.

- A 5 m wide green corridor and grass land will be established within the WWTP to create green landscape at the WWTP and separate the concrete buildings with the roads and residential areas near the front of the WWTP.
- Toilet, washing, and showers areas will be included in the administration building for the operators to use after working shifts. The administrative building shall be designed in such a way that maximise lighting using natural lights, water and electrical equipment will be energy-saving types.
- Sludge will be transported to the existing composting plant at the Landfill/waste treatment plant for waste and hazardous waste of Nghi Son Environment JSC in Truong Lam commune, Tinh Gia district (land for disposal area is 30 ha).
- An Emergency Response plan has been proposed to address the causes where there is some failure in the wastewater treatment system.

5.1.2 Measures to be Implemented in Pre-construction Phase

5.1.2.1 Measures to Prevent Safety Risks related to UXO

Unexploded bombs and mines will be searched for removal right after completing the compensation for site clearance and before carrying out the levelling of the site. This is required to be made prior to the construction of new road, at the WWTP, canals, resettlement sites . The project owner will sign contract with a specified service provider to carry out searching detection and safe destruction of the bombs and mines found at construction sites. The cost for bombs and mines clearance is estimated at around 5.6 billion Vietnamese Dong (equivalence of USD 250,000).

5.1.2.2 Measures to address the Impacts of Land Acquisition and Resettlement

As discussed in Chapter 3, total land area to be acquired is **573,336** m², of which 75,235 m² is residential land; **452,656** m² of annual land (include 1,152 m² public land), 22,305 m² of perennial land and 20,000 m² of productive forest land; and 3,140 m² cemetery land. Total of

AHs is 1,354 AHs. There are 350 AHs whose houses are affected, of which 225 AHs have to relocate; 89 AHs are vulnerable(; 526 AHs are severely affected; 22 AHs are affected business HHs.

To mitigate the potential impacts of land acquisition, Resettlement Actions Plan was (RAP) were prepared to Tinh Gia subproject. The estimated budget for implementing the RAP is **223,574,000,000 VND** (9,976,651 USD equivalent). This cost will cover the compensation and supports to AHs, , implementation of livelihood restoration program, replacement cost surveys, monitoring and implementation. Below is the summary of calculations.

Table Error! No text of specified style in document..87. Cost Estimate for RP Implementation of Tinh Gia Subproject

No.	Contents	Cost estimate ('000)
I	Compensation and support cost	
1	Coastal road from Ninh Hai – Lach Bang 2	49,990,134
2	Construct Binh Minh road to Sao Vang – Nghi Son economic zone	80,895,148
3	Upgrade, rehabilitate Do Be bridge and approach roads	12,254,730
4	Construct road from NH1A to Ninh Hai beach	23,645,502
5	Upgrade, rehabilitate Than canal	3,425,200
6	Upgrade, rehabilitate Cau Trang canal	36,209,752
7	Resettlement site	5,000,000
II	Other costs	
1	Appreciation for site handover	450,000
2	Support for housing repair and relocation	4,414,000
3	Cost for site clearance (2% of total compensation and support)	4,345,689
4	Survey of replacement cost	300,000
5	Income/live-hood restoration program cost	3,094,500
6	Independent monitoring	450,000
III	Total	224,474,655

Compensation and supports given to the affected households will be based on the following key principles:

All affected person 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 project affected person. If, by the end of the project, livelihoods have been shown not to be restored to pre-project levels, additional measures will be provided.

Agricultural land cost: Compensation and support for agricultural land will follow the price list issued by the Thanh Hoa PPC at Decision No.4545/2014/QD-UBND issued on 18/12/2014.

Housing construction cost: Values of houses and other structures are determined according to the market price of construction materials at the time of determining the compensation cost in order to build a replacement house with quality and size at least as the old one, or to repair the affected part. The housing construction unit price shall comply with the decision of the provincial People's Committee.

Cost of trees and farm produce: The proposed price for compensation calculation is based on Decision 4437/2016/QD-UBND issued on 14/11/2016 by Thanh Hoa PPC.

5.1.3 Measures to be Implemented During Construction Phase

As discussed in Chapter 3, the potential impacts and main risks that may occur during the construction include: (i) dust, emission, noise, vibration; (ii) wastewater; (iii) solid wastes and hazardous waste; (iv) Surface water quality reduction; (v) Impacts on Biological Resources; (vi) Impacts on urban landscape; (vii) risk of erosion and landslide; (viii) risk of flooding and sedimentation; (ix) traffic disturbance and traffic safety risks; (x) impact on the existing infrastructure and related services; (xi) Disturbance to businesses and daily activities of local people; (xii) Impacts on cultural and historical resources and Chance find procedures; (xiii) Community Safety and Health; (xiv) risk to safety and health of workers and (xv) Communication to local community. In addition, some special impacts by types of work, such as construction of bridge or sensitive locations along the route, dredging and embankment the canals have also been identified.

Below are the mitigation measures to be implemented during the construction phase of the project and presented by category:

General mitigation measures presented as ECOP (Environmental Codes of Practice). ECOP will be applied to all bid packages by the contractors and supervised by the construction supervision consultant (or Engineer).

Mitigation measure applicable to specific types of activities to be carried out; and Site-specific mitigation measures to address site-specific potential impacts and risks

Bidding documents and construction contracts of each bid package will include the entire ECOP and specific mitigation measures by type of construction activity and location consistent with the work content in the bid package.

The contractors will be required to prepare Site-Specific Environmental and Social Management Plan (SESMP) and submit to the Construction Supervision Consultant and the Project Management Unit (PMU) for review and approval at least two weeks prior to construction commencement. The SESMP will be prepared to meet the mitigation requirements described in below.

5.1.4 Environmental Codes of Practice (ECOP)

The mitigation measures for common negative impacts during the construction phase are presented in Tables 5.2 in the form of Environmental Codes of Practices (ECOP). ECOP will be included in all bidding documents and construction contracts of all bid packages to request the contractors to implement. ECOP compliance will be supervised by the Construction Supervision Consultant (CSC) in coordination with PMU.

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

- i. Dust, emission, noise, vibration;
- ii. Wastewater;
- iii. Solid wastes and Hazardous waste;
- iv. Surface water quality reduction;
- v. Impacts on Biological Resources;
- vi. Impacts on urban landscape;
- vii. Risk of erosion and landslide;
- viii. Risk of flooding and sedimentation;

- ix. Traffic disturbance and traffic safety risks;
- x. Impact on the existing infrastructure and related services;
- xi. Disturbance to businesses and daily activities of local people;
- xii. Impacts on cultural and historical resources and Chance find procedures;
- xiii. Community Safety and Health;
- xiv. Risk to safety and health of workers.

Table Error! No text of specified style in document..88. Environmental Codes of Practices (ECOPs)

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
<p>1. Generated dust, emission, noise, vibration</p>	<ul style="list-style-type: none"> - Maintain the level of emission at construction sites within the permissible limit provided for in QCVN 05: 2013/BTNMT: National Technical Regulation on Ambient Air Quality. - Vehicles in Vietnam must undergo a regular emissions check and obtain certification: “Certificate of conformity from inspection of quality, technical safety and environmental protection” following Decision No. 35/2005/QD-BGTVT - Carry out watering for dust control at least 2 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°C, or in windy weather. Avoid overwatering as this may make the surrounding muddy. - Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. - Dust masks should be used by workers where dust levels are excessive - There should be no burning of waste or construction materials on site. - Cement processing plants should be far from residential areas. - Only use transportation vehicles with valid registry. - Neatly gather construction materials and wastes. Arrange for the workers to collect and gather construction materials and wastes to the designated places at the end of each day or shift. - Do not overload the materials/soils and stones to extreme heights onto trucks, as this may result in drops along transportation routes. Tightly cover the trucks carrying wastes and bulk materials before getting out of construction sites or quarries and borrow pits so as to restrict scattering along transportation routes. - Put temporarily gathered materials and waste heaps with a volume of about 20m³ within barriers or covered so as to avoid dust dispersion. - Transport wastes out of construction sites to the designated locations for reuse or to the disposal sites in the soonest possible time. 	<ul style="list-style-type: none"> - QCVN 05: 2013/MONRE: National technical regulation on ambient air quality - QCVN 26:2010/BTNMT: National technical regulation on noise - QCVN 27:2010/BTNMT: National technical regulation on vibration - TCVN 6438-2005: Road vehicles. Maximum permitted emission limits of exhaust gas - Decision No. 35/2005/QD-BGTVT on inspection of quality, technical safety and environmental protection; 	<p>Contractor</p>	<p>PMU, CSC, IEMC</p>

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> - Do not put vehicles and machines to run idle in more than 5 minutes. - Avoid preparations of construction materials such as mixing concrete near local people’s houses or other sensitive works like pagodas, school gates, or offices. - Locate vehicle washing stations at the exit/entrance of big construction sites. - Periodically wash the trucks used for transporting materials and construction wastes. - Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas. Night construction must be informed to the community at least 2 days in advance. - Perform the method of successive construction for each sewer section in construction sites of long sewer lines. - Observe and secure construction progress correctly. - When needed, measures to reduce noise to acceptable levels must be implemented and could include silencers, mufflers, acoustically dampened panels or placement of noisy machines in acoustically protected areas - Avoiding or minimizing transportation through community areas and avoiding as well as material processing areas (such as cement mixing). 			
<p>2. Wastewater management</p>	<ul style="list-style-type: none"> • The Contractor must be responsible for compliance with Vietnamese legislation relevant to wastewater discharges into watercourses. • Employ local workers to limit the amount of generated domestic wastes and wastewater. • Provide septic tanks for toilets for treating wastewater before it can be discharged into the environment. On-site mobile toilets with 3-compartment septic tanks can be used in areas for major work items as traffic roads and canal. Wastewater from toilets as well as kitchens, showers, sinks, etc. shall be discharged into a conservancy tank for removal from the site or discharged into municipal sewerage systems; there should be no direct discharges to any waterbody. 	<ul style="list-style-type: none"> • QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater; • QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> • Wastewater containing pollutants over standards set by relevant Vietnamese technical standards/regulations must be collected in a conservancy tank and removed from site by licensed waste collectors. • Clear ditches around the workers’ camps every week. • Creating ditches for rain water collection and diversion. • Make appropriate arrangements for collecting, diverting or intercepting wastewater from households to ensure minimal discharge or local clogging and flooding. • Before construction, all necessary wastewater disposal permits/licenses and/or wastewater disposal contracts have been obtained. • At completion of construction works, wastewater collection tanks and septic tanks shall be safely disposed or effectively sealed off. 			
<p>3. Solid waste management and Hazardous waste management</p>	<p>Solid waste management:</p> <ul style="list-style-type: none"> • Before construction, a solid waste control procedure (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) must be prepared by the Contractors and it must be carefully followed during construction activities. • Before construction, all necessary waste disposal permits or licenses must be obtained. • Solid waste may be temporarily stored on site in a designated area approved by the CSC and relevant local authorities prior to collection and disposal through a licensed waste collector. • Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. • No burning, on-site burying or dumping of solid waste shall occur. • If not removed off site, solid waste or construction debris shall be disposed of only at sites identified and approved by the CSC 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. 	<ul style="list-style-type: none"> • Decision No, 59/2007/NĐ-CP on garbage management; • Decision No,38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> • Limit waste pollution from litter and drop of materials. Place dustbins at the workers’ camps. • Temporarily collect and separate domestic wastes. Provide watertight dustbins for domestic waste and tightly cover them to avoid giving rise to bad odors and leachate leakage, attracting flies, mice and other pathogenic species. • Perform concrete mixing on impermeable ground. Collect waste and wastewater containing cement through drainage ditches with sedimentation pits in construction sites before being discharged into receiving waters. • Separate the components and parts which can be reused or recycled in the construction wastes before transporting the waste to treatment in accordance with design documents acceptable to the supervision engineer. • Weathered soil, wood and bricks can be reused for useful purposes such as ground leveling. Wood scraps may be used for cooking. Corrugated iron, iron, steel, packing materials and other materials which can be recycled can be delivered and sold to scrap traders. • Collect waste and tidy up construction sites at the end of a working day/shift and the transport waste out of the construction sites in the soonest possible time. If dredged materials are to be temporarily stored, necessary measures must be applied to control pollution such as gathering them within enclosures, under coverings, within fenced areas, etc. with warning signs. • The Contractor will sign a contract with Landfill/waste treatment plant for waste and hazardous waste of Nghi Son Environment., JSC to collect domestic and hazardous waste, conforming to Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and waste materials. • Excavated materials should be reused for levelling the ground/garden land or disposed off in the three disposal sites pre-identified in the ESIA (in Xuan Lam, Tuong Son, Mai Lam) communes (dredged materials would be disposed off at Ben Ngao, Do Be according to Dredging and Dredged Materials Management Plan) 			

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<p>Hazardous waste management:</p> <ul style="list-style-type: none"> • Temporarily collect, store, and transported for treatment all hazardous wastes (road asphalt, waste oil and grease, organic solvents, chemicals, oil paints, etc.) in accordance with Circular No. 36/2015/TT-BTNMT on management of hazardous waste. • At each site or worker camp and maintenance area, the Contractor must arrange storage area or containers for hazardous waste (drum/plastic/composite containers can be used). These containers are only used to store hazardous waste and must be covered and labelled outside as “HAZARDOUS WASTE CONTAINER”. • Sign contracts with for oil and grease to be delivered to suppliers/manufacturers. • Chemical waste of any kind shall be disposed of at an approved appropriate landfill site and in accordance with local legislative requirements. The Contractor shall obtain needed disposal certificates. • The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers. • Used oil and grease shall be removed from site and sold to an approved used oil recycling company. • Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. • Used oil or oil-contaminated materials that could potentially contain PCBs shall be securely stored to avoid any leakage or affecting workers. • Unused or rejected tar or bituminous products shall be returned to the supplier’s production plant. • Relevant agencies shall be promptly informed of any accidental spill or incident. • Store chemicals appropriately and with appropriate labeling. 	<ul style="list-style-type: none"> • Circular No. 36/2015/TT-BTNMT on hazardous waste management; • Decision No.38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> • Appropriate communication and training programs should be put in place to prepare workers to recognize and respond to workplace chemical hazards. • Prepare and initiate a remedial action following any spill or incident. In this case, the contractor shall provide a report explaining the reasons for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions. 			
<p>4. Water pollution</p>	<ul style="list-style-type: none"> • 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 and QCVN 14:2008/BTNMT. • Provide preliminary sedimentation ponds and ditches of storm water runoff at the construction sites. • Provide construction workers on site with mobile toilets. • Avoid excavation and backfilling during rains. • Gather materials and wastes generated during excavation and backfilling, collect and transport them out of the construction site to the approved disposal sites within the soonest possible time. • Do not allow temporary gathering of bulk materials and mixing of concrete within 50m from ponds, lakes, rivers, streams, or other water sources. • Store used and unused oil and petrol in closed containers on impermeable ground covered with roofs and contained within surrounding banks for easy control and collection in case of leakage. Do not locate oil and petrol storages within 25m from rivers/canals. • Collect and transport excavated soils from the construction of sewers and ditches out of the construction site within 24 hours. • Only perform maintenance work of motored vehicles and equipment, including oil replacement or lubrication in designated areas, without allowing chemicals, petrol, oil, or grease to leak onto soil or into the drainage system or water sources. Trays are to be used to hold rags and materials used in maintenance. Collect and discard wastes in accordance with hazardous waste management regulation. 	<ul style="list-style-type: none"> • QCVN 08-MT:2015/BTNMT – National Technical Regulation on surface water quality • QCVN 09-MT:2015/BTNMT: National Technical Regulation on Underground Water Quality • QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater; • QCVN 40: 2011/ BTNMT: National technical regulation on industrial wastewater; • TCVN 7222: 2002: General requirements for concentrated 	<p>Contractor</p>	<p>PMU, CSC, IEMC</p>

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
		wastewater treatment plants		
<p>5. Impacts on plants and aquatic species</p>	<ul style="list-style-type: none"> • The Contractor shall prepare a Clearance, Revegetation and Restoration Management • Plan for prior approval by the Construction Engineer, following relevant regulations. The Clearance Plan shall be approved by the Construction Supervision Consultant and followed strictly by the contractor. Areas to be cleared should be minimized as much as possible. • Limit disturbances to areas with construction operations, especially in locations covered with green trees or vegetation. Do not use chemicals to clear vegetation. • Do not gather materials and wastes at places covered with vegetation or with green trees, but on vacant land instead. • Use sheet pile driving method using Larsen piles to limit impacts on the water quality. • If possible, green trees should be moved and replanted in other places if the trees are in the way of the pipelines to be constructed. • The contractor shall remove topsoil from all areas where topsoil will be impacted by construction activities, including temporary activities such as storage and stockpiling, etc.; the stripped topsoil shall be stockpiled in areas agreed to by the Construction Supervision Consultant for later use in re-vegetation and shall be adequately protected. • Trees cannot be cut down unless explicitly authorized in the vegetation clearing plan. • When needed, temporary protective fencing will be erected to efficiently protect the preserved trees before commencement of any works within the site. • No area of potential importance as an ecological resource should be disturbed unless there is prior authorization from CSC, who should consult 	<ul style="list-style-type: none"> • Law on environmental protection No. 55/2014/QH13 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<p>with PMU, IEMC and the relevant local authorities. This could include areas of breeding or feeding for birds or animals, fish spawning areas, or any area that is protected as a green space.</p> <ul style="list-style-type: none"> The Contractor shall ensure that no hunting, trapping, shooting, poisoning of fauna takes place. 			
<p>6. Impacts on urban landscape and beauty</p>	<ul style="list-style-type: none"> Carefully cover transport vehicles for materials and waste and periodically wash and clean the vehicles. Dismantle the camps as well as other temporary works set up during construction and restore the site before the completed work could be handed over to the subproject owner. Back fill and tightly seal toilet pits, septic tanks, and temporary sewerage ditches. Do not temporarily gather construction materials and wastes within 20m from the gate of schools, offices temples, pagodas, etc. The Contractor will have to work out construction plans in such a way as to avoid the 1st and 15th days of each lunar month if construction is to be carried out near historical and cultural works such as pagodas, temples, etc. Regularly collect materials and wastes and tidy up the construction site. 	<ul style="list-style-type: none"> Law on environmental protection No. 55/2014/QH13 TCVN 4447:1987: Construction regulation Circular No. 22/2010/TT-BXD on requirements on safety 	Contractor	PMU, CSC, IEMC
<p>7. Erosion and landslide risks 8. Flooding, sedimentation, risks</p>	<ul style="list-style-type: none"> Avoid disturbances and damage to the existing vegetation and green trees. Periodically and thoroughly remove soils, stones and wastes from drainage sewers and ditches inside and around the construction site. Neatly gather materials and wastes so as to limit them being swept away by storm water. Carry out ground leveling and rolling after discarding materials at disposal sites. 	<ul style="list-style-type: none"> TCVN 4447:1987: Construction regulation Circular No. 22/2010/TT-BXD: Regulation on construction safety QCVN 08-MT: 2015/BTNMT – National technical regulation on surface water quality 	Contractor	PMU, CSC, IEMC
<p>9. Traffic management</p>	<ul style="list-style-type: none"> Before construction, carry out consultations with local government and community and with traffic police. 	<ul style="list-style-type: none"> Law on communication and 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> • Set up traffic and maintain instruction signs and warnings to secure safety for people and means of transport during construction. • Arrange and provide separate passageway with safe and easy access for pedestrian and for people with disability and mobility issues especially the areas in proximity of schools, including easy wheel chair access and hand rail. Make staff available any time for helping people with disability if needed. • Put speed limit signs at a distance of 200 m from the construction site. • Carefully cover materials on trucks. Do not load to a height of 10 cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users. Collect spilt soils and materials at the construction site each day to avoid slippery incidents for vehicles. • Do not park vehicles in the roads longer than necessary. Do not allow construction vehicles and materials to encroach upon the pavements. • During construction near schools, deploy staff at the site to guide the traffic at the start of school time and when school is over. Water the roads to prevent dust, limit the speed of traveling trucks, do not allow flared horns, and do not dispose the waste and wastewater onto areas near schools. • Install night lighting of all construction sites. • Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. • Installation of lighting at night must be done, if necessary, to ensure safe traffic circulation. • Employ safe traffic control measures, including road/rivers/canal signs and flag persons to warn of dangerous conditions. • Avoid material transportation for construction during rush hours. • Passageways for pedestrians and vehicles within and outside construction areas should be segregated and provide for easy, safe, and appropriate 	<p>transport No. 23/2008/QH12;</p> <ul style="list-style-type: none"> • Law on construction No. 50/2014/QH13; • Law No. 38/2009/QH12 dated 19/6/2009 amending and supplementing some articles of the Law relating to capital construction investment • Circular No. 22/2010/TT-BXD on regulation on construction safety 		

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	access. Signposts shall be installed appropriately in both water-ways and roads where necessary.			
10. Influence on existing infrastructure and services	<ul style="list-style-type: none"> • Provide information to affected households on working schedules as well as planned disruptions (at least 2 days in advance). • The Contractor must only use vehicles of sizes and loads within permissible limits for the roads along such vehicles’ route. • During the construction under power lines, deploy qualified staff to observe and give instructions to the drivers of cranes and excavators so as to avoid causing damages to power lines, telecommunications lines, etc. • Stop construction when existing works are damaged. Identify causes of related incidents and work out solutions. In case the damages are due to the Contractors’ faults, the Contractors have to repair, recover, and compensate for all damages at their own expenses. The results of handling such damages must be approved by the Supervisor Engineer. • Reinstall the road surface and sidewalks at construction sites after the construction of sewer lines has been completed. • The contractor should ensure alternative water supply to affected residents in the event of disruptions lasting more than one day. • Any damages to existing cable utility systems shall be reported to the authorities and repaired as soon as possible. 	<ul style="list-style-type: none"> • Decree No. 73/2010/ND-CP on administrative penalization of violations related to security and social affairs 	Contractor	PMU, CSC, IEMC
11. Social impacts: disturbance to businesses and daily activities of local people	<ul style="list-style-type: none"> • Inform the community at least 2 weeks before commencement of the construction. In case electricity and water supplies are to be disrupted, the PMU must inform PAHs of the same at least 2 days in advance. • Employ local laborers for simple tasks. Instruct workers on environmental issues, safety and health before construction tasks are assigned. It is advisable to communicate to migrant workers on local customs, practices and habits in order to avoid conflicts with local people. • The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area. 	<ul style="list-style-type: none"> • Decree No. 73/2010/ND-CP on administrative penalization of violations against security and social affairs • Circular No. 22/2010/TT-BXD regulation on construction safety 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> • The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. Conduct sensitization campaigns with both workers and communities on these issues, liaison with local organizations to ensure monitoring, and a grievance redress system to which the community can refer to. • The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers. • Workers temporarily residing at the camps and rented houses must be registered with the local authorities for temporary residence. • Train workers on issues related to social security, social evils, diseases and epidemics, prostitution and drug use, environment, safety and health, HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months. • Prohibit workers from: <ul style="list-style-type: none"> + Consuming alcoholic drinks during working time + Quarreling and fighting + Gambling and indulging in social evils such as drug use and prostitution + Disposing of garbage indiscriminately. 	<ul style="list-style-type: none"> • Directive No. 02/2008/CT-BXD on safety and sanitation issues in construction units • TCVN 5308-91: Technical regulation on construction safety • Decision No. 96/2008/QD-TTg on clearance of UXOs 		
<p>12. Control of impacts on physical cultural resources and Chance find procedures</p>	<ul style="list-style-type: none"> • Do not gather materials and wastes within 20m from cultural, historical, and religious works such as temples, pagodas, churches, monuments, historic relics, etc. Spray water the construction sites next to such works. • Do not use machines generating loud noise and high vibration levels near cultural, historical, and religious works. <p>Chance find procedures:</p> <ul style="list-style-type: none"> • In case of archeological objects being unearthed during the implementation of earthwork, all parties will conform to the following procedures: <ul style="list-style-type: none"> + Suspend construction and strictly protect the site where artifacts exposed; 	<ul style="list-style-type: none"> • Cultural heritage Law No. 28/2001/QH10; • Amended/ and supplemented Law on cultural heritage No. 32/2009/QH12; • Amended and supplemented Decree No. 98/2010/ND-CP 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> + The contractor notifies 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. 			
<p>13. Community’s safety and health</p>	<ul style="list-style-type: none"> • The Contractor will have to conform to regulations in Circular No. 22/2010/TT-BXD by the Ministry of Construction on safety in construction. • The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area. 	<ul style="list-style-type: none"> • Circular No. 22/2010/TT-BXD regulation on construction safety • Directive No. 02/2008/CT-BXD on 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> • The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. • Fence of excavation pits and open channels and make off with luminous cordon and warning signs. Provide sufficient lighting when carry out construction at night. • Limit the speed of transport means to 20km/h within 200m from the construction site so as to minimize dust and noise. • Keep noise-generating machines and vehicles at such suitable distances that noise transmitted to residential areas will not be higher than 70dBA. • Use static compacting when the road base is constructed near areas with many households and weak temporary works to restrict vibration. • The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers. 	<p>safety and sanitation issues in construction units</p> <ul style="list-style-type: none"> • TCVN 5308-91: Technical regulation on construction safety • Decision No. 96/2008/QD-TTg on clearance of UXOs 		
<p>14. Workers' health safety</p>	<ul style="list-style-type: none"> • 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. • 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. • Limit the speeds of vehicles traveling inside construction sites to be 5km/hour. • Provide fire-extinguishers, first-aid bags, and medical cabinets with sufficient medicines for treating general diseases in the locality must be provided at construction sites. • Safely store fuels and chemicals 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. 	<ul style="list-style-type: none"> • Decree No. 22/2010/TT-BXD on regulation of construction safety; • Directive No. 02 /2008/CT-BXD on safety and sanitation issues in construction units; • TCVN 5308-91: Technical regulation on safety in construction; • Decision No. 96/2008/QD-TTg on clearance of UXOs. 	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
	<ul style="list-style-type: none"> • In case of chemical and fuel leakage, the following steps will have to be taken: <ul style="list-style-type: none"> + Immediate check must be carried out to detect any possible case of injury. In case of injury, first-aid must be given and the injured person must be rushed to the nearest medical station for healthcare, and at the same time the case must be informed to the Supervision Engineer and the PMU; + Carry assessment to determine the kind of leaking/overflowing fuel/chemical; + Do not flush overflowing chemicals into drainage systems. Send staff with suitable safety gear to the site to handle the leakage by scattering sawdust (in case of small volumes of leaks/overflow) or sand (for high volumes of leaks/overflow). Use shovels to remove the surface soil layer if the leakage/overflow takes place on vacant land; and + Subsequent to the occurrence of such incident or accident, the Contractor will have to prepare a detailed report describing the incident and performed activities and submit the same to the Supervision Engineer and the PMU for consideration and filing. Such report will also be presented to the Department of Natural Resources and Environment or functional agencies at their request. • Set up the camps with sufficient supplies of clean water, power, and sanitation facilities. There must be at least one toilet compartment for every 25 workers, with separate toilets for males and females. Workers’ beds must be provided with mosquito nets so as to prevent dengue fever. Temporary tents will be unacceptable. • Clean camps, kitchens, baths, and toilets and sanitize regularly, and keep in good sanitation conditions. Provide dustbins and collect wastes daily from the camps. Clear drainage ditches around the camps periodically. • Stop all construction activities during rains and storms, or upon accidents or serious incidents 			

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	Supervised by
<p>15. Communication to local community</p>	<ul style="list-style-type: none"> • Open communications channels are to be maintained with the local government and concerned communities; the contractor shall coordinate with local authorities (leaders of local wards or communes, leaders of hamlets) for agreed schedules of construction operations in areas nearby sensitive places or during sensitive times (e.g. religious festival days). • Copies of Vietnamese versions of these ECOPs and of other relevant environmental protection documents shall be made available to local communities and to workers at the site. • Project information will be disseminated to affected parties (e.g. local authorities, enterprises and affected households, etc.) through community meetings before construction commencement. • A contact address will be provided to the community. • The community will be provided with all information, especially technical findings, in a language that is understandable to the general public and in a form convenient to interested citizens and elected officials through the preparation of fact sheets and news releases, when major findings become available during project phase. • Community concerns and requested information are to be monitored as the project progresses. • Inquiries must be responded by telephone and written correspondence in a timely and accurate manner. • Local residents must be informed about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition operations, as appropriate. • Technical documents and drawings will be provided to local People's Committees, especially the sketch of construction areas and the ESMP 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 affected people could have a channel to voice their concerns and suggestions. 	<ul style="list-style-type: none"> • Decree No. 73/2010/ND-CP on administrative penalization of violations related to security and social affairs 	<p>Contractor</p>	<p>PMU, CSC, IEMC</p>

Workers and Workforce Management

A concern during construction phase of the project is the potentially negative impacts of the workforce interactions with the local communities. For that reason, a Code of Conduct shall be established to outline the importance of appropriate behavior, alcohol abuse, and compliance with relevant laws and regulations. Each employee shall be informed of the Code of Conduct and bound by it while in the employment of the Client or its Contractors. The Code of Conduct shall be available to local communities at the project information centers or other place easily accessible to the communities.

The Contractor is responsible for providing appropriate training to all staff according to their level of responsibility for environmental, health and safety matters.

The Code of Conduct shall address the following measures (but not limited to them):

- All of the workforce shall abide by the laws and regulations of the Socialist Republic of Vietnam;
- Illegal substances, weapons and firearms shall be prohibited;
- Pornographic material and gambling shall be prohibited;
- Fighting (physical or verbal) shall be prohibited;
- Creating nuisances and disturbances in or near communities shall be prohibited;
- Disrespecting local customs and traditions shall be prohibited;
- Smoking shall only be allowed in designated areas;
- Maintenance of appropriate standards of dress and personal hygiene;
- Maintenance of appropriate standards hygiene in their accommodation quarters;
- Residing camp workforce visiting the local communities shall behave in a manner consistent with the Code of Conduct; and
- Failure to comply with the Code of Conduct, or the rules, regulations, and procedures implemented at the construction camp will result in disciplinary actions.

Prohibitions. The following activities are prohibited on or near the project site:

- Cutting of trees for any reason outside the approved construction area;
- Hunting, fishing, wildlife capture, or plant collection;
- Buying of wild animals for food;
- Use of unapproved toxic materials, including lead-based paints, asbestos, etc.;
- Disturbance to anything with architectural or historical value;
- Building of fires;
- Use of firearms (except authorized security guards);

- Use of alcohol by workers during working hours;
- Gambling should be strictly forbidden.
- Washing cars or machinery in streams or creeks;
- Doing maintenance (change of oils and filters) of cars and equipment outside authorized areas;
- Disposing trash in unauthorized places;
- Driving in an unsafe manner in local roads;
- Having caged wild animals (especially birds) in camps;
- Working without safety equipment (including boots and helmets);
- Creating nuisances and disturbances in or near communities;
- The use of rivers and streams for washing clothes;
- Indiscriminate disposal of rubbish or construction wastes or rubble;
- Littering the site;
- Spillage of potential pollutants, such as petroleum products;
- Collection of firewood;
- Poaching of any description;
- Explosive and chemical fishing;
- Latrine outside the designated facilities; and
- Burning of wastes and/or cleared vegetation.

Security. Some security measures shall be put into place to ensure the safe and secure running of the camp and its residents. Some of these security measures include:

- The list of workers must be registered to local authorities in accordance with existing Vietnamese regulations
- Children under 14 years of age will not be hired under the Project
- Adequate, day-time night-time lighting shall be provided;
- Control of camp access. Access to the camp shall be limited to the residing workforce, construction camp employees, and those visiting personnel on business purposes;
- Prior approval from the construction camp manager for visitor's access to the construction camp;
- A perimeter security fence at least 2m in height constructed from appropriate materials;
- Provision and installation in all buildings of firefighting equipment and portable fire extinguishers.
- Any construction worker, office staff, Contractor's employees or any other person related to the project found violating these prohibitions will be subject to disciplinary actions that can range from a simple reprimand to termination of his/her employment depending on the seriousness of the violation.

5.1.5 Specific Mitigation Measures

Depending on the scope of work and type of auxiliary items of each bid package, the Contractors will be required to comply with the specific requirements described below. The CSC and PMU shall monitor the Contractor's compliance.

5.1.5.1 Demolition of Existing Infrastructures

The following measures shall be implemented in order to protect workers and the public from falling debris and flying objects:

- Set aside a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels;
- Conduct sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable;
- Maintain clear traffic ways to avoid driving of heavy equipment over loose scrap;

Provide all workers with safety glasses with side shields, face shields, hard hats, and safety shoes.

5.1.5.2 Workers Camps

Workers' Camp and Site Installation Requirement. Potential sites of workers 'camps were discussed with and proposed by local communities and authorities during consultations. Construction camp sites will have to be approved by local authorities and agreed with local communities prior to their establishment. If additional camps and ancillary construction sites are selected, for following criteria must be used:

- Construction sites, including concrete mixing stations and asphalt stations as well as construction camps will minimize the land occupation by setting them at the interchange areas where relatively large areas of land will be needed eventually.
- Site offices shall be located at least 200 meters from any existing residential settlements. Camp facilities should not be located in steep slopes;
- Site offices, camps be located at least 100 meters from any watercourses, and be operated so that no pollutants enter watercourses. Camp areas shall be located to allow effective natural drainage;
- All construction camps shall be zoned according to their use. For example, workers' camp zone, sanitary facilities, offices, etc.
- The workforce shall be provided with safe, suitable and comfortable accommodations. They have to be maintained in clean and sanitary conditions;
- In every site adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein;
- Potable water for human consumption shall be provided for at camps, site offices, medical facilities, and other areas. Potable water shall follow the National Standards for Drinking Water Quality, and the other municipal water will be in accordance with class B1 of QCVN 08-MT:2015/BTNMT - National technical regulation on surface water quality.
- The camp can be characterized as a housing estate, and the water quota could refer to class B1, QCVN 08-MT:2015/BTNMT - National technical regulation on surface water quality.
- Drainage, wastewater treatment and solid waste disposal of the construction site shall follow national regulations and the mitigation measures presented in the Contractor's Waste Management Plan.

Sanitary Facilities. In every camp site separate and adequate lavatory facilities (toilets and washing areas) shall be provided for the use of male and female workers. Toilet facilities should

also be provided with adequate supplies running water, soap, and toilet paper. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions;

- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers “For Men Only” or “For Women Only” as the case may be;
- Sanitary arrangements, latrines and urinals shall be provided in every work place on the following scale: Where female workers are employed, there shall be at least one latrine for every 25 females or part thereof; Where males are employed, there shall be at least one latrine for every 25 males or part thereof;
- At every construction camp, there must be at least one septic tank. The wastewater from the tank shall not be discharged into any watercourses. The wastewater shall be periodically transported away by a water tank to the nearest treatment plant;
- Sewage tanks shall be designed and installed by the Contractor(s) in accordance with the National Design Code for construction of camps.

Medical Facilities. A medical and first aid kit shall be provided at each camp area. All consumables in the first aid kit should be checked and recharged regularly.

5.1.5.3 Earthworks, Cuts and Fill Slopes Management

Earthworks, cuts and fill slopes shall be carefully managed to minimize negative impacts on the environment

- All earthworks shall be properly controlled, especially during the rainy season.
- The Contractor shall maintain stable cut and fill slopes at all times and cause the least possible disturbance to areas outside the prescribed limits of the works.
- The Contractor shall complete cut and fill operations to final cross-sections at any one location as soon as possible and preferably in one continuous operation to avoid partially completed earthworks, especially during the rainy season.
- In order to protect any cut or fill slopes from erosion, in accordance with the drawings, cut off drains and toe-drains shall be provided at the top and bottom of slopes and be planted with grass or other plant cover. Cut off drains should be provided above high cuts to minimize water runoff and slope erosion.
- The Contractor shall use the excavated material from for filling unless the CSC consider the material unsuitable for filling;
- Any excavated cut or unsuitable material shall be disposed of in designated disposal areas as agreed to by the CSC;

5.1.5.4 Dredging and Dredged Materials Management Plan

Prior to construction, the contractors shall prepare a specific DMMP based on the updating of the DMMP (see the Annex 2). The contractor’s DMMP shall be submitted to the Construction Supervision Consultant for approval before starting the work. The dredging plan will indicate volumes, physical-chemical-biological properties of dredged material, dredging procedures, temporary gathering of dredged materials, and control of polluting material during temporary gathering and transportation, pollution control, and risks at disposal sites.

For Than canal, dredging activities will not be conducted in flood season (from May to September), during extreme weather events (heavy rains, floods, cyclones, etc). Successive dredging method will be applied. Dredge half width of each section of canal from 100m to 200 m, upstream to downstream. The remaining half width will be retained to maintain drainage and irrigation functions of the canal. For each section, coffer dams made of eucalyptus timber and sand bags shall be built surrounding half of canal with where dredging will take place. Pump river water out of the dredging section. Use excavators and buckets to dredge the Than canal to the designed elevation.

When repairing sluice gate, in order to minimize the risk of saltwater intrusion from Lach Bang River to the water quality of Than canal, the following measures should be taken:

- Setup coffer dams made of eucalyptus timber or steel sheet pile and sand bags in front of sluice gate to prevent saltwater intrusion in Lach Bang river. This activity should be done at the time of low tide to reduce the maximum salinity water in the area to be repaired.
- Pump saltwater water in the dyke area to prevent the water back to Lach Bang river then repair sluice gate.
- Construction work should be carried out quickly and only in dry season to ensure flood drainage function of the sluice gate in rainy season.

Some pictures illustrating coffer dams



5.1.5.5 Stockpiles, Quarries and Borrow Pit

Existing borrow pits or quarries located near the project area will be used. However, in case that new borrow pits and quarries are needed, the Contractor shall carry out the following activities:

- Locations of stockpiles, quarries and borrow pits shall be identified and demarcated, ensuring that they are far away from critical areas such as steep slopes, erosion-prone soils, cultivated lands, and areas that drain directly into water bodies. Locations of stockpiles, quarries and borrow pits shall be in non-productive land to the maximum extent possible and be approved by DONRE, PMUs the ECO;
- Location of stockpiles, quarries, and borrow pits shall avoid sensitive areas such as nature reserves, scenic spots, forest parks, water source protection areas, etc.;
- An open ditch shall be built around the stockpile site to intercept wastewater;
- Limit extraction of material to approved and demarcated quarries and borrow pits;
- Stockpile topsoil when first opening the borrow pit. After all usable borrow has been removed, the previously stockpiled topsoil should be spread back over the borrow area and graded to a smooth, uniform surface, sloped to drain. On steep slopes, benches or terraces may have to be specified to help control erosion;
- Excess overburden should be stabilized and re-vegetated. Where appropriate, organic debris and overburden should be spread over the disturbed site to promote re-vegetation. Natural re-vegetation is preferred to the extent practicable;
- Existing drainage channels in areas affected by the operation should be kept free of overburden;
- Prior to the initiation of construction, the materials stockpiles shall be constructed with peripheral storm water drains and interception ditches to divert storm water into rivers downstream, in order to avoid direct erosive impact from storm water. If necessary, sedimentation ponds will also be constructed to remove sands and other solids in storm water before it reaches Than canal downstream.

- The design document indicates that the largest percentage of spoils will be rocks and stones. Thus in order to reclaim the stockpiles after dumping of spoils is completed, the top soil shall be removed before the site is cleared. The top soil will be placed on a corner of the disposal site. The location and pile structure will be taken into consideration for erosion control. The interception ditches and sedimentation ponds in the disposal sites will also be used to control loss of top soil due to erosion;
- The Contractor shall ensure that all borrow pits used are left in a trim and tidy condition with stable side slopes, re-establishment of vegetation, restoration of natural water courses, avoidance of flooding of the excavated areas wherever possible so no stagnant water bodies are created which could breed mosquitoes;
- When the borrow pits cannot be refilled or reasonably drained, the Contractor shall consult with the local community to determine their preference for reuse such as fish farming or other community purposes;
- No foreign material generated/ deposited during construction shall remain on site;
- Areas affected by stockpiling shall be reinstated to the satisfaction of the CSC.

5.1.5.6 Spoil Disposal Sites

If the Contractor proposes any new sites as disposal sites during the construction phase, they have to be approved by PMU and relevant local authorities. The contractor should ensure that these sites (a) are not located within designated forest or cultivated areas, or any other properties; (b) do not impact natural drainage courses; and (c) where they can cause future slides, (d) do not impact endangered/rare flora. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas. The final use of the disposal site shall be approved by the local government.

Besides the requirements for the location of spoil disposal sites, the following actions shall be put into place:

- Land owners shall be compensated if farmland is occupied for disposal sites;
- Before the commencement of the disposal operation, 30 cm of natural soil from the surface shall be first removed and stored at the site. This material will be reserved and used at the end of the disposal operation as cover material for the rehabilitation of the disposal site.
- If the disposal site would be located near a river or water course, a retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities. The surface runoff shall be retained and settled first before allowed discharge into the receiving water;
- To ensure the stability of the spoil disposal site, the mortar rubble masonry pavement and grouted rubble toe protection shall be adopted to prevent erosion and maintain stability.
- A drainage ditch shall be built around the disposal site to control surface runoff;
- The construction of disposal sites and transportation of spoils at night is strictly prohibited near residential areas. The sites shall be watered for dust suppression during their operation;
- Disposal sites close to patches of agricultural land will be limited in size to avoid damages to crops;

For Final Disposal Sites:

- Level the materials after being disposed off
- Slopes of the dumps will not be steeper than 45°
- Build/create the walls to protect slopes
- Create and maintain drainage surrounding each disposal area if the dumps make ground level higher than the surroundings.

5.1.5.7 Demolition of existing and Reconstruction of Do Be bridge:

- Inform the local authorities and communities of the construction plan and schedule, block off and demolition of the existing bridge, or any temporary disruption of services at least one month before start of the construction.
- Install signboard directing the traffic diversion 600m from the bridge before the existing bridge is blocked off for demolition and reconstruction.
- Provide a temporary bridge for the local traffic.
- Fence off the demolition area by metal sheet of at least 2.5m high to ensure safety for people.
- Use net to protect materials from falling down.
- Signboards and fences shall be placed and maintained to safely block off access to the two ends of the existing bridge. Allocate staff to guard the site 24 hours per day. Ensure adequate lighting at night time.
- Use steel Larsen pipe driving method to construct the coffer dam for bridge foundation.
- Prohibit discharge or dumping of any wastewater, slurry, waste, fuels and waste oil into Than canal. All these materials must be collected and disposed of on land at the banks. The slurry and sediment shall also pump to the banks for disposal and shall not be allowed to discharge to Than canal directly.
- Use the mobile toilets to avoid polluting the surrounding environment
- During the construction phase, the contractor would arrange the marker posts, construction site signs, speed limit signs at the proper distance that easily visible of traffic participants. Staff must be deployed to keep an outlook on the traffic and give instructions and warnings, especially when vehicles come in and out of the construction sites or stop for loading and unloading of materials and waste.
- Reasonably arrange time for materials transportation that avoid the peak hours from 6 am to 8 am and from 4 pm to 6 pm.
- Regularly maintain, repair roads used for transporting the construction materials.
- Request drivers to control the speed as prescribed: maintain vehicle speed to ensure the safety in accordance with regulations for the vehicles on the road when crossing the localities.
- Strictly prohibit to use the air horn when crossing through the residential areas.
- Restrict the construction activities at night. If the construction activities at night are unavoidable or disrupt services (supplying electricity, water, etc.), the community must be informed at least one week in advance.
- Restore the damaged infrastructure after construction completion.

5.1.5.8 Construction of New Bridge (Son Hai bridge)

- The bridge works shall be scheduled to avoid the high flow season;
- Local authority and community shall be informed about the construction works the existing bridge with at least two weeks notice.
- Equip life jackets, safety belts, ear plugs to workers when building bridge over Than canal or streamline.
- Life vests and protective equipment are provided to the workers and enforce the use when working in or above water surface, especially during construction of bridge abutments (2-3m high above the water surface);
- For bridge construction, the waste shall be controlled strictly to restrict discharge or dumping of any wastewater, slurry, waste, fuels and waste oil into the water. All these materials must be collected and disposed of on land at the banks. The slurry and sediment shall also pump to the banks for disposal and shall not be allowed to discharge to Than canal directly;
- After bridge construction, the disturbed area shall be reinstated.

- Concrete mixing directly on the ground shall not be allowed and shall take place on impermeable surfaces;
- All runoff from batching areas shall be strictly controlled, and cement-contaminated water shall be collected, stored and disposed of at the approved site;
- Unused cement bags shall be stored out of the rain where runoff won't affect it; Used (empty) cement bags shall be collected and stored in weatherproof containers to prevent windblown cement dust and water contamination.;
- All excess concrete shall be removed from site on completion of concrete works and disposed of. Washing of the excess into the ground is not allowed. All excess aggregate shall also be removed.
- In the course of bore pile driving, the use of bentonite must be conducted inside a cofferdam made of earth or steel to prevent any spillage from overflowing into the environment and all the mixture of soil and bentonite and bentonite spilled over must be collected and the following forms of processing any spillage are recommended
- Construction of bridge pier (abutments) on land: spillage of mixture of soil and bentonite although liquefied and bentonite will be primarily handled: Waste solution of bentonite will be collected into a collector drain, sump or cistern to avoid direct discharge within the construction site, then it will be deposited, preliminary dried and transported for disposal at a designated location either for recycling or recovering the bentonite;
- Construction of piers adjacent to the flow: soil mixed with bentonite, even liquefied, and spilled bentonite will be either moved to storage yards on the shore or placed in containers for depositing or drying and then transported to indicate waste dumps for recycling and recovering the bentonite.
- For any in water construction for bridges, there shall be strict waste control plan to restrict discharge or dumping of any directly discharge of wastewater, slurry, waste, fuels and waste oil into the water. All these materials must be collected and disposed at the banks. The slurry and sediment shall also pump to the banks for disposal and shall not be allowed to discharge to Than canal directly;
- Reinstatement of watercourse crossings shall be carried out, including generic methods for all watercourse crossings and site-specific methods statements for significant or sensitive watercourse crossings;
- After bridge construction, the works area, stream diversion, settlement pond areas and temporary bypasses shall be reinstated to the satisfaction of the ECO and SES.

5.1.5.9 Safety during Blasting:

Small blasting is envisaged under the project for the coastal road work on Km 3+190 to Km 3+500 which runs through steep rock. No house is in the project site at these road sections. Blasting method is electric ticking time explosion with a hole diameter of 30-50mm ÷ and 2-2,5m depth.

- The explosion of mines must comply with the safety rules on explosion of mines promulgated by the State in Decree No. 39/2009/ND-CP dated April 23, 2009 of the Government on industrial explosives.
- Explosives and related equipment must be transported in specialized and highly safe equipment; Detonators must be stored in closed and shockproof box. Speed is limited to max 20k/ h for vehicle transporting explosive material and equipment. During the transport, any collision must be avoided and smoking is prohibited. Vehicles must be 50 m distant from each other. Fire prevention equipment must be available.
- Organize the safe storage and supply of explosives. Make a construction diary book to record all the receipts and deliveries of explosives and detonators.
- Before blasting is carried out, a detailed survey shall be conducted at nearby

- communities to evaluate the degree of impacts due to the blasting activity (e.g. possible damage to structures or infrastructure due to vibration, effects on animals, local residents, etc.). No blasting shall be allowed during nighttime unless prior approval is obtained from the government authority and the CSC.
- Define the scope of guard, guardian and shelter at time of explosion. Define and announce the time of explosion. The radius of danger zone must be calculated according to the conditions at the site and in compliance with regulations on safety and storage, transport and use of explosives.
 - Before carrying out the explosion for demolition, it is obliged to carry out the check and acceptance of each hole of explosive and the explosion grid, etc., in compliance with the regulations on check and acceptance of the drilling and mine explosion works. At the working locations, establish signboards and orders announcing the time of mine explosion ...from the commander-in-chief of the explosion for destruction work.
 - Clear the site, use a chainsaw and by hand to cut down trees within the construction area to prevent the construction process from any possible interruption. Non-duty persons are prohibited to enter the blasting area and the traffic must be temporarily suspended for a short period of time to ensure absolute safety against the explosion.
 - The Contractor shall take necessary precautions to prevent damage to special features and the general environment; organize the protection of dangerous area with signals, signboards, monitoring and command station within the limited boundaries of the explosion area.
 - Announce in advance the explosion to authorities of the locality and to local people and explain the signals.
 - People should be at least 200 m away from the blasting point;
 - For the transportation, storage, process, package on site, connect, blasting and the disposal of the blasting, the procedure shall be in accordance with the Vietnamese regulations on Blasting;
 - Except for detonation, all the power and the light shall be turned off;
 - The excavation face shall be on the same level with the lining of surface. The distance is defined according to the factors of the intensity of the concrete and the character of the wall rock;
 - The safety examination shall be fulfilled after the blasting, whose the procedure shall be performed according to the Vietnamese regulations on blasting;
 - The quantity of blasting materials shall be carefully controlled according to the real situation.

5.1.6 Site- Specific Mitigation Measures

5.1.6.1 The Coastal Road

The site-specific mitigation measures for the coastal road are presented in Table 5.3 below.

Table Error! No text of specified style in document..89. Site-specific Mitigation Measures along The Coastal Road

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
<i>Section 1: Start point intersecting with the planned coastal road</i>					
Km 0+00 - Km 0+500	<p>Agricultural land area</p>  <p>From km 0+240 - 0+500, the road surface will be 2 m above existing ground level</p>	<ul style="list-style-type: none"> - Elevated road may block/alternate existing drainage pattern which lead to localised flooding in crop land - Construction materials and waste may fill up agricultural land and irrigation ditches - Disturb access to agricultural land by farmers - Increased bush fire risks if the workers set fire uncontrolly surrounding the construction area, particularly in dry season - Insects, reptiles may appear in construction areas when their habitats are disturbed, they may attack the workers and cause injuries 	<ul style="list-style-type: none"> - Build compensatory ditch, clean up drainage ditch regularly to maintain hydrological connection between the two sides of the road; - Protect, cover the construction area from falling into crop land, clean up materials if crop land/ditch are filled up; - Provide safe and convenience access for the farmers to travel from one side of the road to the other - The workers are not allow to set fire if not authorized; - Provide protective clothes particularly booths and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them 	Contractors	PMU, CSC, IEMC
Km 0+500	 <p>Le Van ancestral temple</p>	<ul style="list-style-type: none"> - Dust may affect the temple structure - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors 	<ul style="list-style-type: none"> - Do not load materials and waste within 20 m from the temple - Water the construction areas located within 100 m from the temple in hot, dry day - Minimise the volume of materials and wastes temporarily loaded in the area and minimize the activities that generate noise in the 1st and 15th of lunar month - Enforce compliance to the workers of conduct particularly with regards to language and behaviours when present in the area near the temple 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
<p>Km 0+50 0 Km 1+100</p>	 <p>Residential area</p> <p>The road surface at this section will be 1.5 m above existing ground level</p>	<ul style="list-style-type: none"> - Safety risks to the Public in residential areas - Increased level of dust and noise - Construction materials and waste may fill up agricultural land and irrigation ditches - Fragmentation of community at the end section - Localised flooding risks at section passing populated residential clusters - Disturbance on access and daily activities of households due to dust, noise, excavation, movement of trucks etc. in populated residential area - Risks of cracking/damages to existing weak structure, if any - Traffic disturbance and increased traffic safety risks on existing local roads 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when travelling on local road and passing residential areas - Provide safe and convenience access for local residents to travel from one side of the road to the other - Protect materials from falling into agricultural land and ditch, clean up if materials drop in there - Water the construction areas located within 100 m from the residential area at least twice in a hot, dry day - Minimise the volume of materials and wastes temporarily loaded within 100 m from the residential area - Avoid carrying out construction at night time in the area within 100 m from residential areas. If not avoidable, inform communities at least two days in advance - Minimise the volume of materials temporarily loaded within 20 m from any house, clean up drainage ditches if they are filled up - Carry out inventory before road surface compaction and use static compaction method in areas where weak structures are identified - Clean up materials dropped on local road daily 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 1+150	 <p>Kindergarten Ninh Hai commune</p>	<ul style="list-style-type: none"> - Traffic safety risk on the access road during peak hours: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 	<ul style="list-style-type: none"> - Minimise the number of trucks leaving construction sites during the peak hours - Arrange staff to direct traffic on this section on peak hours during peak construction period 	Contractors	PMU, CSC, IEMC
Km 1+150 to Km 1+300	 <p>Residential area</p>	<ul style="list-style-type: none"> - Increased safety risks to the Public - Increased level of dust and noise - Fragmentation of community - Localised flooding risks - Disturbance on access and daily activities of households due to dust, noise, excavation, movement of trucks etc. - Risks of cracking/damages to existing weak structure, if any - Traffic disturbance and increased traffic safety risks on existing local roads 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when travelling on local road or passing residential areas - Provide safe and convenience access for local residents to travel from one side of the road to the other - Water the construction areas located within 100 m from the residential area at least twice in a hot, dry day - Minimise the volume of materials and wastes temporarily loaded within 10 m from any house, clean up drainage ditches if they are filled up - Avoid carrying out construction at night time in the area within 100 m from residential areas. If not avoidable, inform communities at least two days in advance 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
			<ul style="list-style-type: none"> - Carry out inventory before road surface compaction and use static compaction method (instead of vibration) in areas where weak structures are identified - Place speed limit or detour signs on the affected existing road - Clean up materials dropped on local road daily 		
Km 1+300	 <p>General Truong Cong Xuan relic</p>	<ul style="list-style-type: none"> - Dust may affect the structure - Noise may disturb worshipping activities on 1st and 15th lunar month - Material and wastes may affect landscape and hinder access, - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors - Risks of traffic disturbance, accidents and safety on access road 	<ul style="list-style-type: none"> - Do not load materials and waste within 20 m from the relic - Water the construction areas located within 100 m from the relic in hot, dry day - Minimise the volume of materials and wastes temporarily loaded in the area and minimize the activities that generate noise in the 1st and 15th of lunar month - Enforce compliance to the workers of conduct particularly with regards to language and behaviours when present in the area near the temple - Do not load construction materials and wastes within 10 from access road during 1st and 15th lunar month 	Contractors	PMU, CSC, IEMC
Km 1+300 to Km 1+700		<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads - Disturb, interrupt traffic on the local road 	<ul style="list-style-type: none"> - Clean up crop land and drainage ditches if they are filled up by construction materials - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly booths and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
	Agricultural land area		<ul style="list-style-type: none"> - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road daily 		
Km 1+500	 General Pham Van Doan relic	<ul style="list-style-type: none"> - Traffic disturbance on access road - Material and wastes may affect landscape and hinder access. - Dust may affect the structure - Noise may disturb worshipping activities on 1st and 15th lunar month - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors - Traffic disturbance on access road 	<ul style="list-style-type: none"> - Minimise the volume of materials and wastes temporarily loaded in the area and minimize the activities that generate noise in the 1st and 15th of lunar month - Enforce compliance to the workers of conduct particularly with regards to language and behaviours when present in the area near the temple - Do not load construction materials and wastes within 10 from access road during 1st and 15th Lunar month. 	Contractors	PMU, CSC, IEMC
Km 1+700 to Km 1+900	 Residential area	<ul style="list-style-type: none"> - Safety risks to the Public - Traffic disturbance and increased traffic safety risks on village roads - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries 	<ul style="list-style-type: none"> - Protect materials from falling into crop land/ditch. Clean up these if they are filled up by construction materials/wastes - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road daily 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 1+900 to Km 2+400	 <p>Agricultural land area along the route</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries 	<ul style="list-style-type: none"> - Protect materials from falling into crop land/ditch. Clean up these if they are filled up by construction materials/wastes - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them 	Contractors	PMU, CSC, IEMC
Km 2+400 to Km 2+900	 <p>Residential area</p>	<ul style="list-style-type: none"> - Safety risks to the Public - Increased level of dust and noise - Fragmentation of community - Localised flooding - Disturbance on access and daily activities of households due to dust, noise, excavation, movement of trucks etc. - Risks of cracking/damages to existing weak structure, if any - Traffic disturbance and increased traffic safety risks on existing local roads 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when travelling on local road or passing residential areas - Provide safe and convenience access for local residents to travel from one side of the road to the other - Water the construction areas located within 100 m from the residential area at least twice in a hot, dry day - Minimise the volume of materials and wastes temporarily loaded within 10 m from any house, clean up drainage ditches if they are filled up - Avoid carrying out construction at night time in the area within 100 m from residential areas. If 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
			not avoidable, inform communities at least two days in advance - Carry out inventory on existing weak structures along the road to determine the locations that static vibrations should be applied - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped at the intersection with the local road daily		
Km 2+900 to Km 3+500	 <p>Agricultural land area along the route</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads, particularly on the road to the beach. 	<ul style="list-style-type: none"> - Clean up crop land and drainage ditches if they are filled up by construction materials - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them - Avoid or minimize construction activities at this section during peak tourist season - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road daily 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
<p>Km 3+50 0 to 4+90 0</p>	 <p>Residential area; Agricultural land area</p>	<ul style="list-style-type: none"> - Safety risks to the Public - Increased level of dust and noise - Fragmentation of community - Disturbance on access and daily activities of households due to dust, noise, excavation, movement of trucks etc. - Risks of cracking/damages to existing weak structure, if any - Construction materials and waste may fill up agricultural land and irrigation ditches - Disturbance on accessibility to agricultural land - Traffic disturbance and increased traffic safety risks on existing local roads 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when travelling on local road or passing residential areas - Water the construction areas located within 100 m from the residential area at least twice in a hot, dry day - Carry out inventory of weak structure, apply static compaction method at risky locations. - Provide safe and convenience access for the residents to their houses and farmers to travel between the two sides of the road when existing access is disturbed - Clean up crop land and drainage ditches if they are filled up by construction materials - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road daily 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 5+00 to Km 5+600	 <p>Agricultural land area</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Disturb access to crop land - Traffic disturbance and increased traffic safety risks on existing local roads 	<ul style="list-style-type: none"> - Clean up crop land and drainage ditches if they are filled up by construction materials - Provide safe access to crop land along the road for the farmers - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road near construction site regularly 		
Km 5+300	 <p>Son Hai bridge: reinforced concrete, B=21m, L=90m. Pile driving: 40 m deep</p>	<ul style="list-style-type: none"> - Risks of Over clearance of trees and vegetation cover at the two ends of the bridge - surface water quality degraded due to construction materials, excavated/ drilling materials, and bentonite - Injury risks for the workers: falling onto the canal, bush insects bite 	<ul style="list-style-type: none"> - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Avoid temporary loading oil tanks, construction materials, wastes etc. within 20 from the river, protect slopes and create ditches with sedimentation traps surrounding the foot of material/waste dumps - Do not wash construction equipment directly in the river - Provide protective clothes and enforce the workers to use, particularly boots, hard hats, life vest - If insects are found, try to drive them away instead of killing them 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 5+640	 <p>Ending point section 1 (intersects with the approach road Do Be bridge)</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up agricultural land and irrigation ditches - Access to crop land may be disturbed - Traffic disturbance and traffic safety risks on the existing approach road. 	<ul style="list-style-type: none"> - Prevent materials from falling into crop land and ditch. Clean up if they are filled up by construction materials/wastes - Provide safe access to crop land for farmers when existing access is disturbed - Place speed limit sign on the affected existing road - Arrange staff to direct traffic when trucks carrying bulky material moving in and out near the intersection - Clean up materials dropped at the intersection on the approach road daily 	Contractors	PMU, CSC, IEMC
<i>Section 2: Approach road Do Be bridge (Km 5+640)</i>					
Km 5+640 to Km 6+00	 <p>Residential area</p>	<ul style="list-style-type: none"> - Safety risk and disturbance to the residential area - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads, 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster and at the intersection with local road; - provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when travelling on local road or passing residential areas - Water the construction areas located within 100 m from the residential area at least twice in a hot, dry day 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 6+00 to Km 7+600	 <p>Agricultural land</p>	<ul style="list-style-type: none"> - Construction materials and waste may fill up irrigation ditches - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads. 	<ul style="list-style-type: none"> - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Provide safe access to crop land for farmers when existing access is disturbed - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road daily 	Contractors	PMU, CSC, IEMC
Km 7+900	 <p>Khanh Pagoda</p>	<ul style="list-style-type: none"> - Material and wastes may affect landscape and hinder access, - Noise may disturb worshipping activities on 1st and 15th Lunar month - Unsuitable language or behaviours of workers may be offensive to the relic keeper and visitors 	<ul style="list-style-type: none"> - Do not load materials and waste within 20 m from the temple - Water the construction areas located within 100 m from the temple in hot, dry day - Minimise the volume of materials and wastes temporarily loaded in the area and minimize the activities that generate noise in the 1st and 15th of Lunar month - Enforce compliance to the workers of conduct particularly with regards to language and behaviours when present in the area near the temple 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 7+900 to Km 9+700	 <p>Agricultural land</p>	<ul style="list-style-type: none"> - Disturb access to crop land - Materials and wastes may fill up irrigation ditch 	<ul style="list-style-type: none"> - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Provide safe access to crop land for farmers when existing access is disturbed 	Contractors	PMU, CSC, IEMC
Km 9+700 to Km 10+00	 <p>Residential area</p>	<ul style="list-style-type: none"> - Increased safety risks and disturbance to local residents - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries - Traffic disturbance and increased traffic safety risks on existing local roads. 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when travelling on local road or passing residential areas - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road daily 	Contractors	PMU, CSC, IEMC

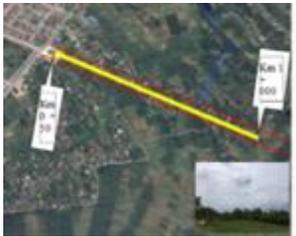
Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 10+640	 <p>Ending point Section 2 (approach road of Lach Bang 2 bridge)</p>	<ul style="list-style-type: none"> - Access through existing bridge will be disturbed - Traffic disturbance 	<ul style="list-style-type: none"> - Place warning and speed limit signs, and reflective bands along the bridge - provided adequate lighting at night - Apply speed limit at 10 km/h to trucks when travelling on the bridge. 	Contractors	PMU, IEMC, CSC

5.1.6.2 Road from Binh Minh to Sao Vang - Nghi Son EZ

The relevant site-specific mitigation measures along the road from Binh Minh to Sao Vang - Nghi Son EZ listed in Table 5.4 will be included into construction bidding and contractual documents of each bid package.

Table Error! No text of specified style in document..90. Site-specific Mitigation Measures along The Road from Binh Minh to Sao Vang - Nghi Son EZ

Location	Sensitive receptors	Impacts	Site-specific Mitigation Measures	Responsibility	Supervision
Km 0+00 - Km 0+050	 <p>Beginning point at the intersection with NH1A</p>	<ul style="list-style-type: none"> - Traffic disturbance and increased traffic safety risks at the intersection with NH1A and near the petrol station 	<ul style="list-style-type: none"> - Place “road works” and “reduced speed” signs on NH1A at 50 m from the intersection and from the petrol station 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Site-specific Mitigation Measures	Responsibility	Supervision
	 <p>The petrol station</p>				
<p>Km 0+050 to Km 1+000:</p>	 <p>Residential area; Agricultural land area</p>	<ul style="list-style-type: none"> - Increased safety risk and disturbance to local community - Construction materials and waste may fill up irrigation ditches - Accessibility to crop land may be interrupted - Risks of vegetation over clearance - Insects and reptiles may attack the workers and cause injuries 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when passing residential areas - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Provide safe access to crop land for farmers when existing access is disturbed - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>

Location	Sensitive receptors	Impacts	Site-specific Mitigation Measures	Responsibility	Supervision
Km 1+000 to Km 1+080	 Cemetery area	<ul style="list-style-type: none"> - Disturb access to graves and worshipping activities, particularly on 1st and 15th of lunar month - Insects may attack the workers 	<ul style="list-style-type: none"> - Mark construction area, minimise disturbed area on the ground - Do not let materials and waste block access to graves - Minimise construction activities during 1st, 15th of lunar month or when there are events at the cemetery - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them. 	Contractors	PMU, CSC, IEMC
Km 1+080 to Km 1+880	 Agricultural land area	<ul style="list-style-type: none"> - Disturb access to crop land - Materials and wastes may fill up crop land and irrigation ditch - Disturbance and increased traffic safety risks at the intersection with commune road - Risks of materials and wastes falling into the Cau Trang canal 	<ul style="list-style-type: none"> - Prevent materials from falling into the irrigation ditch and the Cau Trang canal. Clean up if irrigation ditch is filled up by construction materials/wastes - Provide safe access to crop land for farmers when existing access is disturbed - Place speed limit and/or detour signs on the affected existing road - Clean up materials dropped on local road daily - Provide adequate lighting at the intersection at night time - Protect, prevent materials and wastes from falling into the Cau Trang canal 	Contractors	PMU, CSC, IEMC
Km 1+880 to Km 2+080	 Residential area, Agricultural land area	<ul style="list-style-type: none"> - Community disturbance and increased safety risks - Disturb access to crop land - Crop land and irrigation ditch may be filled up - Traffic disturbance and increased traffic safety risks at the intersection with commune road. 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when passing residential areas - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Provide safe access to crop land for farmers when existing access is disturbed - Place speed limit and/or detour signs on the affected existing road 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Site-specific Mitigation Measures	Responsibility	Supervision
			- Clean up materials dropped on local road daily		
Km 2+080	 <p>Ending point End point intersecting with the coastal road</p>	- Traffic disturbance and increased traffic safety risks at the intersection with the coastal road	- Place speed limit and/or detour signs on the affected existing road - Provide adequate lighting at night time - Clean up materials dropped on local road daily	Contractors	PMU, CSC, IEMC

5.1.6.3 Do Be bridge and Approach Roads

The relevant site-specific mitigation measures along Do Be bridge and approach roads listed in Table 5.5 will be included into construction bidding and contractual documents of each bid package.

Table Error! No text of specified style in document..91. Site-specific Mitigation Measures along Do Be Bridge and Approach Roads

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Upgrading the western approach road of Do Be bridge (L=220 m)	 <p>The alignment is coincided with the existing road</p>	- Disturb access to crop land - Crop land and irrigation ditch may be filled up - Risks on Over clearance of vegetation - Insects from bush may attack the workers - Spreading of invasive plants into agricultural land	- Provide safe access to crop land for farmers when existing access is disturbed - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
			<ul style="list-style-type: none"> - Invasive plant must be burnt onsite before transported away to prevent seeds spreading at disposal area 		
Do Be bridge over Than canal (L=70 m)	 <p>3 piles will be driven into the river bed and two abutments will be built</p>	<ul style="list-style-type: none"> - Disruptions of traffic on the existing bridge - Accident risks to the public underneath during bridge demolition - Place 5km/h speed limit, warning sign, reflective bands along the temporary bridge if built - Surface water quality degraded due to construction materials, excavated/ drilling materials, and bentonite - Injury risks for the workers: falling onto the canal, bush insects bite 	<ul style="list-style-type: none"> - Prior to construction commencement, the contractor must prepare traffic and traffic safety management plan for this site and submit to CSC for review and approval - Detour heavy load vehicles to the nearby bridges - Inform local community at least two weeks and repeat every day before bridge demolition - Install nests and fences on/ surrounding the existing bridge until demolition is completed - Avoid temporary loading oil tanks, construction materials, wastes etc. within 20m from the river, protect slopes and create ditches with sedimentation traps surrounding the foot of material/waste dumps - Do not wash construction equipment directly in the river - Provide protective clothes and enforce the workers to use, particularly boots, hard hats, life vest - Avoid pile driving at night time 	Contractors	PMU, CSC, IEMC
The eastern approach road of Do Be bridge (L=220 m):	 <p>Residential area, of which: 9 business households</p>	<ul style="list-style-type: none"> - Increased dust and noise level - Traffic disturbance and increased traffic safety risks - Temporarily disrupt business activities 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; - provided adequate lighting at night - Avoid loading materials and wastes within 20 m from houses and shops - Spray the disturbed area within 50 m from any house and shops - Minimise disturbance to entry/exit at the petrol station. 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
	 <p>The petrol station; The alignment is coincided with the existing road</p>				

5.1.6.4 Road from NH1A to Ninh Hai Beach

The relevant site-specific mitigation measures along the road from NH1A to Ninh Hai beach listed in Table 5.6 will be included into construction bidding and contractual documents of each bid package.

Table Error! No text of specified style in document..92. Site-specific Mitigation Measures along The Road from NH1A to Ninh Hai Beach

Location	Sensitive receptors	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
Km 0+00:	 <p>Beginning point at the intersection with NH1A</p>	<ul style="list-style-type: none"> - Traffic disturbance - Increased traffic safety risks, particularly at the junction 	<ul style="list-style-type: none"> - Place “road works” and “reduced speed” signs on NH1A at 50 m from the intersection and from the petrol station - Provide adequate lighting at night time - Ensure adequate vision for drivers from NH1A at section near the junction 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
Km 0+000 to 0+100:		<ul style="list-style-type: none"> - Increased dust and noise level at residential area - Increased safety risks at the residential area - Disturb access to crop land - Crop land and irrigation ditch may be filled up - Risks on Over clearance of vegetation - Insects from bush may attack the workers - Traffic disturbance and increased traffic safety on existing local road 	<ul style="list-style-type: none"> - Provide safe access to crop land for farmers when existing access is disturbed - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them - Invasive plant must be burnt onsite before transported away to prevent seeds spreading at disposal area 	Contractors	PMU, CSC, IEMC
Km 0+100 to 0+200	 <p style="text-align: center;">Cemetery area</p>	<ul style="list-style-type: none"> - Disturb access to graves and worshipping activities, particularly on 1st and 15th of lunar month - Insects may attack the workers 	<ul style="list-style-type: none"> - Mark construction area, minimise disturbed area on the ground - Do not let materials and waste block access to graves - Minimise construction activities during 1st, 15th of Lunar month or when there are events at the cemetery - Minimise Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them 		
Km 0+200 to Km 0+750		<ul style="list-style-type: none"> - Disturb access to crop land - Crop land and irrigation ditch may be filled up - Localised flooding risks/risks on disruption of irrigation service - Risks on Over clearance of vegetation - Traffic disturbance and increased traffic safety risks 	<ul style="list-style-type: none"> - Provide safe access to crop land for farmers when existing access is disturbed - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/ wastes - Build compensatory ditches and/or maintain irrigation/drainage function of affected ditches - Mark up construction areas and do not clear up vegetation outside construction areas - Do not load materials and wastes on vegetated land 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
	Ending point at the intersection with the coastal road	<ul style="list-style-type: none"> at the intersection with commune road - Insects from bush may attack the workers - Increased fire risks, damages to the trees if the workers enter the plantation area and set fire there or cut tree branches for various purposes, particularly in dry season. 	<ul style="list-style-type: none"> - Place road work, speed limit, detour signal the intersection with commune road as appropriate - Place reflective band at the intersection with commune road, provide adequate lighting at night - Provide protective clothes particularly boots and gloves and enforce the workers to use - When insects, reptile are found, drive them away or release them into undisturbed areas rather than killing them - Forbit the workers to set fire or clear the trees if unauthorized 		

5.1.6.5 Than canal

The relevant site-specific mitigation measures along Than canal listed in Table 5.7 will be included into construction bidding and contractual documents of each bid package.

Table Error! No text of specified style in document..93. Site-specific Mitigation Measures along Than Canal

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 8+893: Start at Mai bridge		<ul style="list-style-type: none"> - Riverside vegetation may be over cleared - Disturbance to the traffic on the Mai bridge 	<ul style="list-style-type: none"> - Mark up the dredging area and minimize disturbing the areas outside - Place speed limit signboard at the access of the Mai bridge - Avoid loading equipment and materials on the Mai bridge during dredging. 	Contractors	PMU, CSC, IEMC
Km 8+893 to Km 10+070:		<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land due to dredged 	<ul style="list-style-type: none"> - Mark up and minimize disturb area, - Temporary load the dredged materials at sites designated for each section. - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
	 <p>The top image is a map showing a blue line representing an irrigation sewer. Labels include 'Beginning point', 'Agricultural land area', 'Irrigation sewer', and 'Noi Bridge'. Below the map is a photograph of a rice field with a canal.</p> <p>Rice field, crop land area</p>	<p>materials and/or wastewater leaked from dredged materials temporary disposal site</p> <ul style="list-style-type: none"> - Labor safety risk for workers when being bitten by insects, snakes... - Irrigation/drainage function of the existing ditch may be disturbed - Dredged materials may cause nuisance to cemetery visitors 	<ul style="list-style-type: none"> - Provide protective clothes particularly boots and gloves for the workers and enforce the use - When insects/replies are found, drive them away instead of killing them - Carry out dredging half width of the canal each time to maintain flow in the other half. Connect the affected ditch with water from the other half of canal for irrigation/drainage - Do not load dredged materials, equipment, wastes etc. that obstruct access to graves, particularly during 1st, 15th of lunar months and when there are events at the cemetery 		
<p>Km 10 + 71400</p>	 <p>An aerial photograph showing a bridge crossing a canal. A small inset photo shows a closer view of the bridge structure.</p> <p>Noi bridge crossing Than canal</p>	<ul style="list-style-type: none"> - Possible impacts on the bridge abutments if there is no proper dredging and reinforcing method. - Odour and temporary loads of dredged materials along the canal may cause nuisance to the public and affect local people as well as tourists 	<ul style="list-style-type: none"> - Arrange staff to direct driver if bulldozer is used for dredging near the abutment - Carry out manual dredging instead of using machineries at some locations under/ near the bridge abatement if necessary - Monitor the status of the bridge during dredging - Carry out levelling, shaping to keep the temporary loads does not look messy in the area that is visible form the bridge - Transport dry dredged materials to final disposal site as soon as possible 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 10+714 to Km 11+251	 <p>Rice field and crop land area</p>	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land when mud dredged materials and/or wastewater leaked from dredged materials in temporary disposal site - Insects, reptiles such as snake may attack workers. - Irrigation/drainage function of the existing ditch may be disturbed 	<ul style="list-style-type: none"> - Mark up and minimize disturb area, - Temporary load the dredged materials at sites designated for each section. - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river - Provide protective clothes particularly boots and gloves for the workers and enforce the use - When insects/replies are found, drive them away instead of killing them - Carry out dredging half width of the canal each time to maintain flow in the other half. Connect the affected ditch with water from the other half of canal for irrigation/drainage 	Contractors	PMU, CSC, IEMC
Km 11+250	<p>Chay bridge crossing Than canal on the road to Hai Hoa beach</p> 	<ul style="list-style-type: none"> - Dredging activity may affect the stability of the bridge abutment - Odour and temporary loads of dredged materials along the canal may cause nuisance to the public and affect local people as well as tourists 	<ul style="list-style-type: none"> - Arrange staff to direct driver if bulldozer is used for dredging near the abutment - Carry out manual dredging instead of using machineries at some locations under/ near the bridge abatement if necessary - Monitor the status of the bridge during dredging - Carry out levelling, shaping to keep the temporary loads does not look messy in the area that is visible form the bridge - Transport dry dredged materials to final disposal site as soon as possible 	Contractors	PMU, CSC, IEMC
Km 11+250 to Km 12+370	 <p>Rice field and crop land</p>	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before dredging takes place - Mark up and minimize disturb area, - Temporary load the dredged materials at sites designated for each section. - Provide protective clothes particularly boots and gloves for the workers and enforce the use 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
	 <p>Ending point is Binh Minh bridge</p>	<p>the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site</p> <ul style="list-style-type: none"> - Irrigation and drainage function may be affected - Bad Odour and Dredged materials may cause public nuisance. 	<ul style="list-style-type: none"> - When insects/replies are found, drive them away instead of killing them - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river - Carry out levelling, shaping to keep the temporary loads does not look messy in the area that is visible form the bridge - Carry out dredging half width of the canal each time to maintain flow in the other half. Connect the affected ditch with water from the other half of canal for irrigation/drainage - Transport dry dredged materials to final disposal site as soon as possible 		
<p>Km 12+370 to Km 13+320:</p> <p>Km 13+822: Ending point</p>	 <p>Rice field and crop land</p>  <p>Do Be bridge</p>	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or even damages crops and vegetation (due to 5%o salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site - Bad Odour and Dredged materials may cause public nuisance 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before dredging takes place - Mark up and minimize disturb area, - Temporary load the dredged materials at sites designated for each section. - Provide protective clothes particularly boots and gloves for the workers and enforce the use - When insects/replies are found, drive them away instead of killing them - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river - Carry out levelling, shaping to keep the temporary loads does not look messy in the area that is visible form the bridge - Carry out dredging half width of the canal each time to maintain flow in the other half. Connect the affected ditch with water from the other half of canal for irrigation/drainage - Transport dry dredged materials to final disposal 	Contractors	PMU, CSC, IEMC

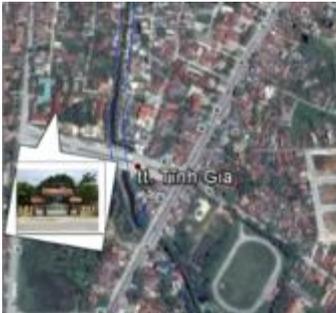
Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
			site as soon as possible.		

5.1.6.6 Cau Trang Canal

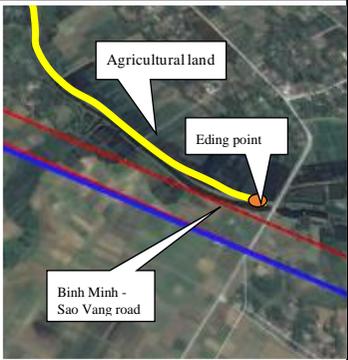
The relevant site-specific mitigation measures along Cau Trang canal listed in Table 5.8 will be included into construction bidding and contractual documents of each bid package.

Table Error! No text of specified style in document..94. Site-specific Mitigation Measures along Cau Trang Canal

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 0+000 to Km 2+000	 <p>Agricultural land area</p>	<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Water quality in the ponds may be affected with increased turbidity and salinity from dredged materials and leaked water - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site - Drainage/irrigation may be disrupted - Bad Odour and Dredged materials may cause public nuisance 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before dredging takes place - Mark up and minimize disturb area, - Temporary load the dredged materials at sites designated for each section. - Provide protective clothes particularly boots and gloves for the workers and enforce the use - When insects/reptiles are found, drive them away instead of killing them - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river - Carry out dredging half width of the canal each time to maintain flow in the other half. Connect the affected ditch with water from the other half of canal for irrigation/ drainage - Transport dry dredged materials to final disposal site as soon as possible 	Contractors	PMU, CSC, IEMC

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
<p>Km 2+00 to Km 3+500</p>	 <p>Residential area in Tinh Gia township</p>	<ul style="list-style-type: none"> - Public nuisance, negative impacts on urban landscape from dredged materials - Odour issue - Increased safety risks - Health risks for the workers when exposed to or in contact with contaminated dredged materials - Community disturbance - Traffic disturbance and increased traffic safety risks, particularly on the bridges, NH1A and Le Huy Thuan road section crossing the canal 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before dredging takes place - Place warning signs and reflective bands surrounding dredging area. Provide adequate lighting at night time - Avoid temporary loading, use watertight tank to transport the damp dredged materials to the final disposal site if possible. Monitor and apply measures to control pollution due to leaked water from dredged materials - Cover or contain tightly dredged materials if temporarily loaded within 20 m from any buildings or houses - Provide protective clothes particularly boots, masks and gloves for the workers and enforce the use - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river if temporarily loaded - Transport dry dredged materials to final disposal site as soon as possible - Avoid loading materials or concentrate at the same time too many people on the bridge/roads crossing the canal 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>
		<ul style="list-style-type: none"> - Public nuisance due to odour, wastewater leakage and dredged materials odor from dredged material may affect the children - Increased safety and traffic safety along the canal, particularly during peak hours - Bad odor affect teaching, learning and relaxing activities, particularly affect 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before dredging takes place - Place warning signs and reflective bands surrounding dredging area. Provide adequate lighting at night time - Avoid temporary loading, use watertight tank trucks to transport the damp dredged materials to the final disposal site if possible. Monitor and 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>

Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
	Tinh Gia township Kindergarten	children. - Disturbance to business households	apply the measures to control pollution due to leaked water from dredged materials - Transport dry dredged materials to final disposal site as soon as possible - Avoid dredging and transportation activities near the kindergarten during peak hours - Cover or contain tightly dredged materials if temporarily loaded within 50 m from business houses		
Km 3+500 to Km 4+700	 Agricultural land area	- Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site - Drainage/irrigation may be disrupted	- Mark up and minimize disturb area, - Temporary load the dredged materials at sites designated for each section. - Provide protective clothes particularly boots and gloves for the workers and enforce the use - When insects/reptiles are found, drive them away instead of killing them - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river - Carry out dredging half width of the canal each time to maintain flow in the other half. Connect the affected ditch with water from the other half of canal for irrigation/ drainage - Transport dry dredged materials to final disposal site as soon as possible	Contractors	PMU, CSC, IEMC

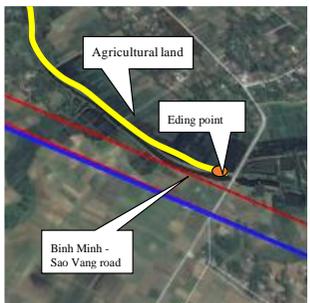
Location	Sensitive receptors	Impacts	Specific mitigation measures	Responsibility	Supervision
Km 4+700 – Km 5+700:	 <p>Agricultural land area</p>	<ul style="list-style-type: none"> - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials temporary disposal site - Irrigation may be disrupted 	<ul style="list-style-type: none"> - Inform the farmers at least two weeks before dredging - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river - Carry out dredging half width of the canal each time to maintain flow in the other half. Connect the affected ditch with water from the other half of canal for irrigation/ drainage. 	Contractors	PMU, CSC, IEMC

5.1.6.7 Sewers, PSs, WWTP

The relevant site-specific mitigation measures along the sewers, PSs, WWTP listed in Table 5.9 will be included into construction bidding and contractual documents of each bid package.

Table Error! No text of specified style in document..95. Site-specific Mitigation Measures along The Sewers, PSs, WWTP

Sensitive receptors	Picture	Site-specific Impacts and Risks	Site-specific Mitigation Measures	Responsibility	Supervision
Sewer along Cau Trang canal				Contractors	PMU, CSC, IEMC
Km 2+00 to Km 3+500:		<ul style="list-style-type: none"> - Public nuisance, negative impacts on urban landscape from dredged excavation - Increased safety risks - Health risks for the workers when exposed to excavate - Community disturbance - Traffic disturbance and increased traffic safety risks, particularly on the bridges, 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before constructing takes place - Mark up and minimize disturb area, - Provide protective clothes particularly boots and gloves for the workers and enforce the use - When insects/reptiles are found, drive them away instead of killing them. 	Contractors	PMU, CSC, IEMC

Sensitive receptors	Picture	Site-specific Impacts and Risks	Site-specific Mitigation Measures	Responsibility	Super-vision
		NH1A and Le Huy Thuan road section crossing the canal			
Km 2+900: Tinh Gia township kindergarten		<ul style="list-style-type: none"> - Increased safety and traffic safety along the canal, particularly during peak hours - Disturbance to business households 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before dredging takes place - Place warning signs and reflective bands surrounding dredging area. Provide adequate lighting at night time - Avoid dredging and transportation activities near the kindergarten during peak hours - Cover or contain tightly dredged materials if temporarily loaded within 50 m from business houses 	Contractors	PMU, CSC, IEMC
Km 3+500 to Km 4+700: Agricultural land area		<ul style="list-style-type: none"> - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Drainage/irrigation may be disrupted 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before construction takes place - Mark up and minimize disturb area, - Provide protective clothes particularly boots and gloves for the workers and enforce the use - When insects/reptiles are found, drive them away instead of killing them. 	Contractors	PMU, CSC, IEMC
Km 4+700 – km 5+700:		Irrigation may be disrupted	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before construction takes place - Mark up and minimize disturb area, - Build connect compensatory irrigation canal before construction 	Contractors	PMU, CSC, IEMC
PS1, capacity of 26m ³ /h		<ul style="list-style-type: none"> - Traffic safety risks when the PS is located near the road 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement - When insects/reptiles are found, drive them away 	Contractors	PMU, CSC, IEMC

Sensitive receptors	Picture	Site-specific Impacts and Risks	Site-specific Mitigation Measures	Responsibility	Super-vision
		<ul style="list-style-type: none"> - Over clearance of vegetation on the land Insects may attack the workers - Soil subsident risks as the pump chamber is 2.5 m deep - Safety risks for local community when passing by, particularly at night time 	<ul style="list-style-type: none"> instead of killing them. - Provide protective clothes particularly boots and gloves for the workers and enforce the use - Shielding, layout of warning signs for deep holes 		
PS2, capacity of 50m ³ /h		<ul style="list-style-type: none"> - Over clearance of crop land risks - Vehicles, construction plants and excavated materials may cause damage to or fill up agricultural land - Soil subsident risks as the pump chamber is 4 m deep 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement - Risks about over clearance of riverside vegetation - Insects, reptiles such as bees or snakes may appear and attack the workers - Shielding, layout of warning signs for deep holes 	Contractors	PMU, CSC, IEMC
WWTP		<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the WWTP - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Irrigation ditches in agricultural land around the plant may be filled up and blocked Surface runoff on elevated ground at the WWTP sites may disturb existing drainage pattern and cause more serious localized flooding 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement - Provide and maintain alternative access to agricultural land surrounding the WWTP - Install fences to separate the WWTP site with agricultural land - Create and maintain drainage ditches surrounding the WWTP - Create sedimentation traps within WWTP and clean up regularly - Provide septic tank toilets for worker to use at WWTP site - Enforce compliance with Codes of Conducts - Build connect compensatory irrigation canal before disposal - Provide and enforce the workers to use life vest when working on the Than canal. 	Contractors	PMU, CSC, IEMC

Sensitive receptors	Picture	Site-specific Impacts and Risks	Site-specific Mitigation Measures	Responsibility	Super-vision
		<ul style="list-style-type: none"> - Surface runoff passing the WWTP may affect the quality of Than canal - Social disturbance related to concentration of the works to the WWTP area - Environmental pollution due to waste and wastewater from Camps at the WWTP - Safety risks for the workers during the construction of WWTP discharge structure - Safety risks for community 			
Than canal (to receive wastewater)		<ul style="list-style-type: none"> - Accident risks for the workers when working on water, safety risks for the community 	<ul style="list-style-type: none"> - Do not load materials and wastes within 50 m from the river, tidy up the sites daily - Place fence and warning sign along the pipes and at the outfall. - Minimize the volume of wastes and materials temporary loaded at the site - Load materials and wastes tidily, remove the wastes from construction sites on daily basis - Include rules about not swimming in the canal if do not have the skills and notice to workers. - Take a drowning warning sign at the construction site. 	Contractors	PMU, CSC, IEMC

5.1.6.8 Site- Specific Mitigation Measures along the Resettlement Sites

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Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
Resettlement site 1: Thong Nhat hamlet - Ninh Hai commune, 1.5 ha		<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust on access road - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc. - Increased traffic safety risks on the access road 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when passing residential areas - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Clean up materials dropped on local road - Maintain drainage channels within and surrounding the resettlement site 	Contractors	PMU, CSC, IEMC
Resettlement site 2: Ron field- Hai Hoa 0.5 ha		<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust and noise - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc. 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when passing residential areas - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Clean up materials dropped on local road daily - Maintain drainage channels within and surrounding the resettlement site 	Contractors	PMU, CSC, IEMC

Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
Resettlement site 3: Cao Thang 3 - Nguyen Binh 0.5 ha		<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust, particularly on the access road - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc. - 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when passing residential areas - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Clean up materials dropped on local road - Maintain drainage channels within and surrounding the resettlement site 	Contractors	PMU, CSC, IEMC
Resettlement site 4: Ray Kenh - Binh Minh 1.5 ha		<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Increased level of dust, particularly on the access road - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc. 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when passing residential areas - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Clean up materials dropped on local road - Maintain drainage channels within and surrounding the resettlement site 	Contractors	PMU, CSC, IEMC

Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
Resettlement site 5: Van Xuan 8 - Binh Minh 0.5 ha.		<ul style="list-style-type: none"> - Disrupt accessibility to agricultural land surrounding the resettlement site - Construction materials and wastes may overflow onto the surrounding agricultural land causing damages to crop trees, affecting productivity - Surface runoff on elevated ground at the resettlement site may disturb existing drainage pattern and cause more serious localized flooding - Increased safety risks to the Public - Disturbance on daily activities of households due to dust, noise, excavation, movement of trucks etc. 	<ul style="list-style-type: none"> - Inform community at least two weeks before construction commencement; - Place warning and speed limit signs, and reflective fences along the areas passing the residential cluster; provided adequate lighting at night - Apply speed limit at 40 km/h to trucks when passing residential areas - Prevent materials from falling into irrigation ditch. Clean up if it is filled up by construction materials/wastes - Clean up materials dropped on local road daily 	Contractors	PMU, CSC, IEMC

5.1.6.9 Disposal Sites

Table Error! No text of specified style in document..97. Site-specific Mitigation Measures at the Disposal Sites

Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
1. The disposal site is located in Xuan Lam commune, Tinh Gia district		<ul style="list-style-type: none"> - Disturbance on daily activities of Xuan Lam CPC office due to dust, noise, movement of trucks etc. - Increased safety and traffic safety at the inter-section with NH1A, particularly during peak hours - The filled up pond at the disposal site may lead to localized flooding to the surrounding areas if drainage is inadequate 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before disposal - Place warning signs at the intersection with NH1A - Place sign to limit speed and ban the use of horn within 50 m from the CPC office - Install fence at the disposal site on the side in front of CPC office to minimize noise and dust - Built/maintain drainage ditches around the disposal site to prevent localised flooding - Level the ground at the disposal area 	Contractors	PMU, CSC, IEMC

Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
			<p>regularly to reduce dust spreading</p>		
<p>2. The disposal site is located in Tuong Son commune, Tinh Gia district</p>		<ul style="list-style-type: none"> - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause localized flooding 	<ul style="list-style-type: none"> - Drainage ditch shall be created/maintained around the disposal site to prevent localised flooding - Level the ground at the disposal site regularly to reduce dust spreading 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>
<p>3. The disposal site is located in Mai Lam commune, Tinh Gia district</p>		<ul style="list-style-type: none"> - The filled up pond at the disposal site may lead to localized flooding to the surrounding areas if drainage is inadequate - Disturbance on daily activities of households due to dust, noise movement of trucks 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before disposal - Place sign to limit speed at 20 km/h - Schedule to avoid trucks to enter the area after 10 pm - Drainage ditch shall be built/maintained around the disposal site and connected the current drainage in the area to control surface runoff to minimize the risk of local flooding to surrounding areas - Level the ground at the disposal site regularly to reduce dust spreading from disposed materials 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>

Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
- Disposal Sites For Dredged Material from Than and Cau Trang canals:					
<p>(1) The disposal site near the salinity control sluice (Ben Ngao sluice)</p>		<ul style="list-style-type: none"> - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in existing agricultural land near by the disposal site if water leaked from dredged materials overflow the temporary disposal pond and run into agricultural land. - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause more serious localized flooding 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before disposal - Before the commencement of the disposal operation, 30 cm of top soil must be removed and reserved for use at the end of the disposal operation as cover material for the rehabilitation of the disposal site. - Install retaining wall and/or interception ditch or settling ponds to allow surface runoff be retained and settled before discharge into the receiving water - Install pipes or create ditches to lead surface water and water leaked from disposal site to run back into the canal to avoid the negative impacts on the surrounding agricultural land. - Level the materials after being disposed off - Slopes of the dumps will not be steeper than 45° - Build/create the walls to protect slopes - To ensure the stability of the spoil disposal site, the mortar rubble masonry pavement and grouted rubble toe protection shall be adopted to prevent erosion and maintain stability. - A drainage ditch shall be built around the disposal site to control surface runoff; - The construction of disposal sites and transportation of spoils at night is strictly prohibited near residential areas. The sites shall be watered for dust suppression during 	<p>Contractors</p>	<p>PMU, CSC, IEMC</p>

Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
			their operation; - Disposal sites close to patches of agricultural land will be limited in size to avoid damages to crops;		
(2) The disposal site, 100m from Do Be bridge		<ul style="list-style-type: none"> - Risk of filling up, flooding, or even damages crops and vegetation (due to 5‰ salinity of the dredged materials) in agricultural land due to dredged materials and/or wastewater leaked from dredged materials disposal site - Public nuisance due to odour, wastewater leakage and dredged materials odor from dredged material. - Surface runoff on elevated ground at the disposal site may disturb existing drainage pattern and cause more serious localized flooding 	<ul style="list-style-type: none"> - Inform local authorities at least two weeks before disposal. - Isolate dredged materials from the surrounding by impermeable materials such plastic sheets and lead the leak water run back to the river. - Before the commencement of the disposal operation, 30 cm of natural soil from the surface shall be first removed and stored at the site. This material will be reserved and used at the end of the disposal operation as cover material for the rehabilitation of the disposal site. - Install retaining wall and/or interception ditch or settling ponds to allow surface runoff be retained and settled before discharge into the receiving water - Level the materials after being disposed off - Slopes of the dumps will not be steeper than 45° - Build/create the walls to protect slopes - A drainage ditch shall be built around the disposal site to control surface runoff; - Disposal sites close to patches of agricultural land will be limited in size to avoid damages to crops. 	Contractors	PMU, CSC, IEMC

Location	Picture	Site-specific Impacts/Risks	Site-specific Mitigation Measures	Responsibility	Supervision
- For Domestic solid waste and hazardous wastes:					
Domestic solid waste / sludge		<ul style="list-style-type: none"> - The risk of erosion and subsidence due to non-compliance with the height regulation (2-3m) - Drainage of waste dumps with a design area of 1-2 ha 	<ul style="list-style-type: none"> - To contract with the functional unit to collect, transport and dispose of the wastes at the Landfill; - To add the terms of mitigation measures applicable in the contract for the service unit, for example: - To pursuant to compliance with the height regulation (about 2-3m) - Design the drainage of waste disposal properly for a 1-2 ha designed disposal area. 	Contractors	PMU, CSC, IEMC

5.1.7 Measures to be Implemented in Operation Phase

As discussed in Chapter 3, number of potential impacts that risks that may happen in operation phase has been considered during project preparation phase. Therefore, the Project Proposals already includes the measures to address some potential impacts and risks during operation phase, together with environmental friendly solutions and greening opportunity. The costs associated with the mitigation measures, as far as possible, has been included in the total Project cost estimation. Meanwhile, some of the mitigation measures will be detailed in detailed engineering design and construction drawings.

The Sections below only discussed about the measures to be implemented during operation phase of the WWTP to address the potential impacts and risks associated with the WWTP operations.

Wastes Management:

The sludge generated from the wastewater treatment plant is be classified as biological sludge (biosolids). When the wastewater treatment plant is operated at capacity of 500 m³/day. As biological treatment technology is applied, sludge will be generated only every several years. Nghi Son Environment., JSC will transport this volume of sludge to the Landfill/waste treatment plant for waste and hazardous waste in Truong Lam commune, Tinh Gia district for treatment.

Municipal waste generated by the workers and the waste collected from the grit chamber at the intake will be stored in 2 containers with capacity of 100 - 150 liters each and transported to the Landfill/waste treatment plant for waste and hazardous waste in Truong Lam commune, Tinh Gia district for treatment.

The WWTP Operator will register the source of hazardous waste with DONRE as required by MONRE Circular No. 36/2015/TT-BTNMT dated 30 June 2015. Hazardous waste will be contained in the barrels/contained house and labeled in accordance with current regulations. Packaging materials of the chemical will be returned to the supplier. All hazardous waste will be transported to and disposed of at the Landfill/waste treatment plant for waste and hazardous waste in Truong Lam commune, Tinh Gia district by licensed dealers.

Measures to Control Chemicals-Related Risks

Chlorine used for wastewater disinfection will be transported to the wastewater treatment plant in specialized means provided by the supplier. Chlorine will be stored at the minimum volume in the store within the WWTP, suitable with the production plan. The procedures for storage and usage of the chemicals will be as instructed by the manufacturer.

The operators of the wastewater treatment plant will be trained on occupational health, safety and environment before started working. When being in contact with chemical, the workers will be required to wear the personal safety instruments such as mask, glass, gloves. First aid kits must be provided at the WWTP office, regularly checked and refilled.

Measures to Minimise System Failure Risks

The Workers shall be required to strictly follow the Operational and Maintenance Procedure of the WWTP. A standby generator for the wastewater treatment plant will be included at the WWTP for use in case of electric cut-off.

Regularly monitor of the treatment system. Use standby equipment or spare parts in case of system failure, if and when possible.

5.2 ROLES AND RESPONSIBILITIES FIR ESMP IMPLEMENTATION

5.2.1 Institutional Arrangements

- Contractors will be responsible for implementing mitigation measures. These measures will be included in bidding documents and their costs are 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's 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.

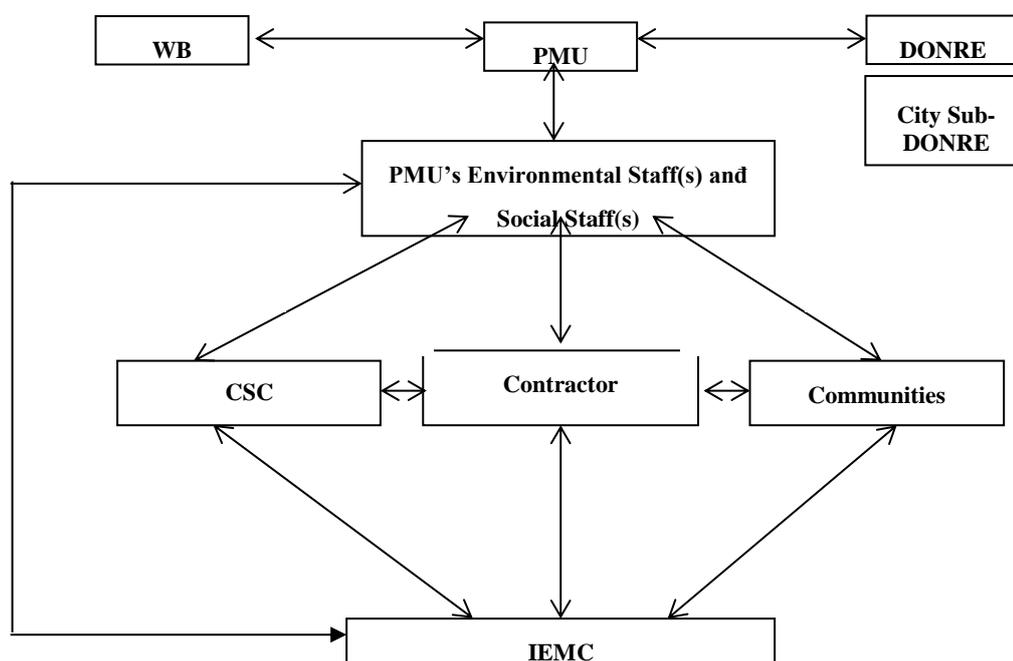


Figure Error! No text of specified style in document..24: Organization diagram for ESMP Implementation

5.2.2 Roles and Responsibilities

Specific responsibility of stakeholders is shown in Table 5.12 below.

Table Error! No text of specified style in document..98. Annotation on Roles and Responsibilities

Stakeholder	Responsibilities
PPC	Overall responsible for environmental safeguard compliance of the Project
PMU	Be responsible for monitoring the overall subproject implementation, including environmental compliance. PMU will be responsible for ESMP implementation and environmental performance of the subproject during the construction and operational phases: (xiii) closely coordinate with local authorities in the participation of the community during subproject implementation; (xiv) Ensure that the detailed design include all environment mitigation measures proposed in the ESMP;

Stakeholder	Responsibilities
	<p>(xv) monitor and supervise to ensure adequate contents of ESMP are incorporated into bidding and contractual documents;</p> <p>(xvi) ensure that an environmental management system is set up and functions properly;</p> <p>(xvii) Repor on ESMP implementation to DONRE and the WB.</p> <p>PMU will assign Environmental Staff(s) (ES) to oversee and coordinate environmental aspects of the subproject.</p>
<p>PMU Environmental and Social Staff(s) (ES)</p>	<p>Beresponsible for monitoring the implementation of the subproject ESMP. Specifically, ES will be responsible for:</p> <p>(xviii) Monitor the incorporation of ESMP into the detailed technical designs and civil works bidding and contractual documents;</p> <p>(xix) Monitor the incorporation of ESMP and RAP monitoring and supervision into the TORs, bidding and contractual documents for the Construction Supervision Consultant (CSC) and other safeguard consultant (IEMC);</p> <p>(xx) provide inputs to the consultant selection process;</p> <p>(xxi) review reports submitted by the CSC and safeguard consultants;</p> <p>(xxii) conducting periodic site checks;</p> <p>(xxiii) propose solutions to handle social and resettlement issues of the subproject; and</p> <p>(xxiv) prepare environmental and social performance section on the progress and review reports to be submitted to the DONRE and the World Bank.</p>
<p>Contractor</p>	<ul style="list-style-type: none"> - Assign Enviromental, Social Health and Safety (EHS) staff to monitor contractor’s compliance to ESIA/ESMP. - Prepare Contractor ESMP (CESMP) for each construction site area, submit to PMU and CSC for review and approval before commencement of construction. - Obtain all permissions for construction (traffic control and diversion, excavation, labor safety, etc. before civil works) following current regulations. - Implement the mitigation measures specified in the ESMP, CESMP, bidding documents etc. - Actively communicate with local residents and authorities and take actions to address their ESHS concerns during construction. - Ensure that all staff and workers understand the procedure and their tasks in the environmental management program. - Report to the PMU and CSC on any difficulties and their solutions. - Report to PMU and CSC if environmental accidents occur and coordinate with agencies and keys stakeholders to resolve these issues.
<p>Construction Supervision Consultant (CSC)</p>	<ul style="list-style-type: none"> - Assign qualified Environmental and Social Staff(s) to supervise the implementation of ESMP and ensure compliance - Be responsible for routine environmental supervision and reporting during construction phase. - Assist the PMU in reporting and maintaining close coordination with the local community. - Arrange, implement training on HIV/AIDs awareness raising for all workers, CSC team and PMU staff. The cost for this training included in the consulting service contract. - Carry out the periodical environmental quality monitoring during construction period and first-year-operation, prepare periodical environmental monitoring and supervision reports for submission to Vietnamese authorities.

Stakeholder	Responsibilities
Independent Environmental Monitoring Consultants (IEMC)	<ul style="list-style-type: none"> - Provide support to PMU to establish and operate an environmental management system, coordinate with the CSC team to provide trainings to the Contractors on project environmental management requirements - Provide trainings, implement capacity building activities for relevant agencies during subproject implementation, carry out random field visits to certify compliance or recommend corrective/improvement actions. - Prepare monitoring reports after each visit.
Local community	<ul style="list-style-type: none"> - Participate in volunteer community environmental and social monitoring.
DONRE	Monitoring compliance with the Government environmental requirements.

5.3 ENVIRONMENTAL COMPLIANCE FRAMEWORK

5.3.1 Environmental Duties of the Tinh Gia PMU/Detail Design Consultants

During the preparation of TORs for consulting services and construction bidding documents, the Tinh Gia PMU will also work closely with the consultants to ensure that: i) contract packaging and cost estimations includes ESMP implementation, including the services on independent safeguard monitoring, environmental sampling/monitoring and compliance supervision, reporting etc.; ii) ECOPs and relevant common as well as site-specific mitigation measures are incorporated into the bidding documents; iii) environmental supervision and training are included in the scope of works assigned to the construction supervision consultant.

At feasibility study/detail engineering design stage, the Tinh Gia PMU shall work closely with the feasibility study consultants and detail design engineers to ensure that the greening/landscaping, environmental friendly solutions and relevant mitigation measures proposed in the ESIA/ESMP are considered and incorporated into the engineering design as appropriate.

During construction phase, the Tinh Gia PMU shall work closely with the supervision consultant to monitor the compliance of contractors and report to relevant authorities. The Tinh Gia PMU will also direct the supervision consultant and contractors on the actions to be undertaken in case when issues are arisen, incidents or accidents etc.

The Tinh Gia PMU will assign at least one staff with suitable qualifications to be Environmental Officer (EO) throughout project implementation. The EO will oversee environmental issues and monitor safeguard compliance of the subproject. The EO will be supported by the Independent Monitorign Consultant, the Environmetnal Officers of the construction supervision team as well as the contractors.

5.3.2 Environmental Duties of the Contractor

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

Remedial actions that cannot be effectively carried out during construction should be implemented upon completion of the works (and before issuance of the Works Acceptance Certificates).

The Contractors’ duties include but not limit to:

- Comply with relevant legislative requirements governing the environment, public health and safety;
- Work within the scope of contractual requirements and other tender conditions;
- Organize representatives of the construction team to participate in the joint site inspections undertaken by the Environmental Supervisors (ES) of the CSC;
- Carry out any corrective actions instructed by the Environmental Officer (EO) of the PMU and the ES;
- In case of non-compliances/ discrepancies, carry out investigation and submit proposals on mitigation measures, and implement remedial measures to reduce environmental impacts;
- Stop construction activities, which generate adverse impacts, upon receiving instructions from the EO and the ES. Propose and implement corrective actions and carry out alternative construction methods, if required, to minimize the environmental impacts; Non-compliance by the Contractor will be cause for suspension of works and other penalties until the non-compliance has been resolved to the satisfaction of the EO and the ES.
- In case the contractor proposes to use source of raw materials that have not been covered in subproject ESIA, the contractor will report to the CSCs and PMUs and coordinate with them in carrying out due –diligence environmental review of these materials sources to assess their compliance to national environmental requirements. Only complied sources can be used under DCIDP.
- The contractor shall be responsible for implementation of corrective measures at his costs. The contractor shall also be responsible for paying the costs of damages caused by non-compliance to ESMO and/or applicable environmental regulations.

5.3.3 Contractor’s Environmental and Social Management Plan (CESMP)

After contract signing, the contractor will be required to prepare and submit a contractor’s site-specific Environmental and Social Management Plan (CESMP) for each contract package and submit to the CSC and PMU for review and clearance.

The objective of the Contractor Environmental and Social Management Plan (CESMP) is to provide information for environmental management during the proposed works/activities on site of Tinh Gia subproject. This is to ensure that the Contractor (and any subcontractors) have minimal impact on the environment. The CESMP will detail how the contractor will mitigate construction impacts and documents the contractor’s response to inspecting, monitoring, verifying, internal auditing and correcting or improving environmental performance. The CESMP must be site-specific and should include details of control measures that will be implemented on site to minimize any potential environmental impacts from the proposed works/activities. If the proposed works/activities contained within the CESMP are altered during the Contract, the CESMP will be required to be modified by the Contractor to reflect these changes or modifications. The contents of the CESMP should include the followings:

- (i) A statement of policy, providing a definition of the Contractor’s environmental policy and an indication of commitment to the execution of its Site Environmental Management Plan.
- (ii) A brief document description; Date of issue; Revision status; Distribution list; and preparation personnel details and signoff.
- (iii) Applicable laws and regulations associated with the requirements in the subproject ESMP.

- (iv) Identification of the contractor licenses, permits and approval associated with the CESMP.
- (v) Details on how the environmental impacts identified in the subproject ESIA will be managed on site, including: 1) the site-specific measures to mitigate impacts during construction; 2) ECOPs; 3) the Contractor ESMP to be developed after the contractor is selected and before construction starts; and 4) the Contractor's Dredging Management Plan that the contractor is required to develop.
- (vi) Contractor's plan to carry out self-monitoring of implementation of the CESMP.
- (vii) Detailed environmental training that all site contractor personnel (including subcontractors) are required to undertake. As a minimum all contractor personnel working at the subproject sites must: i) be familiar and understand the CESMP for the works; ii) be aware of their environmental responsibilities and legal obligations on site; and iii) undertake health and safety and emergency response training.
- (viii) Specific capabilities, support mechanisms and resources necessary to satisfactorily implement the CESMP. Detailed environmental responsibilities of all contractor personnel including subcontractors working on site with appropriate knowledge, skills and training for specific tasks shall be identified.
- (ix) The contractor shall be responsible for preparing monthly environmental reports, as a section within the Progress report required in the bidding document, including accidental report if any, for submitting to the subproject owner. The contents of these reports may include following details:
 - Implementation of the Contractor's CESMP complying with the agreed program;
 - Any difficulties encountered in the implementation of the CESMP and recommendations for remedying them for the future;
 - The number and type of non-compliances and proposed corrective actions;
 - Reports from the Subcontractors involved in the implementation of the CESMP, including minutes of meetings and discussions held by the Contractor;
 - Minutes of meeting from discussions held with the subproject owner regarding implementation of the CESMP.

5.3.4 Contractor's Safety, Social and Environmental Officer (SEO)

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

- Carry out environmental site inspections to assess and audit the contractors' site practice, equipment and work methodologies with respect to pollution control and adequacy of environmental mitigation measures implemented;
- Monitor compliance with environmental protection measures, pollution prevention and control measures and contractual requirements;
- Monitor the implementation of environmental mitigation measures;
- Prepare audit reports for the site environmental conditions;
- Investigate complaints and recommend any required corrective measures;

- Advise the contractor on environment improvement, awareness and proactive pollution prevention measures;
- Recommend suitable mitigation measures to the contractor in the case of non-compliance. Carry out additional monitoring of noncompliance instructed by the ES of PMU and CSC
- Inform the contractor and ES (of PMU and CSC) of environmental issues, submit contractor's ESMP Implementation Plan to the ES of PMU and CSC, and relevant authorities, if required;
- Keep detailed records of all site activities that may relate to the environment.

5.3.5 Independent Environmental Monitoring Consultant (IEMC)

An IEMC shall be contracted PMU to provide some environmental safeguard training for PMU staff and carry out environmental auditing. The IEMC shall carry out the monitoring, including:

- Provide support to PMU to establish and operate an environmental management system, coordinate with the CSC team to provide trainings to the Contractors on project environmental management requirements
- Provide trainings, implement capacity building activities for relevant agencies during subproject implementation, carry out random field visits to certify compliance or recommend corrective/improvement actions
- Provide training for PMU and the CSC, and the representatives of the Contractors on socio-environmental, health and safety issues related to construction;
- Evaluate environmental quality at the areas affected by the construction activities (including site observations, reviewing environmental quality data provided by the CSC, review of other available documents, and supplement sampling if necessary);
- Review contractor's environmental compliance including the implementation of mitigation measures and documentation;
- Review PMU and CSC compliance to ESMP.
- The IEMC will also provide technical advice and assistance to the PMU and the EO in environmental matters.

5.3.6 Environmental Supervision during Construction

During construction phase, a team of qualified Environmental Supervisors (ES) as part of the Construction Supervision Consultant (CSC) shall carry out the environmental supervision as part of construction supervision. The CSC and ES will be mobilised before the commencement of any construction activities. The CSC and ES are responsible for inspecting and supervising all construction activities to ensure that mitigation measures adopted in the ESMP are properly implemented, and that the negative environmental impacts of the subproject are minimized. Specifically, ES of the CSC will:

- Review and assess on behalf of the PMU whether the construction design meets the requirements of the mitigation and management measures of the ESMP,
- Review and clear contractor's SEMP;
- Coordinate with PMU Environmental Officer (EO) in reviewing environmental compliance at newly proposed borrow pits and quarries and advise PMU on whether these are eligible for use by the Project;
- Verify and confirm with PMU environmental supervision procedures; parameters, monitoring locations, equipment and results;

- Supervise contractor's **implementation of its CESMP** including their performance, experience and handling of site environmental issues, and provide corrective instructions;
- Arrange, implement training on HIV/AIDS awareness raising for all workers, CSC team and PMU staff;
- Implement the environmental quality sampling and prepare periodical environmental monitoring reports, including reports on ESMP implementation status to the PPMU and prepare environmental supervision statement during the construction phase; and
- Review payment requests related to environmental mitigation costs if applicable

5.3.7 Compliance with Legal and Contractual Requirements

The constructions activities shall comply not only with **general contractual condition on environmental protection and pollution control requirements in the bidding document, the subproject ESMP, and the CESMP**, but also with environmental protection and pollution control laws of the Socialist Republic of Viet Nam.

All the works method statements submitted by the Contractor to the CSC and PMU for approval to see whether sufficient environmental protection and pollution control measures have been included.

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

The Contractor shall copy relevant documents to the SEO and the ES of CSC and PMU. The document shall at least include the updated work progress report, the updated work measure, and the application letters for different license/permits under the environmental protection laws, and all the valid license/permit. The SEO and the ES shall also have access, upon request, to the Site Log-Book.

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

5.3.8 Penalty System

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

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

5.3.9 Monitoring and Reporting Arrangements

The Project Management Unit (PMU) is responsible for conducting internal monitoring the

implementation of the RP. In addition, the PMU will hire an external monitoring agency (EMA) to undertake independent monitoring of the process of RP implementation and to assess living standard of the affected people during and after the completion of the resettlement.

Both internal and external (independent) monitoring will regularly (on a monthly basis for internal and biannual basis for independent monitoring). An end-of-project evaluation on the implementation of resettlement is required and report will be prepared to confirm whether the objectives of OP 4.12 were achieved.

ESMP monitoring and reporting requirements are summarized in table 5.13.

Table Error! No text of specified style in document..99. Regular Reporting Requirements

No.	Report Prepared by	Submitted to	Frequency of Reporting
1	Contractor to the Employer	PMU	Once before construction commences and monthly thereafter
2	Construction Supervision consultant (CSC)	PMU	Weekly and monthly
4	Community	PMU	After each periodical monitoring
5	IEMC	PMU	Every six-month
6	PMU	DONRE	Every six-month
7	PMU	WB	Every six-month

5.4 ENVIRONMENTAL MONITORING PROGRAM

5.4.1 Scope of Environmental Monitoring in Construction Phase

The environmental monitoring and supervision for construction phase for the entire project is presented in the below table. Sampling locations are described in the Annex 4 and the number of samples are made in accordance with progress of each work.

Table Error! No text of specified style in document..100. Environmental Monitoring Program - Construction Phase

No	Monitored items	Construction phase
I	Monitoring of air quality, noise, vibration	
	1. Monitoring parameters	TSP, CO, NO ₂ , SO ₂ , Noise (L _{eq}), vibration
	2. Monitoring frequency	Measurements taken every three-months, the first monitoring at each work item will be within one month since construction commencement
	3. Applied Regulation	QCVN 05:2013/BTNMT, QCVN 06:2009/BTNMT; QCVN 26:2010/BTNMT; QCVN 27:2010/BTNMT

No	Monitored items	Construction phase
	4. Monitoring positions	20 samples, of which: (1) Coastal road: 4 samples (2) Binh Minh to Sao Vang road: 2 samples (3) Do Be bridge and approach roads: 2 samples (4) Road from NH1A to Ninh Hai beach: 2 samples (5) Than Canal: 2 samples (6) Cau Trang Canal: 2 samples (7) WWTP, sewers, PSs: 4 samples (8) Resettlement sites: 2 samples (<i>Sampling locations are presented in Annex 4</i>)
II	Surface Water Quality Monitoring	
	1. Monitoring parameters	pH, DO, Salinity, COD, BOD, N-NH ₄ ⁺ , N-NO ₂ ⁻ , N-NO ₃ ⁻ , P-PO ₄ ³⁻ , oil & grease, Coliform, Cl ⁻ , Fe, TSS
	2. Monitoring frequency	Measurements taken every three-months, start as early as possible after contract signing and continue during the entire construction phase
	3. Applied Regulation	QCVN 08-MT:2015/BTNMT
	4. Monitoring Locations	10 samples, of which: (1) Coastal road: 3 samples on Than canal (01 sample at Son Hai bridge and 02 samples at inter-section with Than canal). (3) Do Be bridge: 2 samples on Than canal (5) Than Canal: 3 samples – (7) WWTP: 2 samples on Than canal (<i>Sampling locations are presented in Annex 4</i>)
III	Wastewater quality monitoring	
	1. Monitoring parameters	pH, BOD ₅ , COD, TSS, N-NH ₄ , N-NO ₃ , P-PO ₄ , oil & grease, Coliforms
	2. Monitoring frequency	Measurements taken every three-months start as early as possible after contract signing and continue during the entire construction phase
	3. Applied Regulation	QCVN 14:2008/BTNMT
	4. monitoring Locations	10 samples, of which: 01 sample per item from No.2 to No.8 and 03 samples on the coastal road. Remark: wastewater after treatment from worker's camps (if any) (<i>Sampling locations are presented in Annex 4</i>)
IV	Sediments on Than and Cau Trang canals	
	1. Monitoring parameters	Salinity
	2. Monitoring frequency	Measurements taken every three-months start as early as possible after contract signing and continue during the entire construction phase
	3. Applied Regulation	QCVN 03-MT:2015/BTNMT; QCVN 43:2012/BTNMT
	4. Monitoring positions	6 samples, of which: 03 samples on Than canal and 03 samples on Cau Trang canal. (<i>Sampling locations are presented in Annex 4</i>)

5.4.2 Scope of Environmental Monitoring in Operation phase

The environmental monitoring and supervision for operation phase for WWTP is presented in the below table. Sampling locations are described in the Annex 4 and the number of samples are made in accordance with progress of each work.

Table Error! No text of specified style in document..101. Environmental monitoring Program operation phase

No	Monitored items	WWTP operation
I	Monitoring of air quality, noise, vibration	
	1. Monitoring parameters	Odor, TSP, CO, NO ₂ , SO ₂ , H ₂ S, CH ₄ , Noise (L _{eq})
	2. Monitoring frequency	Measurements taken every three-months
	3. Applied Regulation	QCVN 05:2013/BTNMT, QCVN 06:2009/BTNMT; QCVN 26:2010/BTNMT
	4. Monitoring positions	4 samples: 2 samples in the factory of WWTP; 2 samples in the nearest residential area toward the end of the main wind direction <i>(Sampling locations are presented in Appendix 4)</i>
II	Surface Water Quality Monitoring (at the receiving source: Than canal)	
	1. Monitoring parameters	pH, DO, Salinity, COD, BOD, N-NH ₄ ⁺ , N-NO ₂ ⁻ , N-NO ₃ ⁻ , P-PO ₄ ³⁻ , oil & grease, Coliform, Cl ⁻ , Fe, TSS
	2. Monitoring frequency	Measurements taken every three-months
	3. Applied Regulation	QCVN 08-MT:2015/BTNMT, column B1
	4. Monitoring positions	3 samples: 01 sample at the discharge point, 01 sample - 100m from the upstream; 01 sample - 50 - 100 m from the downstream) <i>(Sampling locations are presented in Appendix 4)</i>
III	Wastewater quality monitoring	
	1. Monitoring parameters	pH, BOD ₅ , COD, H ₂ S, N-NH ₄ , N-NO ₃ , P-PO ₄ , oil & grease, Coliforms, TSS
	2. Monitoring frequency	Measurements taken every three-months
	3. Applied Regulation	QCVN 14:2008/BTNMT, column B
	4. Position monitoring	2 samples: 01 sample before treatment and 01 sample after treatment <i>(Sampling locations are presented in Appendix 4)</i>

5.5 TRAINING AND CAPACITY BUILDING

5.5.1 Current PMU's Capacity on Environmental Management

The project will be managed by Project Management Unit for Nghi Son EZ and Thanh Hoa Industrial Zone (PMU) on behalf of Thanh Hoa Provincial People's Committee.

The Project Management Unit have experience in environmental safeguard management. Thanh Hoa Provincial People's Committee have managed number of development projects financed by ADB and the World Bank namely Thanh Hoa Inclusive Development Project (ADB) and Thanh Hoa Domestic Water Supply and Environmental Sanitation Project (World

Bank). The province has good understandings about donor’s safeguard management requirements;

However, currently PMU staffs have limited knowledge on WB safeguard requirements as well as limited knowledge of environment and social issues. Such gaps will be addressed through capacity building program as part of the ESMP.

5.5.2 Safeguard Capacity Building Program

The Table 5.15 below provides a typical training program on safeguard requirements . Training programs will be developed and implemented by IEMC team in coordination with the CSC Environmental Officer .

- *Trainee groups:* the PMU staff, the ESO department staff, the field engineers (FE), construction supervision consultants (CSC), the 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 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 Error! No text of specified style in document..102. Advanced Environmental Training Program

I. Subjects	PROJECT MANAGEMENT UNIT
Training course	Environmental monitoring and reporting
Participants	Staff in charge of environmental issues; environmental managers
Training frequency	Immediately after the project becomes valid effective, but at least one month prior to the first bid package. The next training will be planned on demand.
Duration	One day
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 Subproject includes: <ul style="list-style-type: none"> - Requirements of environmental monitoring; - Monitoring and implementation of mitigation measures; - 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 AUTHORITIES (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	Two-day training for CSC and contractors, and one-day training for others
Content	<ul style="list-style-type: none"> - 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, the independent environmental monitoring consultant (IEMC) implement safety 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	<ul style="list-style-type: none"> - 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; - The rights and responsibilities of environmental monitoring - Environmental monitoring, environmental monitoring form - Measures to mitigate the social impact and monitoring implementation - Other issues to be determined
Responsibility	Contractors, PMU with the assistance of IEMC

5.6 ESTIMATED COSTS FOR ESMP IMPLEMENTATION

5.6.1 Estimated Costs for Each Work of Environmental Protection Measures

Table Error! No text of specified style in document..103.Costs for Environmental Protection Measures

NO.	Works	Costs (estimated)	
		VND	USD
1	Renting areas for dumping mud/dredged material	Included in Contract package value	

2	Prevention and control of fire and explosion (fire extinguishers, fire hoses, emergency lights)	Included in Contract package value	
3	Watering and sprinkling	Included in Contract package value	
4	Trash bins for each construction site/worker camp	30,000,000	2,240
5	Portable toilet for each construction site/worker camp	60,000,000	2,688
6	Planting trees at the roads and canals	Included in Contract package value	13,441
7	Demining for all works	4,161,000,000	35,842
8	Tarpaulin for temporary disposal cells along Than and Cau Trang canal: 80,000 m ² x 3,000 VND/m ² and the final disposal site, 100m from Do Be bridge	375,000,000	16,667

5.6.2 Estimated Costs for Environmental Monitoring Program

According to the unit price of environmental monitoring in the locality, the estimated cost for environmental quality monitoring of the project is stated in the table below:

Table Error! No text of specified style in document..104. Estimated Cost for Samples and Analysis

No	Works	Unit	Quantity	Price (VND)	Sub-Total	
					(1 USD = 22,500 VND)	
				VND	VND	USD
I	Construction phase					
1	Coastal road					
a	Air, noise	sample	48	2,000,000	96,000,000	4,266.67
b	Surface Water	sample	36	2,500,000	90,000,000	4,000
c	Wastewater	sample	36	2,000,000	72,000,000	3,200
d	Soil/sediments	sample	-	1,000,000	-	-
2	Binh Minh to Sao Vang road					
a	Air, noise	sample	10	2,000,000	20,000,000	888.88
b	Surface Water	sample	-	2,500,000	-	-
c	Wastewater	sample	5	2,000,000	10,000,000	444.44
d	Soil/sediments	sample	-	1,000,000	-	-
3	Do Be bridge and approach roads					
a	Air, noise	sample	6	2,000,000	12,000,000	533.33
b	Surface Water	sample	6	2,500,000	15,000,000	666.67
c	Wastewater	sample	3	2,000,000	6,000,000	266.67
d	Soil/sediments	sample	-	1,000,000	-	-
4	Road from NH1A to Ninh Hai beach					
a	Air, noise	sample	10	2,000,000	20,000,000	888.88
b	Surface Water	sample	-	2,500,000	-	-
c	Wastewater	sample	5	2,000,000	10,000,000	444.44
d	Soil/sediments	sample	-	1,000,000	-	-
5	Than canal					

No	Works	Unit	Quantity	Price (VND)	Sub-Total	
					(1 USD = 22,500 VND)	
					VND	USD
a	Air, noise	sample	16	2,000,000	32,000,000	1,422.2
b	Surface Water	sample	24	2,500,000	60,000,000	2,666.67
c	Wastewater	sample	8	2,000,000	16,000,000	711.11
d	Soil/sediments	sample	24	1,000,000	24,000,000	1,066.67
6	Cau Trang Canal					
a	Air, noise	sample	16	2,000,000	32,000,000	1,422.2
b	Surface Water	sample	-	2,500,000	-	-
c	Wastewater	sample	8	2,000,000	16,000,000	711.11
d	Soil/sediments	sample	24	1,000,000	24,000,000	1,066.67
7	WWTP, PSs, Sewers					
a	Air, noise	sample	16	2,000,000	32,000,000	1,422.2
b	Surface Water	sample	8	2,500,000	20,000,000	888.89
c	Wastewater	sample	4	2,000,000	8,000,000	355.55
d	Soil/sediments	sample	-	1,000,000	-	-
8	Resettlement site					
a	Air, noise	sample	4	2,000,000	8,000,000	355.55
b	Surface Water	sample	-	2,500,000	-	-
c	Wastewater	sample	2	2,000,000	4,000,000	177.78
d	Soil/sediments	sample	-	1,000,000	-	-
9	Preparing report	Report				
a	Phase 1	Report	8	5,000,000	40,000,000	1,777.79
b	Phase 2	Report	12	5,000,000	60,000,000	2,666.67
II	WWTP Operation (1 first year)					
a	Air, noise	sample	16	2,000,000	16,000,000	1,422.22
b	Surface Water	sample	12	2,500,000	30,000,000	1,333.33
c	Wastewater	sample	8	2,000,000	16,000,000	711.11
	Preparing report	Report	4	5,000,000	20,000,000	888.89
					825,000,000	36,666

5.6.3 Estimated cost for IEMC

Estimated cost for IEMC is presented in the table 5.19:

Table Error! No text of specified style in document..105. Estimated Costs of IEMC

(Exchange rate: 1 USD = 22,500 VND)

No	Content	Unit	Amount	Unit price (VND)	Sub-total (VND)	Sub-total (USD)
1	Experts 'salary	person-month	30	30,000,000	900,000,000	40,000
2	Accommodation, expenses for business trip	person-day	150	600,000	90,000,000	4,000
3	Travel expenses	Trip/ person	50	5,000,000	250,000,000	11,111
4	Office and communication	month	30	3,000,000	90,000,000	4,000
Total					1,330,000,000	59,111

5.6.4 Estimated Costs for Training Program

Estimated cost for training program on environmental monitoring management capacity is presented in the table 5.20:

Table Error! No text of specified style in document..106. Estimated Costs for Training and Capacity Building

(Exchange rate: 1 USD = 22,500 VND)

Training content	Trainee	Unit	Quantity	Price	Total	
				VND	VND	USD
A. Capacity building programs on safeguard policies (trained by IEMC)						
<i>I. Environmental monitoring and reporting</i>						
PMU	Staff in charge of environmental issues; environmental managers	course	2	10,000,000	20,000,000	889
<i>II. Implementation of mitigation measures</i>						
Stage 1 (30% of total works)	CSC; Construction engineers, site manager	course	5	10,000,000	50,000,000	2,222
Stage 2 (70% of total works)	CSC; Construction engineers, site manager	course	10	10,000,000	100,000,000	4,444
<i>III. Safety and environmental sanitation</i>						
Stage 1 (30% of total works)	Representatives of workers	course	3	5,000,000	15,000,000	667
Stage 2 (70% of total works)	Representatives of workers	course	5	5,000,000	25,000,000	1,111
Sub-total (A)					210,000,000	9,333
B. HIV /Aids training (done by CSC)						
Stage 1 (30% of total works)	Workers, CSC team and PMU staff	course	3	20,000,000	60,000,000	2,667
Stage 2 (70% of total works)	Workers, CSC team and PMU staff	course	7	20,000,000	140,000,000	6,222
Sub-total (B)					200,000,000	8,889
Total: (A)+(B)					410,000,000	18,222

5.6.5 Total Estimated Costs for ESMP Implementation

The following table provides a cost estimate for the implementation of environmental management plan (ESMP). The cost of ESMP¹⁵ 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.

It should be noted that the involvement of the community in the process of ESMP implementation is completely voluntary participation for the benefit of own community and households. The following Table 5.21 provides the estimated costs for environmental quality monitoring and

¹⁵Excluding costs for RP implementation and independent monitoring the performance of RP/EMP

IEMC (in accordance with national practices) for reference purposes. However, final costs will be updated in the detailed design phase.

Table Error! No text of specified style in document..107. Estimated Costs of ESMP Implementation

Content	Items of Tinh Gia sub-project (USD)
(a) Mitigation during construction	As a part of the contract
(b) Monitoring safeguard compliance during construction	As a part of the cost for Construction Supervision Consulting (CSC)
(c) Running cost of PMU social and environmental units	As part of the costs for the PMU
(d) Environmental quality monitoring (done by CSC)	36,666
(e) Independent environmental monitoring consulting (IEMC)	59,111
(f) Safeguard Capacity building programs (done by CSC)	9,333
(g) HIV /Aids Training (done by CSC)	8,889

5.7 GRIEVANCE REDRESS MECHANISM (GRM)

Within the Vietnamese legal framework, citizen rights to complain are protected. As part of overall implementation of the project, a grievance redress mechanism (GRM) will 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. The contractors should indicate contact for any complaints when the contractors announce construction schedule to local communities.

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.

Grievance Redress Mechanism for affected person who lose means of income/livelihoods, are Summarised in the Table 5.22 below.

Table Error! No text of specified style in document..108. Grievance Redress Mechanism

First Stage – Ward/Commune People’s Committee (WPC):	PAP may submit their complaint – either in written or verbal, to the office of the Ward/Commune People’s Committee. W/C PC will receive the complaints and will notify the W/C PC leaders of the complaint. The Chairman of the W/C PC will meet the complainant in person and will solve it within 15 days following the receipt of the complaint.
Second Stage – City/District People’s Committee (C/DPC):	After 15 days since the submission of the complaints, if the aggrieved person does not have any response from the W/C PC, or if the aggrieved person is not satisfied with the decision taken on his/her complaint, the PAP may take the case, either in written or verbal, to the Reception Unit of City/District People’s Committee. The City/District People’s Committee will have 30 days since the date of receipt of the complaint to resolve the case. The City/District People’s Committee will register all the complaints submitted and will inform the District Board for Compensation and Land Acquisition of the City/District PC’s resolution/assessment results. Aggrieved person may elevate the case to the Courts of Law if they wish.
Third Stage – Provincial People’s Committee):	After 30 days, if the aggrieved PAP does not hear from the City/District PC, or if the PAP is not satisfied with the decision taken on his/her complaint, the PAP may escalate the case, either in writing or verbal, provincial People’s Committee, or lodge an administrative case with the City/District People’s Court for resolution. The provincial PC will have 45 days to resolve the complaint to the satisfaction of all the concerned. The provincial PC secretariat is also responsible for registering all complaints that are submitted. Aggrieved person may elevate the case to the Courts of Law if they wish
Final Stage - Courts of	After 45 days following the submission of the complaint at provincial PC,

Law:	if the aggrieved PAP does not hear from the provincial PC, or if PAP is not satisfied with the decision taken on his/her complaint, PAP may take the case to a Courts of Law for adjudication. Decision by the court will be the final decision. Decision on solving the complaints must be sent to the aggrieved PAPs and concerned parties, and must be posted at the office of the People’s Committee where the complaint is solved. After 3 days, the decision/result on resolution must be made available at ward level and after 7 days at the district level.
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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 address 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 Inspection Panel, please visit www.inspectionpanel.org.

CHAPTER 6 - PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

6.1 OBJECTIVES AND PRINCIPLES OF PUBLIC CONSULTATIONS

During the environmental impact assessment, public consultation and disclosure of information are conducted to ensure consensus of local authorities, local non-governmental organizations and local affected community in the project area. Community's involvement is one of basic conditions to ensure local support and it also represents viewpoint of local authority and community on the project. By public consultation, some undefined adverse impacts and mitigation measures can be identified and added in the report. In practice, it will be better for information exchange and update between project's implementer and the community if there is public involvement from the project preparation. In that case, the project can get valuable idea contribution from local community.

Public consultation is specifically required by the World Bank's environmental and social safeguard policies. The public consultation in preparation of the subproject ESIA also must comply with the requirements in the Government's Decree No. 18/2015/ND-CP dated 14 February 2015 on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan, and Circular No. 27/2015/TT-BTNMT dated 29 May 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan. Additionally, the public consultation of the sub-project should be based on the Bank's safeguard policies (OP4.01).

6.1.1 Objectives of Public Consultation

The objectives of Public Consultations are

- To share all information on the items and tentative activities of the Subproject with local community and stakeholders;
- To gather opinions/comments and concerns from local authorities and the community on local particularities and environmentally sensitive matters in the subproject area, especially matters that the environmental assessment impact group has not been aware of. On such basis, the concerns of the local community may be proposed for proper settlement during the selection of subproject design options;
- To collect opinions/comments from the local community on the Subproject's tasks in the preparation of the ESIA as well as comments on the draft ESIA to adequately and precisely assess environmental impacts and propose the most effective and feasible mitigation measures for negative environmental impacts.

6.1.2 Basic principle for public consultation

- Following provisions in Clause 4, Article 12, Decree No.18/ND-CP dated 14/02/2015 promulgated by the Government on information disclosure and consultation with project affected community.
- For projects classified as B category, public consultation should be conducted once after the first draft of ESIA is prepared.

6.2 PUBLIC CONSULTATION WITH LOCAL COMMUNITIES

Consultation on environmental issues is conducted after completion of the first draft of the ESIA. For Tinh Gia project, the consultation on environmental issues was conducted from 10 - 16/10/2017 in 8 project communes and townships.

Additional consultations: After completing draft of the ESIA report, additional consultations in some areas where there can be specific impacts such as (2 residential areas cut by the coastal road, residential area of Tinh Gia township when dredging the polluted Cau Trang canal or the nearest residential area to the wastewater treatment plant) were conducted in November 2017 (from 17 November to 18 November).

Main consultation content:

- Presenting technical solution for work items in residential areas.
- Summary on social and environmental impacts and propose mitigation measures
- Discussion and contribution of ideas/comments on social and environmental impacts and mitigation measures
- Project's investment owner feedbacks.
- Meeting conclusion

Meeting members include:

- Leaders of commune/township People's Committees, Fatherland Front Committee.
- Representatives of organizations, unions (Women's Union, Youth Union, Elderly Association, Veterans Association, Farmer Union...).
- Head of village/residential group under the project.
- Representatives of affected households.
- Representative of project's investment owner

6.3 CONSULTATION WITH LOCAL AUTHORITIES

Project's investment owner had the written document (enclosed with summary report of the ESIA) to consult with commune/township People's Committees and Fatherland Front about idea contribution into social and environmental impacts and mitigation measures for the project.

People's Committees of project communes/townships also commented, contributed ideas and made recommendations on the project's environmental impacts and implementation of mitigation measures.

6.4 PUBLIC CONSULTATION RESULTS

Public consultations were organized with participation of mentioned members including local authority, local mass organizations and affected people. In order to facilitate people in expressing their opinions and wishes, the consultations were openly organized using questionnaires on the situation and consequences of some previous natural disasters, from which participated organization and people could express their wishes and requirement.

6.4.1 Results of Consultation with Communities

Table Error! No text of specified style in document..109. Results of Consultation with the Communities

No	Time and location	Participants	Comments from local community	Responses from PMU and/ consultants
1	Ninh Hai commune 8am – 10.30am on 10/10/2017	Tinh Gia District PC: 1 person <ul style="list-style-type: none"> Chairman/Vice Chairman of Commune PC. Mass organizations of commune (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people Heads of village/residential clusters in project area: 2-5 people Affected households: 20 people. Project owner: 1 - 2 people Consultant: 2 staffs 	<ul style="list-style-type: none"> Agreed to support the project because they understand the project's benefits from improved transportation, water supply, drainage and sanitation. Project should ensure reasonable compensation and resettlement for affected or displaced households Appropriate construction measures must be taken to minimize damage to public property as well as to other public works (electricity, water supply, etc.). Project should be implemented on schedule, successively, avoid prolonged construction which can affect people's living conditions. 	<ul style="list-style-type: none"> Thanked and acknowledged comments of the communities and local authorities This issue will be considered during the ESIA process
2	Hai Hoa commune 2pm – 4.30pm on 10/10/2017	<ul style="list-style-type: none"> Tinh Gia District PC: 1 person Chairman/Vice Chairman of Commune PC. Commune Mass organizations (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people Heads of village/residential clusters in project area: 2-5 people Representatives from AH: 20 people. Project owner: 1 - 2 people Consultant: 2 staffs 	<ul style="list-style-type: none"> Agreed and supported the project because it will bring great benefits to people. Planning and site clearance should be implemented publicly and appropriately, ensuring transparency and fairness. Construction process should be on schedule, not causing environmental pollution and traffic safety risk. Compensation for affected households should be reasonable. 	<ul style="list-style-type: none"> Thanked and acknowledged comments of the communities and local authorities This issue will be considered during the ESIA process
3	Binh Minh commune 8am – 10.30am on 11/10/2017	<ul style="list-style-type: none"> Tinh Gia District PC: 1 person Chairman/Vice Chairman of Commune PC. Mass organizations of commune (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people 	<ul style="list-style-type: none"> Agreed with the project's policy Compensation for affected households should be reasonable. Construction should be informed to local people prior to commencement. Appropriate construction methods should be applied to prevent damage to people's 	<ul style="list-style-type: none"> Thanked and acknowledged comments of the communities and local authorities This issue will be considered

No	Time and location	Participants	Comments from local community	Responses from PMU and/ consultants
		<ul style="list-style-type: none"> • Heads of village/residential clusters in project area: 2-5 people • Representatives from Affected households: 20 people. • project owner: 1 - 2 people • Consultant: 2 people 	assets and public works (electricity system, water system...)	during the ESIA process
4	Nguyen Binh 2pm-4.30pm on 12/10/2017	<ul style="list-style-type: none"> • Tinh Gia District PC: 1 person • Chairman/Vice Chairman of Commune PC. • Mass organizations of commune (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people • Heads of village/residential clusters in project area: 2-5 people • Affected households: 20 people. • Project owner: 1 - 2 people • Consultant: 2 people 	<ul style="list-style-type: none"> • Agreed and supported the project because the project will bring many benefits to the people • Appropriate construction methods should be applied to ensure safety for neighboring structures and labor safety because construction works are located in densely populated areas. • Project should ensure reasonable compensation and resettlement for affected households or affected structure or assets during the construction process. 	<ul style="list-style-type: none"> • Thanked and acknowledged comments of the communities and local authorities • This issue will be considered during the ESIA process
5	Xuan Lam commune, 2pm–4.30pm on 13/10/2017	<ul style="list-style-type: none"> • Tinh Gia District PC: 1 person • Chairman/Vice Chairman of Commune PC. • Mass organizations of commune (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people • Heads of village/residential clusters : 2-5 people • Affected households: 20 people. • Project owner: 1 - 2 people • Consultant: 2 people 	<ul style="list-style-type: none"> • Agreed and supported the project because the project will bring many benefits to the people • Project owner must ensure appropriate compensation for displaced or relocated households. • Project should be implemented on schedule, successively. Prolonged construction should be avoided because it can cause negative impacts on existing surrounding residential areas. 	<ul style="list-style-type: none"> • Thanked and acknowledged comments of the communities and local authorities • This issue will be considered during the ESIA process
6	Hai Nhan commune 8am – 10.30am, on 14/10/2017	<ul style="list-style-type: none"> • People's Committee of Tinh Gia District: 1 person • Chairman/Vice Chairman of Commune PC. • Mass organizations of commune (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people • Heads of village/residential clusters: 2-5 people 	<ul style="list-style-type: none"> • Agreed and supported the project because the project will bring many benefits to the people • For upgrading Cau Trang canal, attention should be paid to dredging and lining embankment for the canal and construction of infrastructure (trees, lighting system, drainage system) along the canal banks. 	<ul style="list-style-type: none"> • Thanked and acknowledged comments of the communities and local authorities • This issue will be considered during the ESIA process

No	Time and location	Participants	Comments from local community	Responses from PMU and/consultants
		<ul style="list-style-type: none"> Representatives from Affected households: 20 people. Project owner: 1 - 2 people Consultant: 2 people 	<ul style="list-style-type: none"> Procedure, technical solution and project implementation time should be ensured appropriately. 	
7	Tinh Gia township 8am – 10.30am, on 15/10/2017	<ul style="list-style-type: none"> Tinh Gia District PC: 1 person Chairman/Vice Chairman of township PC. Mass organizations of township (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people Heads of village/residential clusters in project area: 2-5 people Affected households: 20 people. Investment owner: 1 - 2 people Consultant: 2 people 	<ul style="list-style-type: none"> Agreed with the plan for rehabilitation of township's work items and with the project. For upgrading Cau Trang canal, attention should be paid to dredging and lining embankment for the canal and construction of infrastructure (trees, lighting system, drainage system) along the canal banks. During construction process, environmental impacts such as bad odor should be minimized. Damage to asset and impact on people's movement should also be mitigated. Compensation for affected households along Cau Trang canal should be reasonable. 	<ul style="list-style-type: none"> Thanked and acknowledged comments of the communities and local authorities This issue will be considered during the ESIA process
8	Hai Thanh commune 8am – 10.30am, on 16/10/2017	<ul style="list-style-type: none"> Tinh Gia District PC: 1 person Chairman/Vice Chairman of Commune PC. Mass organizations of commune (Fatherland Front Committee, Women's Union or Farmers' Association, Cadastral Officers, Youth Union): 5 people Heads of village/residential clusters in project area: 2-5 people Affected households: 20 people. Investment owner: 1 - 2 people Consultant: 2 people 	<ul style="list-style-type: none"> Agreed and supported the project. Environmental safeguards during construction should be applied, traffic safety should be ensured. Construction process should be shortened while still meeting technical requirement. When constructing Do Be Bridge, there should be a plan to ensure safe traffic connection on both sides of Kenh Than River. 	<ul style="list-style-type: none"> Thanked and acknowledged comments of the communities and local authorities This issue will be considered during the ESIA process

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No	Location and time	Participant	Community's comment	Investor's feedbacks
1	Ninh Hai commune 8am – 10.30am on 17/11/2017 (2 densely populated residential areas on the coastal road)	<ul style="list-style-type: none"> Ward PC Chairman/Vice Chairman Head of Son Hai village and head of Thong Nhat village and village's political organizations: 5-10 people. Representative of affected household: 70 people. Investor: 1 - 2 people Consultant: 2 people 	<ul style="list-style-type: none"> Agree and support construction of the coastal road. Alignment planning should avoid some sensitive areas such as historical sites, ancestral temple There should be a clear and transparent compensation plan to ensure objectivity and meet current regulations. Ensure construction with safety and on schedule, not affecting people's life and production. Should pay attention to drainage capacity, not causing localized inundation, not affecting agricultural production. 	<ul style="list-style-type: none"> Thanks and notes comments of local community and authority. Notes all comments and considers in the EIA report
2	Binh Minh commune 2pm – 4.30pm, on 18/11/2017 (Wastewater treatment plant)	<ul style="list-style-type: none"> Ward PC Chairman/Vice Chairman. Head of Dong Tien village and village's political organizations: 2-5 people Representative of affected household: 15 people. Investor: 1 - 2 people Tư vấn: 2 people 	<ul style="list-style-type: none"> Agree with construction of wastewater treatment plant. Construction should meet environmental standard before discharging into Than canal. Project area is low-lying land so there should be appropriate construction method, not to cause flooding Should ensure environmental sanitation, apply appropriate treatment method for waste as regulated. Should consider local planning to have appropriate construction method. 	<ul style="list-style-type: none"> Thanks and notes comments of local community and authority. All environmental impacts caused by bad odor, inundation... have been considered in the design to propose suitable mitigation measures such as selection of suitable location to ensure distance of 300m from residential area, planting trees surrounding the plant, constructing drainage system inside and outside the plant to conduct water to Than, with distance of 150m from the construction site. Notes all comments and considers in the EIA report

No	Location and time	Participant	Community's comment	Investor's feedbacks
3	Tinh Gia township 2pm-4.30pm on 17/11/2017 (Dredging and lining embankment for Cau Trang canal)	<ul style="list-style-type: none"> Township PC Chairman/Vice Chairman. Head of residential cluster 1 and villiage's political organizations: 2-5 people Representative of affected household: 15 people. Investor: 1 - 2 people Consultant: 2 people 	<ul style="list-style-type: none"> Agrees with the option of using box culvert to ensure aesthetic and no additional land acquisition and resettlement should be required. Rehabilitation of the canal should ensure technical aspect with a vision to 2030, 2050 to ensure minimum negative impacts. Ensuring drainage for household, organization, restaurant...along the canal banks Attention should be paid to environmental sanitation during construction and dredging of Cau Trang canal. Section passing through Tinh Gia township (densely populated, narrow canal bed 2-3m, various local bridges...) should consider the use of box culvert to ensure people's movement and minimize compensation for loss for the embankment work item. 	<ul style="list-style-type: none"> Thanks and notes comments of local community and authority. Section K0+000 ~ K0+280 has been proposed to be box culvert in the design to meet people's need Notes all comments and considers in the EIA report

6.4.2 Results of Consultation with Commune/township People's Committee

People's Committees of communes / towns in the project area of Tinh Gia district received the Official Letter dated 8/11/2017 of the PMU for construction of Nghi Son Economic Zone and Thanh Hoa Industrial Zones with the draft Environmental and Social Impact Assessment Report of the Integrated Urban Development Project - Tinh Gia Urban Sub-Project, Thanh Hoa Province. After reviewing this document, the People's Committees of the communes / township have the following opinions:

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No.	Location, Time	CPC's comments
1	Ninh Hai CPC (A written reply dated 17/11/2017)	<ul style="list-style-type: none"> • On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the corresponding contents presented in the project. • Recommendations to the Project Owner: <ul style="list-style-type: none"> - It should be ensured according to the approved project dossiers during the subproject project implementation - The Project Owner must be committed to strictly implementation of mitigation measures to minimize negative impacts by wastes in accordance with regulations.
2	Hai Hoa CPC (A written reply dated 20/11/2017)	<ul style="list-style-type: none"> • On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the corresponding contents presented in the project. • Recommendation to the Project Owner: <ul style="list-style-type: none"> - It is recommended that the project progress quickly, ensure quality and technical works. - Strictly comply with regulations on work construction, regularly informed to the local during the project implementation.
3	Binh Minh CPC (A written reply dated 17/11/2017)	<ul style="list-style-type: none"> • On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the corresponding contents presented in the project. • Recommendation to the Project Owner: <ul style="list-style-type: none"> - To well-done the ESMP for Tinh Gia subproject, the activities of site clearance must ensure that is democracy and in accordance with the Law. - To ensure that quality works, traffic safety and environmental protection.
4	Nguyen Binh CPC (A written reply dated 20/11/2017)	<ul style="list-style-type: none"> • On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the corresponding contents presented in the project. • Recommendation to the Project Owner: <ul style="list-style-type: none"> - Suggestion for safety construction with high quality equipments and environmental protection. - The project should be constructed immediately to ensure traffic safety, quality assurance. - The Project Owner must be committed to strictly implementation of mitigation measures to minimize negative impacts by wastes in accordance with regulations.
5	Xuan Lam CPC (A written reply dated 21/11/2017)	<ul style="list-style-type: none"> • On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the corresponding contents presented in the project. • Recommendation to the Project Owner: <ul style="list-style-type: none"> - Compensation for the temporary occupation of the construction site and restoring after construction. - Implement the income restoration program for affected households who have lost their agricultural land, crops, income, etc to support their livelihoods.
6	Hai Nhan CPC (A written reply	<ul style="list-style-type: none"> • On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the

No.	Location, Time	CPC's comments
	dated 20/11/2017)	corresponding contents presented in the project. • Recommendation to the Project Owner: - To ensure work quality during construction period; - To compliance with the proposed environmental and social management plan. - To take measures to compensate people for land clearance so that people can stabilize their life and social security to invest in economic development. - To carry out compensation for affected households so that they can restore their livelihoods.
7	Tinh Gia township PC (A written reply dated 22/11/2017)	• On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the corresponding contents presented in the project. • Recommendation to the Project Owner: - Consultation and information with affected households on land acquisition and environment should be carried out during the project preparation (design, site clearance) and construction periods. - To ensure traffic safety and sanitation condition during the project implementation. - The construction is quick and easy in order not to obstruct traffic, create a safety corridor on both sides of the road and ensure the visibility when participating in traffic. - To ensure good drainage and sanitation during construction.
8	Hai Thanh CPC (A written reply dated 20/11/2017)	• On the negative impacts and measures to mitigate the negative impacts of the project on the natural environment, socio-economic and community's health: Agree with the corresponding contents presented in the project. • Recommendation to the Project Owner: - To ensure traffic safety and sanitation condition during the project implementation. - The project should be constructed immediately, technical assurance.

6.5 INFORMATION DISCLOSURE

The first draft ESIA in Vietnamese had been published at the offices of 8 communes/township, Tinh Gia DPC and the PMU on Oct, 2017 for public consultation. Basing themselves on the contents of the ESIA, the local people could get the subproject information and contribute their opinions/comments on environmental issues. The revised draft ESIA/ESMP in Vietnamese language was published at the offices of 8 communes/township, Tinh Gia DPC and the PMU on November 22th, 2017. The draft ESIA/ESMP (English version) was disclosed on the World Bank website on 28 November 2017. It is expected that the final ESIA/ESMP in English will be disclosed at the World Bank's website in January, 2018.

CONCLUSIONS AND RECOMMENDATIONS

The proposed subproject is expected to bring about significant positive impacts such as improving urban environmental sanitation and landscape, enhancing access for the project area thus contributing to sustainable socioeconomic development in the subproject area. Most of these positive impacts are expected to be achieved during the operation phase of the subproject.

On the other hand, some potential negative environmental and social impacts and risks may also happen during the construction and operation of the facilities provided under the subproject. These include increased dust, noise and gas emission, vibrations, generation of solid wastes and wastewater, surface water quality reduction, traffic disturbance and increased traffic safety risks, damages to existing infrastructure (power/water supply, irrigation etc.) and disruption of related services increased localized flooding/sedimentation and erosion risks, health and safety issues for the public and the workers etc. These impacts are predicted to be at low to moderate level, and manageable through the environmental and social management plan proposed for this subproject. Therefore, the subproject should be implemented.

ANNEXES

ANNEX 1. DUE DILIGENT REVIEWS

1) Landfill/waste treatment plant for waste and hazardous waste of Nghi Son Environment JSC in Truong Lam commune, Tinh Gia district.

1. Project name	Construction of solid waste treatment site in Truong Lam commune, Tinh Gia district, Thanh Hoa province
Description	<p>Scope:</p> <p>The centralized solid waste treatment site was established in Nghi Son economic zone, Truong Lam commune, Tinh Gia district with a total area of 30 hectares, of which:</p> <ul style="list-style-type: none"> - The area for disposal of domestic solid wastes and for other treatment activities is 20 ha. - The area for hazardous waste treatment and recycling is 10 ha. - The plant capacity is divided into two stages as follows: <p>+ Stage 1:</p> <ul style="list-style-type: none"> - Domestic waste: 250 tons/day. - Hazardous waste: 45,000 tons/year. - Industrial waste: 50,000 tons/year. <p>+ Stage 2:</p> <ul style="list-style-type: none"> - Domestic waste: 500 tons/day. - Hazardous waste: 60,000 tons/year. - Industrial waste: 70,000 ton/year. <ul style="list-style-type: none"> - The project was approved by the Ministry of Natural Resources and Environment (EIA) in the Decision No. 2516/QD-BTNMT dated 12/12/2013. - The project has constructed a centralized wastewater treatment system with the capacity of 200 m3/day. - The project has been granted with the certificate No. 14/GXN-TCMT dated 6/2/2015 for implementation of environmental safeguards. - Project's nature: Sanitary burial compartment: <ul style="list-style-type: none"> - Size 80 x 120 m, semi-submerged structure, 3m deep underground and the height of embankment from the ground is 3m. - Roads around burial compartments have red gravel or crushed stone 1 x 2 surface structure. - The structure of each sanitary burial compartment consists of 4 layers: cover layer, waste layer, temporary cover layer of garbage and bottom layer. - Treatment procedure: Domestic waste collected from the surrounding areas is transported to the landfill of Truong Lam Commune. Here the waste will be compressed by the compactor and be covered temporarily with a clay layer of 0.2 m thick. When the waste is filled to the specified height, it will be covered with a layer of HDPE. After a period of time, the organic matter decomposes into gases and the burial height drops to about 40%.

	<p>Capital source: State budget</p> <p>Link with Tinh Gia DCIDP project: Truong Lam landfill site receives all solid waste and hazardous solid waste generated from the construction process of Tinh Gia subproject</p>
Operation	<ul style="list-style-type: none"> - The project has been operated since 2015. - The project has constructed a centralized wastewater treatment system with capacity of 200 m³/day. - The project has been granted with certificate No.14/GXN-TCMT dated 6/2/2015 for implementation of environmental safeguard measures. - At present, the landfill is operated at capacity designed in Phase 1.
EIA	<p>The project's EIA has been approved by the Ministry of Natural Resources and Environment in the Decision No. 2516/QD-BTNMT dated 12/12/2013. Environmental impacts on each component of the project are summarized as follows:</p> <p>+ Assessment on the selection option of the landfill:</p> <ul style="list-style-type: none"> - The land use rate in the area was quite low, a few number of households were affected by land acquisition so the compensation for site clearance was minimized. - Distance from the landfill to the residential area was suitable: within 1km distance from the site there was no concentrated population so the impacts on people (noise, dust and odors) generated from transportation and burial of domestic solid waste were minimized. - Hydrological condition: within 4km distance, there are no rivers and canals used for supplying domestic water but only for irrigation purposes for the whole area. - Climatic condition: suitable because it is located at the end of main wind direction - In term of land planning: It is suitable because it is located in the planning area of solid waste treatment in Thanh Hoa province. <p>+ Assessment on the negative impacts of the landfill from preparation, construction, operation and closure of landfill.</p> <ul style="list-style-type: none"> - Preparation phase: compensation and site clearance would affect the lives of affected people due to: loss of means of production such as loss of one part of field area, crop land..., and affect people's income. - Landfill construction phase: (1) Air quality reduction, noise and vibration caused by dust and gas emission, noise from excavation, embankment, transportation of raw materials and construction waste. of construction and transportation means and machines; (2) deterioration of water quality from domestic effluent from workers' camp and vehicle wash before leaving the site; (3) soil quality reduction due to waste from the site, solid waste from site clearance and domestic waste from construction workers; (4) Other impacts: occupational safety, traffic safety, changing landscape of the area during construction period. - Operation phase of landfill: (1) Wastewater, including: waste water leaking from landfill, domestic wastewater from officials and workers; (2) Gas emission: from the landfill due to the decomposition of organic substances, gas emissions (N₂, H₂S,

	<p>CH4) and noise caused by vehicles, dust and solid waste blown by wind; (3) Other impacts: risk of fire, explosion, hygiene and labor safety, impact on public health due to generation of environment for the growth of flies and pathogenic microorganisms.</p> <ul style="list-style-type: none"> - Closure of the landfill: (1) Wastewater: generation of wastewater is similar to that in the operation phase if final cover and surface drainage are not designed, installed and operated reasonably; (2) emissions of (N2, H2S, CH4) from landfill; (3) Other impacts: subsidence, fire hazard and dispersion of gas from burial compartments, affecting the regeneration of landscapes in landfill area. <p>The most significant environmental impacts are: waste leachate, gas emissions and the generation of flies and disease-causing microorganisms during the operation of landfill. Mitigation measures proposed in the EMP include mitigation measures, roles and responsibilities of stakeholders for environmental monitoring, management and capacity building programs.</p> <p>The total cost of environmental quality monitoring is 200,000,000 VND.</p>
<p>EMP's content</p>	<ol style="list-style-type: none"> 1. Treatment of waste leachate Waste leachate will be collected using perforated HPHD D200 pipes. There will be pumping station at the end of each leachate collection pipeline to collect the leachate to the waste water treatment station with the capacity of 200 m3/day. Leachate treatment technology is based on the technology of membrane filtration technology to ensure current standards. 2. Treatment of gas emission from landfill: Gas emissions (gas) in the landfill are collected by standing collector tanks which are evenly distributed. HDPE D200 pipes collect gas from these tanks and all of the collected gas will be burned by the burner. The tube connected to the burner is equipped with a device to prevent the flame from blowing back. 3. Treatment of odors and disease-causing organisms: In the process of burying garbage, in addition to the daily coating to prevent odor, EM (effective microorganism) is also sprayed regularly, especially after rain. In addition, trees will also be planted to separate the area of landfill with residential area. Surrounding fence will also be constructed. Spraying insecticide for flies, mosquitoes and insects with potential for disease Restraining people's picking up wastes and requiring protective clothing when working in the landfill. The plant has completed the environmental protection works before going into official operation; Environmental monitoring has been carried out once in every 3 months and periodically reporting every 6 months to competent authorities.
<p>Assessment compliance</p>	<p>on At present, the landfill is operating very effectively, complying with competent authorities' requirements for mitigation measure, management and monitoring and is still capable of receiving the project's solid waste. Therefore, negative integration effects are low.</p>



Treatment for hazardous wastes



Classification and treatment of domestic solid waste



Recycling solid waste

Investor will take following measures:

- + Rules and regulations on labor safety: Electrical appliances are grounded with standard resistors, transmission parts should be protected by mesh.

- + Regularly check the safety of the containers, chemical storage, especially the insecticides, mice control chemical....

- + There should be a signboard showing the boundary of the disposal site, which should be placed/hung at visible place. Arrange “No trespassing” signboard and fence at the gas wells to prevent incident.

- + Implement fire prevention and fighting regulations as regulated by the specialized management agency: The investor has built firefighting tanks which have regularly filled with water. In addition, reserve water tanks will also be constructed and CO2 fire extinguishers will be prepared. Regularly conduct training on fire safety for officials, employees ...

- + Provide adequate personal safety facilities.

- The management unit shall prepare work diary to annually monitor following items:

- + Name of waste truck’s driver

- + Type of waste.

- + Time (day, month, year) of waste transportation.

- + Origin of the waste.

- + Notebooks and related materials will be kept during operation duration.

- Apply incentive bonus and punishment policy for the implementation of technical processes and labor safety rules when working at the disposal site.

- Maintain a periodical health check (Once in 6 months) for all employees. Classify health statuses and have timely solution for staffs who are ill or have poor health to timely have treatment and active prevention. At the same time, there should be plans to coordinate with health organizations to examine the health of people in the surrounding areas in order to detect in time the probable causes of diseases caused by the operation of the disposal site.

- Have incentive/allowance policy for workers doing heavy and dangerous work in accordance with State’s regulations.

The contractor will apply a number of measures throughout the process of construction including:

- Providing adequate labor protection as prescribed, workers are arranged with reasonable rest and are provided with 2 sets of protective clothes/year (including hat, mask, glasses, ...).

- Spray water to create reduce dust emission in the construction area and along the transport route with a length of 50m from the project area. Using tank car 5m³ to spray through a hole horizontally arranged under to tank. Water spraying is expected 03 times per day.

- At the storage area of construction materials, especially cement storage area, we will shield carefully to limit the release of dust into the air in windy condition.

- The trucks transporting materials for the construction process will be covered with canvas.

- Apply advanced construction methods, maximize mechanical method and use modern construction machinery with high efficiency of fuel use to limit the generation of dust from exhaust gases.

	<ul style="list-style-type: none"> - Handle with dust: Cover the area of sand, stone and cement before and after loading the materials to prevent dust. - During construction, materials must be properly gathered within the project’s scope as in the construction design drawings. - Regularly cleaning construction site of the work item in the residential area of project communes, NH1A, East – West road, at the intersections with residential areas... - Applying measures to protect the health of workers, reduce the impact on public health. - Contractor will provide workers with good living conditions and hygienic conditions and ensure collection of domestic wastes. - Cooperate with local authorities to disseminate information to workers about social evils, prostitution, epidemics and HIV in the area ... to ensure health for workers and the community. Contractor will cooperate closely with local authorities to ensure good hygiene and epidemic prevention when there is any signs of epidemic; - Alcohol and gambling are strictly prohibited at construction site. Workers will have time table to follow. - Wastewater from personal hygienic purposes (urinating): be treated with septic tank at construction camps with the calculated parameters as follows: - All domestic wastes will be collected once a dy as in the contract between construction contractor with local garbage collector to be transported for treatment as regulated. - Regularly propagate and disseminate information to improve workers’ awareness on environmental sanitation and on proper discharge of waste.
<p>Recommendations</p>	<p>The project management unit should closely work with the operation unit of the landfill in Truong Lam Commune (Nghi Son Environment Joint Stock Company) to:</p> <ul style="list-style-type: none"> - Exchange information on compliance with environmental mitigation between the project’s contractor and the landfill’s operation unit; - Sign contract for transporting and processing solid wastes/dredged sludge/hazardous wastes between the project’s contractor with the landfill’s operation unit to ensure compliance with the solid waste/sludge collection and treatment process.



Figure 1. The process of collecting and transporting wastes to Nghi Son treatment plant

2) Project of the North - South No.2 (linked project to the work item of (1) Coastal road from Ninh Hai –Lach Bang 2 Bridge)

<p>2. Project's name</p>	<p>Construction of North-South 2 road, from the junction with East-West 1 road to NH1A junction, Nghi Son EZ.</p>
<p>Description</p> 	<p>Scope: To construct a road with total length of 6.82 km with width B = 36m. Capital source: Bond of Government of Vietnam: Link with Tinh Gia DCIDP project:</p> <ul style="list-style-type: none"> - The coastal road from Ninh Hai to Lach Bang 2 bridge will be directly connected with the North South 2 road, from the intersection with the East-West 1 road to the junction with NH1A, Nghi Son EZ.
<p>Status</p>	<p>+ Compensation and site clearance have been completed. + 80% of construction has been completed and the road is going to be connected with Lach Bang 2 Bridge and the end point of the coastal road from Ninh Hai to Lach Bang 2 Bridge in November 2017.</p>
<p>EIA's status</p>	<p>This project has been prepared from 2008-2009. The EIA report of the project has been approved by Nghi Son Economic Zone Authority in 2009.</p>
<p>EMP's content</p>	<p>During the field survey in the area under construction, a number of mitigation measures have been implemented by the contractor of this project as follows:</p> <ul style="list-style-type: none"> - The arrangement of camp is reasonable, not affecting the road and traffic condition in the area. - The construction solid waste has been gathered reasonably, covered, dried and then transported to the landfill in Truong Lam commune and discharged according to regulations.

Assessment on compliance	<p>+ This project has fully complied with regulations on environmental protection during the preparation and construction of the project.</p> <p>+ The construction contractor has complied with the measures to minimize the environmental impact and traffic safety and health of workers in construction; Disposal of waste has been made at right place as contracted with the landfill operator in Truong Lam Commune.</p> <p>- Other mitigation measures for solid waste management to be applied include:</p> <p>+ Develop a plan for management and use of construction materials; Avoid material spillage when transporting or gathering at wrong location, affecting construction activities and surrounding environment.</p> <p>+ Scattered and fell stones and soils will be transported to disposal site as designed by the project.</p> <p>+ Surplus iron and steel, cement bags ... shall be gathered collectively on the camps of workers for reusing or selling to local waste collecting establishments.</p> <p>- In order to minimize the pollution caused by oil and grease from the construction process, the investor requests the construction company to take the following measures:</p> <p>+ Minimize the repair of vehicles and machinery in the project area.</p> <p>+ Waste oil and grease (oily cloth, batteries, etc.) will be collected by the construction unit in the tanks located in the camp.</p> <p>+ Once every 3 months, the construction unit will contract with Nghi Son Environment Joint Stock Company to collect and treat the waste in accordance with Circular No. 36/2017/TT - BTNMT dated 30 June 2017 by the Ministry of Natural Resources and Environment on the management of hazardous waste.</p>
Recommendation	<p>The project management unit should closely work with the management board of Nghi Son Economic Zone and industrial parks to:</p> <ul style="list-style-type: none"> - Exchange information on the compliance with environmental mitigation measures of contractor and the road management entity; - Send prior notice on the project construction schedule to the management entity to minimize impacts caused by the construction activities on the work quality for the completed road.

For some available main material quarries intently to be used for the subproject:

1. Name of quarry	Gao mountain quarry, Truong Lam commune, Tinh Gia district, Thanh Hoa province
Operation status	<ul style="list-style-type: none"> - Investor: Tan Thanh 6 One-member limited company - The quarry was granted permit on exploitation and land rental under Permit No. 440/GP-UBND by Thanh Hoa Provincial People's Committee on 28/11/2014. - Quarry's reserve: 2,414,452 m³.
EIA status	<ul style="list-style-type: none"> - The quarry's Environmental rehabilitation scheme was approved under Decision No.2523/QĐ-UBND by Thanh Hoa Provincial People's Committee on 11/8/2014.

	<ul style="list-style-type: none"> - The quarry's EIA report was approved by Head of Nghi Son Economic zone management unit under Decision No.248/QĐ-BQLKKTNS, dated 13/8/2014.
EMP content	<p>- Issues on environmental impacts, safety and health in the quarry include dust, noise, blasting, machine operation, excavation pit/wall, loading and unloading of materials ...). The measures are as follows:</p> <ul style="list-style-type: none"> + Regularly organizing training courses on labor safety and health for both employer and workers. + Workers working at the quarry must be trained in labor safety and passed training courses before entering the workplace. + Workers working at the height of 2m or more, in dangerous climbing positions or under the edge of the floor must wear seat belts, the seat belt must be fastened to the firm pile. Periodically checking the strength of the pile; Workers working on high platform must not use alcohol; rustic tobacco and tobacco; In particular, people with a record of heart attack should not be arranged for heavy work and at height. + Workers must comply with the regulations on safety and labor protection: glasses, helmets, safety belts ... + Keep close contact with local authorities to collect opinions of local communities on environmental protection and find solutions; - Before and after blasting, there must be a warning signal around the safety radius of rock crashing and vibration which is minimum 200m and 300m for equipment and human, respectively. - Utility works should be available in the quarry area for workers's use such as: canteen, toilet, bathing place ... <p>Hazardous wastes generated during the operation of the quarry are oil, grease and waste with around 20 kg/month. This amount will be collected and treated by Nghi Son Environment Joint Stock Company under contract.</p>
Assessment on compliance	<ul style="list-style-type: none"> - Environmental remediation deposit: environmental remediation deposit has been made under current regulation at Environmental Protection Fund of Thanh Hoa Department of Natural Resources and Environment. - Trees have been planted around the quarry with distance to the nearest residential area of 500 m. - Operation parameter: Number of machineries to be used (10 machines including excavator, bulldozer, crane, truck...) and about 50 workers. - Protective facilities (helmet, glove, protective cloths...) are provided sufficiently to worker (2 sets/person); health check once in 6 months about occupational disease, awareness building on HIV/AIDs... - Workers in charge of blasting work (10 workers) have been granted with permits by Department of Industry and Trade. Blasting operation will be warned and informed regularly to the local community. Generally, blasting is done at noon. - Quarry's staffs will be regularly trained on occupational health and safety at Thanh Hoa Department of Labors, Invalids and Social affairs once in 6 months.
2. Quarry's name	Borrow pit in Phu Lam commune, Tinh Gia district, Thanh Hoa province
Opration status	<ul style="list-style-type: none"> - Investor: Duc Minh private company

	<ul style="list-style-type: none"> - The borrow pit was granted with Permit No. 140/GP-UBND on exploitation and land rental by Thanh Hoa Provincial People's Committee on 17/4/2014. - Quarry's reserve: 1,200,000 m³.
EIA status	<ul style="list-style-type: none"> - The borrow pit's EIA report and Environmental rehabilitation scheme with addition of investment in the borrow pit exploitation scope were approved under Decision No.1067/QĐ-UBND by Thanh Hoa Provincial People's Committee on 31/03/2015.
EMP content	<p>- Issues on environmental impacts, safety and health in the borrow pit include dust, noise, blasting, machine operation, excavation pit/wall, loading and unloading of materials ...). The measures are as follows:</p> <ul style="list-style-type: none"> + <i>Regularly organizing training courses on labor safety and health for both employer and workers.</i> + <i>Workers working at the quarry must be trained in labor safety and passed training courses before entering the workplace.</i> + <i>Workers working at the height of 2m or more, in dangerous climbing positions or under the edge of the floor must wear seat belts, the seat belt must be fastened to the firm pile. Periodically checking the strength of the pile; Workers working on high platform must not use alcohol; rustic tobacco and tobacco; In particular, people with a record of heart attack should not be arranged for heavy work and at height.</i> + <i>Workers must comply with the regulations on safety and labor protection: glasses, helmets, safety belts ...</i> + <i>Keep close contact with local authorities to collect opinions of local communities on environmental protection and find solutions;</i> - Utility works should be available in the quarry area for workers's use such as: canteen, toilet, bathing place ... - Hazardous wastes generated during the operation of the quarry are oil, grease and waste with around 20 kg/month. This amount will be collected and treated by Nghi Son Environment Joint Stock Company under contract.
Assessment compliance	<ul style="list-style-type: none"> - Environmental remediation deposit: environmental remediation deposit has been made under current regulation at Environmental Protection Fund of Thanh Hoa Department of Natural Resources and Environment. - Trees have been planted around the borrow pit area with distance to the nearest residential area of 1,000 m. - Operation parameter: Number of machineries to be used (5 machines including excavator, bulldozer, crane, truck...) and about 20 workers. - Protective facilities (helmet, glove, protective cloths...) are provided sufficiently to worker (2 sets/person); health check once in 6 months about occupational disease, awareness building on HIV/AIDs... - Borrow pit staffs will be regularly trained on occupational health and safety at Thanh Hoa Department of Labors, Invalids and Social affairs once in 6 months.

For the disposal site of Lach Bang port project with area of about available 2.5ha:

Project's baseline information:

Project's name: Upgrading and expansion of Lach Bang fish port project – Thanh Hoa province.

Project’s owner: Thanh Hoa Department of Agriculture and Rural Development

Representative of Project’s owner: Thanh Hoa Aqua-product Project Management Unit

Project’s location: The project is located on the right bank of Lach Bang river in Hai Binh commune of Tinh Gia district, about 800m upstream from Lach Bach river estuary.

Work items: To dredge and construct fishing wharves, vessel berths and waterways in front of wharves, sand dikes, architectural works and technical networks ... The total investment capital is 156 billion dong. Implementation duration of the project: 2010 - 2011.

Status of EIA: The EIA report was approved in 2010 by Decision No. 114/QD-BNN-KHCN dated 14 January 2010 of the Ministry of Agriculture and Rural Development approving the EIA report of the project to upgrade and expand the Lach Bang port of Thanh Hoa province.

Main contents of the EMP:

According to the results of periodic monitoring of Thanh Hoa Department of Natural Resources and Environment, the water quality of Lach Bang River has been salinized with the highest salinity of about 28‰, river sediment has salinity of about 6 - 7‰.

Disposal site in the Lach Bang fish port project: includes 4 locations for disposing dredged material from this project. So far, these disposal sites have still had empty land area at the Site 4 (near Ben Ngao sluice - Lach Bang estuary) to receive about 50,000 to 70,000 m³; and mitigation measures for this disposal sites are as follows:

Disposal site	Capacity (m ³)	Mitigation measures for the disposal sites receiving dredged material generated from the project
Site 4 - area 3.7 ha	120,000	Embanking the dyke by in-situ excavated soil Arranging weirs by bamboo piles along the Lach Bang river bank with distance of 50m per weir. For site 1, arrange 39 weirs to prevent inundation for surrounding areas and for draining leachate to Lach Bang river.



Figure 2. Embanking the dyke around the disposal Site 4

ANNEX 2- DCIDP TINH GIA DREDGED MATERIALS AND DREDGING MANAGEMENT PLAN

1. Location of Dredging, Volume and Characteristics of Dredged Materials

The Project proposed to rehabilitate the Than and Cau Trang canals (dredging and embankment lining). The contractors will carry out both dredging of the parts underwater and excavation of the soil, including top soil, on the Than and Cau Trang canal.

The Than canal will be dredged in one section with total length of 5km, canal width is 25.5m. The section to be dredged is from the Mai bridge (Km 8+893) to the Do Be bridge (Km 13+822). The Cau Trang canal will be dredged in a section with L = 5.7 km, B= 4 - 9 m. The maps showing the dredging area are shown in Figures 1 and 2 below.

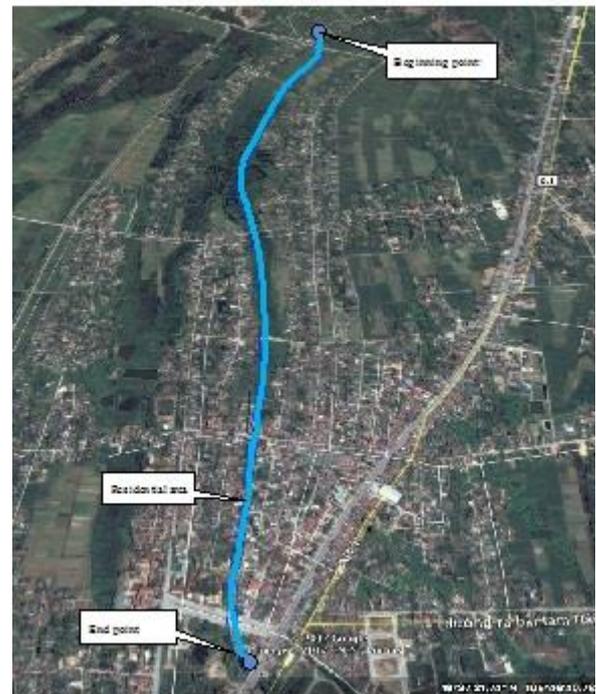


Figure 1: Dredging Area of the Than Canal

Figure 2: Dredging area of the Cau Trang canal

It is estimated that approximately 112,110 m³ of dredged materials will be generated from the dredging and canal lining at the Cau Trang and Than canals. The estimated volume of dredged and excavated materials of each item are listed in the Table 1 below.

Table 1 –Volume of Dredged Materials

No.	Item	Unit	Than canal	Cau Trang canal	Total
1	Dredged material	m3	68,630	43,480	112,110
2	Excavation	m3	59,357	9,520	68,877
	Total	m3	127,987	53,000	180,987

According to baseline data provided in Chapter 2 of the ESIA, the tested contents of heavy metal (Cd, Cu, Pb, Zn) in the sediment samples are within allowable limit. However, salinity in the sediment of the Than canal is at around 5‰.

Table 2 –Sediment Quality on Than and Cau Trang canals

Parameter	Salinity	Cd	Cu	Lead (Pb)	Zinc (Zn)
Unit	‰	mg/kg	mg/kg	mg/kg	mg/kg
T1	4,90	3.12	60.7	8.7	68.5
T2	5,13	2.09	62.3	5.5	69.0
T3	5,26	1.80	60.9	6.3	69.5
T4	5,42	2.18	64.5	8.1	58.9
T5	5,12	1.14	64.1	8.3	67.7
T6	0,71	2.05	63.8	6.8	56.9
T7	0,62	2.11	61.7	5.9	69.2
T8	1,15	3.13	61.5	7.5	59.0
T9	3,81	2.60	62.9	6.6	68.8
T10	5,92	1.15	62.2	7.3	49.1
QCVN 43:2012/BTNMT	-	4.2	108	112	271
QCVN 07:2009/ BTNMT Ctc (mg/l)	-	5	-	15	250
Sampling location:					
TT1: At Than canal at the section passing Dong Hai hamlet, Hai Hoa commune					
TT2: At Than canal section at Son Hai bridge in Binh Minh commune					
TT3: At Than canal section at Do Be bridge in Binh Minh commune					
TT4: At Than canal section at Do Be bridge in Binh Minh commune, at the WWTP site					
TT5: At Than canal section crossing with the access road to Hai Nhan communal People's Committee headquarter					
TT6: At Cau Trang canal at the section passing through residential area of Tinh Gia township					
TT7: At Cau Trang canal at the section crossing with the access road to Tinh Gia district People's committee headquarter					
TT8: At Cau Trang canal section near Cong bridge, Tinh Gia township					
TT9: At Cau Trang canal section crossing with Than canal in Binh Minh commune					
TT10: At Lach Bang river section crossing with Than canal					

2. Temporary and Final Disposal Site

Temporary Disposal Site

Dredged materials from the Than and Cau Trang canals will be loaded temporarily into the existing ponds located along the two canals. The locations of these ponds are listed in Table and shown in the Figure below

Table 3 - Locations of Temporary storage Areas

	Temporary dump sites	Area (m ²)	Volume (m ³)	Location
<i>I</i>	<i>Than canal</i>	<i>43,100</i>	<i>70,425</i>	
1	Temporary dump site 1	11,000	16,500	500 m from beginning point
2	Temporary dump site 2	3,600	5,400	Next to Cau Noi bridge

3	Temporary dump site 3	10,500	15,750	Nex to Chay bridge
4	Temporary dump site 4	18,000	27,000	Between Chay bridge and Binh Minh bridge
5	Temporary dump site 5	3,850	5,775	Next to Binh Minh bridge
<i>II</i>	<i>Cau Trang canal</i>		<i>44,280</i>	
1	Temporary dump site 1	17,100	20,520	800m from begining point
2	Temporary dump site 2	8,400	10,080	At Km 1+200
3	Temporary dump site 3	4,800	5,760	800m from the intersection of NH1A
4	Temporary dump site 4	6,600	7,920	At ending point

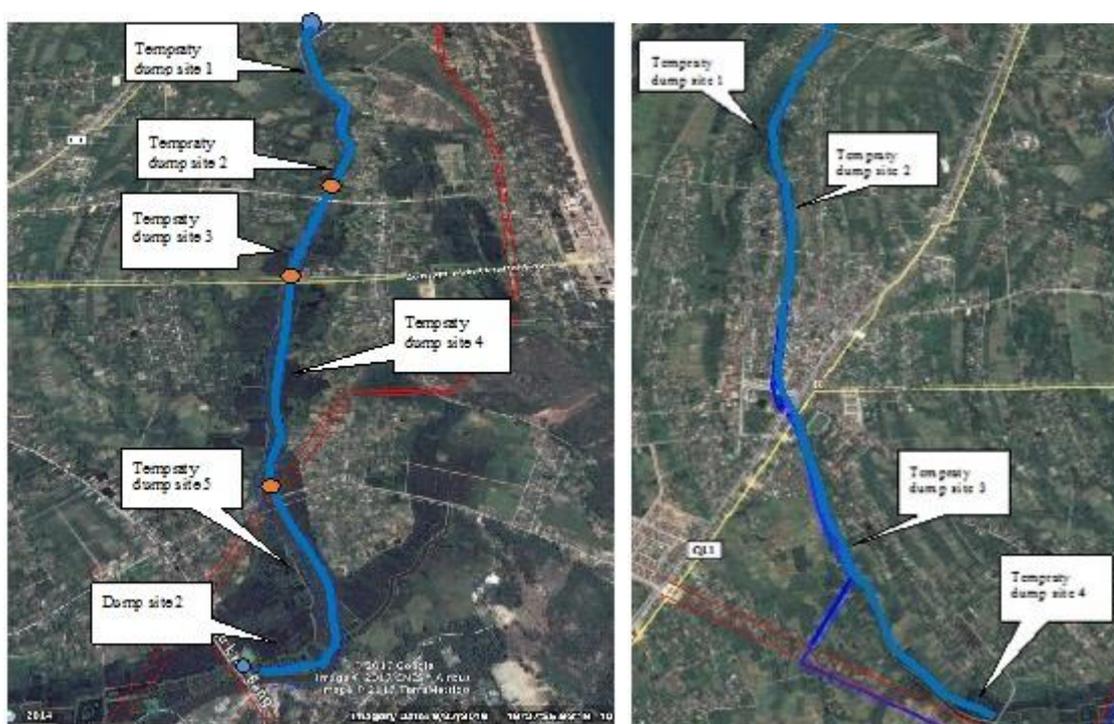


Figure 3: Location of Temporary dump site on Than & Cau Trang canal

Final Disposal Sites

The data in Table 1 also indicate the volumes of dredged materials, which is 112,110 m³. By surveying, collecting data and consulting with stakeholders (DONRE, Tinh Gia District PC, Binh Minh Communal PC), two permanent disposal sites were proposed, including:

- (1) The disposal site near Ben Ngao sluice - Lach Bang river mouth in Binh Minh commune will be used for the Tinh Gia subproject. This is the disposal site formed under the Lach Bang port project. Currently the land area available for disposal is of about available 2.5ha. The distance from the disposal site to the dredging area of Than and Cau Trang canals is 3 - 8 km; The main transportation route is Binh Minh inter-communal road. The disposal site's capacity is about 50,000 m³ (corresponding to the discharge height of about 2 m).



Figure 3. Proposed Disposal Site at Lach Bang rivermouth

(2) The disposal site near Do Be bridge with area of about available 4.5ha. The distance from the disposal site to the dredging area of Than and Cau Trang canals is 0.5 - 5 km. The main transportation route is Binh Minh inter-communal road. The disposal site's capacity is about 67,500 m³ (corresponding to the discharge height of about 1.5 m). So that, total disposal site's capacity is about 117,500 m³. The area of this disposal site is sufficient to accommodate the volume of dredged material from Than and Cau Trang canals.

The locations of the two disposal sites are shown in the Figure 4 below.



Figure 4: Location of Disposal Site for dredged material on Than & Cau Trang canal

3. Social and Environmental Impacts and Risks related to Dredging

The typical potential impacts and risks related to dredging together with mitigation measures are listed in the Table 4 below.

Table 4 – Typical Socio Environmental Impacts and Risks

Impacts and Description	Mitigation Measures
AT DREDGING and TEMPORARY LOADING AREAS	
<i>Interruption to drainage and irrigation service</i> Irrigation service may be disrupted if the existing irrigation ditch is blocked during the dredging and embankment lining	<ul style="list-style-type: none"> - Inform community at least two weeks before dredging - Dredging half width of the canal each time, retain the other half for drainage and irrigation function
<i>Odour and air pollution, nuisance</i>	<ul style="list-style-type: none"> - Inform the community at least one week before dredging is started

Impacts and Description	Mitigation Measures
<p>Decomposition of organic matters under anaerobic conditions generates strong odour-generated gases such as SO₂, H₂S, VOC etc. When the muds are disturbed and excavated, these gases are released much faster into the air. Exposure to odour pollution affect the health of workers, local residents and cause public nuisance</p>	<ul style="list-style-type: none"> - Minimise the duration of temporary loading of dredged materials on-site - Load the materials on-site tidily - Do not load the materials temporarily outside the designated ponds, - Cover the dredged materials while loading temporarily near populated areas
<p><i>Dust and nuisance</i></p> <p>Temporary loading of sludge at the construction site cause nuisance to the public</p> <p>Dry and wet mud may be dropped along the dredging area and on transportation route causing nuisance to the public and traffic safety risks</p>	<ul style="list-style-type: none"> - Avoid temporary loading of dredged materials on-site where possible - Dredged materials must be transported to the final disposal sites earliest possible - 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
<p><i>Traffic Disturbance and increased traffic safety risks</i></p> <p>The placement and operation of dredging equipment and construction plants on the ground, temporary loading of the dredged materials may obstruct or disturb traffic and cause safety risks for the people travelling on the river-side road, particularly at the Cong Town</p>	<ul style="list-style-type: none"> - Place “road work” and “slow down” signboards at the populated or near residential areas - Clean up and rehabilitate the disturbed areas as soon as possible
<p><i>Social Disturbance</i></p> <p>Concentration of workers and equipment, construction plants, temporary loading of materials and wastes, traffic disturbance, dusts and odour pollution etc. may disturb daily activities and the lives of local communities</p> <p>Conflicts may also be arisen if workers, waste, materials, equipment etc. are present outside the construction corridor</p>	<ul style="list-style-type: none"> - Optimise construction duration schedule to maintain irrigation and drainage function but also minimising the impacts on the residents living along the river - 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 - Enforce workers to comply with codes of conducts
<p><i>Landslide and soil subsiding risks at dredging area</i></p> <p>Relative deep excavation or cut and fills on the embankments that create slopes may lead to</p>	<ul style="list-style-type: none"> - 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

Impacts and Description	Mitigation Measures
<p>landslide and soil subsiding at the slopes or excavated areas, particularly in rainy weather</p> <p>Deep excavation also cause risks to the existing buildings nearby, particularly the weak structures or located too close to the deep excavation area.</p>	<ul style="list-style-type: none"> - Consider and select appropriate dredging method that allow minimising soil subsiding risks, for example carry out stepped excavation, stabilise slopes in parallel to dredging - Apply protective measures such as sheet piles at risky locations
<p><i>Water Quality Degradation</i></p> <p>Turbidity in water will be increased when the mud is disturbed; Water leaked from dredged material and surface runoff through disturbed ground also contain high solid contents. Muddy water entering irrigation ditch will cause sedimentation. Aquatic livestock in the river would also be affected by turbid water.</p>	<ul style="list-style-type: none"> - 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
<p><i>Increased Safety risk for the Public</i></p>	<ul style="list-style-type: none"> - 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
<p><i>Health and Safety risk to the workers</i></p> <p>The health of workers may be affected due to exposure to odour and other contaminants from sludge</p> <p>When working in or near Tri river, there is a risk of being drown Insects, reptiles such as bees, snakes from riverside bush may appear and attack the workers</p>	<ul style="list-style-type: none"> - Provide and enforce the workers to use masks, gloves, boots, hats. If and when working in the water, protective cloths, life-vests must be worn. - Do not kill the insects/reptile, try to drive them away
<p><i>Others</i></p>	<ul style="list-style-type: none"> - Other relevant measures specified in ECOP or proposed by the contractors as necessary
MATERIAL LOADING AND TRANSPORTATION	
<p><i>Dust and nuisance, traffic safety risks</i></p> <p>Dust or wet materials may be dropped along the transportation route</p>	<ul style="list-style-type: none"> - 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	
<p><i>Erosion, Landslide risks at final Disposal site</i></p> <p>Although the excavated and dredged materials will be disposed of in the existing holes at the quarries, erosion due to strong wind may still happen if no measures are applied the high dumps of loose granular materials are formed. On the other hand, when the dump is high enough, landslide may happen under the impacts of wind and rainwater</p>	<ul style="list-style-type: none"> - Level the materials after being disposed off - Slopes of the dumps will not be steeper than 45o - Build/create the walls to protect slopes - Create and maintain drainage surrounding each disposal area if the dumps make ground level higher than the surroundings
<p><i>Disturbance to existing drainage</i></p>	<ul style="list-style-type: none"> - Dispose of the materials at designated areas only

Impacts and Description	Mitigation Measures
Unloaded dredged and excavated materials may be disturbed, damage or block the existing drains causing localised flooding	- 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

Risks Related to Salinity of Dredged Materials and Wastewater

As the salinity in dredged materials from the Cau Trang canal is around 3‰, and slightly more than 5‰ in that of the Than canal, if these materials fill up agricultural/garden land, vegetation covers, crop and trees may be affected seriously. On the other hand, if surface runoff passing such dredging materials before entering agricultural/garden land, similar effects may also happen. The impacts of salinity on plants and salinity tolerance ranges of some crops trees are shown in the Box below.

Impacts of Salinity on Plants

Plant species vary in how well they tolerate salt-affected soils. Some plants will tolerate high levels of salinity while others can tolerate little or no salinity. Perennial plants seem to handle salinity better than annual plants. In some cases, salinity also has a toxic effect on plants because of the high concentration of certain salts in the soil. Salinity prevents the plants from taking up the proper balance of nutrients they require for healthy growth¹⁶.

Salinity tolerance ranges of some types trees and plants as shown below¹⁷:

- Fruit Trees: oranges, grape fruit: 2‰, mango: 4‰, sugar canes: 2‰, coconuts: 7‰.
- Rice: 2‰, only when young and multiplying. Rice is very sensitive with salinity during flowering.
- Corn: 1‰, tomatoes: 2‰, beans: 5‰

The potential impacts of dredged materials onto vegetation cover/agricultural land can be managed by isolating the dredged materials and control the surface runoff passing temporary and permanent disposal areas.

The measures to minimise the impacts and risks from to salinity of dredged materials and related wastewater are presented under Temporary and permanent loading requirements specified in the sections below.

4. Dredging Method, Temporary Loading and Transportation of Dredged Materials

Below are the ***dredging methods*** proposed during project preparation phase. The contractor may be proposed adjustments or alternatives provided that the pollution control requirements are met.

Dredging activities will not be conducted in flood season (from May to September), during extreme weather events (heavy rains, floods, cyclones, etc). Successive dredging method will be applied. Dredge half width of each section of canal from 100m to 200 m, upstream to downstream. The remaining half width will be retained to maintain drainage and irrigation functions of the canal. For each section, coffer dams made of eucalyptus timber and sand bags shall be built surrounding half of canal with where dredging will take place. Pump river water out of the dredging section. Use excavators and buckets to dredge the Than and Cau Trang

¹⁶ Salt Tolerance of Plants, Alberta Agriculture and Forestry, [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex3303](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex3303). Accessed 30 November 2017

¹⁷ Salinity tolerance of some crops, Vietnam Sugarcan research institute. <http://www.vienmiaduong.vn/vi/detailkhoa.php?idTin=793>, accessed 30 November 2017

canals to the designed elevation (except the section of Tinh Gia township on Cau Trang canal), at about 0.75 to 1.93 m.

Temporary loading Requirements. Dry the ponds and lay impermeable materials (**tarpaulin**) to cover the bottom and the embankments of these ponds before using them for temporary loading of dredged materials. When the dredged materials are dumped in to these ponds, wastewater will be leaked from the saline wet/damp materials. Create outlet and ditch at one or two locations at each pond and lead the wastewater to run back into the canals. It is important that the contractors, CSC and project owner are well aware that the dredged sediment has salinity at about 5‰, if such sediment or rainwater passing the temporary disposal site enter agricultural land, serious damages to vegetation cover or crops may happen. Therefore, runoff these ponds should be monitored closely. Then

Transportation Requirements. Load and transport the dry dredge materials to the designated disposal sites (the Dump Site 1 is next to the salinity control sluice and the Dump Site 2 is near Do Be bridge). Truck must be covered tightly to prevent materials dropped along transportation route. In cases where damp sediments must be transported, ensure that the truck tank is water tight so as muds do not drop along the road.

Final Disposal Requirements. Lay impermeable materials (**tarpaulin**) to cover the bottom and the embankments of disposal site near the Do Be Bridge before using it for disposal of dredged materials. Create or improve ditches at the site to ensure that surface runoff passing the site will go into the riverside, not inland side while embankments and/or sedimentation traps must be created to prevent disposal materials from entering the river. Laying tarpaulin materials is NOT required to the disposal site near Lach Bang Disposal Site. Slopes must be stabilised in a timely manner to prevent landslide risks. Carry out levelling of ground surface at the disposal site weekly to minimise erosion potentials. Apply top soil on the top if feasible. In addition, the Contractor will implement all the site-specific mitigation measures applicable for the final disposal sites as specified in Table 5.11, Chapter 5.

5. Contractor's Dredging Management Plan

The Contractor is required to prepare a Contractor's Dredging Management Plan (CDMP) and submitted to the Environmental Consultant of the Construction Supervision team and the PMU Environmental Officer for review and approval. The CDMP will include, but not limited to the followings:

- 1) The Scope of Works in the Contract package, construction method and schedule
- 2) Volume and quality of water quality and sediment quality in the dredging area covered by the contract
- 3) Water users that may be affected by the dredging and embankment lining
- 4) Materials uploading and transportation method: indicate proposed route of the transport from the dredged site to the disposal area, time of operation, type of vehicles/trucks and proposed measures to reduce the leakage of the dredged materials from the transport trucks,
- 5) Schedule to inform the nearby communities about the project, disclosure of name and contact number for possible complaints.
- 6) Potential social and environmental impacts, including the site-specific impacts and risks
- 7) Mitigation measures to address the potential impacts and risks. The mitigation measures should be proposed based on ESIA/ECOP, ESMP, SEMP, the potential impacts and mitigation measures presented in Section 4 and 5 of this Plan and the following requirements:

Environmental Quality Monitoring plan carried out by the contractor (particularly pH, DO, TSS, BOD, salinity for water. For soil and sediment: The total dredged sediment is

112,110 m³, The contractor will take at least 6 sediment samples and test for pH, Hg, As, Cd, Cr, and salinity following the guideline given below.

Table5. The number of Sediment samples

Volume of dredged (m ³)	No of Sediment Samples
Up to 25,000	3
25,000 to 100,000	4-6

8) Results of Consultation with affected community about the draft CDMP.

6. Additional Guidance on the Potential Impacts and Mitigation Measures to be included in CDMP

- Disturbance to the ground and on riverbed is kept at minimal; Monitoring is carried out regularly ensure temporary storage of dredged materials in abandoned ponds would not cause pollution to the surrounding; sedimentation trap is installed surrounding these ponds;
- When storm is forecasted, dredging or embankment lining activities will be limited, site protection measures are implemented; all construction activities will be halted in stormy weather;
- Dredging equipment must be operated at slow speed in intervals to allow sedimentation;
- Provide warning signs at dangerous areas, for example, underflows, erosion points, or deep excavation;
- Specified safety equipment such as lifebuoys are provided to the workers and force the use when working in the water. Assign observers throughout work shifts for timely rescue in case of emergency;

The contractor should dig and retain the existing grass to cover the surface of the dredged material after completion at the final disposal sites.

ANNEX 3. MAPS FOR LOCATION OF BASE ENVIRONMENTAL SAMPLING

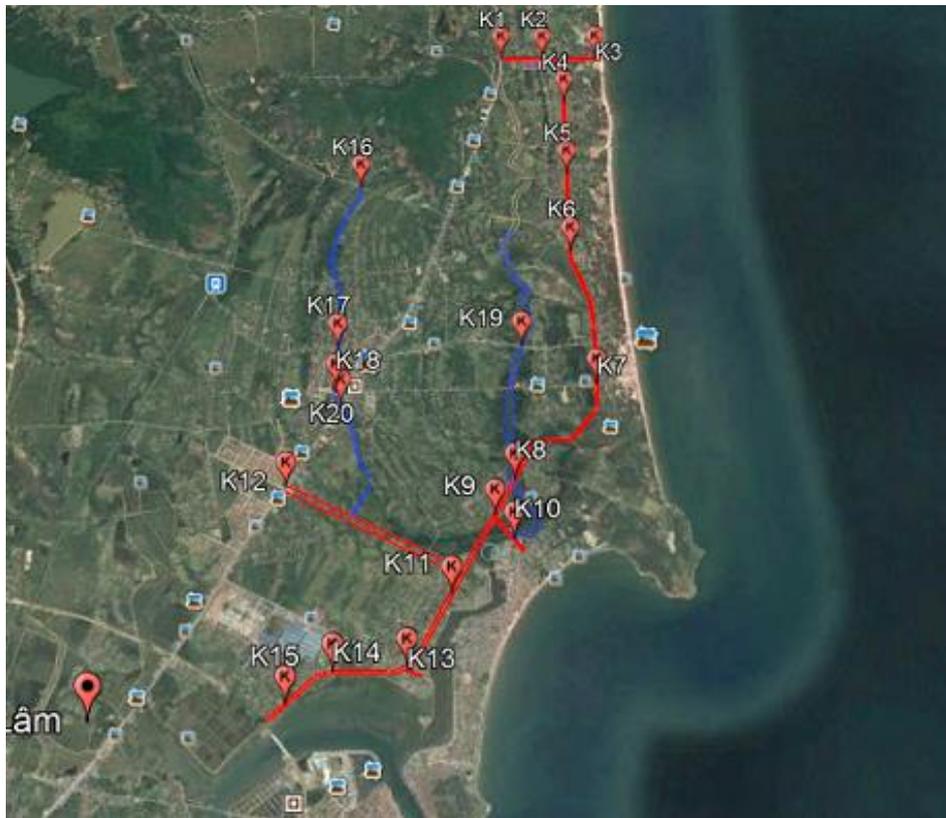


Figure 1. Map for location of air, noise sampling

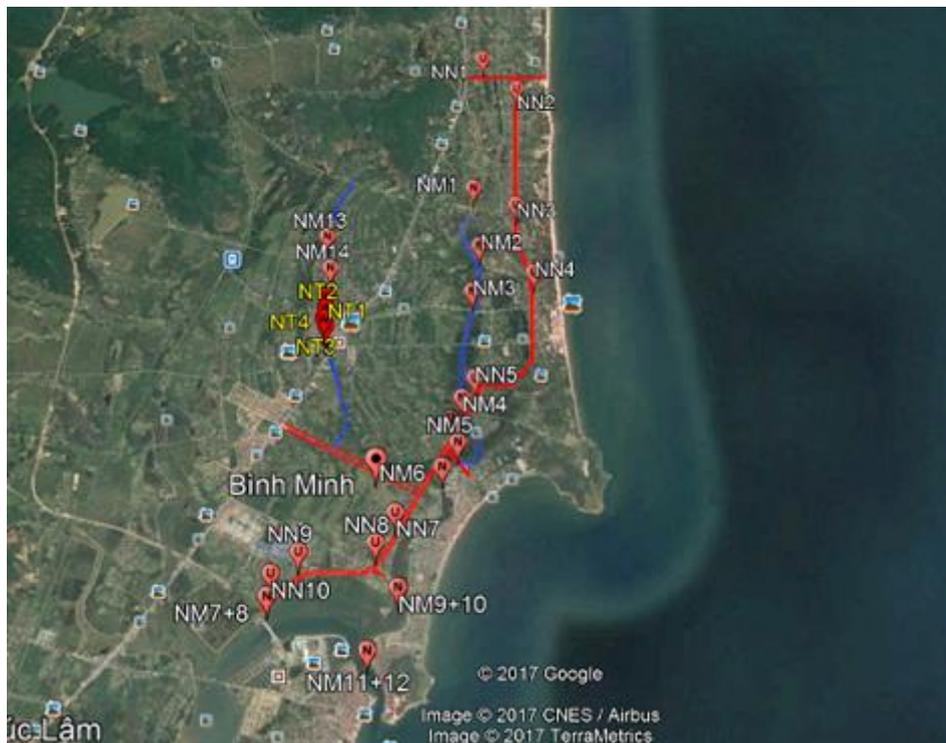


Figure 2. Map for location of surface water, ground water and wastewater quality sampling

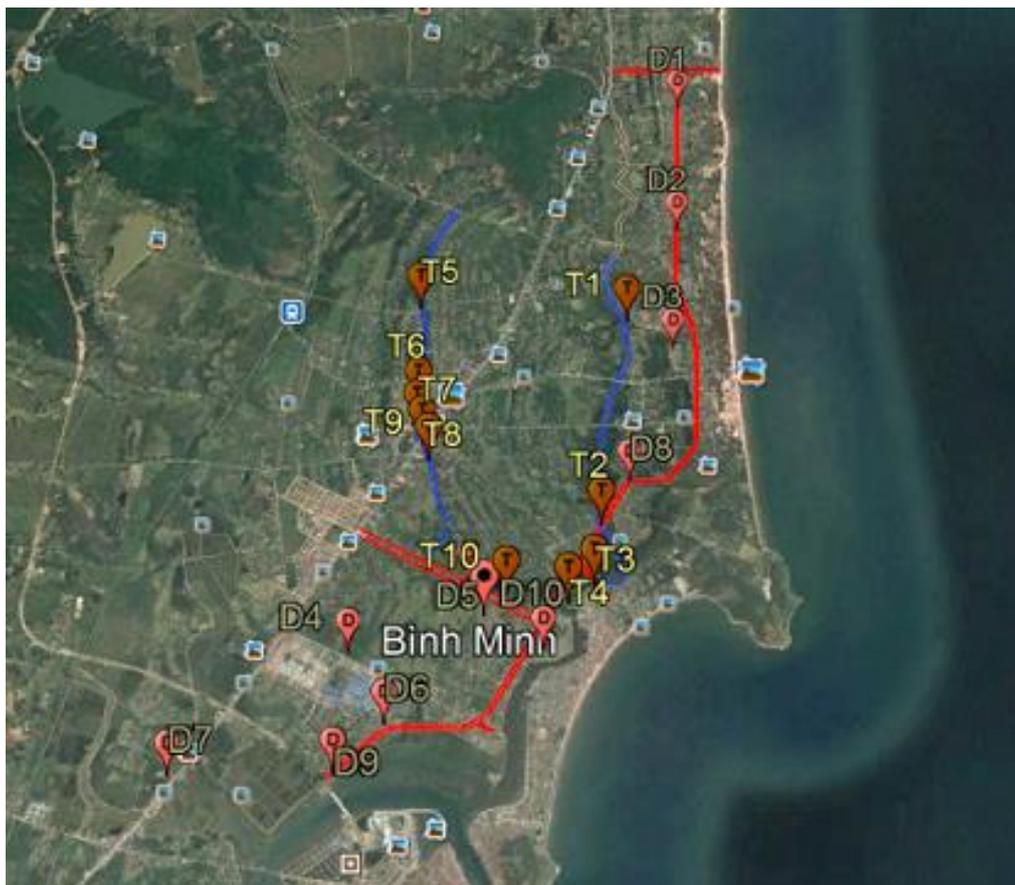


Figure 3. Map for location of soil and sediment sampling

ANNEX 4. MAPS FOR LOCATION OF ENVIRONMENTAL MONITORING

A4.1. Environmental monitoring on construction phase

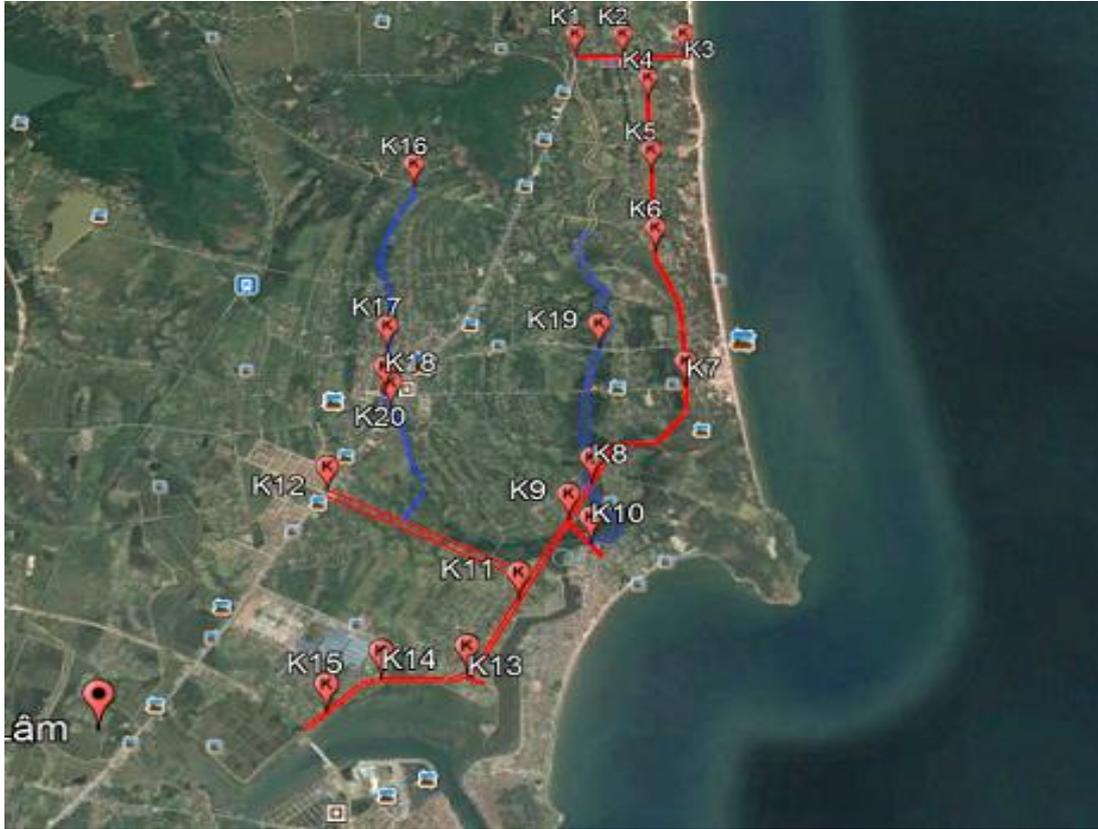


Figure 1. Map for location of air, noise monitoring

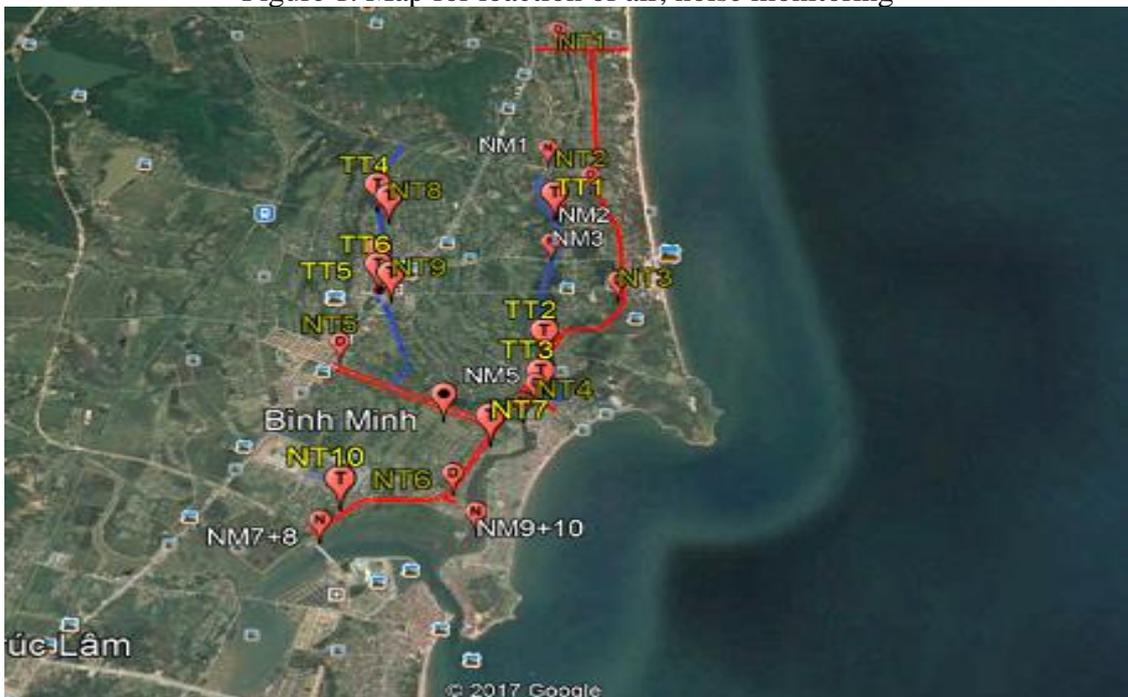


Figure 2. Map for location of surface water and Wastewater quality and sediment monitoring

Location of air, noise monitoring:

- K₁: At the junction between the new road with NH1A in Ninh Hai commune
- K₂: At the junction with the inter-communal road passing through Ninh Hai, near the tentative resettlement area
- K₃: At the end point of the new road, 300m from Hai Thanh beach
- K₄: At the junction between the coastal road with the road passing through Son Hai hamlet residential area in Ninh Hai commune
- K₅: At the junction between the coastal road with the road passing through Dai Tien hamlet residential area in Ninh Hai commune
- K₆: At the junction between the coastal road with the road passing through Thong Nhat hamlet residential area in Ninh Hai commune
- K₇: At the junction between the coastal road with the road passing through Nhan Hung hamlet residential area in Hai Hao commune
- K₈: At the junction between the coastal road with the construction area of Than canal dredging work and Son Hai bridge in Binh Minh commune
- K₉: At the junction between the coastal road with the construction area of the item: upgrading and rehabilitation of Do Be bridge in Binh Minh commune
- K₁₀: At the junction between dredging work of Than canal and the work of upgrading and rehabilitation of Do Be bridge, Binh Minh commune, at the side to Hai Thanh commune
- K₁₁: At the junction between the coastal road with the road passing through Quy Vinh hamlet residential area in Binh Minh commune
- K₁₂: At the junction between Binh Minh-Sao Vang road with NH1A, at hamlet 5 of Nguyen Binh commune
- K₁₃: At the junction between the coastal road with the road passing through Thanh Khanh hamlet residential area in Binh Minh commune
- K₁₄: At the junction between the coastal road with the road passing through Thanh Dong hamlet residential area in Binh Minh commune
- K₁₅: At the junction between the coastal road with the road passing through hamlet 7 residential area in Xuan Lam commune
- K₁₆: At the junction between the work item of Cau Trang canal with the road passing through Thuong Bac hamlet residential area in Hai Nhan commune
- K₁₇: At the junction between the work item of Cau Trang canal with the road passing through residential area 1 of Tinh Gia township
- K₁₈: At the junction between the work item of Cau Trang canal with the road passing through residential area 1 of Tinh Gia township, near Tinh Gia primary school
- K₁₉: At the junction between the work item of Than canal with the road passing through Thong Nhat hamlet residential area in Hai Hoa commune (on the bridge)
- K₂₀: At the junction between the work item of Cau Trang canal with NH1A (near Cong bridge in Tinh Gia township)

Loaction of surface water monitoring:

M₁: Surface water on Than canal at the bridge crossing Than canal at the begining point in Duc Thanh hamlet, Hai Hoa commune

- M₂: Surface water on Than canal at the section passing through Dong Hai hamlet in Hai Hoa commune, where there is agricultural land of the commune

- M₃: Surface water on Than canal at the section passing through Chay bridge in Hai Hoa commune

- M₄: Surface water on Than canal at the section passing through Son Hai bridge in Binh Minh commune

- M₅: Surface water on Than canal at the section passing through Do Be bridge in Binh Minh commune

- M₆: Surface water on Than canal at the section in front of the saline controlled sluice which passes through Giai Kenh bridge in Binh Minh commune (construction area of the WWTP and dredging Than canal)

- M₇: Surface water on Lach Bang river at the end point of the coastal road near hamlet 7 in Xuan Lam commune (high tide).

- M₈: Surface water on Lach Bang river at the end point of the coastal road near hamlet 7 in Xuan Lam commune (low tide).

- M₉: Surface water on Lach Bang river section near trade village in Hai Thanh commune and near construction are of the coastal road in Binh Minh commune (high tide)

- M₁₀: Surface water on Lach Bang river section near trade village in Hai Thanh commune and near construction are of the coastal road in Binh Minh commune (low tide)

Loaction of domestic wastewater monitoring:

NT1: Wastewater after treatment from worker camps of the road from NH1A to Ninh Hai beach at the discharging point.

NT2: Wastewater after treatment from worker camps of the coastal road at the discharging point

NT3: Wastewater after treatment from worker camps of NH1A in Hai Hoa commune at the discharging point

NT4: Wastewater after treatment from worker camps of Do Be bridge at the discharging point

NT5: Wastewater after treatment from worker camps of Binh Minh to Sao Vang road, at hamlet 5 of Nguyen Binh commune at the discharging point

NT6: Wastewater after treatment from worker camps of coastal road, in Xuan Phong commune at the discharging point

NT7: Wastewater after treatment from worker camps of coastal road, in Binh Minh commune at the discharging point

NT8: Wastewater after treatment from worker camps of Cau Trang Canal, in Hai Nhan commune at the discharging point

NT9: Wastewater after treatment from worker camps of Cau Trang Canal, Tinh Gia township at the discharging point

NT10: Wastewater after treatment from worker camps of coastal road, in Xuan Lam commune at the discharging point

Location of sediment monitoring:

TT1: Sediment on Than canal at the section passing Dong Hai hamlet, Hai Hoa commune, on the agricultural land near sampling location of NM2

+TT2: Sediment on Than canal at the section at Son Hai bridge in Binh Minh commune near sampling location of NM4

+TT3: Sediment on Than canal at the section at Do Be bridge in Binh Minh commune near the sampling location of NM5

+TT4: Sediment on Than canal at the section crossing with the access road to Hai Nhan communal People’s Committee headquarter and near sampling location of NM13

+TT5: Sediment on Cau Trang canal at the section passing the residential area of Tinh Gia township

+TT6: Sediment on Cau Trang canal at the section passing through residential area of Tinh Gia township, crossing with the access road to Tinh Gia district People’s committee headquarter.

A4.2. Environmental monitoring on operation phase

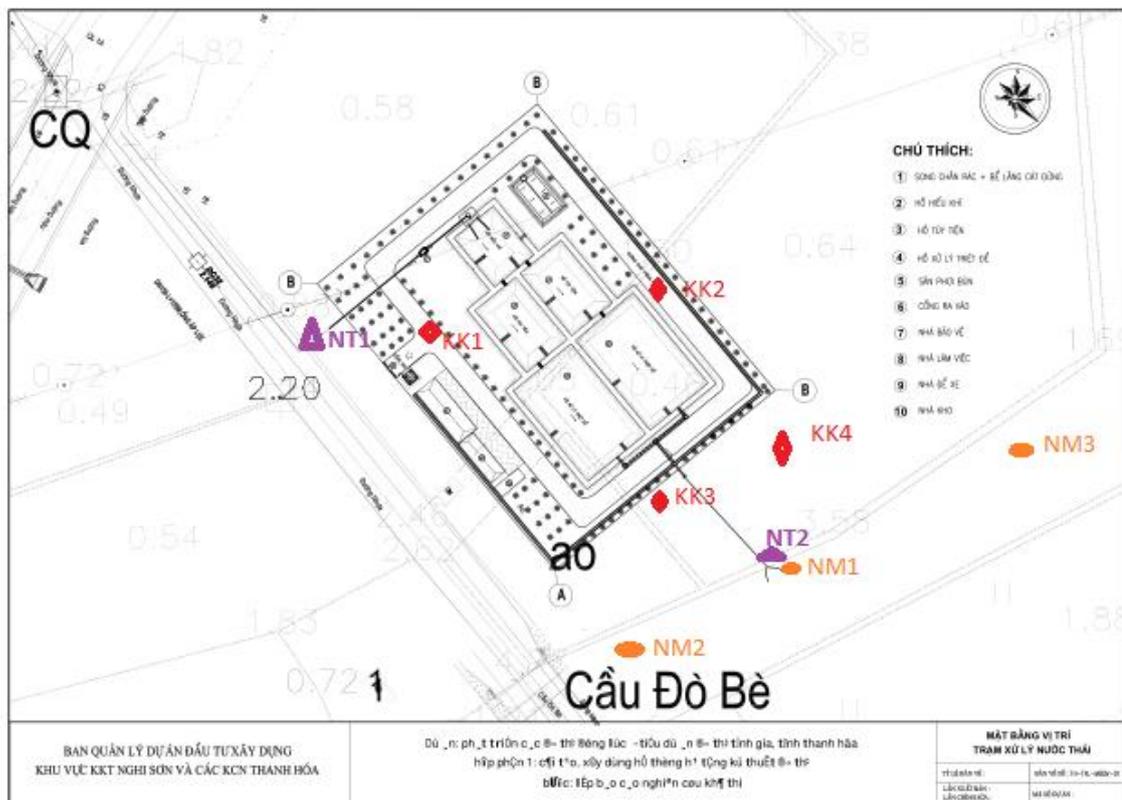


Figure 3. Map for location of WWTP environmental monitoring